THE HIP SOCIETY

The Forty-Fourth Open (Winter) Meeting of The Hip Society

The Twenty-Second Combined Open Meeting of The Hip Society and the American Association of Hip and Knee Surgeons (AAHKS)

Final Scientific Program

Saturday, March 5, 2016
Orange County Convention Center, West Bldg., Valencia Room A
Orlando, Florida
ANNOUNCEMENTS

AAOS Annual Meetings
March 14-18, 2017       San Diego, California
March 6-10, 2018       New Orleans, Louisiana

AAHKS 26th Annual Meeting
Save the Date - New Location!
November 10-13, 2016
Hilton Anatole, Dallas, Texas

AAHKS 26th Annual Meeting Call for Symposia
Submit proposals by May 2, 2016
covering all aspects of arthroplasty and health policy.

AAHKS 26th Annual Meeting Call for Abstracts
Submit abstracts by June 1, 2016 for consideration
as podium or poster presentations.
Submit symposia and abstracts online at www.AAHKS.org

AAHKS 27th Annual Meeting
November 2-5, 2017
Hilton Anatole, Dallas, Texas

Digital Archives Are Yours For 1 Year!
On-site participants of the 2016 Specialty Day Meeting of
The Hip Society and AAHKS will receive complimentary access to
video archives for one year beginning April 15, 2016.

This program is streaming LIVE via the Internet to participants around the world.
Live-streaming and recording services are provided by:

Digitell
WELCOME TO THE TWENTY-SECOND COMBINED OPEN MEETING OF THE HIP SOCIETY AND THE AMERICAN ASSOCIATION OF HIP AND KNEE SURGEONS (AAHKS) AT THE 2016 AAOS SPECIALTY DAY

GENERAL INFORMATION

The Mission of The Hip Society:

The Mission of The Hip Society is to advance knowledge of hip disorders, promote evidence-based treatment, and refine surgery of the hip in order to improve the lives of patients.

Meeting Objectives:

The objectives of the Open Meeting of The Hip Society and AAHKS are to provide up-to-date information on the treatment of hip conditions, including non-arthroplasty options, and the latest surgical techniques as well as the current thinking on bearing surfaces. Other objectives address the difficult primary THA and complication management and include an update on revision THA.

CME Accreditation:

This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint provid- ership of the American Academy of Orthopaedic Surgeons and the Hip Society. The American Academy of Orthopaedic Surgeons is accredited by the ACCME to provide continuing medical education for physicians.

The American Academy of Orthopaedic Surgeons designates this live activity for a maximum of 7.75 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

IMPORTANT

Please complete evaluation online at: https://www.surveymonkey.com/r/16wm or use the QR code here:

Please silence all electronic devices while inside the session room.

Please refrain from unauthorized photography and video recording of presentations.

Your registration for, and attendance of, this session gives The Hip Society permission to capture images of session attendees and to use these images for internal and marketing purposes.
ACKNOWLEDGMENTS

PAST PRESIDENTS OF THE HIP SOCIETY

1969-1970  Frank E. Stinchfield, MD (Deceased)  2011-2012  Adolph V. Lombardi, Jr., MD, FACS
1970-1971  Walter P. Blount, MD (Deceased)  2012-2013  David G. Lewallen, MD
1971-1972  Albert B. Ferguson, Jr., MD (Deceased)  2013-2014  Vincent D. Pellegrini, Jr., MD
1972-1973  J. Vernon Luck, Sr., MD (Deceased)  2014-2015  Paul F. Lachiewicz, MD
1973-1974  Mark B. Coventry, MD (Deceased)  PAST PRESIDENTS OF AAHKS
1974-1975  Emmett M. Lunceford, Jr., MD (Deceased)  1991  J. Phillip Nelson, MD (Deceased)
1978-1979  Marshall R. Urist, MD (Deceased)  1994  Richard C. Johnston, MD, MS
1979-1980  Harlan C. Amstutz, MD  1995  Lawrence D. Dorr, MD
1980-1981  Philip D. Wilson, Jr., MD  1996  Hugh S. Tullos, MD (Deceased)
1981-1982  Richard C. Johnston, MD, MS  1997  Merrill A. Ritter, MD
1982-1983  Clement B. Sledge, MD  1998  Richard H. Rothman, MD, PhD
1983-1984  Floyd H. Jergesen, MD (Deceased)  1999  James A. Rand, MD
1984-1985  C. McCollister Evarts, MD  2000  Richard B. Welch, MD
1985-1986  Jorge O. Galante, MD, DMSc.  2001  John J. Callaghan, MD
1986-1987  Lee H. Riley, Jr., MD (Deceased)  2002  Douglas A. Dennis, MD
1987-1988  William R. Murray, MD (Deceased)  2003  Clifford W. Colwell, Jr., MD
1988-1989  Joseph E. Miller, MD (Deceased)  2004  Richard F. Santore, MD
1989-1990  Donald E. McCollum, MD (Deceased)  2005  Joseph C. McCarthy, MD
1990-1991  J. Phillip Nelson, MD (Deceased)  2006  William J. Hozack, MD
1991-1992  Nas S. Eftekhar, MD  2007  Daniel J. Berry, MD
1992-1993  William N. Capello, MD  2008  David G. Lewallen, MD
1994-1995  Mark G. Lazansky, MD  2010  Mary I. O’Connor, MD
1995-1996  Richard B. Welch, MD  2011  Carlos J. Lavermia, MD
1996-1997  Dennis K. Collins, MD  2012  Thomas P. Vail, MD
1997-1998  Eduardo A. Salvati, MD  2013  Thomas K. Fehring, MD
1998-1999  Robert B. Bourne, MD, FRCSC  2014  Brian S. Parsley, MD
1999-2000  Richard D. Coutts, MD  2000-2001  Leo A. Whiteside, MD
2001-2002  Benjamin E. Bierbaum, MD  2003  Miguel E. Cabanela, MD
2002-2003  Charles A. Engh, Sr., MD  2004  Richard E. White, MD
2007-2008  Lawrence D. Dorr, MD  2008-2009  Wayne G. Paprosky, MD
2009-2010  William J. Maloney, III, MD

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THE HIP SOCIETY BOARD OF DIRECTORS
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Christopher L. Peters, MD - Member-At-Large
Adolph V. Lombardi, Jr., MD – Chair, Fellowship & Mentorship Committee (Ex-Officio)

AAKS BOARD OF DIRECTORS
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Steven J. MacDonald, MD, FRCSC
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David A. Halsey, MD
To say that Dr. Duncan has a deep passion for hip surgery is an understatement. Ever since becoming an orthopaedic surgeon, he has been working on improving hip health. From the time he moved to British Columbia, Canada from his native Ireland, via the United Kingdom, Dr. Duncan has been one of the leading hip surgeons in Canada. A gifted surgeon, he has dedicated his career to improving techniques of revision total hip arthroplasty. When the rest of the world regarded that an infected hip replacement bed needs to be free of any foreign material, Dr. Duncan developed the concept of a mobile spacer, which revolutionized the treatment of the infected hip replacement. He also established one of Canada’s and North America’s premier arthroplasty units, and has trained young surgeons from all over the world. The impact of his wisdom and knowledge has served to improve lives and mobility of millions of patients worldwide.

Dr. Duncan’s thoughtfulness and systematic attention to detail has led to the development for evidence-based algorithms for the treatment of periprosthetic femoral fractures, and the development of the Vancouver Classification, which he humbly named not after himself but after his hometown instead.

Dr. Duncan continues to be an active surgeon, educator and academician in Vancouver, where he has spent his entire professional career. He has been a true leader and a mentor, having made it his mission to inspire his younger colleagues, associates and students to be their best. The Hip and Knee arthroplasty unit that he established continues to be one of the most sought-after units in Canada. An inspiration on and off the podium worldwide, Dr. Duncan continues to be a sought-after speaker at prestigious meetings and conferences around the world.

Dr. Duncan’s vision and dedication has led to the establishment of the Centre for Hip Health and Mobility, the only center of its kind dedicated to studying and finding solutions to problems around the hip.

Dr. Duncan’s lasting legacy to his students, disciples, and colleagues will always be paying the utmost attention to detail, generating and following evidence in surgery, and striving for personal and professional excellence.

The Hip Society is honored to present the 2016 Lifetime Achievement Award to Clive P. Duncan, MD. Congratulations, Dr. Duncan!
Michael M. Morlock
University Professor Dr.habil. Ph.D.
Director, Institute for Biomechanics
Speaker of the Board of Directors, Medical Technology Research Center Hamburg
Founding Member FSP “Regeneration, Implants and Medical Technology”
TUHH Hamburg University of Technology

Michael Morlock received his University degrees in Mathematics and Sport Sciences from the University of Stuttgart (Germany) in 1985.

In 1990, he completed his PhD-degree in Medical Science at the University of Calgary (Alberta, Canada). After 3 years as the head of the Biomechanics Laboratory of novel GmbH (pressure distribution measurement systems) and a post-doc position at the LMU-University (Trauma Surgery, Prof. Lob) in Munich (Germany), he accepted a position as a Senior Research Associate at the Biomechanics Institute of the TUHH (Director: Prof. Dr.sc.techn. E. Schneider).

In 2000, he was awarded a professorship at the Technical University of Vienna (Austria), in 2003 a full professorship at the RWTH Aachen (Germany), and in 2004 the position he still holds as a full Professor of “Biomechanics“ and Director of the Institute of Biomechanics at the TUHH Hamburg University of Technology.

In 2007 he initiated the research area “Regeneration, Implants and Medical Technology” at TUHH. Since 2012 he is a member of the Scientific Committee on Health and Environmental Risks of the European Commission (Working group on metal-on-metal implants). In 2013 he co-founded the Hamburg Research Center for Medical Technology (FMTHH) in conjunction with the University Hospital.

He has received several international awards and served official functions in national and international research organizations. His major scientific interests are in pre-clinical testing, failure analysis, surgeon education, materials in orthopaedics, as well as the interaction between implants and the human body.
The Hip Society Welcomes
The 2016 Hip Society Rothman-Ranawat Traveling Fellows

Derek F. Amanatullah, MD, PhD
Stanford University
Redwood City, CA, USA

Atul F. Kamath, MD
University of Pennsylvania
Philadelphia, PA, USA

Bharath Loganathan,
MBBS, D.Ortho, M.S.(Ortho), FRCS(Edin)
Shalby Hospital
Ahmedabad, Gujarat, India

Matthew J. Wilson,
MBBS (Lond) FRCS (Eng) FRCS (Tr&Orth)
Princess Elizabeth Orthopaedic Centre
Royal Devon and Exeter Hospital
Exeter, Devon, UK

The deadline to submit applications for the 2017 Hip Society Rothman-Ranawat Traveling Fellowship is August 15, 2016. For more information, visit www.hipsoc.org.
THE HIP SOCIETY 2016 AWARDS

The Scientific Awards will be presented from 2:58 pm – 3:15 pm

The 2016 John Charnley Award

The Missing Link: Re-Defining the Natural Progression of Osteoarthritis in Patients with Hip Dysplasia and Impingement

Presenter: Rafael J. Sierra, MD
Co-Authors: Cody C. Wyles, BS; Mark J. Heidenreich, MD; Jack Jeng, MD; Dirk R. Larson, MD; Robert T. Trousdale, MD

The 2016 Otto Aufranc Award

A Multi-Center, Prospective, Randomized Study of Outpatient versus Inpatient Total Hip Arthroplasty

Presenter: Nitin Goyal, MD
Co-Authors: Antonia F. Chen, MD, MBA; Sarah E. Padgett, PA-C; Timothy L. Tan, MD; Michael M. Kheir, BS; Robert H. Hopper, Jr., PhD; William G. Hamilton, MD; William J. Hozack, MD

The 2016 Frank Stinchfield Award

Total Hip Arthroplasty for Femoral Neck Fracture is Not a Typical DRG 470: A Propensity-Matched Cohort Study

Presenter: Alexander S. McLawhorn, MD, MBA
Co-Authors: William A. Schairer, MD; Joseph M. Lane, MD; David A. Halsey, MD; Richard Iorio, MD; Douglas E. Padgett, MD

The Hip Society Scientific Awards
Manuscripts in consideration for the 2017 Hip Society Scientific Awards may be submitted beginning in September 2016 through Clinical Orthopaedic and Related Research (CORR).

The deadline to submit is December 1, 2016.

The 2016 Young Investigator Presentation

The Young Investigator Presentation will be from 4:16 pm – 4:23 pm

Removal of an Infected Hip Arthroplasty is High-Risk Surgery: Putting Morbidity into Context with Other Major Non-Orthopaedic Operations

Presenter: James A. Browne, MD
Co-Authors: Cancienne JM, Novicoff WM, Werner BC
THIS COURSE IS ABOUT ME!

Contemporary Approaches to Adult Hip and Knee Reconstruction
Scott M. Sporer, MD and
R. Michael Meneghini, MD - Program Co-Chairs

Presented by The Hip Society and The Knee Society

FRIDAY, MAY 20th, 2016
11:30 am – 6:00 pm (end times may vary per location)

JOIN US:
Indianapolis, IN or Charlotte, NC or Denver, CO

Visit www.hipsoc.org/Education for more information.
BEING BETTER MATTERS

BETTER SELF-ASSESSMENT MEANS BETTER PATIENT CARE

Experience active, stimulating learning – and have the tools you need to better assess your knowledge of current orthopaedic information – with the AAOS special interest self-assessment examinations.

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NEW! ADULT RECONSTRUCTIVE SURGERY OF THE HIP AND KNEE EXAMINATION

Evaluate your knowledge of primary and revision total hip and total knee replacement. Improve your skills in preventing and managing infection, pain, thromboembolism, and osteolysis. Learn to identify factors contributing to wear of hip and knee bearing surfaces.

- Includes full-length videos of surgical demonstrations.
- Scored and Recorded and Self-Scored formats available

Earn up to 20 CME credits with 200 multiple-choice questions.

Developed in partnership with:
American Association of Hip and Knee Surgeons,
The Hip Society and The Knee Society

TO ORDER, VISIT aaos.org/self_assess OR CALL 800.626.6726
Call for Symposia and Abstracts

ABSTRACT SUBMISSIONS
Submit high-quality scientific and socioeconomic abstracts by June 1, 2016 for consideration as podium or poster presentations. Abstracts are blind reviewed by the AAHKS Program Committee review team. If you are interested in serving on the review team, contact meeting@aaahks.org.

SYMPOSIUM PROPOSALS
Submit proposals by May 2, 2016 covering all aspects of arthroplasty and health policy. Proposals are reviewed by the AAHKS Program Committee.

Submit symposium proposals and abstracts online at www.AAHKS.org
Residents – Expand your surgical skills for hip and knee arthroplasty!

Build your surgical skills leading to proficiency at hip and knee arthroplasty in this free interactive skills course designed exclusively for orthopaedic residents! Spend the majority of your time practicing bone cuts, correct ligament balancing for TKA, determining correct implant sizing and restoring biomechanics in THA, and more!

Work on anatomical specimens under the guidance of expert faculty. Panel discussions and faculty-led small group interactions round out your skills lab experience.

Course highlights include:

- Preoperative planning and templating for hip and knee arthroplasty procedures
- The rationale behind and the surgical skills needed to:
  - Monitor and reproduce leg lengths in THA
  - Monitor and improve hip stability during THA
  - Release soft-tissues to obtain appropriate limb and implant alignment during TKA
  - Maximize motion following TKA
- Optional 4-hour lab devoted to surgical tools for arthroplasty

Register at aaos.org/courses or 1-800-626-6726
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PROGRAM
8:00 am – 8:04 am  WELCOME
Daniel J. Berry, MD (Rochester, MN)
President of The Hip Society

8:05 am – 8:49 am  Session I: Direct Anterior THA: Controversies, Data, Techniques in 2016
Moderator: Steven J. MacDonald, MD, FRCSC (London, ON, Canada)

8:05 am – 8:10 am  Perspective of a Convert: Why I Changed to Direct Anterior Approach and the Associated Learning Curve
Adolph V. Lombardi, Jr., MD, FACS (New Albany, OH)

8:11 am – 8:16 am  The Direct Anterior Approach in a Risk Factor for Early Failure in Cementless Total Hip Arthroplasty: A Multi-Center Study
R. Michael Meneghini, MD (Fishers, IN)

8:17 am – 8:22 am  Surgical Tips and Pearls to Maximize Success of Direct Anterior THA Done with an Orthopedic Table
Joel M. Matta, MD (Santa Monica, CA)

8:23 am – 8:28 am  Surgical Tips and Pearls to Maximize Success of Direct Anterior THA Done without a Fracture Table
William J. Hozack, MD (Philadelphia, PA)

8:29 am – 8:34 am  The Accumulated Evidence Supports Posterior Approach THA as the Gold Standard in 2016
Bryan D. Springer, MD (Charlotte, NC)

8:34 am – 8:49 am  DISCUSSION

8:50 am – 9:40 am  Session II: Contemporary Insights into Unsolved Problems in THA
Moderator: Clive P. Duncan, MD, FRCSC (Vancouver, BC, Canada)

8:50 am – 8:55 am  Abductor Deficiency and THA: Diagnosis and Management
Richard W. McCalden, MD, FRCSC (London, ON, Canada)

8:56 am – 9:01 am  Psoas Impingement & Tendinopathies after THA: Diagnosis and Management
William A. Jiranek, MD (Richmond, VA)

9:02 am – 9:07 am  THA for the Patient with a BMI over 40: Risk and Reward
David G. Lewallen, MD (Rochester, MN)

9:08 am – 9:13 am  Recurrent Dislocation in the Patient with a Constrained Liner or Dual-Mobility Implant: What Now?
John J. Callaghan, MD (Iowa City, IA)

9:14 am – 9:19 am  Pelvic Discontinuity: Newest Knowledge and Technical Tips in Management
Wayne G. Paprosky, MD, FACS (Winfield, IL)
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<tr>
<td>8:00 am – 8:02 am</td>
<td><strong>Welcome</strong>&lt;br&gt;<strong>Thomas P. Vail, MD</strong> (San Francisco, CA)&lt;br&gt;President, The Knee Society</td>
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<td>8:02 am – 8:04 am</td>
<td><strong>Kevin J. Bozic, MD, MBA</strong> (Austin, TX)&lt;br&gt;Chair, Education Committee, The Knee Society</td>
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<td>8:05 am – 8:52 am</td>
<td><strong>Session I: Minimizing TKA Complications</strong>&lt;br&gt;<strong>Moderator: John J. Callaghan, MD</strong> (Iowa City, IA)</td>
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<td>8:05 am – 8:12 am</td>
<td><strong>22 Periprosthetic Joint Infection: Controversies and Areas in Need of Research</strong>&lt;br&gt;<strong>Javad Parvizi, MD</strong> (Philadelphia, PA)</td>
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<td>8:13 am – 8:20 am</td>
<td><strong>28 Prevention and Management of Instability in TKA</strong>&lt;br&gt;<strong>Thomas K. Fehring</strong> (Charlotte, NC)</td>
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<td>8:21 am – 8:28 am</td>
<td><strong>30 Optimizing Risk Factors</strong>&lt;br&gt;<strong>Richard Iorio</strong> (New Rochelle, NY)</td>
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<td>8:29 am – 8:36 am</td>
<td><strong>33 Venous Thromboembolism</strong>&lt;br&gt;<strong>Jay R. Lieberman, MD</strong> (Los Angeles, CA)</td>
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<td>8:37 am – 8:52 am</td>
<td><strong>Discussion</strong></td>
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<td>8:53 am – 10:04 am</td>
<td><strong>Session II: TKA Alignment: Mechanical, Anatomic, or Kinematic</strong>&lt;br&gt;<strong>Moderator: Thomas P. Schmalzried, MD</strong> (Los Angeles, CA)</td>
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<td>8:53 am – 9:00 am</td>
<td><strong>34 Mechanical Alignment</strong>&lt;br&gt;<strong>Douglas A. Dennis</strong> (Denver, CO)</td>
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<td>9:01 am – 9:08 am</td>
<td><strong>35 Anatomic Alignment</strong>&lt;br&gt;<strong>Michael A. Mont, MD</strong> (Baltimore, MD)</td>
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<td>9:09 am – 9:16 am</td>
<td><strong>36 Kinematic Alignment</strong>&lt;br&gt;<strong>Stephen M. Howell, MD</strong> (Sacramento, CA)</td>
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<td>9:17 am – 9:24 am</td>
<td><strong>38 Custom Cutting Guides</strong>&lt;br&gt;<strong>Adolph V. Lombardi, Jr., MD, FACS</strong> (New Albany, OH)</td>
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<td>9:25 am – 9:32 am</td>
<td><strong>39 Robotics for UKA and Potential Role in TKA</strong>&lt;br&gt;<strong>Jess H. Lonner, MD</strong> (Bryn Mawr, PA)</td>
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<td>9:33 am – 9:40 am</td>
<td><strong>41 Computer Navigation: Past, Present, Future</strong>&lt;br&gt;<strong>S. David Stulberg, MD</strong> (Chicago, IL)</td>
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| 9:20 am – 9:25 am | Failed 2-Stage THR  
Arlen D. Hanssen, MD (Rochester, MN) |
| 9:25 am – 9:40 am | Discussion                                                                |
| 9:40 am – 9:55 am | BREAK                                                                    |
| 9:56 am – 10:34 am | Session III: Strategies to Speed Recovery and Decrease Complications after THA  
*Moderator: Mark W. Pagnano, MD (Rochester, MN)* |
| 9:56 am – 10:01 am | Perioperative Management: Get Ahead and Stay Ahead  
Mark W. Pagnano, MD (Rochester, MN) |
| 10:02 am – 10:07 am | Role of Staphylococcal Screening and Treatment Prior to THA  
Scott M. Sporer, MD (Winfield, IL) |
| 10:08 am – 10:13 am | Risk Stratified VTE Prophylaxis after THA  
Jay R. Lieberman, MD (Los Angeles, CA) |
| 10:14 am – 10:19 am | Outpatient Joint Replacement  
Michael E. Berend, MD (Indianapolis, IN) |
| 10:19 am – 10:34 am | DISCUSSION                                                                |
| 10:35 am – 11:10 am | Session IV: Complex Primary THA: Case-Based Discussion on the State of the Art  
*Moderator: Daniel J. Berry, MD (Rochester, MN)* |
| 10:35 am – 10:55 am | Panel: Richard Iorio, MD (New Rochelle, NY); Michael E. Berend, MD (Indianapolis, IN); Greg G. Polkowski, II, MD (Nashville, TN); Prof. Fares S. Haddad, FRCS (London, United Kingdom); Miguel E. Cabanela, MD (Rochester, MN) |
| 10:55 pm – 11:10 am | DISCUSSION                                                                |
| 11:11 am – 11:33 am | Session V: Taper Corrosion in Orthopaedic Devices – Newest Knowledge  
*Moderator: Joshua J. Jacobs, MD (Chicago, IL)* |
| 11:11 am – 11:16 am | Dual Modular Necks in THA: How Big is the Problem? What Caused the Problem?  
What Have we Learned?  
Michael A. Mont, MD (Baltimore, MD) |
| 11:17 am – 11:22 am | When to Revise and What to Revise if Trunionosis is Suspected?  
Joshua J. Jacobs, MD (Chicago, IL) |
<p>| 11:23 pm – 11:33 am | DISCUSSION                                                                |</p>
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<td>Mechanical Guides</td>
<td>Robert E. Booth, MD (Philadelphia, PA)</td>
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<td>9:49 am – 10:04 am</td>
<td>DISCUSSION</td>
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<td>10:05 am – 10:15 am</td>
<td>BREAK</td>
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<tr>
<td>10:16 am – 11:03 am</td>
<td>Session III: The Painful TKA: Prevention, Evaluation, and Management</td>
<td>Moderator: Aaron G. Rosenberg, MD, FACS (Chicago, IL)</td>
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<td>10:16 am – 10:23 am</td>
<td>Managing Expectations</td>
<td>Michael J. Dunbar, MD, FRCSC, PhD (Halifax, NS, Canada)</td>
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<td>10:24 am – 10:31 am</td>
<td>Optimizing Emotional Health</td>
<td>David C. Ayers, MD (Worcester, MA)</td>
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<td>10:32 am – 10:39 am</td>
<td>Pre- and Post-Operative Opioid Management</td>
<td>Thomas P. Vail, MD (San Francisco, CA)</td>
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<td>10:40 am – 10:47 am</td>
<td>The Role of “Pain Management”</td>
<td>Craig J. Della Valle, MD (Chicago, IL)</td>
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<td>10:48 am – 11:03 am</td>
<td>DISCUSSION</td>
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<td>11:04 am – 12:00 pm</td>
<td>Session IV: Transitioning to Value-Based Healthcare</td>
<td>Moderator: Kevin J. Bozic, MD, MBA (Austin, TX)</td>
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<td>11:04 am – 11:11 am</td>
<td>Bundled Payments and Other Value-Based Payment Strategies</td>
<td>Kevin J. Bozic, MD, MBA (Austin, TX)</td>
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<td>11:12 am – 11:19 am</td>
<td>The Role of the EMR in Improving Value</td>
<td>Wael K. Barsoum, MD (Cleveland, OH)</td>
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<tr>
<td>11:20 am – 11:27 am</td>
<td>The Role of Registries in Improving Value</td>
<td>Colin Howie, ChB, FRCS, FRCS (Ortho) (Edinburgh, United Kingdom)</td>
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<td>11:28 am – 11:35 am</td>
<td>Integrated Delivery Systems are Key to Value Creation</td>
<td>Mark I. Froimson, MD (Hunting Valley, OH)</td>
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<td>11:36 am – 11:43 am</td>
<td>Private Practice Models are More Nimble</td>
<td>Daniel B. Murrey, MD, MPP (Charlotte, NC)</td>
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<td>11:44 am – 12:00 pm</td>
<td>DISCUSSION</td>
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<td>12:00 pm – 1:00 pm</td>
<td>LUNCH</td>
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| 11:34 am - 11:50 am | Program Highlight: Presidential Guest Speaker  
  Introduction: Daniel J. Berry, MD (Rochester, MN)  
  Taper Corrosion in THA: What Causes it and Why are We Seeing it Now?  
  Michael M. Morlock, PhD (Hamburg, Germany) |
| 11:54 am - 12:50 pm | LUNCH                                                                   |
| 12:50 pm – 1:28 pm | Session VI: Top 3 New and Impactful Findings from Joint Registries  
  Around the Globe  
  Moderator: Kevin J. Bozic, MD, MBA (Austin, TX)  
  Top Findings from Australian National Joint Registry  
  Richard N. de Steiger, MD (Richmond, Australia)  
  Top Findings from British National Joint Registry  
  Martyn Porter, MD (Wigan, United Kingdom)  
  Top Findings from Scandinavian Joint Registries  
  Henrik Malchau, MD, PhD (Boston, MA)  
  American Joint Replacement Registry: High Level Update  
  Kevin J. Bozic, MD, MBA (Austin, TX) |
| 1:29 pm – 2:19 pm | Session VII: Is Cross-Linked Poly Now the Bearing of Choice?  
  Moderator: William J. Maloney, III, MD (Redwood City, CA)  
  Results of Cross-Linked Poly at 10 Years or More  
  Harry E. Rubash, MD (Boston, MA)  
  Highly Cross-Linked Polyethylene Provides Decreased Osteolysis  
  and Reoperation  
  Paul F. Lachiewicz, MD (Chapel Hill, NC)  
  Ceramic vs. Metal Femoral Heads: What is the Role for Each in 2016?  
  Thomas P. Schmalzried, MD (Los Angeles, CA)  
  Ceramic-on-Ceramic Bearings in 2016: A Perspective from Outside  
  the United States  
  Carsten Perka, MD (Berlin, Germany)  
  Dual Mobility Implants: What is Their Role in Primary THA?  
  Jean-Noël Argenson, MD (Marseille, France)  
  Failed Metal-on-Metal: Current Diagnostic Algorithms and Guidelines  
  Thomas K. Fehring, MD (Charlotte, NC) |

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### Session Vb: Highlights

1:34 pm – 1:39 pm
AAHKS 2015 Annual Meeting  
Gregory G. Polkowski, II, MD (Nashville, TN)

1:40 pm – 1:45 pm
The John N. Insall, MD Traveling Fellowship  
W. Norman Scott, MD (New York, NY)

1:46 pm – 2:31 pm
Session VI: Peri-Operative Management—How Do I Do It?  
Moderator: Daniel J. Berry, MD (Rochester, MN)

| 2:31 pm – 2:50 pm | BREAK |

### Session VII: Case Presentations

Moderator: Thomas P. Vail, MD (San Francisco, CA)

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<th>2:51 pm – 4:05 pm</th>
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| 2:51 pm – 2:58 pm | 60 When is TKA Appropriate?  
Ryan M. Nunley, MD (St. Louis, MO) |
| 2:59 pm – 3:06 pm | 61 When Enough is Enough?  
Michael Ries, MD (Carson City, NV) |
| 3:07 pm – 3:14 pm | 62 Peri-Prosthetic Fractures – What to Do?  
Bassam A. Masri, MD, FRCSC (Vancouver, BC, Canada) |
2:20 pm – 2:52 pm  
**Session VIII: How Do We Ideally Position the Acetabular Component?**

*Moderator: Robert T. Trousdale, MD (Rochester, MN)*

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<tr>
<th>Time</th>
<th>Title</th>
<th>Presenters</th>
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<tr>
<td>2:20 pm</td>
<td>Newest Knowledge on Ideal Component Position</td>
<td>Lawrence D. Dorr, MD (Pasadena, CA)</td>
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<tr>
<td>2:26 pm</td>
<td>The Impact of Lumbar Spine Pathology on Functional Hip Position</td>
<td>Douglas E. Padgett, MD (New York, NY)</td>
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<tr>
<td>2:32 pm</td>
<td>Socket Position and the Risk of Dislocation after Revision THA</td>
<td>Robert L. Barrack, MD (St. Louis, MO)</td>
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<td>2:53 pm</td>
<td>Program Highlight: The Hip Society's 2016 Lifetime Achievement Award</td>
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<td><em>Introduction: Daniel J. Berry, MD (Rochester, MN)</em></td>
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<td><em>Recipient: Clive P. Duncan, MD, FRCSC (Vancouver, BC, Canada)</em></td>
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2:58 pm – 3:15 pm  
**Session IX: The Hip Society Scientific Awards**

*Moderator: Thomas P. Vail, MD (San Francisco, CA)*

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<th>Time</th>
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<tr>
<td>2:58 pm</td>
<td>The John Charnley Award</td>
<td>Rafael J. Sierra, MD (Rochester, MN)</td>
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<td>3:04 pm</td>
<td>The Otto AuFranc Award</td>
<td>Nitin Goyal, MD (Alexandria, VA)</td>
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<td>3:10 pm</td>
<td>The Frank Stinchfield Award</td>
<td>Alexander S. McLawhorn, MD, MBA (New York, NY)</td>
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<td>3:16 pm</td>
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3:27 pm – 4:15 pm  
**Session X: Revision THA Video Technical Tips to Improve Results**

*Moderator: C. Anderson Engh, MD (Alexandria, VA)*

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<th>Time</th>
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<tr>
<td>3:27 pm</td>
<td>Revision THA for Periprosthetic Fracture</td>
<td>George J. Haidukewych, MD (Orlando, FL)</td>
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| 3:15 pm – 3:22 pm | Dealing with Extensor Mechanism Deficiency  
  *Matthew S. Austin, MD (Philadelphia, PA)* |
| 3:23 pm – 3:30 pm | Treatment of the Unstable TKA  
  *Robert T. Trousdale, MD (Rochester, MN)* |
| 3:31 pm – 3:38 pm | Is This Knee Infected?  
  *Kevin L. Garvin, MD (Omaha, NE)* |
| 3:39 pm – 3:46 pm | Patient is Unhappy, but I Don’t Know Why  
  *Robert L. Barrack, MD (St. Louis, MO)* |
| 3:46 pm – 4:05 pm | DISCUSSION |
| 4:06 pm – 4:35 pm | Session VIII: Young Investigator Symposium  
  *Moderator: Mary I. O’Connor, MD (New Haven, CT)* |
| 4:07 pm – 4:12 pm | Paper 1  
  “Closed Incision Negative Pressure Therapy Versus Antimicrobial Dressings Following Revision Hip and Knee Surgery: A Comparative Study”  
  *H. John Cooper, MD (New York, NY)* |
| 4:13 pm – 4:18 pm | Paper 2  
  “Discharge Destination after Total Knee Arthroplasty: An Analysis of Post-Discharge Outcomes and Risk Factors”  
  *Calin S. Moucha, MD (New York, NY)* |
| 4:19 pm – 4:24 pm | Paper 3  
  “Thrombogenic Risk of Unicompartmental Knee versus Total Knee Replacement”  
  *Edwin Philip Su, MD (New York, NY)* |
| 4:25 pm – 4:35 pm | DISCUSSION |
| 4:36 pm – 5:00 pm | Session IX: Transitioning to Outpatient TKA  
  *Moderator: Michael E. Berend, MD (Indianapolis, IN)* |
| 4:36 pm – 4:43 pm | Building an Outpatient TKA Program  
  *Keith R. Berend, MD (New Albany, OH)* |
| 4:44 pm – 4:51 pm | Outpatient TKA is a Triumph of Knowledge over Reason  
  *Bryan D. Springer, MD (Charlotte, NC)* |
<p>| 4:51 pm – 5:00 pm | DISCUSSION |
| 5:00 pm | ADJOURN |</p>
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<th>Time</th>
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<th>Speaker Details</th>
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<tr>
<td>3:33 pm</td>
<td>Extended Trochanteric Osteomy Tips and Tricks</td>
<td>Craig J. Della Valle, MD (Chicago, IL)</td>
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<tr>
<td>3:39 pm</td>
<td>Fluted Tapered Stems in Revision THA</td>
<td>Scott M. Sporer, MD (Winfield, IL)</td>
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<tr>
<td>3:45 pm</td>
<td>Custom Triflange Cup: Planning and Execution</td>
<td>Douglas A. Dennis, MD (Denver, CO)</td>
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<tr>
<td>3:51 pm</td>
<td>The Cup-Cage Construct</td>
<td>Allen E. Gross, MD, FRCS (Toronto, ON, Canada)</td>
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<td>3:57 pm</td>
<td>High-Dose Antibiotic Containing Spacers for Infected THA</td>
<td>Kevin L. Garvin, MD (Omaha, NE)</td>
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<tr>
<td>4:02 pm</td>
<td>DISCUSSION</td>
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<td>4:16 pm</td>
<td>Session XIa: Young Investigator Presentation</td>
<td>Timothy M. Wright, PhD (New York, NY)</td>
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<td>4:16 pm</td>
<td>Removal of an Infected Hip Arthroplasty is High-Risk Surgery: Putting Morbidity into Context with other Major Non-Orthopaedic Operations</td>
<td>James A. Browne, MD (Charlottesville, VA)</td>
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<td>4:21 pm</td>
<td>DISCUSSION</td>
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<td>4:24 pm</td>
<td>Session Xlb: The Hip Society Rothman-Ranawat Traveling Fellowship</td>
<td>Moderator: Chitranjan S. Ranawat, MD (New York, NY)</td>
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<td>4:24 pm</td>
<td>Highlights of the 2015 Experience</td>
<td>Brian M. Curtin, MD (Charlotte, NC) and Eoin C. Sheehan, MD (Tullamore, Ireland)</td>
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<td>4:30 pm</td>
<td>Introduction of the 2016 Hip Society Rothman-Ranawat Traveling Fellows</td>
<td>Chitranjan S. Ranawat, MD (New York, NY)</td>
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<td>4:33 pm</td>
<td>Session XII: Impingement and Dysplasia</td>
<td>Moderator: Michael B. Millis, MD (Boston, MA)</td>
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<tr>
<td>4:33 pm</td>
<td>Complications after Hip Arthroscopy: A Prospective Multicenter Trial</td>
<td>Christopher M. Larson, MD (Edina, MN)</td>
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<tr>
<td>4:39 pm</td>
<td>Risks for Conversion to THA after Primary Hip Arthroscopy in a Healthcare System</td>
<td>Christopher L. Peters, MD (Salt Lake City, UT)</td>
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</table>
4:45 pm – 4:50 pm  97  Average 10-Year Clinical Outcomes of the Bernese PAO for the Treatment of Classic Acetabular Dysplasia
  John C. Clohisy, MD (St. Louis, MO)

4:51 pm – 4:56 pm  99  Predictors of Success for Joint Preserving Surgery of the Hip
  Paul E. Beaulé, MD, FRCSC (Ottawa, ON, Canada)

4:57 pm – 5:10 pm  DISCUSSION

5:10 pm  ADJOURN
I switched from a less invasive direct lateral approach (LIDL) for primary total hip arthroplasty (THA) to a direct anterior supine intermuscular approach (ASI) for the following reasons: 1) the impression of our hospital-based physical therapist that patients done via the anterior approach have better immediate function; 2) speed of recovery; 3) practice harmony, that is, to offer a service consistent with my partners; 4) to comply with patient requests; and 5) for the challenge after 28 years in practice of mastering a new technique that may benefit my patients. We perform the direct anterior approach using a standard radiolucent operative table with extender at the foot, and the assistance of fluoroscopy. The patient is positioned supine with the pubic symphysis aligned at the table break. For femoral preparation and stem insertion, the table is “jack-knifed” by lowering the foot of the table to approximately 45° and placing the bed into approximately 15° of Trendelenburg. A table-mounted femur elevator with traction hook is attached to the bed and used to lift the proximal femur out of the wound.

In a 2009 review from our center [1] comparing 258 THA in patients done via ASI with 372 THA in patients via LIDL, the two groups were similar demographically in terms of age, gender distribution, height, weight, and underlying diagnosis, but BMI was somewhat higher in LIDL patients (30 vs 29 kg/m²; p=0.004). Mean estimated blood loss was higher in ASI patients (138 mL LIDL vs. 155 ASI, p<0.001). However, mean operative times and need for transfusion were similar. More ASI patients were discharged directly to home after surgery, and their Harris hip scores were significantly higher at 6 weeks postoperative (80 vs. 75, p<0.001). Frequency of perioperative complications and reoperations was similar.

In a recent review of all patients undergoing primary THA at our center by three surgeons between 2007 and 2014, 3540 were done via ASI and 2162 were done LIDL (Berend KR et al., Hip Society Members’ Meeting, 2015). The frequency of reoperation related to wound issues or infection was lower in ASI patients (0.9% [32 of 3540] ASI vs. 1.7% [36 of 2162] LIDL, p=0.01), and the frequency of deep infection requiring 1- or 2-staged exchange was substantially lower (0.2% [7 of 3540] ASI vs. 1.0% [21 of 2162] LIDL, p=<0.001).

In an unpublished review of the presenter’s THA experience at an ambulatory surgery center between June 2013 and December 2014, there were 103 patients done via ASI versus 61 patients via LIDL. There was a bias by this surgeon to use the LIDL approach in heavier patients with lower preoperative activity scores. Operative times were longer using the ASI approach (77 vs. 66 minutes) and estimated blood loss was higher (211 vs 144 mL). Need for overnight stay for medical reasons was similar (2 ASI patients (2%) vs. 1 LIDL patient (2%). There were no differences between groups in Harris hip or UCLA scores at early follow-up of 6 months.
In a blinded independent radiographic review of all patients undergoing primary THA done by the presenter in 2014 (Lombardi et al., Hip Society Members’ Meeting, 2015), with 154 done ASI and 138 LIDL, there were no differences in mean abduction or anteversion angles, or frequency of outliers between approach groups. However, medialization of the acetabular component was improved when using the ASI approach.

**Suggested Reading**

Introduction
The direct anterior approach (DAA) for total hip arthroplasty (THA) continues to be marketed heavily with claims of superiority over other approaches. Femoral exposure can be technically challenging and potentially lead to early failure. The purpose of this study was to examine whether surgical approach is associated with early femoral component failure and revision THA.

Methods
A retrospective review of 478 consecutive early revision THAs at three academic centers from 2010 through 2014 was performed. Exclusion criteria resulted in a final analysis sample of 341 early failure THAs. Primary surgical approach was documented for each revision THA, along with the time to revision, and etiology of failure.

Results
44.1% of early failures were originally via the DAA, compared to 32.0% via the direct lateral and 23.6% via the posterior approach (p < 0.001). Early femoral component failure was more common with the DAA (49.6%) than the direct lateral (36.6%, p = 0.044) and posterior (13.8%, p = 0.001) approaches. After multivariate regression, the DAA remained a significant predictor of early femoral failure (p = 0.001). The DAA was significantly less likely to be associated with instability compared to the posterior approach (37.5% vs. 47.5%, p = 0.034), but was more likely to be associated with instability than the direct lateral approach (37.5% vs. 15%, p = 0.043).

Conclusion
Despite claims of early recovery and improved outcomes with the direct anterior approach, our findings indicate the DAA likely confers greater risk for early femoral failure and, along with the posterior approach, a greater risk of early instability compared to the direct lateral approach following THA.

Significance
This study provides evidence concerning the risks of the DAA that should be considered when contemplating adoption in practice or marketing this surgical approach and should be discussed with patients. Further study in the longer term is required to determine if improvements in instrumentation, training and implementation are able to mitigate the risks reported in this study.
Surgical Tips and Pearls to Maximize Success of Anterior Approach THA Done with an Orthopedic Table

Joel M. Matta, MD

For learning any new technique the main principle to follow is: learn the technique thoroughly from start to finish and adopt it as taught, without attempting to modify it until you are very familiar with it. Orthopedic table enhanced anterior approach THA (ATHA) is at this point a well established teachable and repeatable technique though its safety and efficacy depends on adherence to details. These technical details have evolved to become part of the technique since I first taught it at a course in 2003. The technical details and innovations have utilized the invaluable input from high volume expert surgeons as well as from less experienced surgeons taking on the challenges of learning.

Considering Anterior Approach (AA), 3 technical aspects can be a “mental block” for the uninitiated surgeon: 1) supine position, 2) the orthopedic table, 3) checking cup position, leg length and offset with the image intensifier/C-arm. Keep in mind that though you may have been initially trained and experienced with lateral position, a flat table and no x-ray checks, these three technical aspects greatly facilitate Anterior Approach and enhance its repeatability, safety, accuracy and overall “ease of use”.

Make the incision over the tensor and parallel to its fibers posterior and lateral to the normal Smith-Petersen interval to avoid problems with the lateral femoral cutaneous nerve. I believe there are more problems both superficial and deep by going too medial rather than too lateral. If you are too lateral and posterior with your approach at worst you enter the Watson-Jones or Harding interval and you can correct more anterior or proceed with the alternate approach.

Getting comfortable with femoral exposure is the key to confidence and success with anterior approach. I get most of my femoral exposure and mobility in the first 10 minutes of the procedure before the neck cut which minimizes the need for later soft tissue releases. The keys to femoral exposure are: the orthopedic table and its attached femoral hook, proper capsulotomy with exposure from the acetabular rim to the saddle of the neck, dislocation of the hip with full exposure of intertrochanteric line, medial neck and proximal lesser trochanter, and later release of lateral capsule from medial greater trochanter (GT) with possible release of obturator internus tendon (about 25-30% of cases). Do not release the obturator externus tendon which is the primary “anti-dislocator”. The capsule is mobilized from the femur except for a portion posterior while the capsule remains fully attached to the acetabular rim and preserved for approximation at closure.

Acetabular exposure should be without problems after femoral dislocation and the associated capsular mobilization. Ream somewhat anterior to posterior to avoid excessive anterior wall reaming. The reamer is directed also somewhat proximal but not aimed as much proximal as the cup inserter. Consistent reaming in the direction of later cup insertion can result in a cup that is too proximal.

Check with the c-arm to make sure the pelvis is level and has tilt similar to pre-op and insert the cup with real time guidance from the c-arm. The ellipse projected by the acetabular rim is your guide to inclination and anteversion. I utilize “software guided imaging” and match the cup rim ellipse to the ellipse drawn by the software.
For femoral instrumentation the table spar externally rotates, extends, and adducts the extremity and the hook-lift device attached to the table holds the proximal femur in a more anterior and stable position for access. Detach the capsule from the medial GT for exposure. If this is not sufficient for access, expose the medial cortex of the GT by releasing the obturator internus tendon. Be patient and methodical with femoral exposure. Trying to force femoral instrumentation at this point by too forceful lifting with the hook or insertion of the broach in a wrong direction can lead to problems including fracture or perforation of the proximal femur. Your visualization should be good at this point but if there is any doubt, check the broach position with c-arm.

Prior to a trial reduction your guides for leg length and offset are the pre-op templating, the normal sound and feel of broach stability and the relationship of the top of the broach to the GT as indicated by the templating. The neck cut is an approximation and typically will be a little long necessitating counter sinking the broach and later planning the calcar when final length and offset is determined. After these steps the trial femoral components are reduced and the c-arm is used to compare length and offset to the opposite hip. I advocate an “overlay” technique in which permanent prints from the c-arm are overlaid to assess symmetrical length and offset. Currently, I utilize “software guided imaging” which graphically superimposes the 2 hip images. Do not add length or offset beyond what is normal for that patient for the purpose of tensioning soft tissues or the patient will be unhappy with the too long extremity. Your accurately positioned cup, restoration of normal length and offset and soft tissue preservation will ensure hip stability.

Blood loss can be a problem while learning AA. Pay attention to hemostasis of the lateral femoral circumflex vessels, capsular bleeders at the point of attachment of the capsule and femur and the retinacular branches of the medial femoral circumflex. Bleeding from the retinacular vessels which lie along the posterior neck can pose the greatest challenge for hemostasis for the new anterior approach surgeon. I use a bipolar radiofrequency cautery to aid in hemostasis.

Anterior approach technical instruction is available at a number of industry, AAOS, and ICJR sponsored venues. Visiting a surgeon who is expert in AA can also provide an effective supplemental educational experience.
Preoperative planning of the surgical procedure helps with decision making during the procedure. Template component size and position for all patients and with experience, preoperative templating becomes very accurate. If the surgical sizing is not close to the template, you need to evaluate for possible intraoperative problems, such as a varus stem or femoral fracture.

Exposure is paramount. While the DAA can be minimally invasive, any shortcuts taken on exposure will increase the risk of trauma and complications. Make the incision in the proper place, but extend the incision as necessary to provide good exposure with minimal trauma. There are several ways to increase the exposure.

1. Make the incision in the proper place – the flexion crease of the hip is the proximal starting point.
2. Assess the soft tissue (muscle) tension during the exposure to determine the length of the incision.
3. Make capsular incisions to increase separation of the femur from the acetabulum to get good exposure of each.
4. Resect anterior capsule to make your exposure easier and less traumatic.
5. Incise the TFL fascia proximally, if necessary, all the way to the ASIS.

Specific instrumentation helps. All exposures to the hip are facilitated by specific instrumentation designed for the approach. Used properly, specifically designed instrumentation will make the operation easier and less traumatic.

Double osteotomy of the femoral neck eliminates the trauma associated with dislocation of the hip. Further it allows proper assessment of the final and true neck cut planned preoperatively.

Spend time on acetabular exposure and preparation. Insist upon full exposure and use anatomic landmarks defined in the OR to confirm component position and orientation. Intraoperative Xray can be used as an adjunct only. It is important to remove all osteophytes to define the true anatomy of the acetabulum prior to reaming. Removal of osteophytes also will reduce the change of impingement and instability.

Femoral exposure requires specific but minimal releases of capsular structures, but not muscles. The most important release is of the superior capsule – incision of which allows elevation of the
femur without hyperextension of the leg. Release of this area of capsule prior to femoral elevation will eliminate the possibility of trochanteric fracture. What is not often appreciated is that proper acetabular exposure (especially osteophyte removal) also assists in increasing femoral exposure.

**Femoral preparation** requires centralization of the broach. This can be accomplished in a variety of ways (box osteotome, rongeur, back broaching) but the residual superior femoral neck needs to be removed to ensure proper broach and final prosthesis position. The final prosthesis should be inserted by hand into the bed prepared by the broach, and then impacted into its final position.

**Stability, ROM and leg length** should be assessed on every case. Small changes in offset and leg length can substantially improve stability. ROM checks can identify residual osteophytes creating impingement and instability.

**Easy cases** – thin, flexible, long valgus neck, good offset

**Hard cases** – thick, stiff, muscular, short varus neck, low offset
The Accumulated Evidence Supports
Posterior THA as Gold Standard in THA

Bryan D. Springer, MD

There are many factors associated with the success of total hip arthroplasty. These include: appropriate fixation of the implants, recreation of the biomechanics of the hip (leg length and offset), a durable bearing surface, and a surgical approach that facilitates these goals. Much attention has been drawn recently to the direct anterior approach (DA) as a differentiating factor in total hip arthroplasty, with less blood loss, little risk of dislocation and faster recovery. Much of this attention however has been based on marketing claims as well as industry and surgeon promotion with little if any evidence to support superiority of one approach over another\(^1\). Emerging data would suggest that while these surgical approaches can be done safely in expert hands, they are associated with long and steep learning curve, higher early failures rates and unique sets of complications\(^2\)–\(^4\).

The posterior approach to total hip arthroplasty has several advantages. (1) it preserves the hip deltoid (2) is extensile in nature (3) suits all comers with no contraindications and is familiar to most surgeons. Historically, the biggest limitation of the posterior approach was its association with higher dislocation rates. While numerous studies do demonstrate higher dislocation rates, modern THA with the use of larger diameter femoral heads and posterior capsular repair consistently demonstrate dislocation rates less than 1\%\(^5\). It is a common fallacy that the direct anterior approach THA has lower or no dislocations. In fact, the early studies showed equivalent or higher dislocation rates with the DA approach and more recent evidence suggest no difference in dislocation rates between DA and posterior approaches.

A significant amount of attention has been placed on the benefits of the DA approach on early post operative recovery. There remains a paucity of good clinical evidence demonstrating those suppositions particularly in light of modern multimodal pain management and early rehabilitation protocols\(^6\),\(^7\). Two prospective randomized studies demonstrate minimal early benefit with regards to walking aids following surgery\(^8\),\(^9\). Any short term benefits much be weighted however against numerous studies showing higher early and short term complications with regards to fractures, loosening and nerve injury\(^2\),\(^10\)–\(^14\).

Any surgical approach done well can yield excellent results. The enthusiasm for the DA surgical approach should be tempered by the scientific data rather than marketing and promotion. The posterior approach offers a time tested and familiar surgical approach that yields excellent long-term clinical results.
References

Abductor Deficiency and THA: Diagnosis and Management
Richard W. McCalden, MD, FRCSC
London, Ontario, Canada

Deficiency of the abductor mechanism, while relatively uncommon, can result in gait dysfunction and pain following total hip replacement (THR). There are multiple causes for abductor deficiency following THR including: pre-operative abductor dysfunction, damage to the superior gluteal nerve intra-operatively, mechanical failure of the abductor muscle repair, or detachment of the abductor muscles and/or loss of the greater trochanter in the setting of the multiply revised THR. The diagnosis is based on careful history and clinical examination, assessment of the radiographs and can be combined with advanced imaging (MARS MRI) and/or EMG studies. The management of this condition is problematic and remains a challenge for the treating surgeon. In the setting of a superior gluteal nerve palsy, careful clinical follow-up is acceptable as the majority of cases resolve spontaneously by 24 months following THR. In the setting of mechanical abductor deficiency, a number of surgical strategies have been reported including: direct trans-osseous repair, numerous local tendon transfers and the use of allograft reconstruction techniques to replace the abductor mechanism. The evidence for these surgical treatments remains limited (level IV & V) and demonstrates generally variable results. As such, abductor deficiency following THR remains an unsolved problem.

References


Introduction
Anterior psoas impingement as a cause of groin pain after THA was first reported in the US literature in 1995 (1). Trousdale, Cabanela, and Berry suggested the development of this problem was related to increasing use of rough uncemented acetabular components, combined with decreased anteversion of the component. Other studies have suggested some psoas irritation is caused by physical displacement as found in large head THA and resurfacing. Lachiewicz and Kauk suggested this problem was under recognized and treated (2). The incidence is unknown, but one study reported an incidence of 4% in their series of 280 primary THA (3).

Diagnosis
Psoas impingement/tendinitis should be in the differential diagnosis of groin pain which persists beyond 6 months after THA. The character of the pain is dull and aching at rest, increased significantly with flexion activities, and rarely associated with a click or pop. Physical exam can rule out other sources of groin pain, such as hernia, but inspection and palpation may help localize the pain to the anteromedial groin. The finding of groin pain with resisted hip flexion, particularly at 90 degrees of flexion, is suggestive of iliopsoas tendinitis. Those patients suspected of iliopsoas impingement should have plain radiographs, particularly a cross table lateral, to assess for prominence of the anterior rim of the socket beyond the anterior rim of the bony acetabulum. Cross sectional imaging can confirm acetabular component positioning (more experience with CT), as well as swelling and displacement of the psoas tendon (CT or perhaps MARS MRI). In the hands of a skilled musculoskeletal ultrasonographer, ultrasound can show changes in the tendon, particularly when compared to the contralateral tendon. In cases where the diagnosis is not made by this imaging, injection of the tendon sheath (with contrast confirmation) with local anesthetic that produces relief of symptoms is confirmatory.

Treatment
For confirmed cases of psoas tendinitis, there has been no level 1 trial of nonoperative vs operative treatment. Review of the literature suggests more failures in the nonoperative groups, but these were small uncontrolled series. Expert opinion suggests that all patients with confirmed IP tendinitis have a trial of injection of corticosteroid injection (3). Reports of surgical release of the IP tendon (most at the tendon insertion at the lesser trochanter) have largely been effective in relieving pain, although few studies have evaluated post release function. Open release has been described via numerous surgical approaches including posterior, anterolateral, and medial. Arthroscopic release of the tendon both at the joint and distally has been described in patients without THA (5).
References

THA for the Patient with BMI over 40: Risk and Reward
David G. Lewallen, MD

Obesity and the diseases linked to it such as diabetes have been associated with higher complication rates and increased medical costs following Total Hip Arthroplasty (THA). Due to the rising prevalence of obesity and the adverse impact it has on the development of osteoarthritis, there has been a worldwide surge in the number of obese patients presenting for THA procedures, including those morbidly obese (BMI > 40) and those who are super-obese (BMI > 50).

The Reward
When THA is successful (as is true for the majority of morbidly obese patients operated) the operation is just as dramatically effective as it is for other patients. Excellent pain relief and dramatically improved function is the result, even though obese patients generally achieve a lower overall level of function than non-obese patients. Morbidly obese patients with a successful THA and without early complications are some of the most grateful of patients. This is especially true if they have been denied surgery for prolonged periods due to their weight and have had to bear severe joint changes and symptoms during a long period of time leading up to arthroplasty.

The Risks
There is a nonlinear increase in complications, reoperations, and especially infection with increasing BMI that begins between a BMI of 25 to 30, and rises thereafter with a relative inflection point in some incidence curves for complications at around a BMI of 40. This has caused some surgeons to suggest a BMI of 40 as an upper limit for elective hip arthroplasty. Risks continue to rise after a BMI of 40 and when the BMI is over 50, in our series 52% of patients had at least one complication. Of these 24% had at least one major complication and 33% at least one minor complication with some suffering more than one complication overall. These data make it reasonable to ask whether the outcomes in some morbidly obese patients might be improved by weight loss, bariatric surgical intervention and other measures aimed at optimizing the multiple companion comorbidities and medical conditions (such as diabetes) that often accompany excess weight. Unfortunately there has been limited information to date on the best means for optimizing of these patients, and as important the effectiveness of these interventions, so that the timing and performance of the eventual arthroplasty procedures might have the highest possible success rate.
The Costs
The adverse impact of obesity on medical resource utilization and costs associated with THA has been well documented. Due to longer initial length of stay, greater resource utilization, higher early complication rates and any readmissions and reoperations the costs for even a single individual patient can climb dramatically. In a review of data on primary THA patients from our institution, even after adjusting for age, sex, type of surgery, and other comorbidities, for every 5 unit increase in BMI beyond 30 kg/m² there was an associated $500 higher cost of hospitalization and an increase of $900 in 90-day total costs (p=0.0001).

The Future
The numbers of morbidly obese patients with severe osteoarthritis presenting for possible THA will only continue to increase in the years ahead. Comprehensive multidisciplinary programs are urgently needed to better manage obese patients with weight reduction options, optimization of medical comorbidities, and treatment of any associated issues, such as protein malnutrition. When end-stage joint changes and symptoms occur we must have such help to maximize the benefit and reduce the complications of hip arthroplasty in this high risk patient population.
Failure of Revision for Dislocation has been reported in 15-40 percent of cases. Use of constrained liners and dual mobility components have definitely helped in reducing the incidence of recurrence following revision for dislocation. However 10 to 30 percent of constrained liner and as yet unknown percentage of dual mobility liner constructs fail.

When the surgeon is faced with this scenario what is important in the evaluation of the situation and what are the options for treatment?

As constrained liners have been available for a longer period of time in this country we have more experience of treating failures of these devices. The surgeon must try to determine why the component failed. One of the most common scenarios is that the liner was placed in a hip with malpositioned components. Focus is placed on the evaluation of acetabular component positioning but femoral component malposition can also contribute to failure. It can be helpful to evaluate the pre revision radiographs taken prior to placing the constrained liner. Next the overall laxity of the joint needs to be assessed as well as any contributing boney impingement. In addition today we are gaining a better understanding of the contribution of a stiff spine and hyper mobile spine in dislocation of hip components and this must be evaluated. Finally presence or absence of functional hip abduction needs to be assessed. Treatment depending upon which of these variables are present can include returning to a large head construct, changing to a dual mobility liner or a less constraining constrained liner or revising one or both of the original hip components to optimize positioning. In a case with stiff or hypermobile spines this may require non traditional placement of the components. Finally abductor reconstruction may be warranted.

In the case of a failed dual mobility component it can fail by intraprosthetic dislocation or dislocation of the liner from the shell. Especially with modular shells some of these can easily be converted to constrained liner constructs. Otherwise the surgeon must evaluate contributions to the failure including component malposition, boney or soft tissue impingement and abductor insufficiency.

References
Pelvic Discontinuity: Newest Knowledge and Technical Tips in Management
Wayne G. Paprosky, MD and Neil P. Sheth, MD

Acetabular bone loss is a challenging problem often encountered in the setting of revision total hip arthroplasty (THA). When a chronic pelvic discontinuity is seen concomitantly with severe bone loss, achieving adequate fixation and getting the discontinuity to heal further complicates the operation. The reconstruction of the acetabulum is centered on the presence of anterosuperior and posteroinferior column support to attain component fixation and construct stability.

The Paprosky classification is most commonly used to determine the location and degree of acetabular bone loss. The classification utilizes four radiographic elements for pre-operative evaluation: (1) superior migration in reference to the superior obturator line, (2) degree of ischial osteolysis, (3) degree of teardrop osteolysis, and (4) integrity of Kohler’s line. Typically, a type IIIB acetabular defect, an “UP and OUT” pattern, has unsupportive columns and can be associated with a chronic pelvic discontinuity.

There are several options which currently exist to address acetabular bone loss with an associated chronic pelvic discontinuity. Reconstruction options typically include one of the following: posterior column plating, cage/ring construct, acetabular allograft, cup-cage construct, jumbo cup +/- porous metal augments, and custom triflange acetabular component. We advocate the use of the acetabular distraction technique with a jumbo cup and modular porous metal acetabular augments for the treatment of severe acetabular bone loss and associated chronic pelvic discontinuity.

There are several key points to consider when using the distraction technique. Following adequate acetabular exposure, the acetabulum should be assessed for the presence of a discontinuity using a Cobb elevator. Once presence of a discontinuity is confirmed, the superficial portion of the discontinuity is debrided, being careful not to debride too aggressively and create further instability of the discontinuity. When augments are utilized, their function needs to be determined; augments either provide primary construct stability (implanted prior to the cup for column reconstruction) or supplemental fixation (implanted after cup insertion). A 2.4 mm wire is inserted into each of the columns and an acetabular distractor is placed over the K-wires. The acetabulum is reamed on reverse with the acetabulum distracted. Once the columns are engaged by the reamer, it will typically dislodge from the reamer handle. This identifies the cup size; we propose the use of the Trabecular Metal™ revision shell. During cup insertion, it is important to cement the augments to the cup and unitize the entire construct. The K-wires are removed following cup implantation, and a liner is cemented in the proper orientation. Early results have demonstrated 95% success looking at ew-revision as an end-point (Sporer et al. CORR 2012).
What to Do When the Two-Stage THA for Infection Fails
Keith A. Fehring, MD; Matthew P. Abdel, MD; Tad M. Mabry, MD; Arlen D. Hanssen, MD
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Introduction
Failed 2-stage reimplantation with subsequent infection is a devastating outcome and attempts at further 2-stage reimplantation procedures are fraught with difficulties without clear guidelines for treatment or prognosis. A staging system to stratify patients according to infection type, host status, and local soft tissue status may prove useful when developing treatment algorithms for these difficult patients. The purpose of this study was to report the results of a subsequent 2-stage reimplantation following a failed 2-stage protocol for periprosthetic hip infection, as well as identify risk factors for failure, and complications associated with these procedures.

Patients and Methods
We retrospectively identified 20 patients who underwent a second 2-stage exchange arthroplasty for recurrent infection from 2000 - 2013. Minimum follow-up was 2 years (mean 3.5 years). All patients were treated with high dose antibiotic spacers, received 6 weeks of intravenous antibiotics, and the mean time to reimplantation was 19 weeks (range: 8-74 weeks). Fourteen patients (70%) placed on lifelong antibiotic suppression.

Results
The overall rate of infection was 40% but when classified by the staging system the Type C patients had a recurrence rate of 66%. There was no difference in the reinfection rate in patients placed on antibiotic suppression when compared with those who were not on antibiotic suppression. At failure with recurrent infection, a new micro-organism was identified in 43% of the patients. The overall reoperation rate for any reason was 80%. Excluding infection, the most common reasons for reoperation were hip instability (33%), acetabular loosening (17%) and femoral loosening (17%). All patients required gait aids for ambulation at last follow-up.

Discussion
This data suggests that expectations following a second two-stage exchange arthroplasty for periprosthetic hip infection should be tempered and that a staging system may be useful to determine whether or not to proceed with another attempt at two-stage reimplantation. In the absence of recurrent infection, the rate of reoperation for hip instability and implant loosening are considerable.

References
The entirety of the patient experience after contemporary total knee and total hip replacements in 2016 is markedly different from that encountered by patients just a decade ago. Ten years ago most patients were treated in a traditional *sick-patient model* of care and because they were assumed to require substantial hospital intervention, many cumbersome & costly interventions (e.g. indwelling urinary catheters, patient-controlled-analgesic pumps, autologous blood transfusion, continuous passive motion machines) were a routine part of the early postoperative experience. Today the paradigm has shifted to a *well-patient model* with a working assumption that once a patient has been medically optimized for surgery then the intervention itself, hip or knee replacement, will not typically create a sick-patient. Instead it is expected that most patients can be treated safely & more effectively with less intensive hospital intervention. While as orthopedic surgeons we are enamored with the latest surgical techniques or interesting technologies most busy surgeons recognize that advances in perioperative pain management, blood management, and early-mobilization therapy protocols account for the greatest share of improvements in patient experience over the past decade.

One can think pragmatically to *get ahead and stay ahead* of 3 predictable physiologic disturbances that adversely impact rapid recovery after knee and hip replacement: fluid/blood loss; pain; and nausea. The modern orthopedic surgeon and his/her care team needs a simple strategy to proactively, not reflexively, manage each of those 3 predictable impediments to early recovery. Those surgical teams that routinely get ahead and stay ahead in each of those areas will routinely witness faster recovery, lower costs and greater patient satisfaction and that is clearly a win for patient and surgeon alike.

Effective pain management improves patient satisfaction, decreases hospital stay, and facilitates discharge to home. Today’s emphasis is on a multi-modal strategy that minimizes the use of opioids. Most protocols use preop medications including an NSAID, acetaminophen, an oral opioid and some include gabapentin. Regional anesthesia is typically preferred over general. Both peripheral nerve blocks and periartricular local anesthetic cocktail injections have proved as effective adjuncts in decreasing early postoperative pain. Postoperative oral medications delivered on a schedule, not just as needed, often include acetaminophen, an NSAID and some included gabapentin. Oral and parenteral opioids are reserved for breakthrough pain.

Role of Staphylococcal Screening and Treatment Prior to THA
Scott M. Sporer, MD

Background
- 1-2% primary TJA patients will develop a Surgical site infection (1)
- Staphylococcus species the most common infecting organism
- 15-20% of Patients colonized by Methicillin-Susceptible Staphylococcus (2)
- 5% of Patients colonized by Methicillin-resistant Staphylococcus aureus (MRSA) prior to surgery
- Physicians: 1.5% MRSA, 36% MSSA (3)
- $1.62 Billion expected cost in 2020 (1)

Techniques
- Nasal Decolonization with intranasal mupirocin
- Chlorhexidine showers/cloth
- Addition of Vancomycin preoperatively
- Isolation

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Results

- 50-70% Reduction in rates of Surgical site infection(2, 4)
- Patients may remain (+) after decolonization(5, 6)
- Cost Effective(7)

References

The selection of a prophylaxis agent is a balance between efficacy and safety. Total hip arthroplasty patients receive DVT prophylaxis because orthopaedic surgeons are concerned about the morbidity and mortality associated with pulmonary embolism. However, at the same time there is great concern about excessive bleeding. The goal is to provide the appropriate anticoagulation to prevent symptomatic pulmonary embolism and DVT but at the same time avoid over anticoagulation which can be associated with bleeding and other wound problems. Therefore, risk stratification is necessary.

Although risk stratification is the ideal way to determine the appropriate prophylaxis agent to use for a specific patient, there is no validated risk stratification strategy available today. There is general agreement at this time that patients who have had a prior PE or symptomatic DVT are at higher risk for development of a pulmonary embolism. In addition, there is a general belief that patients who have coagulation abnormalities (i.e. Factor V Leiden, Protein C and S deficiency) have an increased risk of developing a pulmonary embolism. Other factors that have been mentioned as associated with PE after total hip arthroplasty include age, female gender, and higher body mass index. The selection of a prophylaxis regimen should be influenced by the ability to mobilize the patient after surgery.

References

Outpatient Joint Replacement
Michael E. Berend, MD

Refinement of surgical techniques, anesthesia protocols, and patient selection has facilitated a recent transformation to same day discharge for arthroplasty care. The trend for early discharge has already happened for procedures formerly regarded as “inpatient” procedures such as upper extremity surgery, arthroscopy, ACL reconstruction, foot and ankle procedures, and rotator cuff repair. Our program began focused on Partial Knee Arthroplasty (PKA) and has now expanded to primary TKA and THA, and select revision cases.

Over the past two-year period we have performed 1,230 Joint Arthroplasty procedures (THA, TKA, PKA) with no readmissions for pain control. Overall readmission rate was 2% with approximately half of the readmission being for outpatient manipulation under anesthesia following TKA. Patient selection is based on medical screening criteria and insurance access. The program centers on the patient, their family, home recovery, preoperative education, efficient surgery, and represents a shift in the paradigm of arthroplasty care. It can be highly beneficial to patients, surgeons, anesthesia, facility costs, and payors as arthroplasty procedures shift to the outpatient space.

Perhaps the most significant developments in joint replacement surgery in the past decade have been in the area of multimodal pain management. This has reduced length of stay in the inpatient hospital environment opening the opportunity for cost savings and even outpatient joint replacement surgery for appropriately selected patients. The hallmark of this program is meticulous protocol execution. Preemptive pain control with oral anti-inflammatory agents, gabapentin, regional anesthetic blocks that preserve quad function for TKA (adductor canal block) and local anesthetic spinal and pericapsular long acting local anesthetics with the addition of injectable ketorolac and IV acetaminophen are key adjuncts. Over the past two years utilizing this type of program over 60% of our joint arthroplasty patients are now returning home the day of surgery.

Concerns over readmission are appropriate. The rates of complications and readmissions are less than our inpatient cohort in appropriately selected cases with a standardized care map. We believe this brings the best VALUE to the patients, surgeons, and the arthroplasty system.

References

Dual modular necks were introduced as a solution to the restrictions imposed by early monoblock total hip arthroplasty (THA) implants. This allowed for intraoperative adjustment of femoral heads and necks, better restoration of leg length, and increased control of hip offset. Because they enable a more customized fit to the patient, modular hip implants have gained popularity among surgeons. However, despite these advantages, modularity has recently been highlighted as a potential source of THA failure. Over time, modular components may exhibit signs of wear, corrosion, and mechanical insufficiency. This talk will highlight the major issues associated with dual modular necks in THA. We will detail methods for diagnosis and treatment, updates on outcomes, and our algorithm for the management of these patients.

Adverse local tissue reactions (ALTR) related to tribocorrosion 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. Our group has identified 27 patients who were revised for an ALTR secondary to corrosion at the modular femoral head-neck taper with a MOP bearing.\(^1\) Patients presented at a mean of 4.3 years (range, 0.4 to 25 years) after their index procedure and 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 levels with significance set at a p-value of < 0.05.

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 levels (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 two cases where a metal as opposed to a ceramic head was used.

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 levels.

Corrosion of metallic implants due to contact with body fluids is almost unavoidable, especially at interfaces or in gaps. It has always been there but only anecdotally reported from the early days of osteosynthesis and arthroplasty in combination with implant failure rather than biological reactions. Taper corrosion became suddenly clinically relevant with the introduction of large modular metal-on-metal hip joint articulations (MoM). With the use of large and very large metal heads in MoM articulations, which have a larger lever arm and can generate high friction in unfavorable situations, suddenly the taper interface exhibited problems on a previously unknown scale. Due to the higher mechanical loading, the taper connection was more sensitive with respect to assembly conditions, contamination, manufacturing tolerances, material choice and other factors such as taper design. Changes to the taper design (reduction in length and diameter) made in the 1990’s to increase the range of motion with small heads (28 and 32mm) have possibly reduced the mechanical strength of this connection, which did not matter for small heads or low friction situations. Smaller incisions (less exposure of the taper) or increased patient weight or activity might also play a role in the etiology of the problem.

Once the problem was identified, everybody started to look for signs of corrosion at tapers in any kind of endoprosthesis and bearing articulation and such signs were found in nearly every kind of taper connection. Most studies addressing the issue point out the multi factorial nature of the problem. Assembly load, head offset, flexural rigidity and contamination appear to be the principal factors involved in the development of “mechanically induced crevice corrosion”, as Jeremy Gilbert has called it. The presently available findings for THA can be summarized in a few key statements:

- Taper connections have been used in millions of endoprosthesis and their benefits clearly outweigh the associated risks if used sensibly. The call for Monobloc prosthesis is over exaggerated.
- Every taper connection is a potential source of problems and assembly conditions are crucial for a proper functioning.
- Taper corrosion can occur in any bearing articulation and head size if the assembly strength is not sufficient.
- Taper design, material and surface morphology are important but the optimal parameters are not known.
- Taper connections under high bending loads are more endangered (e.g. XL-heads, bi-modular stem designs or modular revision stems).
- The critical amount of corrosion to produce a clinical relevant problem is yet unknown.
- Taper connections between similar Titanium alloys rather fail mechanically (fracture) than due to biological reactions.
- Taper connections involving Cobalt-Chromium-Alloys rather fail due to biological reactions than mechanically.
- Cells play a role in the corrosion process but the clinical relevance of this influence is yet unknown.
- The use of ceramic heads of the last generation reduces the extent of the problem.
- The clinically observed phenomena cannot yet be fully reproduced in the laboratory setting; such good results of pre-clinical testing cannot be directly transferred to the clinical reality.
Session VI: Top 3 New and Impactful Findings from Joint Registries Around the Globe

12:50 pm - 12:55 pm

Top 3 Impacts from the Australian Orthopaedic Association National Joint Replacement Registry
Professor Richard de Steiger, Deputy Director AOANJRR

Introduction
The AOANJRR began data collection on 1st September 1999 and has had full national coverage since 2002. Procedures reported to the Registry are cross validated with independently collected state health department data in a sequential multilevel matching process, which enables almost 100% data collection. The Registry has records of over 1 million hip and knee replacements and revisions.

1 Outlier Prostheses
Joint Replacement Registries play a significant role in monitoring arthroplasty outcomes by publishing data on survivorship of individual prostheses or combinations of prostheses. Although registry data indicate that most prostheses have similar outcomes, some have a higher than anticipated rate of revision when compared to all other prostheses in their class. The AOANJRR has developed a method to report prostheses with a higher than expected rate of revision and these are referred to as “outlier” prostheses. Using this process the Registry has identified 103 prostheses or prostheses combinations that have a higher than expected rate of revision compared to devices in their own class up to Dec 31st 2013. Of these 95% showed reduced usage the following year and 55% had no further recorded use.

The AOANJRR was the first registry to report a higher than expected rate of revision for the ASR resurfacing Hip Arthroplasty in 2007 and the ASR XL Acetabular System in 2008. These prostheses were withdrawn from the Australian market in 2009. The AOANJRR also identified early problems with large head metal on metal conventional total hip arthroplasty reducing the exposure of patients to these devices. The Registry also publishes 10 year outcomes of THA that have more than 350 procedures recorded and in 2014 28 of the 59 femoral and acetabular combinations had a 10 cumulative percent revision < 5%.

2 Surgeon effect on the outcome of Total Hip Arthroplasty
Patient, surgeon and prosthesis factors may affect the outcome of hip and knee replacement and the relative importance of each of these elements is yet to be established. The Registry has undertaken an analysis to determine if the rate of revision for THA is related to the number of procedures a surgeon performs per year or the number of years a surgeon has been in practice. For the volume of surgery analysis four groups were identified, surgeons who performed ≤10 procedures per year, >10 ≤25, >25 ≤70 and >70 per year. For the experience analysis surgeons were grouped into those surgeons who had been operating for < 3 years post fellowship, 3-7 years and ≥ 8 years.
Surgeons averaging >70 procedures per year had a lower rate of revision than surgeons performing less than 70 procedures for all the types of primary THA. However surgeons who do perform a lower number of procedures can still have a low rate of revision when choosing well performing prostheses whereas surgeons undertaking a large number of procedures do not improve the outcome of a prosthesis that has been identified as having a higher than expected rate of revision.

Overall, for all prostheses the most experienced group had a lower rate of revision than the 3-7 year group and for the less experienced group only for the first 3 months. When a prosthesis specific analysis was performed using the two most commonly implanted THA recorded in the registry there was no effect of experience, once again suggesting choice of prosthesis is important.

3 Surgeon Access to AOANJRR

One of the aims of the registry is to provide information to the stakeholders in the form of presentations, publications and the Annual Report. To provide more timely feedback surgeons can access their own data on a secure WebPortal which provides information as soon as data is logged into the registry. Surgeons can compare their own results against the overall national data. Surgeons who have visited the website have a lower rate of revision than surgeons who have never accessed their data.
Three Important Findings from the National Joint Registry of England, Wales, Northern Ireland and the Isle of Man

Martyn Porter, MD

1. There has been a secular decline in 90 day mortality following primary total hip replacement between 2003 and 2011. The 90 day mortality was 0.56% in 2003 which fell to 0.29% in 2011. Factors associated with decreased mortality were: posterior approach, chemical thromboprophylaxis and spinal anaesthesia. Type of prosthesis was unrelated to mortality.

2. Mix and match describes a situation whereby a surgeon mixes a component from one company (for example an acetabular component) with another component from another company (for example a femoral component). Historically this has been done in fairly large numbers where surgeons felt this would be of benefit. This practise goes against current advise. Analysis of this mix and match has revealed that in some instances survivorship is better than non-mix and match and is not significantly worse in other situations. This provides some reassurance in relation to this component selection.

3. Survivorship analysis at the ten year mark reveals that many difference brands with different types of fixation have low revision rates and with comparable results. The traditional debate of cemented versus cementless fixation is becoming less pertinent in that this analysis suggests that it is the total hip construct, ie stem, acetabular component, liner, bearing materials and fixation that are important in combination.
Top Findings from Scandinavian Joint Registries

Henrik Malchau, MD, PhD
Boston, MA

The Nordic countries, including Denmark, Sweden, Finland, and Norway, have all had a long and successful tradition of arthroplasty registries. Results presented by the Nordic registries have suggested differences exist among the countries related to data collection system, data/variables being collected, data definition, and statistical methods used. Reports from the Nordic registries have further shown differences regarding indication for surgery, characteristics of the joint replacement populations, fixation methods used, and implant survival. Due to these differences, the results from the different Nordic registries have not been fully comparable. Furthermore, although the Nordic registries are population-based, the numbers of patients included in specific populations (e.g., patients that undergone joint replacement due to rheumatoid arthritis or patients operated due to osteonecrosis) or the number of patients developing specific adverse events after surgery (e.g., revision due to infection or periprosthetic fracture) are relatively small, limiting the statistical precision of risk estimates and possibility to draw valid conclusions.

The Nordic registries have acknowledged these limitations and the need for collaboration across national borders. Thus, the NARA was established in 2007 with the overall aim to improve the quality of their research and their understanding of the clinical course of patients undergoing joint replacement surgery, and thereby enhance the possibility for quality improvement of treatment with joint replacement surgery.

In order to achieve the overall aim of NARA, several specific aims were set. These are summarized below:

- to create one common Nordic minimal dataset, in order to compare demographics and results regarding total joint replacement surgery among countries, and to study results in patient groups which are too small to be studied in each separate country.
- to hold two yearly NARA meetings including two or more representatives from each register.
- to hold an academic seminar at Nordic Orthopaedic Association meeting every other year.
- to promote joint Nordic research where it will be of common interest and higher the quality.
- to cooperate on methods developing in research and quality work in register studies.
- to coordinate a joint Nordic standpoint towards other international register associations.

Relevant results from the NARA annual report for 2015 will be summarized.
American Joint Replacement Registry (AJRR): High Level Update
Kevin J. Bozic, MD, MBA

Introduction
In Fall 2015, AJRR released their second Annual Report. Since that time, AJRR has enrolled more hospitals and additional hospitals have begun submitting data.

Materials and Methods
Hospitals voluntarily submit data to the registry via secure electronic data file transfer of procedural metrics extracted from the hospital's electronic health record (EHR) system. The second Annual Report included data from 2012-2014 (N=211,721 procedures). The report covered basic metrics derived from the procedural information contained in the registry database. Each procedure imported into the AJRR was subject to additional data verification prior to inclusion. Additionally, data from a statistically powered sample (N=12 hospitals) was audited for accuracy (audit agreement rate = 91.5%).

Results
The second Annual Report included data on N=211,721 procedures from N=236 hospitals (n=82,841 hips and n=128,880 knees), doubling the number of hospitals submitting data compared to the previous report. Procedures were performed by more than 2,200 surgeons. Results pertaining to procedure and diagnosis codes were consistent with other registry findings as was the revision burden (10.0% for hips; 8.1% for knees). Procedural and component data reporting was greatly enhanced compared to the previous Annual Report. Data demonstrate that femoral neck fracture accounts for more than one in 10 hip arthroplasties. Surface replacement arthroplasty has fallen to less than 0.5% of hip procedures. Moreover, there has been an increase in the use of ceramic femoral heads compared to cobalt chromium (38.7% to 49.0% over the three year period). For knee arthroplasties, posterior stabilized components were used in over half (57.8%) of all knee procedures while cruciate retaining designs were used in nearly a third (29.6%). Patellar resurfacing continues to be the predominant practice in the United States in contrast to Scandinavia, with 81.8% of patients receiving a patellar component in 2014. In 2014 AJRR also conducted a pilot program of its Level II platform. Lab values, prophylaxis and data on beta blockers were not con-
sistently submitted if the element was not a discrete value in the EMR or if data was not originally captured in the hospital. Submission of comorbidities was straightforward due to ICD-9 coding. ICD-10 will allow for more granularity with these elements.

Conclusions
AJRR has made great progress throughout 2015 and has enrolled 600 hospitals representing all 50 states. Acquiring more procedures will enhance our ability to generalize data and conduct longitudinal analyses. Finally, AJRR began acceptance of Level III/Patient Reported Outcomes in 2015 and in 2016 will collect Level II data for risk adjustment of surgical complications.

Learning Objectives
1. After this presentation, learners will be able to describe the development of a national arthroplasty registry.
2. Participants will be able to discuss findings from the second AJRR Annual Report.
3. Attendees will have the ability to explain future directions for a national arthroplasty registry.
13-Year Evaluation of Highly Cross-Linked Polyethylene Articulating with Either 28mm or 36mm Femoral Heads Using Radiostereometric Analysis and Computerized Tomography

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Background
The objective of this 13 year prospective evaluation of HXLPE was to (1) assess the long-term wear of HXLPE articulating with 2 femoral head sizes using radiostereometric analysis (RSA), and to (2) determine if osteolysis is a concern with this material through the use of plain radiographs and computerized tomography (CT).

Methods
All patients received a Longevity® HXLPE liner with tantalum beads and either a 28mm or 36mm femoral head. Twelve patients (6 in each head size group) agreed to return for 13 year RSA, plain radiograph, and CT follow-up. The 1 year and 13 year plain radiographs as well as the CT scans were analyzed for the presence of osteolysis.

Results
The 13 year mean ± standard error steady state wear was 0.05 ± 0.02mm with no significant increase over time or between the 2 head size groups. Two patients’ CT scans showed radiolucent regions in the acetabulum of 4.51cm3 and 11.25cm3, respectively. In one patient, this area corresponded to a partially healed degenerative cyst treated with autograft during surgery. The second patient had an acetabular protrusio treated with autograft and the CT scan revealed areas of remodeling of this graft. One patient’s 13 year plain radiographs showed evidence of cup loosening, and linear radiolucencies in zones 2 and 3.

Conclusion
There was no evidence of significant wear over time using RSA. The CT scans did not show evidence of osteolysis due to wear particles. These results suggest that this material has reduced wear compared to conventional polyethylene, irrespective of head size.

Key words: Total hip arthroplasty, highly cross-linked polyethylene, radiostereometric analysis, computerized tomography
Highly Crosslinked Polyethylene Provides Decreased Osteolysis and Reoperation at Minimum 10 Years Followup

Paul F. Lachiewicz, MD
Chapel Hill, NC

Background
Highly cross-linked polyethylene was introduced to decrease periprosthetic osteolysis and reoperation, but this has not been conclusively proven.

Questions/Purposes
We asked the following questions: (1) What is the long-term survival of a modern, cementless titanium acetabular component with screw fixation? (2) What are the differences in the rate of reoperation and incidence of osteolysis between components with standard and highly cross-linked polyethylene at minimum 10 years follow-up time?

Methods
One surgeon performed 513 consecutive primary total hip arthroplasties (450 patients) using one modern, cementless, titanium-mesh acetabular component (Trilogy) with screw fixation. Standard polyethylene was used in 304 hips and highly cross-linked polyethylene (Longevity) in 209 hips. Survivorship analysis to 20 years was performed using the entire cohort. We analyzed the rate of reoperation and radiographic osteolysis in two cohorts of hips, 133 with standard polyethylene and 112 with highly cross-linked polyethylene, with a minimum follow-up time of 10 years.

Results
Of the entire cohort of 513 hips, no acetabular component was removed or revised for aseptic loosening. With a minimum follow-up of 10 years, there were significantly more reoperations in the cohort with standard polyethylene (11 of 133, 8%) than highly crosslinked polyethylene (1 of 112, 1%; p=0.03). Osteolysis was seen in 24% (32 of 133 hips) with standard polyethylene, compared to 13% (15 of 112 hips) with highly cross-linked polyethylene (p=0.02). These differences occurred despite the presence of patients with greater BMI and higher activity in the cohort with highly cross-linked polyethylene.

Conclusions
We continue to use this acetabular component with highly cross-linked polyethylene. Longer follow-up is required to determine the progression of osteolysis.
Ceramic vs. Metal Femoral Heads: What is the Role for Each in 2016?
Thomas P. Schmalzried, MD

Compared to cobalt chromium alloy, ceramic femoral heads wear less against UHMWPE, although the reduction may not be clinically significant when paired with a cross-linked polyethylene. In the Australian national joint replacement registry, of the five bearing combinations with 14 year cumulative percent revision (CPR) data, the lowest is metal femoral heads with cross-linked polyethylene (5.4%). Using ceramic or metal femoral heads with non cross-linked polyethylene results in the highest CPR at 14 years (11.4% and 9.9%, respectively) (1).

The utilization of ceramic heads has increased in recent years. Domestically, more than 50% of femoral heads are now ceramic. This is due, at least in part, to a reduction in patient age at the time of surgery. A stronger influence, however, may be the concern for an adverse local tissue reaction (ALTR) due to taper corrosion with a cobalt chromium femoral head (2). Taper corrosion necessitating revision surgery was recognized decades ago (3-4), and there are concerns that the incidence is increasing. Variables in design, manufacturing, biomechanics, and modular head assembly have all been implicated (5). While the incidence of clinically significant taper corrosion is unknown, ALTR does not appear to occur absent a cobalt chromium interface. Ceramic heads have a small risk of in vivo fracture (6) and cost more. The relative benefit of ceramic heads is greatest in younger, more active patients, if there is a long-term reduction in wear and osteolysis, and the fracture risk remains low.

References


Ceramic-on-Ceramic Bearings in 2016:
A Perspective from Outside the United States
Carsten Perka, MD (Berlin, Germany)

The number of young patients needing a total hip arthroplasty (THA) is increasing continuously. Due to the higher life expectancy of these patients wear-related problems are the most established long term risk factors for aseptic failure. Particularly the higher activity of young patients leads to high demands especially the bearings after total hip arthroplasty. Resulting in a current progress of alumina ceramic-on-ceramic bearings and mixed ceramics these materials are an increasingly attractive bearing solution.

Modern ceramics are extremely hard, scratch-resistant, biocompatible, offer a low coefficient of friction, have superior lubrication and the lowest wear rates in comparison to all other bearings in THA.

Concerns regarding the use of ceramics are the risk of fracture, the occurrence of noises and as a potential long term risk the stress shielding behind the relatively stiff acetabular component. The data of the newest generation of mixed ceramics (delta ceramic) are showing a reduction of the risk of head fractures on 0.03-0.05 %, and a risk of liner fractures at about 0.02 %. These fracture rates are lower than the risk of stem fracture in almost all registries. The causes for noises of ceramic-ceramic bearings (“The squeaking hip”) are not fully understood. The cup and stem design, malpositioning of the components with resulting edge loading and impingement, the loss of lubrication, a higher BMI and an unstable hip are discussed.

Nevertheless the overwhelming number of papers shows excellent results especially in younger and more active patients. The correct operative technique resulting in a stable hip without malalignment of the components and without impingement is certainly more important than in other bearings. In case of a non-impinging component implantation, ceramic-on-ceramic bearings have substantial advantages over all other bearings in THA. Due to the superior hardness, ceramic bearings produce less third body wear and are virtually impervious to damage from instruments during the implantation process. The increasing number of used ceramic-ceramic bearings in Europe and the current results in literature show the growing confidence because of excellent clinical results.


Dual Mobility Implants: What is Their Role in Primary THA?
Jean-Noel Argenson, Remi Philippot, Matthieu Ollivier, Sebastien Parratte, Xavier Flecher
The Institute for Locomotion, Marseille, France
The Bellevue Hospital, Saint-Etienne, France

Introduction
The main reason for revision following primary Total Hip Arthroplasty (THA) remains dislocation. The cumulative risk of dislocation in primary THA has been described to be 7% at twenty-five years.\(^1\) Dual Mobility (DM) implants have been proposed to reduce the incidence of dislocation both in primary and revision THA.

The Concept
Dual mobility (DM) THA as described by Bousquet in the seventies, aims to combine two fundamental principles: large diameter bearings with increased jump distance to provide stability, and low-friction arthroplasty with smaller-diameter heads to produce less wear. The first generation of DM implants was associated with two issues: intra-prosthetic dislocation due to cam effect and wear between the retentive liner and the prosthetic neck, late cup loosening particularly in patients younger than 65 years. These failures were mainly attributable to delamination of the alumina coating sintered on a nonporous surface, resulting in third-body wear.

The Results
The series investigating the use of first generation DM implants in primary THA exhibited a very low dislocation rate (0 to 0.88%) and a 93% to 96% survivorship at ten years.\(^2,3\) The early results of second generation DM implants, as recently described in a prospective series of 100 patients at a mean follow-up of 6 years did not found any dislocation or revision \(^4\).

The Indications: Dual-mobility cups are widely used in some countries in both primary and revision THA. In primary THA the most commonly admitted indications for primary DM implants include: patients older than 75, patients with constitutional hyperlaxity and/or previous history of dislocation on a contralateral THA, patients with neurologic disease impairing locomotion such Parkinson or hemiplegia, patients with cognitive impairment (such Alzheimer’s disease or dementia), and post-fracture THA. The long-term results of second generation DM implants might condition the expansion of indication to younger patients in primary THA \(^4,5\).

References


Failed Metal-On-Metal:
Current Diagnostic Algorithms and Guidelines
Thomas K. Fehring, MD
OrthoCarolina Hip and Knee Center

Metal-on-metal total hip arthroplasties were heralded as a solution for hip instability and wear-induced periprosthetic osteolysis. Unfortunately the advent of adverse local tissue reactions (ALTRs) has tempered enthusiasm for this bearing option. Not unlike metal-on-plastic bearings, patients have a variable response to metal debris and therefore there are variable thresholds for when cobalt and chromium may lead to ALTRs.

The challenge for arthroplasty surgeons is to diagnose ALTRs before they occur. Unfortunately there is no single diagnostic test to accurately diagnose ALTR. Similar to the work-up for periprosthetic infection, multiple clinical and diagnostic variables must be considered when evaluating a patient presenting with a painful metal-on-metal hip arthroplasty. However regardless of the bearing surface, all diagnostic possibilities must be considered before indicting the bearing surface as the cause of pain.

The salient clinical signs of a malfunctioning bearing include pain, mechanical symptoms, and abductor weakness. Implant and design considerations which are concerning include monoblock cups, surface replacement in small females, acetabular components with a functional arc less than a hemisphere, modular neck implants, and a cup malpositioned with a high abduction angle or a version abnormality.

Metal ion levels (cobalt-chromium) and cross-sectional imaging are the main diagnostic tools in assessing the metal-on-metal patient. While a diagnostic ion level threshold (>7) has been suggested as important, the correlation between ion levels and tissue necrosis has been questioned \(^{(1)}\). Cross-sectional imaging in the form of ultrasound and metal artifact suppression MRIs (MARS) are useful diagnostic tools. However, at this time the presence of pain is insufficient to identify or rule-out ALTR. Cross-sectional imaging abnormalities have been identified in asymptomatic patients in both metal-on-metal and metal-on-poly total hips \(^{(2,3)}\).

Therefore, decisions on revision surgery should not be made on isolated ion levels or isolated cross sectional imaging abnormalities. Similar to the algorithm for periprosthetic infection, multiple clinical and diagnostic variables must be taken into account before recommending revision surgery. A risk stratification strategy has been described to help guide the decision making process \(^{(4, 5)}\).
### TABLE II MoM ‘Low’ Risk Group

<table>
<thead>
<tr>
<th>'Low' Risk Group Stratification</th>
<th>'Low' Risk Group Stratification</th>
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<tbody>
<tr>
<td><strong>Patient factors</strong></td>
<td>Patient with low activity level</td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
<td>Asymptomatic (including no systemic or mechanical symptoms)</td>
</tr>
<tr>
<td><strong>Clinical examination</strong></td>
<td>No change in gait (i.e., no limp, no abductor weakness)</td>
</tr>
<tr>
<td><strong>Implant type</strong></td>
<td>No swelling</td>
</tr>
<tr>
<td><strong>Radiographs (2 views ± serial for comparison when available)</strong></td>
<td>Small-diameter femoral head (&lt;36 mm) modular MoM THA; hip resurfacing in males &lt;50 with osteoarthritis</td>
</tr>
<tr>
<td><strong>Infection work-up (ESR, CRP, ± hip aspiration)</strong></td>
<td>Optimal acetabular cup orientation (40° ± 10° inclination for hip resurfacing)</td>
</tr>
<tr>
<td><strong>Metal ion level test (if available)</strong></td>
<td>No implant osteolysis/loosening</td>
</tr>
<tr>
<td><strong>Cross-sectional imaging (if available): these studies include MARS MRI; ultrasound or CT when MRI contraindicated or MARS protocol not available</strong></td>
<td>Within normal limits</td>
</tr>
<tr>
<td><strong>Treatment recommendation</strong></td>
<td>Low (&lt; 3 ppb)</td>
</tr>
<tr>
<td></td>
<td>Within normal limits</td>
</tr>
<tr>
<td><strong>Annual follow-up</strong></td>
<td>Annual follow-up</td>
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</tbody>
</table>

### TABLE III MoM ‘Moderate’ Risk Group

<table>
<thead>
<tr>
<th>'Moderate' Risk Group Stratification</th>
<th>'Moderate' Risk Group Stratification</th>
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</thead>
<tbody>
<tr>
<td><strong>Patient factors</strong></td>
<td>Male or female</td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
<td>Dysplasia (for hip resurfacing)</td>
</tr>
<tr>
<td><strong>Clinical examination</strong></td>
<td>Patient with moderate activity level</td>
</tr>
<tr>
<td><strong>Implant type</strong></td>
<td>Symptomatic</td>
</tr>
<tr>
<td><strong>Radiographs (2 views ± serial for comparison when available)</strong></td>
<td>Mild local hip symptoms (e.g., pain, mechanical symptoms)</td>
</tr>
<tr>
<td><strong>Infection work-up (ESR, CRP, ± hip aspiration)</strong></td>
<td>No systemic symptoms</td>
</tr>
<tr>
<td><strong>Metal ion level test</strong></td>
<td>Change in gait (i.e., limp)</td>
</tr>
<tr>
<td><strong>Cross-sectional imaging (MARS MRI; ultrasound or CT when MRI contraindicated or MARS protocol not available)</strong></td>
<td>No abductor weakness</td>
</tr>
<tr>
<td><strong>Treatment recommendation</strong></td>
<td>No swelling</td>
</tr>
<tr>
<td><strong>Revision surgery</strong></td>
<td>Large-diameter femoral head (≥36 mm) modular or nonmodular MoM THA</td>
</tr>
<tr>
<td></td>
<td>Recalled MoM implant</td>
</tr>
<tr>
<td></td>
<td>Hip resurfacing with risk factors (female with dysplasia)</td>
</tr>
<tr>
<td></td>
<td>Modular neck device</td>
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<td></td>
<td>Optimal acetabular cup orientation</td>
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<tr>
<td></td>
<td>No implant osteolysis/loosening</td>
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<td></td>
<td>Within normal limits</td>
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<tr>
<td></td>
<td>Moderately elevated (3-10 ppb)</td>
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<tr>
<td></td>
<td>Presence of abnormal tissue reactions without involvement of surrounding muscles and/or bone</td>
</tr>
<tr>
<td></td>
<td>Simple cystic lesions or small cystic lesions without thickened wall</td>
</tr>
<tr>
<td></td>
<td>Follow-up in 6 months</td>
</tr>
<tr>
<td></td>
<td>Consider revision surgery if symptoms progress, imaging abnormality progresses, and/or there are rising metal ion levels over 6 months</td>
</tr>
</tbody>
</table>
References


Spinopelvic Motion and Cup Placement in THR

Lawrence D. Dorr, MD

Recent research initiated by Lazennec et al [1] has focused attention on the importance of spinopelvic balance, and correct cup inclination and anteversion in THR. Our research identified three categories of spinopelvic balance/imbalance, and correlated these to inclination and anteversion [2]. Our current research extends that knowledge by defining the types of imbalance that create an “at-risk for impingement” cup position during postural change of sitting and standing. The pelvis normally shifts from anterior tilt while standing to posterior tilt while sitting (sacral tilt [ST] is 40° standing to 20° sitting), and with the posterior tilt the acetabulum opens in both inclination and anteversion to allow clearance for the flexed femur. This change in cup position from standing to sitting as seen on the lateral spinopelvic hip x-rays is termed ante-inclination. With spinal imbalance caused by arthritis or surgical fusion [3], there are 4 distinct patterns which create risks for impingement and its consequences of dislocation, edge loading and wear, and impingement pain. Most commonly imbalance is caused by stiffness of the construct (ΔST from stand-sit < 12°). So, acetabular opening does not occur. Therefore, cup positions necessary with stiff constructs must provide a mechanical opening of the acetabulum to compensate for the absent biological opening so that the sitting ante-inclination is >45° with sacral acetabular angle >65°.

The first pattern is a flat pelvis-stiff in which the ST standing is 30° or less (normal standing is 40° ± 5°) with ΔST <12°. Cup inclination must be 45°-50°, anteversion of 20°-25°, to keep normal ante-inclination; the hip off-set should be increased 5 mm to prevent bone-bone impingement of the trochanter/posterior femur against the pelvis with hip extension. If the ΔST is <10°, the standing absolute ST is <20° and especially if the patient has a low pelvic incidence (PI) we use a Dual Mobility cup.

The second pattern is flat pelvis-flex and the difference from the first pattern is with sitting the ST is near 0 with the spine having a reverse tilt (kyphosis). The ΔST may be in the normal range (13°-27° is a pathological posterior tilt, with the standing ST <30°) that creates abnormal flexibility. The cup needs the same position as with flat-stiff.
The third pattern is *anterior-stiff* in which the spine is stiff in lordosis so the pelvis has anterior tilt even with sitting. Since there is no posterior tilt of the pelvis the acetabulum remains closed with sitting, creating a risk of impingement with the flexed femur causing posterior dislocation. The cup must be mechanically opened with 45° inclination and 20°-25° anteversion. If this imbalance has \( \Delta ST < 10^\circ \) we use a Dual Mobility cup.

A fourth pattern is the excessively flexible hip which has \( \Delta ST \) of 30° or more with an absolute standing ST of 45° or more. In these hips the acetabulum opens wide with sitting so cup inclination should be 35°-40° and anteversion 15°-20° to keep ante-inclination of the cup below 70°. Ante-inclination of 70° or more creates risk for drop out dislocation.

References


Acetabular component position has long been implicated in stability and wear in total hip arthroplasty. Optimal position has been elusive. The inability to determine a “safe zone” for stability has been attributed partly due to failure to include femoral position in the analysis as well as the impact of pelvic alignment. Work from our center has suggested the importance of determining pelvic tilt and adjusting acetabular version accordingly.

Recognizing that pelvic mobility is inherently linked to spinal mobility, we investigated the impact of lumbar spine degeneration upon pelvic motion in the sagittal plane. 325 consecutive patients undergoing primary THR were evaluated using EOS® imaging. Images were captured in both standing and sitting. The goal sitting was to align the femur to be parallel to the floor to achieve at close to “90°” as possible using an adjustable stool. Each lumbar disc space was evaluated for facet arthrosis, height narrowing, and end plate changes. A spine with 3 or more degenerative segments was labelled degenerative disc disease (DDD). Measurements included sacral slope, lumbar lordosis, and femoral angle for both standing and sitting.

Our analysis found that patients with DDD had:

- Stand with less lumbar lordosis resulting in more posterior pelvic tilt
- Sit with more lumbar lordosis and less posterior tilt
- Require more flexion through the femur to achieve 90°

Patients with DDD and limited pelvic posterior tilt may be at risk for impingement and consideration of increased socket anteversion may be warranted.

Maratt et al, Pelvic tilt in patients undergoing total hip arthroplasty: when does it matter? J Arthroplasty 2015
Socket Position and the Risk of Dislocation after Revision Total Hip Arthroplasty
Anita Sadhu, MD; Denis Nam, MD; Benjamin Coobs, MD; Toby Barrack; Robert L. Barrack, MD
Washington University School of Medicine

Acetabular component positioning is considered a surgeon-controlled variable affecting stability following total hip arthroplasty (THA). Recently, the importance of the traditional Lewinnek “safe zone” for acetabular alignment (5°-25° of anteversion and 30°-50° of inclination) on dislocation risk has been questioned following primary THA. The purpose of this study was to compare cup alignment in revision THAs that have sustained a postoperative dislocation to a group of matched revision THAs without dislocation.

A database of revision THA’s that subsequently incurred dislocation was compiled from surgical clinic, emergency room, and operating room medical records. Revision diagnoses were limited to osteolysis, aseptic loosening, polyethylene wear, and metallosis. This cohort was matched to a cohort of revision THA controls (non-dislocators) for surgical approach, gender, age (± 2 years), BMI (± 2 points), and revision diagnosis. Acetabular component position was measured using Martell Hip Analysis Suite. The percentage of patients in each cohort within the traditional “safe zone” was compared using Chi-square analyses.

60 revision THAs sustaining a dislocation and 60 revision THAs without dislocation were included for analysis. All subjects examined had undergone a posterior approach for each hip procedure.

The percentage of dislocating revision THA’s within the safe zone for both inclination and anteversion was 47% (28 of 60) versus 66% (40 of 60, p=0.03) in the control cohort. For inclination only, 66% of dislocators (40 of 60) and 88% of non-dislocators (53 of 60, p=0.005) were within the safe zone. For anteversion only, 70% of dislocators (42 of 60) and 73% of non-dislocators (44 of 60, p=0.6) were within the safe zone.

While numerous factors affect hip stability, this matched-cohort study suggests that acetabular component positioning remains an important variable in decreasing the risk of dislocation following revision THA. As optimal patient-specific component positioning continues to be an area of future investigation, targeting the traditional safe zone remains a suitable goal to decrease the risk of dislocation following revision THA.
References

The John Charnley Award

The Missing Link: Re-Defining the Natural Progression of Osteoarthritis in Patients with Hip Dysplasia and Impingement
Rafael J. Sierra, MD; Cody C. Wyles, BS; Mark J. Heidenreich, MD; Jack Jeng, MD; Dirk R. Larson, MD; Robert T. Trousdale, MD

Background
Structural hip deformities including developmental dysplasia of the hip (DDH) and femoroacetabular impingement (FAI) are thought to predispose patients to degenerative joint changes. However, the natural history of these malformations is not clearly delineated.

Questions/Purposes
Among patients undergoing unilateral THA that have a contralateral hip without any radiographic evidence of hip disease, what is the natural history and progression of osteoarthritis in the native hip based on morphological characteristics? Among patients undergoing unilateral THA that have a contralateral hip without any radiographic evidence of hip disease, what are the radiographic parameters that predict differential rates of degenerative change?

Methods
Seven-hundred twenty-two patients ≤55 years that received unilateral primary total hip arthroplasty (THA) from 1980-1989 were identified. Preoperative radiographs were reviewed on the contralateral hip and only hips with Tönnis Grade 0 degenerative change that had minimum 10-year radiographic followup were included. Radiographic metrics in conjunction with the review of two experienced arthroplasty surgeons determined structural hip diagnosis as DDH, FAI, or normal morphology. Every available follow-up AP radiograph was reviewed to determine progression from Tönnis Grade 0–3 until the time of last follow-up or operative intervention with THA. Survivorship was analyzed by Kaplan-Meier methodology, hazard ratios, and multi-state modeling.

Results
One-hundred sixty-two patients met all eligibility criteria with the following structural diagnoses: 48 DDH, 74 FAI, and 40 normal. Mean age at the time of study inclusion was 47 years (range 18-55), with 56% females. Mean follow-up was 20 years (range 10 – 35 years). Thirty-five patients eventually required THA: 16 (33.3%) DDH, 13 (17.6%) FAI, 6 (15.0%) normal. Kaplan-Meier analysis demonstrated that patients with DDH progressed most rapidly, followed by FAI, with normal hips progressing the slowest. The mean number of years spent in each Tönnis stage by structural morphology was as follows: Tönnis 0: DDH = 17.0 years, FAI = 14.8 years, normal = 22.9 years; Tönnis 1: DDH = 12.2 years, FAI = 13.3 years, normal = 17.5 years; Tönnis 2: DDH = 6.0 years, FAI = 9.7 years, normal = 8.6 years; Tönnis 3: DDH = 1.6 years, FAI = 2.6 years, normal = 0.2 years.

Analysis of degenerative risk for categorical variables showed that patients with femoral head lateralization >10 mm, femoral head extrusion indices >0.25, acetabular depth-to-width index <0.38, lateral center-edge angle <25°, and Tönnis angle >10° all had a greater risk of progression from Tönnis 0 to Tönnis 3 or THA. Among patients with FAI morphology, femoral head extrusion indices
>0.25, lateral center-edge angle <25°, and Tönnis angle >10° all increased the risk of early radiographic progression. Analysis of degenerative risk for continuous variables using smoothing splines showed that risk was increased for the following: femoral head lateralization >8 mm, femoral head extrusion index >0.20, acetabular depth-to-width index <0.30, lateral center-edge angle <25°, and Tönnis angle >8°.

**Conclusions**
This study defines the long-term natural history of DDH and FAI in comparison to structurally normal young hips with a presumably similar initial prognostic risk (Tönnis Grade 0 degenerative change and contralateral primary THA). In general, the fastest rates of degenerative change were observed in patients with DDH. Furthermore, risk of progression based on morphology and current Tönnis stage were defined, creating a new prognostic guide for surgeons. Lastly, radiographic parameters were identified that predicted more rapid degenerative change, both in continuous and categorical fashions, subclassified by hip morphology.

**Level of Evidence**
Level II prognostic study
The Otto AuFranc Award

A Multi-Center, Prospective, Randomized Study of Outpatient versus Inpatient Total Hip Arthroplasty

Nitin Goyal, MD; Antonia F. Chen, MD, MBA; Sarah E. Padgett, PA-C; Timothy L. Tan, MD; Michael M. Kheir, BS; Robert H. Hopper, Jr., PhD; William G. Hamilton, MD; William J. Hozack, MD

Background
Length of stay following total hip arthroplasty (THA) has slowly decreased over the last two decades, mirroring trends for other procedures commonly performed in many surgical specialties. However, published studies that have examined same day and “early” discharge protocols after THA are in highly selected patient groups done by senior surgeons in a nonrandomized fashion without controls.

Questions/Purposes
The first purpose of this prospective, randomized, multi-center study was to evaluate and compare THA patients who are discharged on the same day as their surgery (“Outpatient,” less than 12 hour stay) to those who are discharged after an overnight hospital stay (“Inpatient”) with regards to the following outcomes: (1) patient-reported satisfaction, (2) postoperative pain, (3) peri-operative complications and healthcare provider visits (urgent care/emergency department, readmission, or physician office) and (4) relative work effort for the surgeon’s office staff. A secondary purpose of this study was to determine if there are specific patient or surgical factors that are associated with discharge on the day of THA surgery, and if these factors can be identified preoperatively.

Methods
A prospective, randomized study was conducted at two high-volume adult reconstruction centers between September 2014 and June 2015. Among 209 subjects who were all under the age of 75 years at surgery with a body mass index (BMI) less than 40 kg/m2, 106 were randomized to the Outpatient group and 103 were randomized to the Inpatient group. All subjects had a primary THA performed by the direct anterior approach with spinal regional anesthesia at a hospital facility.

Results
On the day of surgery, subjects who were discharged the same day had higher VAS satisfaction than those who remained in the hospital for one or more nights (96 versus 86, p=0.009) but there was no difference on the day after surgery (90 versus 89, p=0.55). At 4-week follow-up, the subjects who were discharged the same day had higher VAS satisfaction than those who remained in the hospital for one or more nights (89 versus 81, p<0.001). On the day of surgery, subjects who were discharged the same day had lower VAS pain than those who remained in the hospital for one or more nights (2.3 versus 3.9, p<0.001). This trend was reversed on the first day after surgery when subjects who were discharged the same day had higher VAS pain (at home) than those who remained in the hospital for one or more nights (4.0 versus 2.8, p<0.001). At 4-week follow-up, there was no difference in VAS pain among subjects who were discharged the same day and those who remained in the hospital for one or more nights (1.4 versus 2.0, p=0.26). There was no difference in reoperations, visits to primary care physicians (PCPs), specialists, urgent care centers, emergency departments (EDs), or readmission between the two groups (p>0.05). At 4-week follow-up, there was no difference in the number of phone calls and emails with the surgeon’s office (p=0.13).
Of the 106 subjects randomized to outpatient surgery, 81 (76%) were discharged as planned. The remaining 25 subjects were discharged after one night in the hospital. There was no difference in age (59.6 versus 61.5 years, p=0.26) or gender (46% versus 56% female, p=0.25) for the 81 discharged on the day of their surgery compared to the 25 who stayed overnight. Of the 103 subjects randomized to inpatient surgery with an overnight hospital stay, 79 (77%) were discharged as planned. Of the remaining 24 subjects, 16 met the discharge criteria on the day of their surgery and elected to leave the same day while eight subjects stayed more than one night. The 16 subjects randomized to inpatient surgery who elected to leave the same day were younger (53.9 versus 61.0 years, p=0.003) and predominantly male (94% versus 47%, p=0.001) compared to the 87 who stayed in hospital one or more nights.

Conclusions
Using a multi-center, prospective, randomized design, the current study demonstrates that outpatient THA can achieve high patient satisfaction in a broad patient population without increasing complication rates or requiring additional work for the surgeon’s office. Since 24% (25/106) of patients planning to have outpatient surgery were not able to be discharged the same day, facilities to accommodate an overnight stay should be available.

Level of Evidence
Level I - Therapeutic Randomized Control Study
The Frank Stinchfield Award

Total Hip Arthroplasty for Femoral Neck Fracture is Not a Typical DRG 470:
A Propensity-Matched Cohort Study
Alexander S. McLawhorn, MD, MBA; William A. Schairer, MD; Joseph M. Lane, MD; David A. Halsey, MD; Richard Iorio, MD; Douglas E. Padgett, MD

Background
Hip fractures are a major public health concern. For displaced femoral neck fractures (FNF), the episode of care for total hip arthroplasty (THA) is different than one performed for osteoarthritis (OA). Yet, Medicare Severity Diagnosis Related Groups system does not distinguish between THA performed for fracture and OA.

Questions/Purposes
What are the differences in in-hospital and 30-day postoperative clinical outcomes for THA performed for FNF versus OA? Is a patient’s fracture status associated with differences in in-hospital and 30-day postoperative clinical outcomes after THA?

Methods
The National Surgical Quality Improvement Program database contains prospectively collected outcomes for surgical patients up to 30 days after discharge. THA patients with OA or FNF were compared using two methods, first as an unadjusted cohort, and also as a one-to-one matched cohort using a propensity score based on age, gender, ASA grade, and medical comorbidities. Outcomes of interest included complications, transfusion, length of stay (LOS), discharge destination, and readmission. There were 42,692 patients identified (41,739 OA; 953 FNF), with 953 patients in each group for the matched analysis.

Results
For both the cohort comparison and the matched comparisons, operative time was slightly longer in the FNF group, and FNF patients had higher rates of longer LOS and more complications compared to patients with OA. Transfusions were more common for FNF in the unadjusted comparison, but the rates were similar in the matched comparison. Both surgical and medical complications were higher for FNF in both the unadjusted cohort and the matched comparisons. Similarly, for both comparisons, the FNF group had higher rates of discharge to inpatient facility as well as higher rates of unplanned readmission.

Fracture status was strongly associated with any postoperative complication (Odds Ratio [OR] 2.80, 95% Confidence Interval [CI] 2.05-3.84, p<0.001), readmission (OR 1.80, 95% CI 1.00-3.24, p = 0.049), and discharge to an inpatient facility (OR 1.68, 95% CI 1.39-2.02, p<0.001).
Conclusions
Compared to THA for OA, THA for FNF is associated with significantly greater rates of complications, longer LOS, more likely discharge to continued inpatient care, and higher rates of unplanned readmission. This implies higher resource utilization for patients with a fracture. These differences persist after matching of pre-operative risk factors. As healthcare reimbursement move towards bundled payment models, it would seem important to differentiate patients and procedures based upon the resource utilization they represent to healthcare systems.

These results show different expected resource utilization in these two fundamentally different groups of hip arthroplasty patients, suggesting a need to modify healthcare policy in order to maintain access to THA for all patients.

Level of Evidence
Level III Therapeutic study.
The most common reason for revision for periprosthetic fracture of the femur is the presence of a fracture around a loose femoral component. These so-called Vancouver B2 or B3 fractures are much more common than B1 fractures, which occur around a well-fixed implant. Revision strategies should focus on stable fixation into the distal fragment, while preserving vascularity of proximal fragments. Both fully coated cylindrical and titanium modular fluted tapered (TMFT) stems can be used effectively. The author prefers the advantages of modularity that TMFT stems offer. The patient is positioned laterally and C arm is used. “Connecting” fracture lines in the proximal femur can facilitate exposure of the acetabulum, and the distal femoral diaphysis. A prophylactic cable is placed at the mouth of the distal fragment. Reaming is performed referencing the hip center, and ensuring appropriate distal bypass. In general, the author prefers to obtain 10 cm of bypass of the stem past the most distal stress riser. The real implant is driven into the distal fragment. Biplanar C arm views are obtained to ensure adequate bypass, diaphyseal fit, and avoid anterior femoral cortical perforation. Trialing then proceeds until hip stability and leg length is acceptable. The proximal body is assembled and the proximal fragments are “wrapped” around the implant with an economy of cerclage cables. A period of protected weight bearing is recommended.
Extended Trochanteric Osteotomy: Tips and Tricks
Craig J. Della Valle, MD
Rush University Medical Center, Chicago, IL

The extended trochanteric osteotomy (ETO), as popularized by Paprosky, is a versatile exposure that is useful for complex primary and revision total hip arthroplasty (THA). It is relatively easy to do (once you have done a few), is easy to repair with 2-3 cables and heals reliably. By opening up the femoral canal, and mobilizing the greater trochanter, the ETO affords the surgeon the following advantages:
- Direct access to the femoral canal for implant or cement removal
- Improved acetabular exposure and a “straight shot” at the femoral isthmus for machining and implanting the revision component.
- Correction of femoral remodeling (if present)

An ETO can be done at one of (3) times during the case
- Prior to dislocation of the hip. This is rare and technically difficulty to do, but very helpful if the hip is very stiff and exposure is challenging (e.g. extensive HO)
- After dislocation of the hip but prior to removal of the stem (most common).
- After removal of the stem. This is the easiest way to learn how to do an ETO as there is no stem in the way and the surgeon can simply osteotomize the femur from back to front. Useful if there is a long cement mantle or if the surgeon wants to benefit from one of the above advantages such as improved exposure.

Preoperative planning is crucial to determine the length of the ETO. It should be long enough to remove what you need to get out but short enough to preserve enough femoral isthmus for distal fixation of the revision stem.

Technical tips include
- Great care with preserving the soft tissues of the osteotomized fragment; if you devascularize the fragment it will not heal.
- Place a prophylactic cerclage wire distal to the ETO to protect the remaining femur.
- Insert the stem first, then repair the ETO around the revision stem; this oftentimes requires some sculpting of the lateral fragment as the revision stem is larger than the primary stem.

References
Fluted Tapered Stems for Femoral Revisions
Scott M. Sporer, MD

Introduction: Cementless fixation remains the standard for most revision surgical procedures. Monoblock extensively porous coated stems have demonstrated excellent long-term results for the majority of femoral revision procedures. However, the poor results of extensively coated cylindrical femoral revision stem in larger femoral defects (Paprosky Type IIIB and IV) or in patients with large femoral canals resulted in the increased utilization of modular tapered fluted stems. Multiple surgeons have presented excellent mid term results for both implant stability and patient outcomes using this method of fixation. Due to the success of modular fluted revision femoral stems, these implants are now used more routinely in all femoral revisions cases by many surgeons. There are multiple advantages to using tapered fluted stem for all femoral revisions rather than attempting to obtain stable fixation with an alternative device.

Advantages of Modular Fluted Tapered Stems:
- Independent Adjustment of Leg Length
  - Leg length adjusted AFTER distal fixation obtained
  - Ability to verify distal fixation (e.g. – varus remodeling)
- Independent Adjustment of Offset
  - Offset can be adjusted independent of leg length
  - Minimize impingement → decrease instability
- Independent Adjustment of Femoral Version
  - Unknown femoral retroversion remodeling
  - Ability to adjust suboptimal cup position
- Ability to be used in All Defect Types
  - Able to be utilized on Paprosky Type II-IV defects
  - No need to alter reamers midway through surgery
- Ability to get “proximal fixation”
  - Multiple proximal body sizes
  - May minimize risk of implant fracture
  - Minimize stress shielding

Advantages of Non-Modular Fluted Tapered Stems:
- Potential “Easier” procedure
  - Ability to prepare femur and trial component as one unit
  - Ability to remove implant and easily re-ream to obtain appropriate level of seating
- Possible Lower implant cost

Disadvantages of Modular Fluted Tapered Stems:
- Component Fracture
  - Uncommon in current generation (Roller-hardening, shot peening, etc.)
- Increased Cost
  - Institution dependent
- Increased Surgical Time
Disadvantages of Non-Modular Fluted Tapered Stems:

- Limited Offset Options
  - Instability
  - Need to waste stem
- Higher Incidence of Stem Subsidence
- Varying level of component insertion compared to reamer
- Remain susceptible to stem fracture in small sizes if unsupported

References

Numerous surgical treatment methods have been utilized for treatment of massive periacetabular bone loss in revision total hip arthroplasty including structural allografting, impaction allografting, noncustom anti-protrusio cages, jumbo cups with modular acetabular augments, and custom, triflanged acetabular components (CTAC). CTAC are designed from a thin-cut CT scan with subsequent 3-D reconstruction of the pelvis. Metal subtraction software programs minimize metal-induced distortion. This type of component is typically utilized in Type III defects when little to no osseous support remains in the acetabulum. Fixation is obtained by creation of a triflanged prosthetic component which is anchored to the ilium, ischium, and pubis with multiple fixation screws. Acetabular defects are grafted with cancellous allograft.

Literature review of clinical results with CTAC use out to 10 years has demonstrated reliable fixation and survival of the device itself, even in cases with pelvic discontinuity. However, reoperation rates for complications such as dislocation, infection, etc. are substantial in some reports, likely related to the complexity of cases in which a CTAC is selected (massive bone loss, multiple previous surgical procedures).

Advantages of CTAC use include obtaining rigid fixation on remaining host bone (ilium, ischium, and pubis). Its custom design enhances the precision of fit. Biomechanically, the device is much stronger than traditional non-custom cages. Finally, its design incorporates use of modular polyethylene liners (neutral, extended lip, or constrained) that enhances the surgeon’s ability to achieve hip stability intraoperatively.

Disadvantages include increased cost and delay in surgery pending implant manufacture (usually 4 to 6 weeks). Substantial exposure of the ilium is required for accurate placement of the iliac flange of the prosthesis. This risks injury to the superior gluteal nerve. For this reason, a greater trochanteric osteotomy is considered to relieve tension on the superior gluteal neurovascular pedicle during insertion of a CTAC. Cement augmentation of ischial screws is recommended in cases with severe ischial osteolysis. Ideally, the CTAC should be designed with two rows of 3-4 iliac screws and a minimum of four ischial screws. The central dome of the prosthesis should be designed to contact the remaining ledge of the inferior ilium to reduce shear stresses on the iliac, ischial, and pubic flange fixation.

Bibliography


The indications for a cup cage reconstruction are massive bone loss with or without pelvic discontinuity where in the past we have utilized a conventional cage (ref 1,2). Although the posterior approach can be effective, the senior author’s preference is a lateral approach using a modified sliding trochanteric osteotomy (ref 3). An extended trochanteric osteotomy is employed when an accompanied femoral revision with need to access to the femoral canal distal to the lesser trochanter is anticipated (ref 4).

Gentle reaming of the acetabulum is carried out. Reaming continues until either bleeding bone is obtained or it becomes clear that bony support will decrease with further reaming. If the reamer does not achieve any degree of engagement in the surrounding bone, a conventional cage rather than a cup-cage may be necessary. The proximal 1 to 2 cm of the ischium should be exposed and the slot for the ischial flange created. Morsellized allograft mixed with any autograft from reaming is now packed into defects especially the discontinuity site. Uncontained defects can be reconstructed by structural allografts or augments. Then trial is performed to find the size of the cup which fits the acetabulum and the cage which fits into the cup and extends from ischium to ilium. The cages are specifically sized for the cup diameter. The cup should be press fit as much as possible to distract and help to stabilize the discontinuity. We insert a cup 2mm larger than our last reamer. Every attempt should be employed to provide some contact to bleeding bone preparing the environment for the cup to stabilize the discontinuity after ingrowth occurs. Considering that the lateral dome of the acetabulum is usually the most deficient part, placing the cup in 45° inclination does not provide it with the best host bone contact. Therefore, the cup is usually placed in a relatively vertical position. This also provides better access to the ilium for the superior flange of the cage. It should be in a fairly retroverted direction as well, so that the ischial flange of the cage can be inserted to the ischium.

Once the revision ultra-porous cup is inserted to the actabular defect, it should be fixed with at least two screws. The direction of the screws is dictated by the location of better bone stock. Although revision ultra-porous cups come with multiple screw holes, if deemed necessary, creating more holes is technically possible using the regular bone drill bits. We cover all of the holes even those containing screws with bone wax to make possible future removal easier and to prevent the cement from intruding to the bone-cup interface which may impair the bone ingrowth into the cup.

Then, the slot for the ischial flange of the cage is created. The starting point is located in the inside surface of the acetabular rim, at 7 o’clock in the right and 5 o’clock in the left hip. The direction is dictated by the exposed lateral surface of the ischium and is confirmed by drilling a hole and using a depth gauge to make sure that for a distance of 3 cm the flange will be surrounded by bone. The slot is initiated using a special osteotome but completed by the real flange of the cage to avoid inadvertent perforation of the ischium by the sharp osteotome and endangering the sciatic nerve.
A helpful practice is to template with a trial cage and to adjust the superior and inferior flanges of the real cage before insertion. Usually the upper flanges need to be bent downward to the ilium and the lower ones upward to align with the ischium. The last action before inserting the cage is to prepare the lateral ilium for the upper flange. Abductor muscles should be gently elevated from an appropriate length of the ilium. This should be performed carefully to avoid damage to the superior gluteal neurovascular bundle and resultant lurch. Cage insertion starts with inserting the inferior flange all the way into the slot. Then the cage is impacted into the cup so that the upper flanges lie flat on the ilium, slightly towards posterior. The fixation depends on the distal flange and the screws through the superior flanges to the ilium. A minimum of three bicortical 6.5mm screws should be used to fix the flanges to the ilium but before that, it is recommended to insert a couple of screws in the dome of the cage through the cup and ilium. The latter screws will push the cage further into the concavity of the cup and minimize the gap between the two. Also by following a perpendicular direction relative to the flange screws, they provide a much stronger construction. From a biomechanical point of view, inserting one screw into the ischium just medial to the inferior flange is helpful to provide some compression force at the discontinuity site.

A cemented polyethylene liner should be inserted into the cage aiming for about 40° abduction and 20° anteverision, independent from position of the cup cage. We recommend using an elevated-rim liner to achieve more posterolateral coverage. This is important because the cup cage is in a vertical and retroverted position that leaves the liner uncovered posterolaterally. Keep the pressure on the cup until the cement hardens. This results in penetration of some cement through the cage holes and elimination of the gap between the cup and the cage.

Acetabular bone loss and presence of pelvic discontinuity were assessed according to the Gross classification. Sixty-seven cup-cage procedures with an average follow-up of 74 months (range, 24-135 months; SD, 34.3) months were identified; 26 of 67 (39%) were Gross Type IV and 41 of 67 (61%) were Gross Type V (pelvic discontinuity). Failure was defined as revision surgery for any cause, including infection (ref 5).

The 5-year Kaplan-Meier survival rate with revision for any cause representing failure was 93% (95% confidence interval [CI], 83.1-97.4), and the 10-year survival rate was 85% (95% CI, 67.2-93.8). The Merle d’Aubigné-Postel score improved significantly from a mean of 6 preoperatively to 13 postoperatively (p < 0.001). Four cup-cage constructs had non-progressive radiological migration of the ischial flange and they remain stable.

The cup-cage construct is a reliable option to treat chronic pelvic discontinuity and severe acetabular bone defects if stable fixation cannot be obtained through the use of a high-porosity metal cup with or without augments.

References


High-Dose Antibiotic-Containing Spacers for Infected Total Hip Arthroplasty

Kevin L. Garvin, M.D.

University of Nebraska Medical Center

For more than 20 years, high-dose antibiotic-impregnated spacers have been a mainstay for successful management of a prosthetic hip infection. The spacer serves two purposes. The first is the elution of high-dose antibiotics to treat any residual bacteria that remain at the surgical site after debridement. The second purpose is to facilitate early mobilization of the patient thereby preventing muscle atrophy and scarring, as well as helping to lessen the complications and risks associated with prolonged immobilization and bed rest. The selection of antibiotics for use in bone cement requires that the antibiotics are stable during the exothermic process of cement polymerization, of low risk for allergy or other side effects, water soluble and effective against the pathogens commonly identified as causing a prosthetic joint infection. Aminoglycosides (gentamicin) were the first to be used followed by vancomycin, colistin, clindamycin, cephalosporin and others. High doses of antibiotics are safe for the majority of patients because the antibiotics are primarily released locally with relatively low systemic levels. However, the growing number of patients with renal disease and the emerging resistance of bacteria to aminoglycosides have encouraged surgeons to consider alternative antibiotics to aminoglycosides. A recent report of prosthetic knee infections included using high doses of ceftazidime-vancomycin impregnated cement. Comparable success (85%) was achieved with this antibiotic regimen for a two-stage reimplantation. Mechanical properties of cement are also affected by the type of antibiotic but this is less of a concern for the temporary spacer used to deliver high doses of antibiotics.

Manufactured molds or custom-type molds are available to shape the antibiotic-laden polymers. The material is injected into the mold while the methacrylate is in a doughy state. Once polymerized, the soft silicone mold is removed and the antibiotic-laden acrylic spacer can be inserted as a temporary prosthesis. Intramedullary dowels also formed from molds can be inserted into the canal to increase the local antibiotic delivery. In contrast, prefabricated antibiotic-laden bone cement spacers release a very low dose of antibiotics and therefore are not used for the treatment of a prosthetic joint that is infected. If bone loss is severe and the temporary spacer cannot provide soft tissue and joint stability then antibiotic-impregnated beads may be necessary to fill the dead space and provide local antibiotic delivery.

In summary, high-dose antibiotic-impregnated spacers are effective in releasing antibiotics at the site of infection and facilitating early mobilization of the patient. However, some challenges still exist. Cases of resistant organisms, immunocompromised hosts and complex surgeries with severe bone loss will continue to attract our attention as we aim to improve the outcomes of patients with prosthetic joint infections.
References


Removal of an Infected Hip Arthroplasty is High-Risk Surgery: Putting Morbidity into Context with other Major Non-Orthopaedic Operations

James Browne, Jourdan Cancienne, Wendy Novicoff, Brian Werner
University of Virginia

Introduction
Two-stage revision remains the standard approach for periprosthetic infection (PJI) of total hip arthroplasty (THA) in the United States. The postoperative risks associated with removal of an infected prosthesis and placement of a spacer have not been thoroughly studied.

Methods
Patients who underwent THA implant removal and spacer placement were identified in a large administrative database using ICD-9 and CPT codes. Morbidity and mortality rates were assessed for the 90-day postoperative period whereas readmission rates were assessed at 30-days postoperatively to avoid including potential planned readmissions for reimplantation. These outcomes were then compared to those following coronary artery bypass grafting (CABG), carotid endarterectomy (CEA), prostatectomy, pancreatoduodenectomy (Whipple procedure), and kidney transplant. Odds ratios (OR), 95% confidence intervals (CI) and chi square tests were calculated. p< 0.01 was considered significant.

Results
Implant removal and spacer placement for THA PJI (n=10,458) had a 30-day readmission rate of 11.6% and 90-day mortality rate of 3.7%. Major complications (deep vein thrombosis [DVT], pulmonary embolism [PE], myocardial infarct [MI], acute renal failure [ARF], pneumonia [PNA], stroke [CVA]) were seen in 15.3% of patients. Postoperative morbidity was often higher compared to other procedures studied. For example, compared to Whipple patients (n=28,446), THA explant patients had a higher incidence of DVT (OR 1.4, CI 1.2-1.7), PNA (OR 1.2, CI 1.1-1.4), MI (OR 1.6, CI 1.2-2.1), ARF (OR 2.5, CI 2.3-2.8), transfusion (OR 4.2, CI 3.9-4.4), and CVA (OR 1.4, CI 1.1-1.7), all p-values <0.001. 90-day mortality rates were significantly higher compared to CEA, prostatectomy, and kidney transplant (odds ratios between 2.9 to 14.0, p<0.0001). Readmission rates at 30-days were significantly higher when compared to all other groups including CABG and Whipple (odds ratios between 1.4 to 8.3, p<0.0001).

Discussion and Conclusion
Removal of an infected THA with spacer placement is high-risk surgery. This large study including over 10,000 patients helps quantify the risks of readmission, morbidity, and mortality. The rates of adverse outcomes are higher than for many non-orthopaedic operations typically considered to be major surgery.
Session XII: Impingement and Dysplasia

4:33 pm – 4:38 pm

Complications after Hip Arthroscopy: A Prospective, Multicenter Trial Utilizing a Validated Grading Scheme
Christopher M. Larson, MD; John Clohisy, MD; Paul Beaule, MD, FRCSC; Bryan T. Kelly, M. Russell Giveans, Rebecca M. Stone, ATC; Kathryn M. Samuelson

Background: There is limited literature looking at comprehensive complication rates after arthroscopic hip procedures.

Hypothesis/Purpose: To prospectively report complication rates for a consecutive series of hips undergoing arthroscopic procedures.

Study Design: Case Series

Methods: Over a twenty-nine month period, 1,615 consecutive hips with a mean age of 30.5 years underwent arthroscopic hip procedures at four institutions. The diagnosis, demographic information, and procedures were recorded, and a validated complications grading classification for hip joint surgery was utilized prospectively.

Results: There were 1487 primary hip arthroscopies and 128 revision hip arthroscopies. Arthroscopy femoroacetabular impingement (FAI) correction was performed in 1505 hips (93.2%), and 1273 hips (78.8%) had a labral repair procedure. The most common event was post-operative lateral femoral cutaneous nerve (LFC) disturbance (16.5%), and persisted beyond 6 months in only 1.6%. The incidence of iatrogenic chondral injury was 1.2%, iatrogenic labral puncture (0.9%), superficial portal infection (1.1%), sensory deficit about the foot (0.8%), deep venous thrombosis (0.1%), pulmonary embolism (0.1%), perineal numbness (pudendal nerve) (1.4%), heterotopic ossification (0.8%), and femoral neck stress fracture (0.1%). There was no iatrogenic instability, AVN, or extra-abdominal fluid extravasation identified in this cohort. The overall complication rate, not including temporary LFC periportal and thigh numbness (sequelae) was 8.3% (134 hips). Overall 7.4% had a grade 1, 0.7% Grade 2, 0.4% grade 3, and 0.1% grade 4 complication. There was a significantly higher rate of complications for greater surgical and traction time (p < 0.01) and for females as compared to males (p=.017). No differences were found between primary versus revision cases (p=.123), labral repair versus debridement (p=.209), and BMI had no effect on complication rate (p=.103).

Conclusions: The overall complication rate after hip arthroscopy at tertiary hip centers was 8.3% with higher rates reported with greater surgical and traction times and for females. Compared to surgical hip dislocation using the same classification system, the overall rate of complications was similar but the rate of higher grade complications was lower for arthroscopic hip procedures.
Risk Factors for Hip Arthroscopy Failure in a Single Healthcare System

R. Presley Swann MD; Jenny Marland PT, DPT; Jackie Lee PhD;
Mike B. Anderson MSc; Hugh West MD; Christopher Peters MD

Background
Over the past 10 to 15 years, the number of hip arthroscopy procedures performed has risen exponentially, but few data exist to guide clinicians in determining which patients are likely to require full conversion to total hip arthroplasty (THA) or repeat/revision arthroscopy.

Questions/Purposes
1. What is the rate of conversion from primary hip arthroscopy to THA?
   a. What factors are associated with conversion of hip arthroscopy to THA?
2. What is the rate of conversion from primary hip arthroscopy to revision arthroscopy?
   a. What factors are associated with the need for revision hip arthroscopy?

Methods
Querying the data warehouse of the Intermountain Healthcare (IHC) system to identify all patients who underwent hip arthroscopy between 2003 and 2014 we a performed secondary data analysis. Data were extracted on patient age, gender, body mass index, American Society of Anesthesiologists (ASA) physical status score, operating surgeon, and hip outcome. Participating surgeons were categorized as performing either a high volume (≥ 100 per year) or low volume (< 100/year) of hip arthroscopies.

Results
Of 1058 eligible patients, 94 (9%) progressed to THA at a mean time to conversion of 1.35 years (range 0.01 – 7.8). Increasing age (p<0.001), higher ASA scores (p=0.011), and low surgeon volume (p=0.016) were significant predictors of THA conversion. Twenty percent (n=212) underwent subsequent revision arthroscopy. Younger age (p<0.001), lower body mass index (p=0.040) and increasing ASA scores (p<0.001) were all associated with an increased risk for revision arthroscopy.

Conclusions
In this healthcare system, 27% of hip arthroscopy procedures required repeat arthroscopy or conversion to THA. Surgeon volume less than 100 cases per year, increased patient age and higher BMI were also associated with an increased risk of revision arthroscopy or THA.

Key Words: hip arthroscopy, total hip arthroplasty, risk factors, outcomes, age, ASA score, procedure volume

References


Average Ten Year Clinical Outcomes of the Bernese PAO for the Treatment of Classic Acetabular Dysplasia

Stephen T. Duncan, MD, Lexington, KY; Kayla Thomason, BS, St. Louis, MO; Geneva Baca, BA, Granite City, IL; Gail Pashos, BS, St. Charles, MO; Perry L. Schoenecker, MD, St. Louis, MO; John C. Clohisy, MD, St. Louis, MO

Introduction
In patients with symptomatic acetabular dysplasia, the Bernese periacetabular osteotomy (PAO) is an effective procedure for deformity correction and early relief of pain and hip dysfunction[2-6]. There is a paucity of data regarding the longer term results of this procedure[1]. The purpose of this study was to analyze the average 10 year clinical, radiographic, and total hip arthroplasty (THA) conversion results following the PAO for the treatment of symptomatic DDH.

Methods
We performed a retrospective analysis of 186 consecutive hips (159 patients) treated with the PAO for symptomatic DDH with 10.3 years average followup (range, 6.9 to 17.9). Preoperatively, all patients had hip pain and sufficient hip joint congruency. Patient demographics, radiographic measurements, and patient reported outcome scores [modified Harris Hip score (MHHS), UCLA, WOMAC] were analyzed.

Results
Average age was 25 years (range,10 to 60), with 138 females (87%) and 21 males (13%) and BMI of 25.5 kg/m2. Average lateral center edge angle improved 25.9° (12.0° to 36.2°, p <0.001), and 30.5° (9.5° to 40.0°, p<0.001) in the anterior center edge angle. The Tönnis angle decreased from 22.25° to 4.5° (p< 0.05). Improvements in outcomes included: MHHS [20.8 points; (65.4 to 85.3, p<0.001)], UCLA [1.4 points (6.8 to 7.1, p<0.05)], and WOMAC subscores which demonstrated clinically significant improvement.

Table 1. Average 10 year clinical outcome and radiographic measures

<table>
<thead>
<tr>
<th></th>
<th>Initial</th>
<th>Follow-up</th>
<th>Average delta</th>
<th>p = value</th>
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<tr>
<td>UCLA</td>
<td>6.8</td>
<td>7.1</td>
<td>↑ 1.4</td>
<td>0.042</td>
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<tr>
<td>mHHS</td>
<td>65.4</td>
<td>85.3</td>
<td>↑ 20.8</td>
<td>&lt; 0.001</td>
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<td>WOMAC Pain</td>
<td>63.9</td>
<td>85.1</td>
<td>↑ 25.4</td>
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<tr>
<td>WOMAC Stiffness</td>
<td>72.4</td>
<td>81.0</td>
<td>↑ 17.0</td>
<td>0.017</td>
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<tr>
<td>WOMAC Function</td>
<td>74.0</td>
<td>88.0</td>
<td>↑ 18.3</td>
<td>0.042</td>
</tr>
<tr>
<td>WOMAC Total</td>
<td>71.7</td>
<td>87.3</td>
<td>↑ 19.6</td>
<td>0.025</td>
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<tr>
<td>LCEA measure, degrees</td>
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<td>36.2</td>
<td>↑ 25.9</td>
<td>&lt; 0.001</td>
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<tr>
<td>Tönnis angle, degrees</td>
<td>22.25</td>
<td>4.5</td>
<td>↓ 17.7</td>
<td>&lt; 0.05</td>
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<tr>
<td>ACEA measure, degrees</td>
<td>9.5</td>
<td>40.0</td>
<td>↑ 30.5</td>
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</table>
Ten hips (10.9%) required conversion to THA at 82.3 months (range, 16 to 197 months), 2 hips (2.2%) required early postoperative revision (1 for overcorrection of the deformity and loss of hip flexion and 1 for loss of reduction likely due to patient noncompliance), 1 hip (1.1%) required revision at 11 years for relative overcorrection of the deformity and impingement, and 1 patient (1.3% of patients) passed away of unrelated causes.

**Discussion and Conclusion:**
The PAO is an effective technique for surgical correction of symptomatic DDH in adolescents and young adults. Average ten year results were very good with a low conversion rate to THA and 86% survivorship.

Factors Predicting Success for Joint Preserving Surgery of the Hip

Paul E. Beaulé, MD, FRCSC

Professor of Surgery; Head of Division of Orthopedic Surgery
University of Ottawa, Ontario, Canada

Introduction
Despite the successful outcomes of hip preservation surgery, failures do occur leading onto repeat surgery or worsening hip function in 10-20% of patients[1-3]. Although improving clinical results can be done by better patient selection and optimizing of surgical technique the means to achieve this are not clear as well as how to best focus our efforts. One approach is to categorize failures/repeat surgeries into failure modes permitting a more in-depth analysis.

When reviewing our overall experience at our center of 1013 cases our overall failure rate was 11% (109) at a mean time of 2.5 years. However if we then look at separating these failures into three Modes we gain a bit more insight into where efforts can be directed in improving success after JPSH. Out of the 1013 hips, 6% (64 hips) had a Mode 1 failure that we define as hips undergoing subsequent joint replacement surgery. The mean age of this group was 49 with 33 males @ a mean time of 3.1 yrs: 55 were following arthroscopy, 8 following surgical dislocation (SD), and 1 following periacetabular osteotomy (PAO); 2% (19 hips) had Mode 2 failure that we define as an incorrect diagnosis. The mean age was 29 at a mean time of 2.2 yrs: 10 following arthroscopy; 5 following SD; 2 following PAO. Finally, 2.2%(24 hips) had Mode 3 failures that we define as mal correction with a mean age 31; @mean time of 2 yrs: 23 following scopes and 1 following SD. Overall complication rate was less than 4% (40/1013) with only 0.8% (8/1013) altering management.

We will review factors predicting success as function of the 3 failure Modes:

MODE 1- Organ Failure:
If we then look at the factors that can help minimize Mode 1 failures these would be primarily based on patient selection as a function of health status of the hip joint i.e. degree of arthritis. The current standard in defining the overall health of the hip joint are patient age and presence or absence of arthritic changes on plain x-rays (sclerosis, joint space narrowing, osteophytes). In general, patients less than 35 years of age with a Tonnis grade of 1 or less tend to have the best long-term outcome [3-6]. More recently with the advent of more advanced cartilage imaging techniques such as dGEMRIC and T1Rho there is capacity for direct quantification of proteoglycan content thus enabling greater sensitivity and specificity in determining arthritic status of the joint. Having said that, other structures within the hip joint including the labrum, cartilage, synovium and bone, can contribute to hip pain and decreased function and influence the outcome of joint preserving surgery of the hip. Using hi-resolution 3T MRI a semi quantitative scoring system was developed for comprehensive evaluation of the hip joint. Using a regression analysis and correlating to percent change in the HOOS score, we identified 3 items on MRI that were predictive: Osteophyte in anterior zone of acetabulum (r=-.411, p=.016); Bone Marrow Edema-supero-lateral acetabulum (r=-.440, p=0.046); subchondral cyst supero-lateral acetabulum (r=-.391, p=0.022). Presence of these changes could help counsel the treating physician in regards to expected outcome after joint preserving surgery of the hip.

Modes 2 –Incorrect Diagnosis:
One of the key underlying issues leading to poor clinical outcome and/or early clinical failures despite surgical expertise is having the correct diagnosis. Clohisy et al7 found that many of the stand-
ard radiographic parameters used to diagnose DDH and/or FAI have poor observer reliability. Accordingly, a more clear set of definitions and measurements must be developed to allow for more reliable diagnosis of early hip disease. Methods to improve the reliability of a radiographic evaluation may increase the clinical utility of these parameters. In addition, some pathology maybe very difficult to perfectly categorize into one group which brings into play the concept of a transitional form of hip pathology. It is unclear what percentage of patients fit within that group and more importantly who to best address them surgically remains to be determined.

In order to guide us somewhat better we performed a study asking if soft tissue structures can differentiate between dysplasia and cam-femoroacetabular impingement of the hip. Fifty-seven patients who underwent preoperative MRA and corrective hip surgery were retrospectively identified yielding three groups: 17 with hip dysplasia [DDH] (11F, 6M; mean age 35.1 yrs, range 19.6-53.6); 20 with isolated labral tears [LT] (17F, 3M; mean age 38.4 yrs, range 15.2-62.1) and 20 with cam-type femoroacetabular impingement [FAI] (11F, 9M; mean age 38.8yrs, range 18.9-51.2). Measurements of the hip labral length, capsule thickness, and psoas, rectus femoris and gluteal muscle dimensions were performed, with normalization of the values for statistical analysis. We found that in patients with dysplasia the labrum was longer/hypertrophy associated with a thicker capsule anteriorly and superiorly compared to the FAI and isolated labral group. In regards to the musculature the rectus was larger in the transverse plane.

Consequently, in borderline cases these findings may serve as discriminators between the three main subgroups of FAI, Dysplasia and isolated labral pathology.

**Mode 3 – Mal-Correction.**
A recent paper by Clohisy et al[12] looking at the most common reasons for revision surgery noted that both open and arthroscopic technique were almost equally split in regards to previous surgical approaches. More importantly for both FAI and dysplasia, hip arthroscopy was the most common previous surgical approach at 86% and 64%, respectively with inadequately corrected structural disease as the most common reason for secondary surgery: femoral osteochondroplasty and acetabular reorientation.

For example, patients with labral tears due to underlying DDH may expect to have little to no symptomatic benefit from arthroscopy[13;14]. Conversely, overcorrection with PAO can lead to retroversion which can cause FAI, creating a new problem[15]. There is retroversion present in one sixth of patients with DDH and if not recognised beforehand can be problematic[16].

Head-neck offset deformity may go un-recognised and can cause impingement after PAO[17]. There may be associated chondral damage with dysplasia which can be a cause of poor outcome after PAO and doing a hip arthroscopy to deal with intra-articular pathology at the same time might be more beneficial[2].

In the treatment of FAI, cases of associated retroversion and/or global over coverage, there is still no consensus as to what magnitude of over-coverage should be the threshold for rim trimming or PAO. The extent to which acetabular rim trimming is done is also important because over trimming can cause dysplasia leading to early degeneration of the joint[18]. Similarly there are no clear indications for labral debridement versus repair. It is generally assumed that preservation and repair to keep the labrum intact is preferable to labral debridement or excision[19].

More importantly, one underlying issue is that surgeons who are expert in a particular kind of hip preservation procedure may be inclined to treat everything with the same technique. However, the pathology and not the surgical armamentarium should dictate the best technique. This is difficult
to assess but certainly in our series this represented just over 2% of our failures and although relatively low, requires attention. This may reflect to some extent a rapidly evolving field as well as the importance of continued professional development in regards to attendance of meetings as well as visiting surgeons/centers with particular expertise.

Conclusion
Success of surgical treatment depends on accurate diagnosis with careful selection of the hip preservation procedure most suited to the pathology and also on the expertise of the surgeon. The importance of introducing modes of failure will permit to improve the reliability of our treatments as well as permit effective comparison of surgical techniques in the treatment of pre-arthritic hip disease. Future work is necessary in achieving consensus in both diagnosis and surgical management to minimize early failures and improve predictability of surgery.

Reference List


CME Accreditation Statement
This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of the American Academy of Orthopaedic Surgeons and the Hip Society. The American Academy of Orthopaedic Surgeons is accredited by the ACCME to provide continuing medical education for physicians.

Credit Hours
The American Academy of Orthopaedic Surgeons designates this live activity for a maximum of 7.75 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Goals and Objectives
The objectives of the Open Meeting of The Hip Society are to provide up-to-date information on the treatment of hip problems including arthroplasty and non-arthroplasty options and surgical techniques. Interactive symposia will be utilized.

Upon completion of this program, 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 joint.
• Determine indications and complications in total hip arthroplasty.
• Critique presentations of surgical techniques and demonstrations of treatment options.
• Evaluate the efficacy of new treatment options through evidence-based data.

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Each participant in The Hip Society/AAHKS Meeting has been asked to disclose if he or she has received something of value from a commercial company, which relates directly or indirectly to the subject of their presentation. These responses reflect the answers from a series of questions submitted by all persons participating in the Academy’s overall online Disclosure Program, which is available to all Academy members at www.aaos.org/disclosure.

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