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

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

FINAL SCIENTIFIC PROGRAM

Saturday—March 18, 2017
San Diego Marriott Marquis & Marina
Marriott Grand Ballroom 5
IMPORTANT!

Ready. Set. Respond.

The following sessions of The Hip Society/AAHKS Specialty Day programming will utilize the Audience Response System (ARS) feature of My Academy app:

- Session V
- Session VII
- Session VIII

We Are Streaming Live

This program is streaming live in its entirety. The live stream is not accredited for CME. Everyone who is registered to attend the program in person receives complimentary access to the live stream, and to the archived content, for one year, through March 10, 2018.

Questions?

Email hip@aaos.org or call (847)698-1632

Thank you for attending our 2017 Specialty Day programming! We hope to see you in 2018 in New Orleans!
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 (Winter) 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 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. The American Academy of Orthopaedic Surgeons designates this live activity for a maximum of 7.5 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Evaluation

Your opinion matters! Please complete your evaluation online at: https://www.surveymonkey.com/r/HSWM2017 or use the QR code to access with your handheld smart device:

![QR Code]

Photography

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.
Join Us In New Orleans!
The 2018 AAOS Annual Meeting and Specialty Day

March 6-10, 2018
## ACKNOWLEDGEMENTS

### Past Presidents of The Hip Society

<table>
<thead>
<tr>
<th>Year</th>
<th>President</th>
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<tbody>
<tr>
<td>1969-1970</td>
<td>Frank E. Stinchfield, MD †</td>
<td>2007-2008</td>
<td>Lawrence D. Dorr, MD</td>
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<td>1971-1972</td>
<td>Albert B. Ferguson, Jr., MD †</td>
<td>2009-2010</td>
<td>William J. Maloney, III, MD</td>
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<td>1972-1973</td>
<td>J. Vernon Luck, Sr., MD †</td>
<td>2010-2011</td>
<td>Chitranjan S. Ranawat, MD</td>
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<td>1973-1974</td>
<td>Mark B. Coventry, MD †</td>
<td>2011-2012</td>
<td>Adolph V. Lombardi, Jr., MD</td>
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<td>1974-1975</td>
<td>Emmett M. Lunceford, Jr., MD †</td>
<td>2012-2013</td>
<td>David G. Lewallen, MD</td>
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<td>1976-1978</td>
<td>Augusto Sarmiento, MD</td>
<td>2013-2014</td>
<td>Vincent D. Pellegrini, Jr., MD</td>
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<td>1979-1980</td>
<td>Harlan C. Amstutz, MD</td>
<td>2015-2016</td>
<td>Daniel J. Berry, MD</td>
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<td>1980-1981</td>
<td>Philip D. Wilson, Jr., MD †</td>
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<td>Richard C. Johnston, MD, MS</td>
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<td>Clement B. Sledge, MD</td>
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<td>1983-1984</td>
<td>Floyd H. Jergesen, MD †</td>
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<td>C. McCollister Evarts, MD</td>
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<td>1985-1986</td>
<td>Jorge O. Galante, MD, DMSc. †</td>
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<td>1986-1987</td>
<td>Lee H. Riley, Jr., MD †</td>
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<td>1987-1988</td>
<td>William R. Murray, MD †</td>
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<td>Joseph E. Miller, MD †</td>
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<td>Donald E. McCollum, MD †</td>
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<td>J. Phillip Nelson, MD †</td>
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<td>Robert H. Fitzgerald, Jr., MD</td>
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<td>Richard B. Welch, MD</td>
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<td>Richard H. Rothman, MD, PhD</td>
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<td>Dennis K. Collins, MD</td>
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<td>Leo A. Whiteside, MD</td>
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<td>Miguel E. Cabanela, MD</td>
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<td>Charles A. Engh, Sr., MD</td>
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ACKNOWLEDGEMENTS

The Hip Society Board Of Directors (2016-2017)
Harry E. Rubash, MD - President
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Douglas E. Padgett, MD - 2nd Vice President
Craig J. Della Valle, MD - Secretary
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C. Anderson Engh, Jr., MD
Don S. Garbuz, MD
A. Seth Greenwald, D.Phil. (Oxon)
Mark W. Pagnano, MD
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Matthew P. Abdel, MD – 2018 Chair
Gregory G. Polkowski II, MD – Past Chair
Bryan D. Springer, MD – Education Council Chair
Jonathan L. Schaffer, MD – Industry Relations Chair

Did We Hit The Mark?

In 2016, in Orlando, we conducted a comprehensive and focused survey to redefine the value and success of our Specialty Day programming. We carefully analyzed your comments, critique, and suggestions. We have implemented many of your suggestions when planning the 2017 Specialty Day program, including:

1. Topics of interest to our participants have been incorporated.
2. Session times are closely coordinated with The Knee Society.
3. Complimentary boxed lunch will be provided to all registered participants.
4. We will be using the Audience Response System through the Academy App.
5. We will be presenting one combined session on value, quality, and economics at the end of the day.

Tell us what you think. Complete the survey that will be handed out, and return it to any staff member before you leave. Thank you for your thoughts!
Contemporary Approaches to Adult Hip and Knee Reconstruction
Presented by The Hip Society and The Knee Society

PROGRAM HIGHLIGHTS:
- Small group case-based format
- Close interaction with world-renowned faculty
- Key primary hip and knee arthroplasty concepts
- Avoid and manage potential complications
- Unicompartmental knee arthroplasty, outpatient arthroplasty, bundled payment models
- Expert panel on modern perioperative management
- Video vignettes of select surgical techniques and tips

PROGRAM CO-CHAIRS:
R. MICHAEL MENEGHINI, MD
SCOTT M. SPORER, MD

SPECIAL GUEST SPEAKER:
WILLIAM N. CAPELLO, MD

PROGRAM FACULTY:
KEVIN L. GARVIN, MD
DAVID G. LEWALLEN, MD
JOHN B. MEDING, MD
RYAN M. NUNLEY, MD
MARK W. PAGNANO, MD

Indianapolis, IN
Chicago, IL
Omaha, NE
Rochester, MN
Mooresville, IN
St. Louis, MO
Rochester, MN

FRIDAY, MAY 12, 2017 | 11:00 AM - 6:00 PM
The William N. Capello, MD Education Center, IU Health Saxony Hospital | 13000 E 136th St, Fishers, IN 46037

Visit www.hipsoc.org and click on the EDUCATION tab to learn more
Call (847) 698-1638 | Email hip@aaos.org
The Hip Society and The Knee Society invite you to join us at JAMM2018 in Park City, Utah, USA, on January 21-24, 2018. JAMM2018 is a unique learning and networking opportunity for orthopaedic surgeons specializing in the adult hip and knee arthroplasty. This highly anticipated and exclusive red-carpet event will be:

- co-chaired by Fred D. Cushner, MD, Aaron A. Hofmann, MD, Adolph V. Lombardi, Jr., MD, and Christopher L. Peters, MD, with a star-studded faculty cast drawn from members of The Hip Society and The Knee Society
- presented during the 2018 Sundance Film Festival
- limited to 100 physician attendees
- enhanced by “The Golden Hip” and “The Golden Knee” video competitions
- a dynamic blend of case-based presentations and small group discussions complemented by didactic lectures
- CME-accredited
Cecilia Rogmark graduated from medical school at Lund University 1990. She is an orthopaedic surgeon at Skane University Hospital in Malmö-Lund, Sweden, since 1995, and was appointed consultant in 2004. Since then she had shared her time between research and clinical work.

Cecilia Rogmark defended her PhD thesis in 2003, titled “Femoral Neck Fractures. Aspects on Treatment and Outcome.” The main study was a randomised multicenter trial comparing internal fixation and arthroplasty in 450 patients with displaced femoral neck fractures.

2004 she was appointed co-director of the national Swedish Hip Arthroplasty Register (SHAR), with responsibility for the hip fracture cases. As a member of the executive committee, she has made continuous contributions to the development of SHAR in terms of quality improvement, communication and research. She has for several years been associated to Nordic Arthroplasty Register Association (NARA) and International Society of Arthroplasty Register (ISAR).

In 2012 Cecilia Rogmark became associate professor at Lund University, and is now supervising several PhD students. Her research team focus on both specific surgical issues in the treatment of hip fractures and on improving the entire clinical pathway to optimize outcome in orthogeriatrics. In addition, she engages herself in evidence-based treatment of fractures in general, for example as a member of the steering committee of the Swedish Fracture Register and a former member of the board of the Swedish Ortho-Trauma Society.

She was member of the Fragility Fracture Network’s international panel for hip fracture audits 2013-2015, and still works within that global organization.

With her focus on education and improvement of clinical care, she is frequently invited as opponent at doctoral dissertations and speaker at international and national meetings.
PROGRAM HIGHLIGHTS

The Hip Society’s 2017 Scientific Award (Session VIa, 1:00 pm to 1:34 pm)

The 2017 John Charnley Award
A Randomized Clinical Trial of Direct Anterior Approach and Mini-Posterior Approach Total Hip Arthroplasty
Presenter: Michael J. Taunton, MD
Co-Authors: Robert T. Trousdale, MD; Rafael J. Sierra, MD; Ken Kaufman, PhD; Mark W. Pagnano, MD

The 2017 Otto Aufranc Award
A Prospective, Randomized Study of Crosslinked and Non-crosslinked Polyethylene for Total Hip Arthroplasty at 15-Year Followup
Presenter: Charles A. Engh, Jr., MD
Co-Authors: Henry Ho, MS; Supatra Sritulanondha, MPH; Ann C. Williams, BS; Robert H. Hopper, Jr, PhD

The 2017 Otto Aufranc Award
Dual-Mobility Constructs in Revision THA Reduced Dislocation, Re-Revision & Reoperation Compared to Large Femoral Heads
Presenter: Matthew P. Abdel, MD
Co-Authors: Molly A. Hartzler, MD; Peter K. Sculco, MD; Michael J. Taunton, MD; Mark W. Pagnano, MD; Arlen D. Hanssen, MD

The 2017 Frank Stinchfield Award
Identification of the ‘At Risk’ Genotype for Development of Pseudotumours around Metal-on-Metal Total Hip Arthroplasties
Presenter: Andrew P. Kurmis, FRACS, MBBS, PhD
Co-Authors: Brett KJ Kilb, MD; Andrew P. Kurmis, MD, PhD, FRACS; Michael Parry, MD, MBChB, FRCS(UK); Karen Sherwood, PhD; Paul Keown, MD, DSc, FRCP(C); Bassam A. Masri, MD, MHS, FRCS(C); Clive P. Duncan, MD, MSc, FRCS(C); Donald S. Garbuz, MD, MHSc, FRCS(C)

Congratulations to all award winners and their co-authors!

The Hip Society’s 2018 Scientific Awards


The deadline to submit your best research is December 1, 2017.
TRAVELING FELLOWSHIP OPPORTUNITIES

The Hip Society’s Rothman-Ranawat Traveling Fellowship

At the core of the mission of The Hip Society is the promotion of the science of disease of the hip. Fundamental to science are the basic tenets of education and research. The ultimate benefactors of our knowledge are the patients. The Hip Society Rothman-Ranawat Traveling Fellowship is open to four (4) young orthopaedic surgeons, from North America, and throughout the world. The traveling Fellows will visit up to twelve (12) sites in North America as identified by The Hip Society. The ultimate goal of the fellowship is to offer the young surgeons an inspirational tour of state-of-the-art facilities providing exemplary surgical care of the hip joint throughout North America.

Congratulations, The Hip Society’s 2017 Rothman-Ranawat Traveling Fellows!

Carlos A. Higuera-Rueda, Cleveland, OH, USA
Christopher E. Pelt, Park City, UT, USA
Takahito Yuasa, Urayasu-city, Chiba, Japan

More information may be found on The Hip Society’s website www.hipsoc.org, on the Education tab.

The deadline to apply for the Fellowship is August 15, 2017.

The Hip Society-British Hip Society Traveling Fellowship

The Hip Society is proud to partner with the British Hip Society to provide an exceptional exchange opportunity to two (2) outstanding North American candidates. Successful candidates will travel throughout the United Kingdom for a period of three-four weeks and will be hosted by world-renowned experts in adult hip reconstruction. The program will include opportunities for scientific exchange, OR observations, close interaction with faculty, as well as social and cultural events.

More information may be found on The Hip Society’s website www.hipsoc.org, on the Education tab.

The deadline to apply for the Fellowship is February 1, 2018.
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.

COMING SPRING 2016
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 SUBMISSIONS

ABSTRACT SUBMISSIONS
Submit high-quality scientific and socioeconomic abstracts by June 1, 2017 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 June 1, 2017 covering all aspects of arthroplasty and health policy. Proposals are reviewed by the AAHKS Program Committee.

SURGICAL TECHNIQUE VIDEO PROPOSALS
Submit high quality, clinically relevant proposals for videos that will provide high educational value. Selection of videos is based on the overall quality and thoroughness of the proposal submission. The deadline for proposals is June 1, 2017.

Start your submission now by logging in to www.AAHKS.org.

RESERVE HOTEL ROOM NOW!
You can log in to www.AAHKS.org to make your hotel reservation now at the Hilton Anatole in Dallas. Meeting registration will open in June 2017.
AAHKS
2017 SPRING MEETING
MAY 5 – 6 · SAN FRANCISCO

Do you enjoy the fall meeting but miss the intimate interactions of AAHKS meetings of the past? Are you looking to get your questions answered by leading experts in a small group setting? Then the AAHKS Spring Meeting is for you!

The meeting will be centered around a case-based discussion format in small groups with a maximum of 10 participants per faculty member and symposia on important topics ranging from the business of orthopaedics to perioperative optimization and management. The meeting will facilitate the ideal learning atmosphere for the practicing hip and knee surgeon wanting to learn more about primary and revision hip and knee arthroplasty.

Friday, May 5 – Saturday, May 6, 2017
The Westin St. Francis
San Francisco on Union Square

- Limited attendance
- Instructional Course Lectures (ICL)
- Small group breakouts with faculty

Log in to register for the meeting at www.AAHKS.org
# HIP

Marriott Grand Ballroom 5

## 7:55 am – 8:00 am

**WELCOME**

*Harry E. Rubash, MD (Boston, MA) – President, The Hip Society*

*Kevin J. Bozic, MD, MBA (Austin, TX) – Chair, Education Committee*

## 8:00 am – 8:45 am

### Session I: Minimizing Complications

*Moderator: Kevin L. Garvin, MD (Omaha, NE)*

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<td>The Changing Pattern of Complications After THA</td>
<td><em>Daniel J. Berry, MD (Rochester, MN)</em></td>
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<td>8:08 am</td>
<td>Modifying Risk Factors/Preventing Readmissions</td>
<td><em>Richard Iorio, MD (New Rochelle, NY)</em></td>
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<td>8:15 am</td>
<td>Avoiding Venous Thromboembolism</td>
<td><em>Jay R. Lieberman, MD (Los Angeles, CA)</em></td>
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<td>8:22 am</td>
<td>Preventing Infection</td>
<td><em>Craig J. Della Valle, MD (Chicago, IL)</em></td>
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**DISCUSSION**

## 8:45 am – 9:30 am

### Session II: Implant Wear: An Update

*Moderator: William J. Maloney, III, MD (Redwood City, CA)*

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<td>Long-term Results with Polythene</td>
<td><em>James I. Huddleston, III, MD (Redwood City, CA)</em></td>
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<td>8:53 am</td>
<td>Update on Ceramics</td>
<td><em>Adolph V. Lombardi, Jr., MD, FACS (New Albany, OH)</em></td>
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<td>Are There Indications for Metal-on-Metal THA and Resurfacing?</td>
<td><em>Robert L Barrack, MD (St. Louis, MO)</em></td>
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<td>9:07 am</td>
<td>Future Bearing Surfaces: What to Look For!</td>
<td><em>Orhun K. Muratoglu, PhD (Boston, MA)</em></td>
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**DISCUSSION**
7:55 am – 8:00 am  
**WELCOME**  
*Thomas P. Sculco, MD (New York, NY) – President of The Knee Society*  
*Stephen J. Incavo, MD (Houston, TX) – Chair, Education Committee*

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<th>Event Description</th>
<th>Speaker(s)</th>
<th>Page</th>
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</thead>
</table>
| 8:00 am – 8:45 am | **Session I: The Difficult Primary TKA-1**  
**Moderator: Arlen D. Hanssen, MD (Rochester, MN)** |  
8:01 am – 8:07 am  
Management of Stiff Knee  
*Steven J. MacDonald, MD (London, ON, Canada)* | 25   |
|          |                                                        | 8:08 am – 8:14 am  
Flexion Contracture  
*Adolph V. Lombardi, Jr., MD, FACS (New Albany, OH)* | 29   |
|          |                                                        | 8:15 am – 8:21 am  
The Valgus Knee: Is It More Difficult?  
*Paul F. Lachiewicz, MD (Chapel Hill, NC)* | 31   |
|          |                                                        | 8:22 am – 8:28 am  
Previous Incisions: What to Do?  
*John J. Callaghan, MD (Iowa City, IA)* | 32   |
|          |                                                        | 8:28 am – 8:45 am  
DISCUSSION |      |
| 8:45 am – 9:30 am | **Session II: The Difficult Primary TKA-2**  
**Moderator: Douglas A. Dennis (Denver, CO)** |  
8:46 am – 8:52 am  
Extra-Articular Deformity  
*Stephen J. Incavo, MD (Houston, TX)* | 33   |
|          |                                                        | 8:53 am – 8:59 am  
Previous ACL or Osteotomy Surgery  
*David Backstein, MD, FRCS(C) Toronto, ON, Canada* | 35   |
|          |                                                        | 9:00 am – 9:06 am  
Prior Infection  
*Arlen D. Hanssen, MD (Rochester, MN)* | 38   |
|          |                                                        | 9:07 am – 9:13 am  
Is Constraint Needed in Primary TKA?  
*Mark P. Figgie, MD (New York, NY)* | 40   |
|          |                                                        | 9:13 am – 9:30 am  
DISCUSSION |      |
<table>
<thead>
<tr>
<th>Time</th>
<th>Session III: Taper Corrosion</th>
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<tr>
<td>9:30 am</td>
<td>Session III: Taper Corrosion</td>
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<tr>
<td>9:30 am – 10:15 am</td>
<td>Moderator: Wayne G. Paprosky, MD, FACS (Winfield, IL)</td>
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<tr>
<td>9:31 am – 9:37 am</td>
<td>State-of-the-Art in Understanding This Issue</td>
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<td>Joshua J. Jacobs, MD (Chicago, IL)</td>
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<tr>
<td>9:38 am – 9:44 am</td>
<td>Clinical Presentation/Diagnosis</td>
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<td>Michael A. Mont, MD (Cleveland, OH)</td>
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<tr>
<td>9:45 am – 9:51 am</td>
<td>Fretting and Corrosion at the Head-Neck Junction of Well-Functioning THAs</td>
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<td>Douglas E. Padgett, MD (New York, NY)</td>
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<tr>
<td>9:52 am – 9:58 am</td>
<td>Optimizing Clinical Treatment and Outcomes</td>
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<tr>
<td></td>
<td>Young-Min Kwon, MD, PhD, FRACS, FRCS (Boston, MA)</td>
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<tr>
<td>9:58 am – 10:15 am</td>
<td>DISCUSSION</td>
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<tr>
<td>10:15 am – 10:30 am</td>
<td>COFFEE/REFRESHMENT BREAK</td>
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<tr>
<td>10:30 am – 11:25 am</td>
<td>Session IV: Prevention/Management Geriatric Hip</td>
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<td>10:30 am</td>
<td>Session IV: Prevention/Management Geriatric Hip</td>
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<tr>
<td>10:30 am – 11:25 am</td>
<td>Moderator: Harry E. Rubash, MD (Boston, MA)</td>
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<tr>
<td>10:31 am – 10:37 am</td>
<td>Prevention of Geriatric Hip Fractures</td>
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<td>Joseph M. Lane, MD (New York, NY)</td>
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<tr>
<td>10:38 am – 10:44 am</td>
<td>Developing and Implementing a Comprehensive Hip Fracture Program</td>
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<td>Stephen L. Kates, MD (Richmond, VA)</td>
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<td>10:45 am – 10:51 am</td>
<td>Fix or Replace? Results from “Big Data”</td>
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<td>George J. Haidukewych, MD (Orlando, FL)</td>
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<tr>
<td>10:52 am – 10:57 am</td>
<td>Introduction of Presidential Guest Speaker</td>
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<td>Harry E. Rubash, MD (Boston, MA)</td>
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<td>10:58 am – 11:13 am</td>
<td>Presidential Guest Speaker: Outcomes of Comprehensive Hip Fracture Mgmt</td>
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<td>Programs: An International Perspective</td>
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<td></td>
<td>Cecilia Rogmark, MD, PhD (Lund, Sweden)</td>
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<tr>
<td>11:14 am – 11:25 am</td>
<td>DISCUSSION</td>
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<tr>
<td>Time</td>
<td>Session III: Current Trends in Arthroplasty</td>
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<td>9:30 am - 10:15 am</td>
<td><strong>Moderator: Clifford W. Colwell, MD (La Jolla, CA)</strong></td>
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<tr>
<td>9:31 am - 9:37 am</td>
<td>Current Joint Restoration Procedures</td>
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<td>Patrick C. McCulloch, MD (Houston, TX)</td>
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<tr>
<td>9:38 am - 9:44 am</td>
<td>Unicompartmental Arthroplasty in 2017</td>
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<td>Craig J. Della Valle, MD (Chicago, IL)</td>
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<tr>
<td>9:45 am - 9:51 am</td>
<td>ACL/PCL Design: What the Future Holds</td>
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<td>Christopher L. Peters, MD (Salt Lake City, UT)</td>
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<td>9:52 am - 9:58 am</td>
<td>Medial Pivot Design</td>
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<td>C. Lowry Barnes, MD (Little Rock, AR)</td>
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<tr>
<td>9:58 am - 10:15 am</td>
<td>DISCUSSION</td>
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<td>10:15 am - 10:30 am</td>
<td>COFFEE/REFRESHMENT BREAK</td>
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<thead>
<tr>
<th>Time</th>
<th>Session IVa: The Knee Society's Scientific Awards</th>
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<tbody>
<tr>
<td>10:30 am - 11:00 am</td>
<td><strong>Moderator: Thomas P. Sculco, MD (New York, NY)</strong></td>
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<tr>
<td>10:31 am - 10:33 am</td>
<td>Introduction: The John N. Insall, MD Award</td>
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<tr>
<td>10:33 am - 10:39 am</td>
<td>“Higher Tissue Concentrations of Vancomycin with Intraosseous Regional Prophylaxis in Revision TKA”</td>
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<td></td>
<td>Simon W. Young, FRACS (Auckland, New Zealand)</td>
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<tr>
<td>10:39 am - 10:40 am</td>
<td>Award Presentation</td>
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<tr>
<td>10:41 am - 10:43 am</td>
<td>Introduction: The Chitranjan S. Ranawat, MD Award</td>
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<tr>
<td>10:43 am - 10:49 am</td>
<td>“Does Computer Navigation in Knee Arthroplasty Improve Functional Outcomes in Young Patients?”</td>
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<td>Young-Hoo Kim, MD (Seoul, South Korea)</td>
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<td>10:49 am - 10:50 am</td>
<td>Award Presentation</td>
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<tr>
<td>10:51 am - 10:53 am</td>
<td>Introduction: The Mark Coventry, MD Award</td>
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<tr>
<td>10:53 am - 10:59 am</td>
<td>“A Randomized Clinical Trial on Patellofemoral vs. Total Knee Replacement for Patellofemoral Osteoarthritis”</td>
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<td></td>
<td>Anders Odgaard, MD, DMSc (Aarhus, Denmark)</td>
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<td>10:59 am - 11:00 am</td>
<td>Award Presentation</td>
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<thead>
<tr>
<th>Time</th>
<th>Session IVb: Highlights</th>
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<tbody>
<tr>
<td>11:00 am - 11:15 am</td>
<td>AAHKS 2016 Annual Meeting</td>
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<tr>
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<td>William A. Jiranek, MD (Richmond, VA)</td>
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<tr>
<td>11:01 am - 11:08 am</td>
<td>The John N. Insall, MD Traveling Fellowship</td>
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<td>W. Norman Scott, MD (New York, NY)</td>
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<td>Time</td>
<td>Session V: Transitioning to Outpatient THA: Point/Counterpoint</td>
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<tr>
<td>11:25 am – 12:00 pm</td>
<td>Session V: Transitioning to Outpatient THA: Point/Counterpoint</td>
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<tr>
<td>11:25 am – 11:32 am</td>
<td>Building an Outpatient THA Program</td>
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<tr>
<td>11:33 am – 11:40 am</td>
<td>Outpatient THA is a Triumph of Passion Over Reason</td>
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<tr>
<td>11:41 am – 12:00 pm</td>
<td>DISCUSSION</td>
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<tr>
<td>12:00 pm – 1:00 pm</td>
<td>LUNCH – Box lunches provided to all participants</td>
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### Session VIa: The Hip Society’s Scientific Awards

**Moderators:** Paul E. Beaulé, MD, FRCSC (Ottawa, ON, Canada) & C. Anderson Engh, Jr., MD (Alexandria, VA)

<table>
<thead>
<tr>
<th>Time</th>
<th>Introduction: The John Charnley Award</th>
<th>“A Randomized Clinical Trial of Direct Anterior Approach and Mini-Posterior Approach Total Hip Arthroplasty”</th>
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</thead>
<tbody>
<tr>
<td>1:01 pm – 1:02 pm</td>
<td>Introduction: The John Charnley Award</td>
<td>“A Randomized Clinical Trial of Direct Anterior Approach and Mini-Posterior Approach Total Hip Arthroplasty”</td>
<td>58</td>
</tr>
<tr>
<td>1:02 pm – 1:08 pm</td>
<td>“A Randomized Clinical Trial of Direct Anterior Approach and Mini-Posterior Approach Total Hip Arthroplasty”</td>
<td>Michael J. Taunton, MD (Rochester, MN)</td>
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<td>1:08 pm – 1:09 pm</td>
<td>Award Presentation</td>
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<tr>
<td>1:10 pm – 1:11 pm</td>
<td>Introduction: The Otto Aufranc Award</td>
<td>“A Prospective, Randomized Study of Crosslinked and Non-crosslinked Polyethylene for Total Hip Arthroplasty at 15-Year Followup”</td>
<td>60</td>
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<tr>
<td>1:11 pm – 1:17 pm</td>
<td>“A Prospective, Randomized Study of Crosslinked and Non-crosslinked Polyethylene for Total Hip Arthroplasty at 15-Year Followup”</td>
<td>Robert H. Hopper, Jr., PhD (Alexandria, VA)</td>
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<td>1:17 pm – 1:18 pm</td>
<td>Award Presentation</td>
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<tr>
<td>1:18 pm – 1:24 pm</td>
<td>“Dual-Mobility Constructs in Revision THA Reduced Dislocation, Re-Revision &amp; Reoperation Compared to Large Femoral Heads”</td>
<td>Matthew P. Abdel, MD (Rochester, MN)</td>
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<td>1:24 pm – 1:25 pm</td>
<td>Award Presentation</td>
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<tr>
<td>1:26 pm – 1:27 pm</td>
<td>Introduction: The Frank Stinchfield Award</td>
<td>“Identification of the ‘At Risk’ Genotype for Development of Pseudotumours around Metal-on-Metal Total Hip Arthroplasties”</td>
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<tr>
<td>1:26 pm – 1:34 pm</td>
<td>“Identification of the ‘At Risk’ Genotype for Development of Pseudotumours around Metal-on-Metal Total Hip Arthroplasties”</td>
<td>Andrew P. Kurmis, FRACS, MBBS, PhD, (Vancouver, BC, Canada)</td>
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<td>1:33 pm – 1:34 pm</td>
<td>Award Presentation</td>
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</table>
| 11:15 am – 12:00 pm | **Session V: “Lessons Learned” from Difficult Cases**  
**Moderator:** Robert T. Trousdale, MD (Rochester, MN)  
**ARS in use** |
| 11:16 am – 11:21 am | Case 1                                    |
| 11:22 am – 11:27 am | Case 2                                    |
| 11:28 am – 11:33 am | Case 3                                    |
| 11:34 am – 11:39 am | Case 4                                    |
| 11:40 am – 11:55 am | Panel Discussion  
Kevin L. Garvin, MD (Omaha, NE); William L. Griffin, MD (Charlotte, NC); Douglas D.R. Naudie, MD (London, ON, Canada); Carlos J. Laervinia, MD (South Miami, FL) |
| 11:55 am – 12:00 pm | Audience Votes                            |
| 12:00 pm – 1:00 pm | **LUNCH**  
Box lunches provided to all participants |
| **1:00 pm – 1:45 pm** | **Session VI: Perioperative Issues**  
**Moderator:** Daniel J. Berry, MD (Rochester, MN)  
**ARS in use**   |
| 1:01 pm – 1:07 pm | Pain Control  
Mark W. Pagnano, MD (Rochester, MN) |
| 1:08 pm – 1:14 pm | Post-Op Rehab/Physical Therapy  
Matthew S. Austin, MD (Philadelphia, PA) |
| 1:15 pm – 1:21 pm | Anticoagulation and Bleeding: Where Are We in 2017?  
Javad Parvizi, MD (Philadelphia, PA) |
| 1:22 pm – 1:28 pm | Bilateral TKA: How To Do It Safely  
Thomas P. Sculco, MD (New York, NY) |
| 1:29 pm – 1:45 pm | **DISCUSSION** |
**Session VIIb: The Hip Society's Fellowships**

**Moderator:** Chitranjan S. Ranawat, MD (New York, NY)

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<tbody>
<tr>
<td>1:35 pm – 1:36 pm</td>
<td>Introduction of the Hip Society Fellowships</td>
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<tr>
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<td>Chitranjan S. Ranawat, MD (New York, NY)</td>
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<tr>
<td>1:36 pm – 1:40 pm</td>
<td>Highlights of the 2016 Hip Society – British Hip Society Traveling Fellowship</td>
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<td>Michael Blankstein, MSc, MD, FRCS(C) (South Burlington, VT) &amp; Joseph M. Schwab, MD, (Milwaukee, WI)</td>
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<tr>
<td>1:40 pm – 1:44 pm</td>
<td>Recap of the 2016 Rothman-Ranawat Fellowship</td>
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<td>Atul F. Kamath, MD (Philadelphia, PA)</td>
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<tr>
<td>1:44 pm – 1:45 pm</td>
<td>Introduction of the 2017 Hip Society Rothman-Ranawat Traveling Fellows</td>
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<td>Chitranjan S. Ranawat, MD (New York, NY)</td>
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**Session VII: “Lessons Learned” from Difficult Cases**

**Moderator:** Thomas P. Schmalzried, MD (Los Angeles, LA)

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<tr>
<td>1:46 pm – 1:51 pm</td>
<td>Case 1</td>
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<tr>
<td>1:52 pm – 1:57 pm</td>
<td>Case 2</td>
</tr>
<tr>
<td>1:58 pm – 2:03 pm</td>
<td>Case 3</td>
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<tr>
<td>2:04 pm – 2:09 pm</td>
<td>Case 4</td>
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<tr>
<td>2:10 pm – 2:23 pm</td>
<td>Panel Discussion</td>
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<td>Michael E. Berend, MD (Indianapolis, IN); John J. Callaghan, MD (Iowa City, IA); Scott M. Sporer, MD, MS (Winfield, IL); Wayne G. Paprosky, MD, FACS (Winfield, IL)</td>
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<tr>
<td>2:23 pm – 2:30 pm</td>
<td>Audience Votes</td>
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<tr>
<td>2:30 pm – 2:45 pm</td>
<td><strong>COFFEE/REFRESHMENT BREAK</strong></td>
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<td>Time</td>
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<tr>
<td>1:45 pm – 2:30 pm</td>
<td><strong>Session VII: Instability in TKA: Causes and Prevention</strong>&lt;br&gt;<em>Moderator: Robert L. Barrack, MD (St. Louis, MO)</em></td>
</tr>
<tr>
<td>1:46 pm – 1:52 pm</td>
<td>AP and ML Instability&lt;br&gt;<em>David G. Lewallen, MD (Rochester, MN)</em></td>
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<tr>
<td>1:53 pm – 1:59 pm</td>
<td>Patella Instability&lt;br&gt;<em>Giles R. Scuderi, MD (New York, NY)</em></td>
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<td>2:00 pm – 2:06 pm</td>
<td>Extensor Mechanism Failure&lt;br&gt;<em>Rafael J. Sierra, MD (Rochester, MN)</em></td>
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<td>2:07 pm – 2:13 pm</td>
<td>The Unstable Revision TKA&lt;br&gt;<em>Michael D. Ries, MD (Carson City, NV)</em></td>
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<td>2:14 pm – 2:30 pm</td>
<td><strong>DISCUSSION</strong></td>
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<td>2:30 pm – 2:45 pm</td>
<td><strong>COFFEE/REFRESHMENT BREAK</strong></td>
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<td>1:45 pm – 2:30 pm</td>
<td><strong>Session VIII: Patient Satisfaction</strong>&lt;br&gt;<em>Moderator: William J. Griffin, MD (Charlotte, NC)</em></td>
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<td>2:46 pm – 2:52 pm</td>
<td>Is It Expectation?&lt;br&gt;<em>Matthew J. Kraay, MD (Cleveland, OH)</em></td>
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<tr>
<td>2:53 pm – 2:59 pm</td>
<td>How Do We Measure It?&lt;br&gt;<em>Philip C. Noble, PhD (Houston, TX)</em></td>
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<tr>
<td>3:00 pm – 3:06 pm</td>
<td>Can We Identify a Poor Surgical Candidate?&lt;br&gt;<em>David C. Ayers, MD (Worcester, MA)</em></td>
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<td>3:07 pm – 3:13 pm</td>
<td>What To Do About It?&lt;br&gt;<em>Jay R. Lieberman, MD (Los Angeles, CA)</em></td>
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<tr>
<td>3:14 pm – 3:30 pm</td>
<td><strong>DISCUSSION</strong></td>
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<tr>
<td>2:45 pm – 3:30 pm</td>
<td><strong>Session VIII: Surgical Approaches to the Hip</strong></td>
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<tr>
<td>2:46 pm – 2:52 pm</td>
<td>Direct Anterior Approach to the Hip: The New Gold Standard or a Marketing</td>
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<td>Opportunity?</td>
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<td>2:53 pm – 2:59 pm</td>
<td>Posterior Approach: Still the “Gold Standard”?</td>
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<td>3:00 pm – 3:06 pm</td>
<td>Is Surgical Approach a Risk Factor for Early Failure of Primary THA?</td>
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<td>3:07 pm – 3:30 pm</td>
<td><strong>DISCUSSION</strong></td>
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<tr>
<td>3:30 pm – 4:15 pm</td>
<td><strong>Session IX: Instability</strong></td>
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<tr>
<td>3:31 pm – 3:37 pm</td>
<td>Incidence and Causes of Instability in Total Hip Arthroplasty</td>
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<tr>
<td>3:38 pm – 3:44 pm</td>
<td>The Solution: Large Diameter Femoral Heads</td>
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<td>3:45 pm – 3:51 pm</td>
<td>The Solution: Dual Mobility Cups</td>
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<tr>
<td>3:52 pm – 3:58 pm</td>
<td>The Solution: Constrained Acetabular Components</td>
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<tr>
<td>3:59 pm – 4:15 pm</td>
<td><strong>DISCUSSION</strong></td>
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**Session X: Transitioning to Value-Based Healthcare is a COMBINED SESSION with The Knee Society and will be held in Grand Ballroom 8.**
### Session IX: Complications

**Moderator: William L. Healy, MD (Newton, MA)**

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<th>Topic</th>
<th>Speaker/Institution</th>
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<tbody>
<tr>
<td>3:31 pm – 3:37 pm</td>
<td>Optimizing Risk Factors and Preventing Readmissions</td>
<td>Richard Iorio, MD (New Rochelle, NY)</td>
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<tr>
<td>3:38 pm – 3:44 pm</td>
<td>Infection Prevention: What Should We Do?</td>
<td>Bryan D. Springer, MD (Charlotte, NC)</td>
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<tr>
<td>3:45 pm – 3:51 pm</td>
<td>When is Irrigation and Debridement Indicated for Infection?</td>
<td>David J. Mayman, MD (New York, NY)</td>
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<tr>
<td>3:52 pm – 3:58 pm</td>
<td>Two Stage vs. One-Stage Treatment of Deep Infection in 2017</td>
<td>Fares S. Haddad, MD (London, United Kingdom)</td>
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<tr>
<td>3:59 pm – 4:15 pm</td>
<td>DISCUSSION</td>
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### Combined Session X: Transitioning to Value-Based Healthcare

**Moderators: Kevin J. Bozic, MD, MBA (Austin, TX) & Richard Iorio, MD (New Rochelle, NY)**

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<th>Time</th>
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<th>Speaker/Institution</th>
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<tbody>
<tr>
<td>4:16 pm – 4:22 pm</td>
<td>Optimizing Patient Health Status and Improving Outcome for TJA: Using Population Health Management to Deliver Value-Based Care</td>
<td>Joseph A. Bosco, III, MD (New York, NY)</td>
</tr>
<tr>
<td>4:23 pm – 4:29 pm</td>
<td>Partnering with the Patient to Improve Outcomes in the TJA: The Role of Shared-Decision Making in Advising Patients of Risk and Comorbidity Burdens</td>
<td>Kevin J. Bozic, MD, MBA (Austin, TX)</td>
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<td>4:30 pm – 4:50 pm</td>
<td>Value-Based Payment Strategies, MACRA, and the Merit-Based Incentive Payment Program: Advanced Alternative Payment Models Are Our Best Way Forward</td>
<td>Shari M. Ling, MD, Deputy Chief Medical Officer, Centers for Medicare and Medicaid Services (Brooklyn, MD)</td>
</tr>
<tr>
<td>4:51 pm – 4:57 pm</td>
<td>The Role of Registries, PR0s, and Quality Measures in Improving Value and Outcomes and Determining Physician’s Payment: This is Our Future!</td>
<td>David C. Ayers, MD (Worcester, MA)</td>
</tr>
<tr>
<td>4:58 pm – 5:15 pm</td>
<td>DISCUSSION</td>
<td></td>
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<tr>
<td>5:15 pm</td>
<td><strong>MEETING ADJOURNED</strong></td>
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</tbody>
</table>

*Harry E. Rubash, MD (Boston, MA) & Thomas P. Sculco, MD (New York, NY)*
ABSTRACTS
The most common reasons for revision after total hip arthroplasty (THA) historically have been aseptic loosening, bearing wear, hip instability, and infection.

As the methods of implant fixation, bearing surfaces, femoral head diameter, operative approaches and the most commonly used implant technologies have changed, the frequency of specific types of revision after THA are also changing.

Overall the rate of revision after primary THA has fallen over the last decade, mainly as a consequence of improved implant fixation and common use of cross-linked polyethylene (PE) bearings.

Wide use of uncemented implant fixation is leading to fewer late revisions for implant loosening. However, the widespread use of uncemented fixation has led to more early revisions for femoral periprosthetic fracture.

Crosslinked PE use is notably reducing revisions for PE wear, especially in younger patients. There are still some patients with metal-metal bearings requiring revision surgery, but this is mainly a “tail” from more frequent use in the mid 2000’s.

Dislocation remains the second most common reason for revision after mechanical failure, but larger diameter heads have reduced the absolute rate of revision for this indication. Dual-mobility implant use in selected patients may also reduce the overall rate as time goes on.

Use of the direct anterior approach by some surgeons has been associated with lower rates of early revision for dislocation, but a higher risk of early revision for femoral component loosening.

Infection has not declined and remains a major unsolved problem.
While THA generally has favorable clinical outcomes in patients with advanced OA, there remains a risk of unfavorable outcomes. This includes operative and post-operative complications potentially leading to readmissions or revision surgery. Often these suboptimal outcomes are tied to comorbidities or complications associated with their THA. Modifiable risk factors for poor clinical outcomes following THA include: 1. morbid obesity, 2. poorly controlled diabetes and nutrition, 3. *Staphylococcus aureus* (S. aureus) colonization, or hepatitis C and/or HIV infection, 4. cardiovascular disease, 5. venous thromboembolic disease (VTE), 6. tobacco use, 7. neurocognitive, psychological and behavioral problems (including drug or alcohol dependency) and 8. physical deconditioning, frailty and fall risk. Together, these eight modifiable risk factors significantly account for avoidable complications and poor clinical outcomes following TJA. Identifying and modifying these risk factors prior to surgery presents an opportunity to decrease avoidable complications, improve clinical outcomes, and decrease costs associated with unnecessary health services utilization following these procedures.

Although some of these modifiable risk factors may be longstanding and recalcitrant to change, patients may express a renewed interest in addressing them if they stand in the way of obtaining THA, a procedure they hope will result in dramatic changes in pain, physical function and quality of life. The prospect of undergoing THA may therefore provide an opportunity (i.e. “teachable moment”) to identify and manage such modifiable risk factors through shared decision making. Primary care physicians, internists and specialty physician involved in the pre-admission clearance process can all participate in decreasing these risk factors preoperatively. By implementing these risk factor optimization programs, we were able to lower our complications after THA operation and our readmission rates. The concept of a Perioperative Orthopaedic Surgical Home (POSH) to optimize patients preoperatively is the NYULMC plan to deal with these difficult patients.

**Comorbidity Prevalence in TJA patients**

<table>
<thead>
<tr>
<th>Comorbidity</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Musculoskeletal comorbidities</td>
<td>73.8%</td>
</tr>
<tr>
<td>Hypertension</td>
<td>60.1%</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>55.3%</td>
</tr>
<tr>
<td>Tobacco use</td>
<td>22.0%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>19.2%</td>
</tr>
<tr>
<td>Depressive disorders</td>
<td>14.5%</td>
</tr>
<tr>
<td>Morbid Obesity</td>
<td>13.8%</td>
</tr>
<tr>
<td>Ischemic Heart Disease</td>
<td>13.5%</td>
</tr>
<tr>
<td>Dysrhythmias</td>
<td>10.8%</td>
</tr>
<tr>
<td>Valve disease</td>
<td>7.8%</td>
</tr>
<tr>
<td>Cerebrovascular Disease</td>
<td>4.4%</td>
</tr>
<tr>
<td>CHF</td>
<td>2.8%</td>
</tr>
</tbody>
</table>
Additionally, the patients with comorbidities that did not have a readmission may have an increased risk of a complicated initial hospitalization: 506/2772 TJA patients had a length of stay of 7 days or longer with average costs of $32,609- $84,678 per admission, substantially higher than our average of $24,000 during that time period. The vast majority (95%) of increased length of stay or readmitted patients had at least 1 modifiable risk factor in their history. Additionally, about 50% had 2 or more modifiable risk factors. We have validated a POSH Readmission Scoring Tool which quantifies modifiable risk factors and predicts readmission risk, thus identifying patients who would benefit from surgery delay and risk factor optimization.
<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Points on Risk Stratification Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Infection risk factors: Staphylococcus Aureus colonization</strong></td>
<td>Hard Stop</td>
</tr>
<tr>
<td>Every patient is screened</td>
<td></td>
</tr>
<tr>
<td>If positive for Staphylococcus colonization:</td>
<td></td>
</tr>
<tr>
<td>▶ Nasal mupirocin or providone-iodine, chlorhexidine</td>
<td></td>
</tr>
<tr>
<td>▶ Glucocortic (CGR) wipes, and appropriate antibiotic coverage</td>
<td></td>
</tr>
<tr>
<td>▶ If these requirements are not met then hard stop until protocol implemented</td>
<td></td>
</tr>
<tr>
<td><strong>Smoking (Tobacco use)</strong></td>
<td>1</td>
</tr>
<tr>
<td>All tobacco users will be enrolled in tobacco cessation program 4 to 8 weeks prior to surgery</td>
<td></td>
</tr>
<tr>
<td><strong>Obesity</strong></td>
<td>Hard Stop</td>
</tr>
<tr>
<td>BMI greater than 40:</td>
<td></td>
</tr>
<tr>
<td>▶ Enroll in nutritional counseling program</td>
<td></td>
</tr>
<tr>
<td>▶ Long-term weight loss program, and</td>
<td></td>
</tr>
<tr>
<td>▶ Undergo bariatric consult</td>
<td></td>
</tr>
<tr>
<td>BMI 35-40:</td>
<td>2</td>
</tr>
<tr>
<td>▶ Patients will be enrolled in nutritional counseling with</td>
<td></td>
</tr>
<tr>
<td>&gt;&gt;&gt; consideration of acute weight loss program</td>
<td></td>
</tr>
<tr>
<td>BMI 50-55:</td>
<td>1</td>
</tr>
<tr>
<td>▶ Enroll in nutritional counseling program</td>
<td></td>
</tr>
<tr>
<td><strong>Cardiovascular Disease</strong></td>
<td>1</td>
</tr>
<tr>
<td>Patient has history of coronary artery disease (CAD), stroke, peripheral vascular disease or VTED, age ≥60 years and 2 cardiac risk factors: renal insufficiency (CrCl ≤ 60ml/min); Diabetes; chronic obstructive pulmonary disease; Hypertension; Recent smoker (&lt;30 days); Cancer; Heart failure</td>
<td></td>
</tr>
<tr>
<td>▶ All qualifying patients will be enrolled in OPTIMIZE OS perioperatively</td>
<td></td>
</tr>
<tr>
<td><strong>Venous Thromboembolic Disease</strong></td>
<td>2</td>
</tr>
<tr>
<td>History of pulmonary embolus or deep venous thrombosis:</td>
<td></td>
</tr>
<tr>
<td>▶ Consider inferior vena cava (IVC) filter or aggressive VTED management</td>
<td></td>
</tr>
<tr>
<td>Has VTED risk factors: CVA, COPD, BMI &gt;30, CAD, stroke, PVD, activated protein C resistance</td>
<td>1</td>
</tr>
<tr>
<td><strong>Neurocognitive, psychological and behavioral problems</strong></td>
<td>2</td>
</tr>
<tr>
<td>(including alcohol and drug dependency)</td>
<td></td>
</tr>
<tr>
<td>Alcohol abuse or chronic active narcotic dependency</td>
<td>2</td>
</tr>
<tr>
<td>Neurocognitive deficits such as traumatic brain injury (TBI), active psychiatric illness, dementia etc.</td>
<td>1</td>
</tr>
<tr>
<td>Score of 7 or more on catastrophizing, PHQ-9</td>
<td></td>
</tr>
<tr>
<td><strong>Physical Deconditioning</strong></td>
<td>2</td>
</tr>
<tr>
<td>Nonambulatory or needs assistance with transfers status</td>
<td></td>
</tr>
<tr>
<td>Comorbidities affecting physical function and ambulation</td>
<td>1</td>
</tr>
<tr>
<td><strong>Diabetes</strong></td>
<td>Hard stop</td>
</tr>
<tr>
<td>Fasting blood glucose ≥180</td>
<td></td>
</tr>
<tr>
<td>▶ Must be corrected prior to surgery, consider referral to diabetic management clinic (endocrinologist)</td>
<td></td>
</tr>
<tr>
<td>High A1c ≥ 8</td>
<td>2</td>
</tr>
<tr>
<td>▶ Referred to diabetic management clinic (endocrinologist)</td>
<td></td>
</tr>
<tr>
<td>Well controlled DM</td>
<td>1</td>
</tr>
</tbody>
</table>

POSH Risk Factor Scoring Tool, RRAT
Risk Ratio at each POSH Readmission Scoring level (for the random set)

<table>
<thead>
<tr>
<th>POSH Score</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Readmitted (A)</td>
<td>21</td>
<td>36</td>
<td>37</td>
<td>45</td>
<td>49</td>
<td>43</td>
<td>24</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>None (B)</td>
<td>89</td>
<td>95</td>
<td>39</td>
<td>31</td>
<td>12</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ratio = A/B</td>
<td>0.24</td>
<td>0.38</td>
<td>0.95</td>
<td>1.45</td>
<td>4.08</td>
<td>14.33</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>OR (Linear)</td>
<td>0.19</td>
<td>0.41</td>
<td>0.89</td>
<td>1.94</td>
<td>4.21</td>
<td>9.14</td>
<td>19.86</td>
<td>43.12</td>
<td>93.64</td>
</tr>
<tr>
<td>OR (Non-Linear)</td>
<td>0.24</td>
<td>0.38</td>
<td>0.95</td>
<td>1.45</td>
<td>4.08</td>
<td>14.33</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>OR (Linear, Age)</td>
<td>0.18</td>
<td>0.40</td>
<td>0.90</td>
<td>1.91</td>
<td>4.56</td>
<td>10.23</td>
<td>20.20</td>
<td>44.68</td>
<td>104.24</td>
</tr>
<tr>
<td>OR (NL, Age)</td>
<td>0.23</td>
<td>0.37</td>
<td>0.95</td>
<td>1.48</td>
<td>4.26</td>
<td>15.21</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Patients with a POSH Score of 3 had a 1.94 times higher risk of readmission, and with a score of 4 had a 4.21 times higher risk of readmission. This represents an overwhelming opportunity for cost savings, improvement in care and improvement in quality of life for our TJA patients.

-Optimization interventions based on modifiable risk factors

- MRSA Screening and Decolonization, weight based antibiotic dosing, and use of Vancomycin and Gentamycin in high risk patients
- Aggressive HIV and HCV treatment optimization
- Smoking cessation (hard stop)
- Cardiovascular Optimization and Stroke Prevention (using PT, High dose Statins, and ACE inhibitors perioperatively)
- Aggressive weight control (hard stop at a BMI of 40)
- Catastrophizing avoidance
- Drug and alcohol interventions
- Fall education prevention, Frailty screening
- Physical deconditioning physical improvement interventions
- Diabetes control and nutritional interventions
- Screening for high risk VTED patients with thrombophyllia testing and risk stratification in order to avoid aggressive anticoagulation

Modifiable risk factors do play a major role in outcomes post THA. By addressing these issues and enrolling patients in a risk modification program prior to surgical intervention, we may be able to lower rates of complications associated with these procedures. In light of these findings, we are implementing a Peri-operative Orthopaedic Surgical Home (POSH) model that allows for risk stratification of TJA candidates and clinical treatment to mitigate modifiable risk factors in high-risk patients. At NYULMC HJD, we have incorporated a trans-departmental (anesthesia, internal medicine, pulmonary, cardiology, endocrine, nutrition, bariatrics, physical therapy and psychiatry) approach to decrease perioperative morbidity and mortality and decrease readmissions. In today’s bundled payment and quality driven environment, it is no longer economically feasible to simply accept increased risk in poorly managed patients. We have chosen to take an active role in managing modifiable risk factors and will delay surgery until these risk factors are controlled. We are funding a risk stratification coordinator to facilitate management and optimization of modifiable risk factors. At NYULMC HJD we are in year 3 of the BPCI
program. There were 721 Medicare primary TJA patients in year 1 (January 1, 2013 to December 31, 2013) and 785 in year 3 (June 1, 2014 to May 31, 2015) available for analysis. Average hospital length of stay was decreased from 3.58 days to 2.96 days. Discharges to inpatient facilities decreased from 44% to 28%. Number of readmissions at 30 days decreased from 7% to 5%; at 60 days decreased from 11% to 6.1%; and at 90 days decreased from 13% to 7.7%. Although improved care coordination can assist in increasing efficiency of care and controlling costs, it does not prevent all complications and readmissions. Patient selection and risk optimization is the key to decreasing readmissions and complications associated with patient related factors.

References

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Avoiding Venous Thromboembolism  
Jay R. Lieberman, MD

The selection of a prophylaxis agent is a balance between efficacy and safety. Total hip arthroplasty patients receive DVT prophylaxis because orthopaedic surgeons want to prevent the morbidity and mortality associated with pulmonary embolism. The selection of a prophylaxis agent is a balance between efficacy and bleeding. The prophylaxis must prevent symptomatic pulmonary embolism and DVT but at the same time avoid over anticoagulation which may lead to bleeding and other wound problems. Risk stratification is the key to effective prophylaxis.

Although there is great interest in using risk stratification to select a prophylaxis regimen 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) and higher body mass index are probably at increased risk of developing a VTE. The selection of a prophylaxis regimen should also be influenced by the ability to mobilize the patient after surgery. Further research on effective risk stratification strategies is needed.

References

Minimizing the risk of periprosthetic joint infection (PJI) is of interest to all surgeons performing hip and knee arthroplasty. Among the most critical factors to reducing the risk of infection include the use of pre-incisional antibiotics, appropriate skin preparation with clippers (as opposed to a razor for hair removal) and the use of an alcohol based skin preparation. Host factors are also likewise critically important including obesity, diabetes, inflammatory arthritis, renal insufficiency, skin disorders and patients who are otherwise immune-compromised. If modifiable risk factors are identified, it would seem reasonable to delay elective surgery until these can be optimized.

Another factor to consider is the nutritional status of the patient. In a study of 501 consecutive revisions, we found that serological markers suggestive of malnutrition (albumin, transferrin or total lymphocyte count) were extremely common. Specifically, among patients who presented for treatment of a chronic infection, 53% had at least one marker for malnutrition. What was more disturbing, however, that of those patients undergoing an aseptic revision, serum markers of malnutrition were associated with a 6x risk of acute postoperative infection complicating the patient’s aseptic revision. We have confirmed this association in a large study of nearly 50,000 patients in the NSQIP database showing that patients with hypoalbuminemia were at 2x higher risk for surgical site infection following primary total joint arthroplasty.

At our center, we also have studied the use of dilute betadine at the end of the case, prior to wound closure, in an attempt to decrease the load of bacteria in the wound. In a retrospective review the prevalence of acute postoperative infection was reduced from just under 1% (18/1862) to 0.15% (1 of 688; p = 0.04). It is critical that the betadine utilized be STERILE and the dilution we use is 0.35% made by diluting 17.5cc of 10% povidone-iodine paint in 500cc of normal saline. Although this is a retrospective review, it does suggest a benefit and we have not seen any problems associated with its use.

References:


Long-term Results with Polythene
James I. Huddleston, III, MD

Highly cross-linked polyethylene (XLPE) was introduced nearly twenty years ago to reduce wear rates in total hip arthroplasty. Initial hip simulator studies of XLPE produced wear rates significantly lower than those for conventional polyethylene, even with large diameter femoral heads (up to 46mm). The wear resistance of XLPE in long-term in vivo studies is similar to the data reported in the in vitro analyses. In studies with at least ten years follow-up, the mean steady-state linear femoral head penetration rates for XLPE range from 0.2 – 42 μm/year.

Despite its improved wear resistance, wear rates of XLPE may still increase with increasing head size. One study using plain radiographs reports 1) osteolytic lesions in 14% of hips (12/84) at minimum ten years of follow-up and 2) increased volumetric wear with increasing head size. These findings were supported by another recent study that reported 1) a trend of increasing volumetric wear with increasing head size and 2) wear rates unaffected by liner thickness or acetabular component position with ≥ 36mm femoral heads.

While concerns regarding the oxidative stability and mechanical properties of the first generation XLPEs have not been a significant clinical issue to date, second generation cross-linked polyethylenes have been introduced to address these potential deficiencies. Short-term in vivo data on these materials have yielded wear rates (Martell method and radiostereometric analysis) and safety comparable to the first generation XLPEs. Longer follow-up is needed to determine the value of these second generation XLPEs.

Update on Ceramics

Adolph V. Lombardi, Jr., MD, FACS

The search for the optimal bearing combination for use in patients undergoing total hip arthroplasty (THA) presents a challenge for orthopaedic surgeons as they consider the pros and cons of each material and interaction. Younger patients undergoing THA require several decades of implant use under increased activity demands. Implant longevity and stable fixation is necessary for 30 or more years. A recent U.S. study of implant utilization trends that included 174 hospitals and 105,000 THA between 2001 and 2012 found that in 2012 93% of THA were cementless and 35% of THA bearings were ceramic-on-highly crosslinked polyethylene (HXLPE) [1]. Another recent article used the Nationwide Inpatient Sample from 2009 to 2012 to study bearing usage trends in 9265 primary THA in patients 30- to 59-year-old or younger [2]. The researchers observed ceramic-on-polyethylene as the most commonly used bearing surface, used in 36% of patients, and which represented an increase from an earlier study of extremely young patients undergoing primary THA between 2006 to 2009, use of so-called hard-on-hard bearings decreased [3]. Benefits of ceramic-on-HXLPE bearings are that unlike metal-on-polyethylene and metal-on-metal combinations, taperosis and adverse reactions to metal debris are non-existent. Ceramic-on-polyethylene is forgiving, it is an extremely low wear couple, it is the current presenter’s bearing of choice in high demand patients, and it is a good option in the scenario of revision of failed metal-on-metal for taperosis. Advantages to bulk ceramics are: extremely hard and scratch resistant to third body wear, not damaged by instruments and repositioning, excellent wettability, extreme low wear against itself with no know pathogenic reaction to ceramic particles, inherently stable with no oxidation or aging effect, no corrosion, safe in terms of metal ion release, no known risk of hypersensitivity or allergy, and no concerns about biological reaction. Biolox® ceramics have been available since 1974, with fourth generation Biolox® Delta introduced in 2003. Extensive clinical experience includes over 1630 published studies with over 12 million Biolox® components implanted with almost every available hip system. Two recent meta-analyses studies of randomized controlled trials comparing ceramic-on-ceramic to ceramic-on-polyethylene found significantly higher linear wear in ceramic-on-polyethylene but higher incidences of noise and fracture in ceramic-on-ceramic THA [4, 5]. There were no differences in revision, function, dislocation, osteolysis or loosening. A recent meta-analysis review of randomized controlled trials reporting survivorship of ceramic-on-ceramic, ceramic-on-HXLPE, and metal-on-HXLPE found no difference among bearing surfaces in risk of revision after primary THA in patients younger than 65 [6]. Risk ratio for revision was 0.65 (p=0.50) between ceramic-on-ceramic and ceramic-on-HXLPE, and 0.40 (p=0.34) between ceramic-on-ceramic and metal-on-HXLPE. A recent study of ceramic-on-HXLPE bearings for 130 cementless THA in 119 patients younger than 50 years at mean follow-up of 8.3 years (range, 7-9 years) reported mean postoperative Harris hip score of 94, UCLA activity score of 8.1, no acetabular revisions, no osteolysis, no head or liner fracture, and 0.022 ±0.003 mean annual penetration rate of the femoral head [7]. While longer follow-up is necessary, ceramic-on-HXLPE bearings are an attractive option in younger, high demand patients undergoing primary THA.


Are There Indications for Metal-on-Metal THA and Resurfacing?

Robert L. Barrack, MD

Given the high success rate for modern total hip replacement with metal or ceramic heads against cross-linked polyethylene, a high risk alternative is not warranted. Alternative procedures such as metal-on-metal hip resurfacing or metal-on-metal hip replacement must demonstrate and equivalent rate of implant survival in addition to a clinical advantage. A case can be made for hip resurfacing in highly selected cases. The same cannot be said for hip replacement.

The implant survival for hip resurfacing can be equivalent to modern hip replacement if the indications are limited to osteoarthritis in males under 55 – 60. In this specific cohort 5 – 10 year survival rates equivalent to that of standard hip replacement have been reported in the Australian registry. Since the resurfacing procedure has less margin for error, unique complications when an ideal component position is not consistently obtained, and the component is somewhat more expensive, some clinical advantage must be demonstrated. The suggested potential advantages less bone loss (more physiological loading and less stress shielding), improved function and satisfaction, and a higher level of performance in return to demanding activity levels. Stress shielding has been demonstrated to be substantially less with hip resurfacing compared to hip replacement with femoral neck bone loss in the proximal femur of 10% with THA in stems in modern design compared to 0% for hip resurfacing. This may also have a clinical consequence since pain drawing studies have indicated that thigh pain is 3 – 4 times greater following hip replacement compared to hip resurfacing in a similar patient cohort. In a multi-center national study from five major centers when over 800 hip arthroplasty patients were surveyed by an independent interviewer, hip resurfacing patients perceived less limb length discrepancy, less thigh pain, less limp while walking and were more active. Similar results have been reported in terms of higher activity levels in two case controlled studies and one randomized clinical trial. A summary of 12 major peer review studies that were recently published favored hip resurfacing in terms of higher activity levels in eight studies and found no difference in four studies.

While a case can be made for clinical advantage and indications for hip resurfacing in selected patients, the same cannot be said for metal-on-metal hip replacement. Revision rates are higher in all registries reporting on metal-metal total hip except those with 28mm head. Since there is no clinical advantage, increased cost, and a unique set of complications such as noise generation and adverse tissue reaction, there is not currently an evidence based indication to support the use of metal-on-metal total hip arthroplasty.
In this talk I would like to provide a preview of what the future may hold for bearing surfaces to address some of the major remaining issues in total hip patients.

Highly cross-linked UHMWPE, with the clinically-demonstrated high wear resistance, has successfully addressed the periprosthetic osteolysis (PPO) secondary to particulate debris by markedly reducing the overall particle burden evidenced by many individual clinical follow-up studies (1). Dislocation, infection, trunnion corrosion, and pain management are now the major remaining modes of failure in total hip patients. Some of these failures greatly complicate revision surgery and compromise outcomes.

Dislocation resistance increases with increasing femoral head size, which, unfortunately also increases the wear of the UHMWPE acetabular component. Highly cross-linked UHMWPEs enabled the use of larger than conventional femoral head sizes by reducing the risks associated with wear of the acetabular components (2); and helped to reduce the occurrence of dislocation in total hip patients (3). Recently, the use of dual mobility liners helped further decrease dislocation rate, again made possible by the advance of cross-linking (4). While in the United States dual mobility implants are mostly used in revision surgery, worldwide use of these are increasing in primary osteoarthritis patients. With larger femoral components either in dual mobility or conventional total hip designs, some patients experience anterior impingement of soft tissues and resultant hip pain (5). A future bearing surface would need to minimize the soft tissue impingement. Contouring the femoral component to a more anatomical shape in these bearing surfaces has the potential of reducing the soft tissue impingement and in turn reduce the anterior hip pain (6).

Hip resurfacing arthroplasty (HRA) maximizes the femoral head size and in turn minimizes dislocation rate (7). The original HRA implants used polyethylene as the acetabular liner; however, with the staggeringly high wear rate of conventional polyethylene articulating against these very large femoral components, patients suffered extensive periprosthetic osteolysis (8). In the past decade, metal-on-metal hip resurfacings have become popular; yet their outcomes became complicated with metal wear debris and metal ion release, limiting patient indications to a very narrow base. Future HRAs would likely be fabricated from highly crosslinked monoblock acetabular liners to markedly minimize or even eliminate metal wear debris and ion release to make HRAs applicable to a wider patient population.

Antibiotics in bone cement provide some relief in fighting infection in total hips. Alternatively, future bearing surfaces could act as carriers for therapeutic agents. There is compelling evidence that antibiotics blended in UHMWPE can be delivered locally during the first few weeks after surgery and minimize the colonization of any bacterial contamination of the implants and the surgical site (9). Opioid use in postsurgical pain management could increase revision rate (10) and also could contribute to its misuse. What do future bearing surfaces have to offer on this front? In fact, UHMWPE can be blended with analgesics, such as bupivacaine, to deliver these locally over a period of days at sufficient quantities for more efficient pain management. Current data with such implants in rats exhibited very promising outcomes.
Trunnion corrosion typically occurs with large Co-Cr femoral heads, mostly because of the micromotion induced through the increased moment arm, rocking the head. The contributions to this micromotion by increases in coefficient of friction (COF), such as what happens with highly crosslinked UHMWPE, are negligible when compared to what is caused by the rocking caused by the femoral heads. Currently, preference is given to ceramic femoral heads to avoid trunnion corrosion. Future nonmetallic bearing surface materials, such as femoral components fabricated from poly ether-ether ketone (PEEK), an engineering, metal replacement polymer, could potentially reduce complications related to trunnion corrosion.

Future bearing surfaces still have a lot to offer to address some of the remaining problems in total hip surgery. This paper will present data to support the above arguments.

10.Inacio et al. BMC Musculoskelet Disord. 2016; 17: 122
Mechanically assisted crevice corrosion (MACC) is a well-described phenomenon that was first reported in the early 1990s\(^1,2\) after the introduction of modular heads in total hip arthroplasty. While many retrieval studies conducted during that era documented the presence of corrosion in cobalt alloy/cobalt alloy, cobalt alloy/titanium alloy and alumina ceramic/cobalt alloy combinations, there were a very limited number of reports indicating that there were clinical sequelae associated with MACC. Gilbert et al.\(^2\) described the mechanistic basis of MACC whereby the inciting event was fretting at the head-neck coupling leading to disruption of the passivating oxide layer, re-passivation, depletion of oxygen, change in the local solution chemistry (decrease in pH and increase in chloride ion concentration) resulting in instability of the oxide and subsequent attack of the underlying metal. This sequence of events can lead to the release of large quantities of metal degradation products.

In retrospect, as we consider cases of osteolysis from that era, some of the local tissue reactions that were attributed to polyethylene were likely a reaction to corrosion debris which has subsequently been shown to be capable of causing osteolysis in experimental animal models\(^3\) and in humans with corroded modular stainless steel intramedullary femoral nails\(^4\). Furthermore, in some cases histological analysis of periprosthetic tissue associated with failed corroded devices from that area demonstrated a perivascular lymphocytic infiltrate akin to what was later reported as ALVAL (aseptic lymphocyte-dominated vasculitis-associated lesion) in association with failed metal-on-metal devices.\(^5\)

Subsequent to this early experience with head/neck modularity, the concern regarding MACC seemed to have virtually disappeared from our literature, presumably because the orthopaedic implant industry responded by producing head-neck couplings with better performance. However, this issue has re-emerged over the last few years and has taken on a new significance since MACC has been associated with adverse local tissue reactions (ALTR) and clinical failure\(^6\) at a prevalence rate reported to be approximately 1 - 2\%.\(^7\). The central question is: Why is this happening now? In this presentation, five possibilities are considered: i) the implants have changed; ii) the operation has changed; iii) the patients have changed; iv) the surgeon’s awareness has changed; and 5) the patients are being over- or misdiagnosed. At this juncture, the MACC-associated ALTR is incompletely understood.


The modular head-neck junction of the femoral component was introduced in order to decrease the implant inventory and to allow for a simplified adjustment of leg length, offset, and soft tissue balancing [1]. Furthermore, it offers the advantage of allowing easy change of the femoral head while retaining the stem during revision procedures [2]. However, despite the convenience of modular implants, they have been shown to be associated with corrosion at the head-neck junction [3,4,2,5–9]. In this session, we will discuss clinical presentation and diagnosis of taper corrosion.

Patients who underwent total hip arthroplasty with a modular implant and present with groin pain should be fully evaluated for a possibility of taper corrosion and adverse local tissue reactions, as well as the other causes of post-operative hip pain (impingement, bursitis, lumbar disease, tendinitis, infection, or loosening) [7]. Although, groin pain is the most common presenting symptom of taper corrosion, patients can also present with pain in the thigh, trochanter, or buttock [7]. Patients develop taper corrosion over time, and therefore, typically present after a year or two post-THA [2].

Plain radiographs should be obtained to rule out subsidence, loosening, or osteolysis [7]. Patients who have taper corrosion usually have normal radiographs, with occasional medial calcar erosions. Laboratory tests should include erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) to rule out infection, as well as serum cobalt and chromium levels (normal, 0.24 and 0.28 ng/ml). Metal ion abnormalities in modular taper corrosion usually demonstrate greater elevations in cobalt levels (sometimes 5 times higher), when compared to chromium levels (in metal-on-metal it is the opposite) [2]. Although the association between the elevation in metal ion levels and possibility of taper corrosion is well known, it is still debated at what point a surgical intervention is necessary, and therefore, the patient’s history and physical examination should be taken into account. In addition, metal artifact reduction sequences-magnetic resonance imaging (MARS-MRI) has been shown to be the most sensitive modality in recognizing soft-tissue abnormalities in patients with taper corrosion, and can augment the laboratory and physical findings. The most common imaging finding in these patients is a thickened joint capsule and iliopsoas tendon inflammation with fluid collection. In patients who have contraindications to MRI, ultrasound with or without CT scan can be utilized [7].

In summary, taper corrosion usually presents as a groin pain, one to two years post-operatively. The diagnostic tests that need to be ordered include: standard radiographs, ESR, CPR, cobalt and chromium levels, MARS-MRI, and ultrasound and/or CT scan in patients with contraindications to MRI.
References


INTRODUCTION: Adverse local tissue reactions (ALTR) and elevated serum metal ion levels secondary to fretting and corrosion at head-neck junctions in modular total hip arthroplasty (THA) designs have raised concern in recent years. Factors implicated in these processes include trunnion geometry, head-trunnion material couple, femoral head diameter, head length, force of head impaction at the time of surgery, and length of implantation. Our understanding of fretting and corrosion in vivo is based largely on the analysis of retrieved prostheses explanted for reasons related to clinical failure. Work from our lab has demonstrated that damage to trunnions is reduced in implants of similar metals and with trunnions of greater diameter and longer taper engagement lengths. However, little is known about the natural history of head-neck tapers in well-functioning total hip replacements. We identified 56 well-functioning THA prostheses retrieved at autopsy. We sought to determine the pull-off force required for disassembly and to characterize fretting and corrosion apparent at the head-neck junctions of THAs that had been functioning appropriately in vivo.

METHODS: 56 cobalt-chromium femoral stems which engaged 43 cobalt-chromium femoral heads and 13 ceramic heads were retrieved at autopsy after a mean length of implantation (LOI) of 10.6 ± 5.4 years (range 1.2-24.5). There were 36 12/14 tapers (5 ceramic, 31 CoCr heads) and 20 14/16 tapers (8 ceramic, 12 CoCr heads). Femoral heads were pulled off on a uniaxial load frame according to ASTM standards under displacement control at a rate of 0.05mm/s until the femoral head was fully disengaged from the trunnion. Mating surfaces were gently cleaned with 41% isopropyl alcohol to remove any extraneous debris. Femoral trunnions and head tapers were examined under a stereomicroscope by two independent graders to assess the presence and severity of fretting and corrosion (method previously established) The previously established scoring method has been adjusted in that the possible scores range from 0-3 as opposed to the original 1-4. Trunnions and tapers were divided into 8 regions: anterior, medial, posterior, and lateral in both proximal and distal zones. Minimum possible damage score per hip was 0 (indicating pristine surfaces). The maximum possible score per hip was 96 (2 damage modes x 2 mating surfaces x 8 regions x max score of 3 per region).

RESULTS: Mean pull-off force among all retrievals was 2746 ± 1260 N. Among taper designs, significantly more force was required to pull off ceramic heads mated to a 12/14 taper than to pull off cobalt-chrome heads (1655 – 4246 N). Evidence of fretting or corrosion was rare (Fig 1). All but one implant had minimal evidence of fretting and/or corrosion and most appeared almost pristine with machining marks still visible on many of the implants (Fig 2). One of the 12/14 Co-Cr implants with a 15.5 head length demonstrated moderate trunnion damage after 11.3 years in vivo (Fig 3). Length of implantation was not correlated with trunnion damage.

CONCLUSION: THAs that had been well-functioning in vivo showed little evidence of fretting and corrosion. The presence of fretting and corrosion was not correlated with increased LOI. This study represents the largest autopsy retrieved trunnion analysis. Our results demonstrate that using this particular stem (Co-Cr alloy) with either the 12/14 or 14/16 taper and either a ceramic or CoCr head created little evidence of
fretting and or corrosion. However, these results may not be applicable to other stem designs, material compositions, or trunnion designs. Further investigation is required to clarify the clinical implications of these results.

**Results**

![Damage Score vs Length of Implantation](image)

**Fig 1. Damage Score vs Length of Implantation**

![Image of retrieved component with minimal or no damage](image)

**Figure 2. Retrievals were noted to have minimal or no damage. Machining marks were still visible on all retrievals.**
Fig 3. The 12/14 taper with CoCr head demonstrating fretting and corrosion
Comparing all the specimens grouped by head material and taper geometry and using an ANOVA yields a p-value of 0.18 (indicating no differences with the numbers available). Comparing only the specimens with 12/14 tapers using an Independent Samples t-test with equal variances not assumed also yields a p-value of 0.18 (indicating no differences with the numbers available). Since the data is not normally distributed, comparing only the specimens with 12/14 tapers using a Mann-Whitney U test yields a p-value of 0.11 (indicating no differences with the numbers available). Descriptive data for the 4 groups is summarized below.

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<th>FORCE</th>
<th>95% Confidence Interval for Mean</th>
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<td>Lower Bound</td>
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<td>CoCr 12/14</td>
<td>2128.7125</td>
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<td>Co Cr 14/16</td>
<td>2278.5594</td>
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<td>Cermic 12/14</td>
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<td>Ceramic 14/16</td>
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Modularity in total hip arthroplasty (THA) allows surgeons to optimize implant reconstruction to patient anatomy intraoperatively. The introduction of femoral stem head-neck modularity has now been a mainstay design feature for over two decades. The so-called ‘dual-taper’ THA implants possess interchangeable necks, providing additional modularity at the femoral neck-stem interface. Recently, however, there is increasing concern regarding the occurrence of adverse tissue reactions in THA patients with metal-on-polyethylene bearings due to corrosion at modular taper junctions, which is emerging as an important reason for failure requiring revision surgery. Although adverse local tissue reactions (ALTR) or ‘pseudotumours’ were initially described as a complication of metal-on-metal bearings, the presence of ALTR in patients with taper corrosion is thought to result from corrosion at the modular taper junction, secondary to reciprocating movement at the modular junction leading to fretting corrosion in a process described as mechanically assisted crevice corrosion (MACC). Therefore, the focus of this presentation is to summarize clinical challenges in treatment and outcome of patients with adverse local tissue reactions due to taper corrosion and review up-to-date evidence.

Revision surgery for taper corrosion necessitates a thoughtful systematic approach to reduce intraoperative complications. Meticulous and careful debridement must be performed to remove the pseudotumour, while protecting neurovascular structures. The largest diameter ceramic femoral head with titanium sleeve compatible with the acetabular component is used to maximize head/neck ratio in order to optimize intraoperative stability. Removal of a well-fixed stem, when indicated, is technically challenging. Techniques such as trochanteric osteotomies, stack pin techniques and “top-out” techniques have been described for stem removal. The use of modular revision femoral implants such as titanium modular tapered femoral stems is frequently required to optimize intra-operative stability in the presence of extensive tissue necrosis.

Patients undergoing revision surgery due to taper corrosion are often concerned about the systemic elevation of metal ion levels and inquire about the time required to return to normal. The metal ion levels in the vast majority of patients with elevated cobalt and chromium ion levels decline to very low or undetectable levels following revision surgery, with the serum cobalt and chromium levels declining on average by 32% and 21% at six weeks post-revision surgery.

The revision surgery may lead to increased complication rates and re-revision rates in the setting of significant adverse tissue reaction. A high rate of early complications (20%) and re-revisions (8%) was recently reported following revision of ALTR associated with taper corrosion. The most common complication was dislocation despite use of large femoral head sizes, followed by ALTR recurrence. Intraoperative tissue necrosis was correlated with complication rate, suggesting the importance of early systematic evaluation of at-risk patients including metal ion levels and MARS MRI in optimizing revision surgery outcome.
References


Metabolic bone disease status has a marked influence on hip and knee arthroplasty. Inadequate bone mass and altered bone quality weaken bone and result in low energy fractures. Poor bone states alter the bone anatomy, compromise porous incorporation. Increase risk of periprosthetic fracture, and worsen revision surgery. This session will highlight diagnosis, provide strategies for resolving calcium and Vitamin D supplements and prioritize the current osteoporotic drug options.
Developing and Implementing a Comprehensive Hip Fracture Program

Stephen L. Kates, MD

Leadership

Orthopaedic surgeon
Hospitalist / Geriatrician
Anesthesiologist
Nursing
Collegial relationships
Agree on admitting service
Ortho and medicine see the patients daily

Standard hip fracture order sets

Co-developed
Agreement on local “best practices”
Geriatric needs considered
Compromise to the practical
Avoid iatrogenic errors

Co-management of inpatients

Geriatrics/Hospitalists plus Orthopaedic surgeons co-manage patient with nurses, social workers and therapists

Protocol driven care pathways

Avoid variation & errors
“Inappropriate creativity”
Increased efficiency, productivity, satisfaction
Entire team knows shares expectations

Protocol driven care pathways

For stable patients
Ideally < 24 hours from admission*
Improves outcomes
Should be a quality metric

**Early surgery for stable patients**

Demand matched implants

Standard approach to each fracture

Goal is stable repair allowing immediate weight bearing

This approach shown to be superior

**Standard surgical protocol**

Use a printed poster in the OR

All surgeons should buy-in

**Coordinated discharge with social work**

Starts on admission

Rehabilitation or LTC placement

Home with home care services

Team members support and consistent

Length of stay 4.5 d average

**Post-Acute Care Variation**

Need partner SNF’s

Helps to have partner medical team there

Home Health agency partner

Align incentives to streamlined care

**Summary**

Many changes in the next few years

Driver: cost reduction

Need leadership, order sets, care pathway, co-management and care coordination

Success will require redesign of care model
Fix or Replace? Results from “Big Data”  
George J. Haidukewych, MD

Over the last decade, several high level randomized trials have helped to determine a definitive answer in the treatment of displaced femoral neck fractures in the elderly patient. Focusing on functional outcomes as well as complication and reoperation rates, arthroplasty consistently exhibited superior results when compared to internal fixation. Analyzing the highest level randomized trials over the past 15 years, each study favored arthroplasty (either hemi- or total) over internal fixation in all categories, all studies concluding that arthroplasty had a significantly lower risk in complications, revisions, reoperations, functional outcomes, and postoperative pain. In this presentation, results from these trials will be reviewed, along with the future questions that concern this important topic.

The presentation will cover the clinical pathway of hip fractures in elderly patients, and displaced femoral neck fracture in particular. Preoperative fast-track care can shorten time-to-surgery and improve outcome. For displaced femoral neck fracture, the advantages of arthroplasty compared to internal fixation are supported by several studies. The discussion of total hip arthroplasty (THA) versus hemiarthroplasty (HA) and uni- versus bipolar HA is based on a number of studies, but no clear-cut evidence based recommendation can be made, mainly due to the many factors that influence the outcome. In elderly, THA seems to give the best patient reported outcome. THA may be particularly advantageous for active, lucid patients with relatively long remaining life-expectancy. For biologically more aged patients HA is probably satisfactory, and for the oldest, unipolar implants are considered sufficient. If the hospital setting allows emergency THA surgery in sufficient numbers and quality, the remaining group of patients considered for bipolar HA may be very small. Direct lateral approach reduces the risk of dislocation compared to posterior approach. If posterior approach is used, other measures to reduce dislocation risk may be dual mobility cups or larger heads of conventional THA. Cemented implants lower the risk of periprosthetic fracture and its subsequent morbidity and mortality. As the risk of perioperative death related to bone cement can be reduced by adequate measures, cemented implants are recommended in fracture cases. Regardless of hip fracture type, long term rehabilitation (6 months or longer) and care provided by a multidisciplinary team are equally important parts of the treatment as high-quality surgery.
Background: Enacting a transition of total hip arthroplasty (THA) patients from the inpatient to outpatient setting requires planning, detailed coordination and proper patient selection. This will outline the essential elements and processes required to build an outpatient THA program.

Methods: The essential elements of an outpatient THA program include appropriately trained surgical and perioperative staff, a coordinated partnership with anesthesia, a multi-modal pain control program and perioperative outpatient protocols, a perioperative medical specialist or team, physical therapy, a robust patient and family education program, facilities conducive to THA procedures and instrumentation, optimized surgical techniques and patient selection based on specific surgical and medical risk factors. Perhaps the most challenging for the orthopaedic surgeon is selecting patients based on medical risk stratification and optimization.

A retrospective review of 1120 consecutive primary total joint arthroplasties in an early discharge program was performed. An Outpatient Arthroplasty Risk Assessment (“OARA”) score was developed based by a high volume arthroplasty surgeon and dedicated perioperative internal medicine specialist to stratify patients as “low-moderate risk” and “not appropriate” for early discharge. OARA and American Society of Anesthesiologists (ASA) scores were analyzed with respect to length of stay.

Results: The positive predictive value of the OARA score was 81.6% for same or next day discharge, compared to 56.4% for ASA ($p < 0.001$) and 70.3% for CCI ($p = 0.002$). Patients with OARA scores $\leq 59$ were $2.0$ (95% CI 1.4:2.8) times more likely to be discharged early than those with scores $\geq 60$ ($p < 0.001$), while a low ASA score was $1.7$ [95% CI 1.2:2.3] times more likely to be discharged early ($p = 0.001$). CCI did not predict early discharge ($p \geq 0.301$). With deliberate patient education and expectations for outpatient discharge, the odds of early discharge predicted by the OARA score, but not ASA score, increased to $2.7$ (95% CI 1.7:4.2).

Conclusion: The elements outlined above provide the basis for a successful outpatient THA program. The OARA score for patient selection has more precise predictive ability than the ASA score, and is enhanced with a robust patient education program to establish appropriate expectations for early discharge. Ultimately, patient care and safety should remain the primary focus when building a successful outpatient THA program.
Outpatient THA is a Triumph of Passion Over Reason  
Vincent D. Pellegrini Jr., MD

Despite general enthusiasm for shortened length of hospital stay and rapid recovery following total joint replacement, there are important factors that suggest caution when considering adoption of outpatient surgery protocols after these procedures. Specifically, perioperative complications threaten smooth recovery after total hip replacement; by 3 months after operation, 2.7% of patients require reoperation, 6% experience some type complication, and 15% are readmitted for some cause. These numbers are not trivial, but often escape the attention of the operating surgeon.

For total hip replacement, there are three principal areas of concern relative to routine outpatient procedures:

a) Patient safety relative to early complications – A substantial percentage of early complications after THA occurs soon after operation. A Charlson Index of 2 or greater or in-hospital DVT/PE increase index hospitalization costs by more than 10%. Specifically, 1.25% of patients experience symptomatic VTE after THA and 20% occur during the index admission.

b) Acute pain management is integral to optimal outcome - Postoperative analgesia in the 24 hours following operation has a major impact on early convalescence and ultimate functional outcome following THA. Regional anesthesia and peripheral nerve blocks are best employed with inpatient monitoring; premature mobilization risks postural hypotension and increases fall risk.

c) Cost penalties for readmission exceed savings for outpatient surgery - P4P with readmission penalties from CMS may curtail enthusiasm for outpatient THA. In THA patients with minimal comorbidities, length of stay is as strong a predictor of readmission as is preadmission severity of illness. The cost associated with a single readmission is enough to cover the cost of 14 incremental postoperative hospital days after index procedure!

The issue of outpatient THA is not CAN it be done but, rather, SHOULD it be done?
THE JOHN CHARNLEY AWARD

A Randomized Clinical Trial of Direct Anterior Approach and Mini-Posterior Approach Total Hip Arthroplasty

Michael J. Taunton, MD; Robert T. Trousdale, MD; Rafael J. Sierra, MD; Ken Kaufman, PhD; Mark W. Pagnano, MD

Full Title:
A Large Randomized Clinical Trial of Direct Anterior Approach and Mini-Posterior Approach Total Hip Arthroplasty: Which provides better early functional recovery?

Background
Choice of surgical approach for total hip arthroplasty (THA) has provided significant controversy in the orthopedic literature. There has been a suggestion that the direct anterior approach (DAA) leads to less muscle damage than the Mini Posterior Approach (MPA). However, there is little evidence to support the clinical significance to date.

Questions/Purposes
(1) Does DAA result in quicker gains in activities of daily living than MPA?
(2) Does DAA have superior patient reported outcome measures than MPA?
(3) Does DAA have improved radiographic outcomes than MPA?
(4) Does DAA have a higher complication rate than MPA?

Methods
Between March 1, 2013, and May 31, 2016, 115 patients undergoing primary unilateral THA were randomized to either DAA or MPA, 1 patient was excluded after screening, and 15 patients withdrew after randomization. Recruitment stopped when 52 patients had been randomized into both the DAA group and 49 in the MPA group (n = 101). One high-volume surgeon performed all of the DAA and three high-volume surgeons performed the MPA THAs, regardless of who the patients’ initial consulting surgeon was. Groups did not differ in mean age (65.4 years; SD 10.7; range, 38-86 years), sex (52% female), or mean body mass index (mean 29.2 kg/m2; SD 6.2kg/m2; range, 21.3-40 kg/m2) (all p >0.40). Operative details, in-hospital complications, therapy progress, pain scores, and functional results from a milestone diary were recorded. Functional results included time to discontinue gait aids, discontinue all narcotics, and independence with various activities of daily living. Activity in study subjects was measured with 5 wearable activity monitoring sensors with tri-axial MEMS accelerometers and validated custom algorithms and conducted over three days at pre-op, 2 weeks, 8 weeks, and one year for each patient. Clinical and radiographic outcomes, SF-12, WOMAC, and HHS scores to one year were also tabulated.

Results
Does DAA result in quicker gains in activities of daily living than MPA?
Early functional recovery favoured DAA compared to MPA; time to discontinue walker (10 vs. 14.5 days, p=0.01), time to discontinue all gait aids (17.3 vs 23.6 days, p=0.04), discontinue narcotics (9.1 vs. 14 days, p=0.05), ascend stairs with gait aid (5.4 vs. 10.3 days, p<0.01), and to walk 6 blocks (20.5 vs. 26.0 days, p=0.05). There were no other differences in early functional milestones. In hospital outcomes
favoured DAA including; morphine equivalents (DAA 100 mg vs. MPA 144 mg, p=0.01), average in-hospital VAS pain score (DAA 2.1 vs. MPA 3.1, p<0.01), and walking with physical therapy at first session (DAA 100 ft. vs MPA 67 ft. p=0.02). Activity monitoring at two weeks postoperatively favoured DAA; mean steps per day were 3897 (SD 2,258, Range 737-11,010) versus MPA 2,235 (SD 1,688, Range 27-7,450) (p <0.01), percent of day active, DAA 10.5% (SD 4.6, Range 3.9 - 24.6) versus MPA 6.9% (SD 3.7, Range 1.5-17.3)( p <0.01). There was no difference in activity monitoring pre-operatively, at two months, or at one year.

Does DAA have superior patient reported outcomes than MPA?
The SF-12 physical component change at two months favoured the DAA with at delta of 15, compared to a delta of 10 in the MPA (p=0.03). There was no difference at one year. There was no difference in the SF-12 mental component or the HOOS at any time point.

Does DAA have improved radiographic outcomes than MPA?
There was no difference in the radiographic parameters measured in the two groups. Radiographic measurements included LLD (DAA 0.8 vs MPA -0.3;p=0.17), acetabular anteversion (DAA 23 degrees vs MPA 24 degrees; p=0.21), acetabular abduction (DAA 37 degrees vs MPA 39 degrees; p=0.10), and femoral offset (DAA 0 mm vs MPA 0 mm; p=0.66). There was no loosening or subsidence of any of the components in any hip.

Does DAA come at a higher cost in regards to a higher complication rate than MPA?
The all cause complication rate of the MPA was 10% (5/49), with one dislocation, one wound dehiscence treated non-operatively, 2 intraoperative femoral calcar fractures treated with a cable, and one DVT treated with Xarelto. The all-cause complication rate of the DAA was 8% (4/52), with one dislocation, two wound débridements for dehiscence, and one pubic rami fracture at three months due to a fall.

Conclusions
Both the direct anterior and posterior approach provided excellent early postoperative recovery with a low complication rate. The direct anterior patients had objectively faster recovery than the mini-posterior approach patients, with slightly shorter times to achieve milestones of function and as measured by advanced, quantitative activity monitoring at 2 weeks postoperatively.

Level of Evidence
Level I
THE OTTO AUFRANC AWARD

A Prospective, Randomized Study of Crosslinked and Non-crosslinked Polyethylene for Total Hip Arthroplasty at 15-Year Followup

Charles A. Engh, Jr, MD; Henry Ho, MS; Supatra Sritulanondha, MPH; Ann C. Williams, BS; Robert H. Hopper, Jr, PhD

Introduction: In 1999, our institution initiated a prospective, randomized Institutional Review Board-approved study to compare the clinical outcome of primary total hip arthroplasty (THA) patients who were randomized to either crosslinked polyethylene (XLPE) or non-crosslinked, conventional polyethylene (CPE) liners. At nominal 15-year follow-up, we compared the XLPE and CPE liners based on survivorship, wear rates, incidence of osteolysis, patient satisfaction and Harris Hip Scores.

Methods: Of the 230 THAs that were randomized, 196 (85%) have known outcomes. These include 65 THAs that did not require any reoperation prior to the patient’s death and 20 THAs that have undergone revisions involving the liner. Among patients not known to be deceased or revised, minimum 14-year clinical outcome data is available for 110 THAs and radiographic follow-up is available for 85 THAs. Polyethylene wear was measured radiographically using Martell’s Hip Analysis Suite and osteolysis was assessed prior to revision or at most recent follow-up. Survivorship was calculated using the Kaplan-Meier method.

Results: Among the 116 THAs randomized to XLPE liners, there have been four reoperations including one open reduction without component exchange and three liner and head exchanges for recurrent dislocation. Among the 114 THAs randomized to CPE liners, there have been two liner and head exchanges for recurrent dislocation and 15 related to wear. Using reoperation for wear-related complications as an endpoint, the 15-year survivorship is 100% for XLPE and 86±7% for CPE liners (p<0.001). Among unrevised THAs with minimum 14-year radiographic follow-up, the mean steady-state linear wear rate for THAs with XLPE liners was significantly lower than the mean linear wear rate for the THAs with CPE liners (0.03 vs 0.18 mm/yr, p<0.001). Osteolysis of any size was noted among 9% (4/45) of the hips in the XLPE group and 50% (20/40) of the hips in the CPE group (p<0.001). Based on their own perceptions, 98% (61/62) of unrevised patients with XLPE liners and 98% (47/48) with CPE liners reported they were satisfied with the outcome of their THA (p=1.0). Harris Hip Scores among unrevised patients were similar, averaging 86±16 (median 94, range 34 to 100) for the XLPE group compared to 86±14 (median 92, range 44 to 100) for the CPE group (p=0.97).

Discussion and Conclusion: This prospective, randomized study is one of the first investigations to show long-term clinical benefits associated with the use of XLPE that are becoming increasingly evident during the second decade of in vivo service.

Level of Evidence: Level I - Therapeutic Randomized Control Study
Background: Dislocation is one of the most common complications after revision total hip arthroplasty (THA). Dual-mobility (DM) constructs and large femoral heads (i.e. 40-mm) are two contemporary, non-constrained bearing options used in revision THAs to minimize the risk of dislocation. We sought to determine if DM constructs would provide a clinically meaningful reduction in complications including dislocations, re-revisions for dislocation, and reoperations as compared to 40-mm large femoral heads in revision THAs.

Methods: From 2011 to 2014, a consecutive series of 302 revision THAs receiving either a DM construct (126 cases) or a 40-mm large femoral head (176 cases) were retrospectively reviewed. Primary endpoints included dislocation, re-revisions for dislocation, and reoperations. Age and body mass index were similar between the groups, but there was a slight predominance of females in the DM group (52%) compared to the 40-mm large head group (41% female). There was a bias to use DM constructs in those patients at highest risk for dislocation as 33% of DM patients had the index revision THA completed for a diagnosis of recurrent dislocation versus 9% in the 40-mm large head group. Mean effective head size in the DM group was 47 mm (range, 38 – 58 mm). Overall mean follow-up was 3.6 years (3.3 years in the DM group and 3.9 years in the 40-mm large femoral head group).

Results: The subsequent dislocation rate in the dual-mobility group was lower (3% in the DM group versus 10% in the 40-mm large head group; p=0.03), and this difference was present even in the face of the bias to use DM constructs in the highest risk patients (i.e. pre-revision diagnosis of recurrent dislocations). Re-revision for dislocation in the DM group was lower (1% in the DM group versus 6% in the 40-mm large head group; p=0.03). Reoperation for any cause in the DM group was lower (6% in the DM group versus 15% in the 40-mm large head group; p=0.02).

Conclusion: Compared to patients treated with a 40-mm large femoral head, revision THA patients who received a dual-mobility construct had a lower risk of subsequent dislocation, lower risk of re-revision for dislocation, and lower risk of reoperation for any reason at 3.6 years of follow-up. Those findings were present despite a selection bias to use the dual-mobility constructs in those patients at the highest risk for subsequent dislocation. Given the substantively lower risk of subsequent dislocation, re-revision, and reoperation with the dual-mobility construct, some surgeons may wish to consider whether the role of dual-mobility constructs should be judiciously expanded in contemporary revision total hip arthroplasty.
Identification of the ‘At Risk’ Genotype for Development of Pseudotumours around Metal-on-Metal Total Hip Arthroplasties

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Introduction: Once touted as the future of hip replacement, metal-on-metal (M-o-M) bearing surfaces have fallen sharply from favour with the emergence of a strong body-of-evidence demonstrating unacceptably high premature implant failure rates. The previously unpredictable development of Adverse Local Tissue Reactions (ALTRs) has been a substantive contributor to this. While the underlying pathophysiology of these so-called ‘pseudotumours’ is now well understood, the fundamental predisposing patient risk factors have remained elusive. The aim of this research, as a clinical-genotype correlation analysis, was to identify specific alleles associated with the development of ALTRs in patients with in situ M-o-M total hip arthroplasties (THAs).

Methods: A case-control study of patients who received a large-head, primary M-o-M THA between 2005-2008 was performed, with a minimum follow-up of 5-years. ‘Case’ subjects were patients that had undergone revision of a primary M-o-M THA secondary to symptomatic ALTRs. ‘Control’ subjects were randomly selected asymptomatic patients, with no evidence of ALTRs on protocol-specific screening. Baseline demographics and high-resolution genotype (HLA Class-II) were collected for all patients. Pre-revision serum metal-ion concentrations were used for ‘Case’ subjects, while samples were drawn at the time of final study follow-up for ‘Control’ subjects. Traditional parametric and non-parametric descriptive statistics were performed. The association between the genotype and revision surgery secondary to ALTRs was quantified according to a univariate odds ratio (OR), and an adjusted odds ratio, based on a binary logit model with gender as a covariate. The performance of genotype as a screening test was also evaluated.

Results: Twenty-six ‘Case’ and 28 ‘Control’ subjects were recruited. Cohorts were similar with respect to age at time of primary M-o-M THA (mean: 54.8 vs. 54.9 years, p=0.950), serum cobalt (median: 5.48 vs. 8.47 ug/L, p=0.094) and serum chromium concentrations (median: 2.86 vs. 4.24 ug/L, p=0.271). Mean timeframe from primary M-o-M THA to symptomatic revision was 5.5 years (range: 1.1-9.5). Duration from primary M-o-M THA to final study follow-up was 7.3 years (range: 6.0-8.8) for the ‘Control’ subjects. The prevalence of the Risk Genotype was 29.6% (16/54) among the entire cohort. Univariate tests found the Risk Genotype (OR: 3.50 [95%CI: 1.11, 11.07], p=0.04), and female gender (OR: 4.98 [95%CI: 1.43, 17.31], p=0.01) to be positively associated with revision surgery secondary to ALTRs. Adjusting for gender, the odds of revision was 6.07-times greater among patients with the Risk Genotype present, than patients without [95%CI: 1.45, 25.37] (p=0.012). Among females, the specificity of Risk Genotype was 1.00 [95%CIExact: 0.48, 1.0] (pExact=0.031), and for males it was 0.78 [95%CIExact: 0.563, 0.925] (pExact=0.005).

Conclusion: The findings of this study suggest that, among patients with a primary M-o-M THA, allelic variation within the MHC Class II loci may be a strong, independent risk factor associated with the need for subsequent revision surgery secondary to pseudotumour formation. To our knowledge, this work represents the first demonstrated link between patient-specific genotype and the predictive likelihood of ALTR development. Given the hypothesis-generating nature of this novel undertaking, confirmatory prospective clinical studies are required to further elucidate this correlation and to explore the clinical utility of targeted genetic screening in this specific population. This research may, however, represent a key missing piece-in-the-puzzle that is metal-ion induced pseudotumour formation.
Surgical Approaches to the Hip

Direct Anterior Approach to the Hip: The New Gold Standard or a Marketing Opportunity?

Keith R. Berend, MD

Anterior supine intermuscular total hip arthroplasty (ASI-THA) has emerged as a muscle sparing, less-invasive procedure. It is versatile, with reported use expanding beyond the primary realm to revision and resurfacing THA as well as treatment of acute fracture in elderly patients, who due to their diminished regenerative capacity may benefit more from the muscle-sparing nature of the anterior approach. The direct anterior supine intermuscular approach is used in the majority of primary THA and many revision procedures at our center for the following reasons: 1) the impression of our hospital-based physical therapists that patients done via the anterior approach have better immediate function; 2) speed of recovery; 3) practice harmony, that is, to offer a consistent service; and 4) to comply with patient requests.

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 a direct lateral approach (DL), the two groups were similar demographically although BMI was somewhat higher in DL patients (30 vs 29 kg/m²; p=0.004). Estimated blood loss was higher in ASI patients (138 mL DL vs. 155 ASI, p<0.001). However, operative times and need for transfusion were similar. More ASI patients were discharged directly to home after surgery, and Harris hip scores were significantly higher at 6 weeks (80 vs. 75, p<0.001). Frequency of perioperative complications and reoperations was similar.

In a study examining the incidence of periprosthetic fractures with this approach [2] we identified 2869 primary ASI-THA done using a single cementless, tapered stem design with both short and standard length options. There were 26 (0.9%) early periprosthetic femoral fractures, with 23 requiring revision. When looking at the potential risk factors of age, gender, BMI, and stem length, the only significant finding was that increased age was associated with increased risk of femoral fracture. Logistic regression analysis revealed a significant age-fracture association for female gender only, which remained when controlled for BMI, stem length, or both. The early femoral fracture rate may warrant consideration of using a different design or approach in elderly female patients.

In a recent review of all patients undergoing primary THA at our center by three surgeons between 2007 and 2014, 3540 were ASI and 2162 were DL (Berend KR, 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] DL, 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] DL, p=<0.001).

The findings from our institution are supported by other authors that have shown similar benefits of early recovery using the anterior approach. Goebel et al. reported that ASI-THA had less postoperative pain, required less pain medication, and had shorter length of stay and a quicker time to full recovery than more
traditional approaches [6]. Likewise, Alecci et al demonstrated improved post-operative pain scores, decreased length of stay and a greater percentage of patients were discharged to home with the ASI approach versus a standard lateral based approach [7]. Retrepo et al compared the ASI and direct lateral approaches in a prospective, randomized study [8]. Using numerous validated outcome measures the DAA had significantly better improvements at 6 weeks, 6 months, and 1 year. At 2 years, results were the same between the two groups [8]. The ASI approach also causes less soft-tissue disruption as evidenced on MRI [9].

There are complications with the anterior approach, most notably periprosthetic femur fracture, but the rate appears to be low and decreases with increased experience. There is no need for a special operative or fracture table to perform the procedure. As with any technique care must be taken as a surgeon becomes comfortable with the approach. We recommend for the novice surgeon to have one-on-one training sessions on cadavers before attempting on patients in their practice. Thoughtful patient selection and patience are encouraged during the early phases of implementation but overall we have found the anterior approach to be advantageous. Further research needs to look at comparisons of the differing anterior techniques and to assess the long-term outcomes of the approach. It is our hope that continued refinement of the technical aspects of ASI-THA may lessen complication rates in the future.

**Suggested Reading:**
The excitement and enthusiasm that accompanies the introduction of many new technologies and techniques can be self-sustaining, meaning that the appeal of doing something new or different (not necessarily doing something better) becomes the prime driver. Such is likely the case today with the direct anterior approach to total hip arthroplasty. Can THA be done successfully through a direct anterior approach? Certainly the answer is yes; and with experience it can be done in relatively broad groups of patients with an acceptable risk of complications. Is it a better way to do THA than other approaches? Well, “better” implies a value-judgement and while proponents can point to small increases in early function the detractors can point to small increases in complications so how one values function versus complications fundamentally influences the interpretation of better.

Contemporary THA done with a variety of approaches and coupled with advanced anesthetic, pain management and rapid rehabilitation protocols has been shown to be safe and effective with both short hospital stays (48 hours) and even outpatient surgery in selected patients. The purported benefits of direct anterior related to more rapid recovery, better function, or a lower dislocation risk just have not proved to be demonstrable in broad groups of patients. In regard to recovery there are now several studies suggesting no difference at 2 hours; 2 days; 2 weeks or 2 years after surgery. In contrast however a large RCT from Mayo Clinic did show some short-term improvement in function including ability to carry out more complex gait activities with direct anterior THA at 2 months. In regard to lower risk of dislocation if we pool the data from big published studies Sariali (1.5%) Matta (0.6%) Jewett (1%) and Woolson (0%) the mean is 0.88%. Interestingly, contemporary posterior approach THA with formal capsular repair also has <1% dislocation rate when we look at published data from White (0.5%) Pagnano (0.3%) and Dorr (0%).

Compared to mini-posterior THA the direct anterior does come at a cost including: longer operative times; additional equipment and/or personnel; unique complications; and in some techniques the need for intraoperative fluoroscopy with attendant exposure to radiation for the surgeon and staff.

It is clear in 2017 that the direct anterior approach is another technique for performing a very successful procedure, namely total hip arthroplasty. With advanced anesthetic, pain management, and rapid rehabilitation protocols it will be extremely difficult to prove any additional benefit associated with THA surgical technique. Mini-posterior approach THA remains the gold standard approach in 2017.


Is Surgical Approach a Risk Factor for Early Failure of Primary THA?

Bryan D. Springer, MD

Background
In an era of innovation in surgical approaches for total hip arthroplasty (THA), there is concern for increasing trends of early failure related to approach. The literature is largely devoid of studies evaluating the incidence of early failure in primary THA stratified by approach.

Questions/Purposes
(1) Is there a difference in incidence of early failure (<5 years) between direct anterior approach and posterior approach primary total hip replacements?
(2) Is there a difference between direct anterior approach and posterior approach for primary total hip arthroplasty with regards to time to early failure?
(3) Is there an increased risk of failure by mode between the direct anterior approach compared to the posterior approach for primary total hip arthroplasty?
(4) Is there an increased risk of early failure based on anterior versus posterior approach and stratified by bone morphology (Dorr type) or stem-type

Methods
A retrospective review was performed on consecutive primary THAs completed from 2007 to 2014 at a high-volume, tertiary referral center. THAs were stratified by surgical approach. Only the direct anterior (DAA) and posterior approaches (PA) were included. The primary outcome measure was early revision (<5 years). Surgical approach, time to failure (TTF), mode of failure, proximal bone morphology, stem type, age, sex, and body mass index (BMI). Descriptive statistics was performed using SAS software.

Results
6,894 consecutive primary THAs performed between 2007 and 2014 were included. 2,431 THAs (35.3%) were performed via a DAA while 4,463 (64.7%) were performed through a PA. There were 103 revisions overall. There was no difference in the overall revision rate for DAA THAs (41/2431; 1.69%) compared to PA THA (62/4463; 1.39%) (p=0.33). There was no difference observed between the DAA and PA with regards to time to early failure (p=0.96). DAA THAs had a higher rate of early revisions for femoral component loosening compared to PA THAs (p=0.0007). Of all the revision THAs, 35.7% (15/41) of DAA THAs were revised for femoral loosening compared to 8% (5/62) for the PA (p=0.0003). DAA THAs were also more often revised for component malposition unrelated to instability, tendonopathy or unexplained pain (p=0.01). The PA had a higher incidence of revision for instability (p=0.04). There was no difference in modes of failure with regards to acetabular loosening, early periprosthetic fracture (<3 months), or infection. Early failure by femoral loosening occurred more often in Dorr A bone (p=0.03). No significant findings where found with regards to stem type and early failure.

Conclusions
In this study the DAA had a higher failure mode of femoral loosening, particularly in Dorr A bone, while PA had a higher mode of failure for revision due to instability. Overall revision rates were not statistically different.
Incidence and Causes of Instability in Total Hip Arthroplasty

Javad Parvizi, MD, FRCS

**Incidence:** There are over 00,000 THAs done each year in the United States; one of the major complications is instability. It occurs in 0.3% to 10% of cases after primary arthroplasty and up to 28% after revision THA. The risk of dislocation after total hip arthroplasty diminishes as time passes after surgery without dislocation.

**Etiology:** There are four main causes of instability: (1) positional (no radiographic abnormality); (2) component malposition (femur or acetabulum); (3) soft tissue imbalance; and (4) component malposition. Several factors are associated with higher rates of dislocation, including female sex, nonunion of the trochanteric osteotomy, revision surgery, and use of a posterior approach. Patients can initiate the dislocation by either using too vigorous a range of motion, usually in external rotation, or secondary to some sort of fall/loss of balance.

**Evaluation:** Recurrent dislocation should be examined carefully for a definite cause. A careful history and a thorough physical exam are mandatory. Taking the hip through a full range of motion can help diagnose component-to-component impingement, inadequate offset soft-tissue tension, extra-articular impingement, and other possible causes. Imaging studies are taken to evaluate the abduction and anteversion of the cup and anteversion of the femoral component. However, in a small number of patients evaluating instability can be difficult and an identifiable etiology is never elucidated.

**Prevention:** Factors important in preventing dislocation are proper placement of components, adjustment of myofascial tension, component design, and patient compliance with restrictions.

**Treatment:** Most dislocations after THA are single episodes that can be managed nonoperatively with closed reduction and bracing for 3 months. Long-term bracing is a possible solution for recurrent dislocation in a patient with limited goals for activity.

When these measures fail, surgical options should target the underlying etiology. Surgical treatment for recurrent instability entails component revision, use of a larger femoral head, constrained liner. Insertion of bipolar arthroplasty into the reamed acetabulum may be the best salvage procedure. Greater trochanteric advancement and soft tissue enforcement have been described but lack consistent results. Revision of the malpositioned component is the most common and effective surgical intervention. Categories of treatment of dislocations were established that correlate to the cause of the dislocation: (1) Category I is a successful closed reduction; (2) Category II is a successful reoperation; (3) Category III is a reoperation with subsequent repeat dislocations successfully treated with closed reduction; and (4) Category IV is comprised of hips that require multiple reoperations for treatment of dislocations.
References:

1. Current Orthopedics, online version
3. Up To Date, online version
Managing hip instability is a challenging proposition that should be problem based and information driven. The “problem based” approach is derived from the realization that hip instability is multifactorial in origin, requiring soft tissue solutions (capsular repair, trochanteric advancement), accurate biomechanical reconstruction (length, offset, and impingement considerations), optimization of implant placement (abduction and anteversion angles), and bearing surface options. The bearing surface options offer an array of bearing sizes, coverage, and constraint that is driven by the design of the bearing.

The decision about the optimal bearing should also be information driven. Constraint can be enhanced by fully containing the femoral head in the socket with a traditional “constrained” articulation, but also by increasing the jump distance using the advantages of larger head size or geographic enhancement of the coverage with a lipped/offset acetabular insert. The fully constrained option may be optimal in paralytic conditions, absent abductor situations, or recalcitrant situations such as patients with recurrent failure of other devices in the setting of a long spinal fusion. However, the fully constrained hip is prone to failure with repeated mechanical challenges in vivo, and most often requires open reduction in the setting of failure. With these limitations in mind, the modular, multiple bearing acetabular component option has gained some popularity. There are reports of stability when the multiple bearing socket is used in routine primary or revision applications, but concerns for potential intra-prosthetic dislocation and corrosion of a modular metal inner bearing interface. Also, when critically evaluated, in many cases the multiple bearing option may offer enhanced theoretical range of motion that is not clinically meaningful without providing advantages in jump distance over a 32 or 36 non-modular bearing (depending upon the socket size).

The largest diameter, single bearing hip socket/bearing combination provides an advantage over all other bearing options by adding increased jump distance, regional coverage, and increased range of motion when compared to constrained sockets, and proven technology with a known track record of performance when compared to modular options.
The Solution: Dual Mobility Cups

Arlen D. Hanssen, MD

Dislocation remains one of the most common complications after revision total hip replacement (THR). Dual-mobility (DM) constructs and large femoral heads (LFH) are two contemporary, non-constrained bearing options used to minimize the risk of dislocation in revision THR. We recently investigated whether DM constructs provide a clinically meaningful reduction in the complications of dislocation, re-revision for dislocation and reoperation when compared with LFH (40mm) in revision THR.

Between 2011-2014, a consecutive series of 302 revision THAs receiving either a DM construct (126 cases) or a 40-mm LFH (176 cases). This subset represented 23% from the total of 1316 consecutive revision THR. Age and body mass index were similar between the groups but there was a slight predominance of females in the DM group (52%) versus the LFR group (41% female). There was also a bias to use DM constructs in those patients at highest risk for dislocation and reoperation as 33% of DM patients had the index revision THA done for a diagnosis of recurrent dislocation vs 9% in the LFH group. Mean effective head size in the DM group was 47 mm (range, 38 – 58 mm). Mean follow-up was 3.6 years.

The subsequent dislocation rate in the dual mobility construct group was lower (3% DM versus. 10% in the LFH; p=0.03) and this difference was present even in the face of the bias to use DM for the highest risk patients. Re-revision for dislocation in the DM construct group was lower (1% DM versus 6% in the LFH group; p=0.03). Reoperation for any cause in the DM group was lower (6% DM versus 15% in the LFH group; p=0.02). Reoperation subsequent to two-stage reimplantation was also lower in DM (2.4%) vs LFH (5.1%) and for revision for aseptic loosening: DM (0%) vs. LFH (3.4%).

When compared to patients treated with a 40-mm LFH, for revision THR patients who received a DM construct had a lower risk of subsequent dislocation, re-revision for dislocation, and reoperation for any. These findings were present despite a selection bias in this study to use the DM construct in patients at the highest risk for subsequent dislocation. Given the substantively lower risk of subsequent dislocation, re-revision and reoperation with the dual mobility construct some surgeons may wish to consider whether the role of DM should be judiciously expanded into more cases during contemporary revision THR.
Instability after total hip arthroplasty is the most common indication for revision arthroplasty and can be difficult to treat. There are options available including use of larger femoral heads, dual mobility sockets and constrained sockets. The purpose of this study is to evaluate the outcomes associated with the use of a constrained acetabular component as a treatment for instability after hip arthroplasty. We reviewed the clinical and radiographic outcomes of 149 arthroplasties, that had been performed with use of a single design of constrained acetabular component between 2007 and 2012 at a single institution. Patient demographics and case specific data were collected. The Mann-Whitney U test was used to assess continuous variables. Categorical variables were examined using the Chi-square test and Fisher’s exact test when appropriate. Survival probability was calculated using the Kaplan-Meier method.

The mean age at time of index surgery was 70 years, 65% were female, and mean BMI was 26.3. The average number of previous surgeries was 3.6. The constrained liner was cemented into a well-fixed cup in 40 hips (20%). In eighty-two (55%) hips the constrained component was implanted for the treatment of recurrent instability, and in sixty-seven (45%) hips it was implanted because the hips demonstrate instability during revision surgery. At an average duration of follow-up of 4.2 (2-7) years the overall revision rate was 10.6%. The constrained acetabular device eliminated or prevented hip instability in all patients except five; 3.3% had a new dislocation and six (4.0%) had failure of the retentive ring. Three revisions (2%) were performed for deep infection, and 2 (1.3%) for acetabular component loosening. Radiographic analysis revealed a non-progressive radiolucent line around the cup in 19 hips (12.7%). When stratified by patient age, survivorship for patients less than 65 years of age versus those greater than 65 years were similar.

This study correlates with results of other papers in the literature looking at outcome of constrained tripolar type sockets. The focal constraint socket with a metal ring type design have a much greater failure rate (9-29%) Constrained liners remain an excellent option for hip instability in early to mid term follow up.  
Population Health: The health outcomes of a group of individuals, including the distribution of such outcomes within the group. (Kindig and Stoddart 2003)

Population Health Management: The aggregation of patient data across multiple health information technology resources, the analysis of that data into a single, actionable patient record, and the actions through which care providers can improve both clinical and financial outcomes. (https://www.wellcentive.com/what-is-population-health-management/)

The following road map has been suggested for helping healthcare organizations navigate the path toward implementing effective population health management.

- Establish precise patient registries
- Determine patient-provider attribution
- Define precise numerators in the patient registries
- Monitor and measure clinical and cost metrics
- Adhere to basic clinical practice guidelines
- Engage in risk-management outreach
- Acquire external data
- Communicate with patients
- Educate patients and engage with them
- Establish and adhere to complex clinical practice guidelines
- Coordinate effectively between care team and patient
- Track specific outcomes

(Sanders, Dale, A Landmark, 12-Point Review of Population Health Management Companies. Retrieved 2014-03-17)

How is Population Health and Population Management applied to enhance value in total joint arthroplasty?

Identifying patients at risk for complications prior to surgery enables providers to address and mitigate these risk factors, thus decreasing the risk of complications. Potentially modifiable risk factors include tobacco use, obesity, poorly controlled diabetes and nasal colonization with staphylococcus aureus species. (5). It is ethically acceptable for providers to insist that these risk factors are addressed prior to preforming an elective procedure, even if it results in a delay of a procedure. (3) Additionally, identifying these risk factors allows surgeons to provide a more accurate estimation of the magnitude of risk to potential patients, thus improving the patient’s ability to make an informed decision as to whether to proceed with the surgery. This is the hallmark of shared decision making. (1)For example Maoz and colleagues determined that patients who smoke, are obese and have nasal staph aureus nasal colonization are at a tenfold higher risk of developing a surgical site infection following hip replacement. (4) This data may dissuade a patient from undergoing a joint replacement, or may motivate them to modify these risk factors prior to surgery.
Risk factor identification also allows the more effective use of finite resources. The Readmission risk assessment tool (RRAT) is a questioner which identifies patients at risk for readmission following joint replacements. Identifying patient at high and low risk for readmission allows providers to shift resources from low risk to high risk patients, thus making more efficient use of available resources. (6) Risk factor identification allows for more accurate risk stratification. For example the CJR stratifies risks by diagnosis and also by the presence of major co-morbidities. Identifying major co-morbidities places these patients into a different DRG (469 vs. 470) and allows for higher reimbursement. As a result of our understanding of the different costs and outcomes associated with hip replacement for fractures vs., hip replacement for arthritis, the hip fracture patients are no longer compared to the non-fracture arthroplasty patients when the bundled costs are calculated.

Adopting and utilizing evidence based clinical pathways (EBCPs) is essential to managing patients attributed to a bundled payment episode of care. Adhering to EBCPs decreases variation in in care and outcomes both on an individual provider and institutional based level. To maximize utilization of EBCPs each stakeholder should be allowed to the development and application of the pathways. Thus, each stakeholder assumes ownership of these pathways. This becomes important as most bundled care arrangements involve a large number of providers whose practices vary based on their different experience and knowledge levels. Using accepted EBCPs decreases the care and outcome variation inherent in large groups of providers. Equally as important, the collective expertise and experience amassed by high volume providers, both at an individual provider and institutional level, is incorporated into EBCPs. Once developed, these EBCPs can be adopted by low volume providers including both physicians and institutions, thus transferring the experience, expertise and improved outcomes achieved by high volume providers to low volume providers. (2,8,10)

Examples of EBCPs which result in improved outcomes at a reduced cost include institutional wide venous thromboembolism (VTE) prevention and blood management clinical pathways. Institutional wide VTE prophylaxis pathways ensures that each patient receives the most appropriate level of VTE prophylaxis in order to best balance the risk and rewards of VTE prevention in total joint arthroplasty. These pathways insure that patients of low volume providers, who may not have the experience in VTE prophylaxis receive the same quality prophylaxis as the patients of more experienced providers. This decreases the variation in care and leads to improved outcomes and more cost effective care. (13)

A comprehensive evidenced based blood management pathway in which decision making and transfusion ordering is controlled by an electronic medical record creates value by decreasing transfusion rates. These pathways incorporate the latest evidence based transfusion triggers in addition to incorporating the use of tranexamic acid to decrease blood loss. Value is created when costly blood transfusions and the increased complication rates associated with these transfusions are avoided. (10,14) Post-operative pain management EBCPs decrease physician specific variation and result in reduced opioid consumption, decreased length of stay and enhanced functional recovery. (11,12)

Accurate, actionable and contemporary data is essential for the cost effective management of a bundled episode of care. The federal government’s voluntary BPCI and its mandatory CJR and SHFFT bundled programs are reconciled retrospectively. This means that all costs are paid by the federal government in the traditional fashion. Then the total episode associated costs are compared against a target price. If the total paid costs fall below the target price than the providers receive a portion of the difference in a bonus payment (provided they have met certain quality metrics). If the total episode costs are in excess of the target price, then the providers must pay the government a portion of the difference. The issue is that the government reconciles these costs months after the episode of care is over. (30) Thus any issues that increase the cost of care, such as high readmission rates and high utilization of post-acute inpatient rehabilitation need to be addressed as they occur in order to avoid increased cost and decreased quality.
Those providers who rely on the government’s reconciliation to track readmissions and post-acute costs must wait months to get this data. This precludes these providers from addressing these issues in real time. Those providers who have invested and developed a robust data collection and dissemination infrastructure, are at a competitive advantage as they learn about problems soon enough to correct them. (31)

This data must be readily accessible to all providers involved in the bundle. It also must be transparent and provider specific. If used correctly, transparent, provider specific data identifies outliers and fosters changes in behavior. Additionally, accurate, transparent data, enables those who manage the bundled payment programs to make data driven decisions including allocating resources in an efficient manner. For example, providers with high readmission rates are readily identified and resources can be applied to understanding and correcting the reasons for these rates. Institution wide and provider specific SSI rates are time sensitive. The soon issues with SSIs are identified, the quicker they can be corrected. Those providers with the fastest access to this data have a competitive advantage over their peers. This is important as both the CJR and SHFFT programs will eventually compare costs between institutions located in geographic regions in order to determine which institutions are financially rewarded and which are penalized.

Using data to identify variations in outcomes and costs is the hallmark of quality programs. Variations in outcomes present an opportunity for quality improvement. For example, the costs of hip and knee prosthesis can vary widely between providers. Rarely if ever do the providers with highest implant cost have the improved outcomes to justify these costs. Programs which identify high implant cost surgeons and which use reference pricing to decrease total cost and cost variation have been successfully used for both total joint prostheses and spine implants (15,16). Additionally, tracking implant waste allows identification of waste patterns, and increases awareness of the value lost when implants are wasted. (17). Data which tracks VTE rates, SSI rates, readmission rates, post discharge costs is an essential component to managing bundles. As stated above, those providers who have access to the most accurate, timely data, and who use it to drive decision making enjoy a competitive advantage over their peers who do not have access to high quality, actionable data. (20,22)


Partnering with the Patient to Improve Outcomes in TJA: The Role of Shared-Decision Making in Advising Patients of Risk and Comorbidity Burdens

Kevin J. Bozic, MD, MBA

In shared decision making (SDM), both physicians and patients make necessary contributions to the dialogue about a patient’s condition and best way to achieve the optimal outcome for that patient. The physician provides expert clinical knowledge of conditions, treatment options and associated risks and benefits, and limitations of evidence. The patient contributes their goals, preferences, and values (Wennberg 2009).

There are tools and strategies that can help clinicians and patients engage in shared decision making. Decision aids, which can be various formats including DVDs, booklets, and web-based tools, present patients with information on their condition, treatment options and associated risks and benefits, and help patients assess their goals and preferences. Communication aids can take the form of prompt sheets or health coaches. One example is a health coach that helps patients develop question lists for their health care provider to ensure they get information that is important for their decision making process. Questionnaires can be used to assess patients’ knowledge of their condition or treatment options, their values and preferences, and their decision status.

The use of decision aids has been shown to improve knowledge and lead to more accurate perception of risks (Stacey 2014). Decision aids have also been found to lower decisional conflict, reduce proportions of people who were passive in decision making, and reduce the proportion who were undecided (Stacey 2014).

In a randomized trial of SDM in patients with osteoarthritis of the hip and knee, patients in the intervention group received decision aid in the form of a DVD with an accompanying booklet that provided information on treatment choices for hip and knee osteoarthritis. Prior to their visit, patients had a question listing consultation with a pre-medical intern to develop a focused written list of questions for their surgeon. After their visit, patients received an audio recording of their office visit and a copy of their surgeon’s dictated note (Bozic JBJS 2013). Patients in the intervention group were more likely to reach an informed decision during the first visit, and had higher confidence in knowing what questions to ask their doctor. Surgeons reported higher satisfaction with the intervention group visits. There were no significant differences in the duration of the office visits or the proportion of patients choosing surgery for the treatment of their hip or knee osteoarthritis. (Bozic JBJS 2013)

Patient-reported outcomes (PROs)—assessments of symptoms and function directly from the patient—can inform the shared decision making process. PROs may be used to allow clinicians to better predict post-operative patient outcomes. In one study, pre-operative PROs (Knee Injury and Osteoarthritis Outcome Score [KOOS] score) predicted whether patients achieved minimally clinically important difference (MCID) in post-operative KOOS score (Berliner 2016). A threshold effect was detected; above a certain level of pre-operative function, the patient’s chance of achieving a MCID in function post-operatively fell. Mental health scores also played a role. With lower mental component scores, patients had lower thresholds for achieving MCID—i.e., these patients have lower probability of achieving a MCID for a given level of
preoperative function (Berliner 2016). Collecting and using PROs in clinical decision making could also improve patient engagement (involving patients in their own care through collaboration, behavior change, and new technologies), if patients’ data are shared with them and used to engage patients in shared decision making.

Using PROs in the decision making process can help ensure appropriate treatment is offered, based on patients’ function and symptoms. A patient’s physical and mental health may show that they have a substantial impairment in physical function, but poor coping skills, and therefore may benefit from cognitive and/or behavioral therapy before considering surgery. Another patient may have moderately impaired physical function, good coping skills, and decide to proceed with surgery. At some point after surgery, their scores could be used to evaluate the success of the procedure in terms of reducing pain, improving physical and mental health, and quality of life.

Shared decision making using patient-reported outcomes should be incorporated into routine clinical care. Tools such as decision aids, personalized for each patient, could allow more precise estimates of the potential risks and benefits of treatment options and help ensure appropriate treatment. Incorporating SDM tools and use of PROs into practice will require training and careful attention to implementation, but the benefits to patients and providers could be substantial in terms of enhancing knowledge and decision quality and confidence, improving the efficiency of the consultation, and identifying appropriate candidates for surgery.

References


Through listening to clinicians and engaging as partners, the Centers for Medicare and Medicaid Services (CMS) has been able to develop innovative payment reforms. Collectively we have made great progress on transforming our delivery system into one that provides better quality of care for patients and pays for care in a smarter way.

This presentation will provide a high level overview of current policies such as the Medicare and Chip Reauthorization Act (MACRA) Quality Payment Program (QPP). The QPP is centered on clinician choice and accountability, allowing clinicians to choose the best way to deliver quality care and to participate in the program based on their practice size, specialty, location or patient population, while rewarding them based on the quality of care they provide. It has 2 tracks: 1. The Merit-based Incentive Payment System (MIPS) and 2. Advanced Alternative Payment Models (APMs). We will discuss it in the broad context and more specifically as it relates to hip and knee surgeons. Finally, we will open for a discussion about some challenges to participating in these emerging opportunities.
The Role of Registries, PROs, and Quality Measures in Improving Value and Outcomes and Determining Physician’s Payment: This is Our Future!

David C. Ayers, MD

- PROs support the IOM vision for 21st Century to use information technology to support patient-centered, evidence based decisions
- As healthcare moves to a value based reimbursement system PROs are used to define outcomes and quality and therefore are the numerator of the value equation
- PROs have moved into clinical Practice In TJR
  - Ayers, Bozic. The Importance of Outcome Measurement in Orthopedics
    CORR 471: 3409-3411, 2013
  - Orthopedic surgeon reimbursement in US increased by PRO reporting in PQRS through FORCE-TJR
  - Pay for Performance Quality Reporting; Pilot project by BC of MA
  - PROs used for negotiations with insurance companies, ACOs and referring MDs as a measure of quality
- PROs can be collected in a busy practice with >85% follow-up at 1 year
  - Ayers, Franklin. Integrating PRO into Ortho. Practice; Proof of Concept from FORCE-TJR
    CORR: 471(11) 3482-3488, 2013
- PRO must bring value to visit; real time scoring; CAT enabled
- PRO used for Shared Decision Making and part of routine clinical care, not “research”
  - Ayers. Patient-Reported Outcomes Move into Clinical Practice.
    Orthopedics Today. August 2014
- FORCE-TJR has collected >35,000 patients PROs (Pre-op, 6M and 1 Yr Post-op with 86% collection rate).
  - Franklin, Allison, Ayers. Beyond Implant Registries; a Patient-Centered Approach to TJR.
    - National TJR research registry and Comparative effectiveness consortium based at University of Massachusetts Medical School
    - Currently includes >225 sites in >28 states in the US
    - Established by a $12 Million P50 Grant from AHRQ
    - Currently collects and measures Level 1,2,3, and 4 data
    - Establish PRO standards at the surgeon and hospital level
    - Now using FORCE platform and infra-structure members manage bundled payment programs with CMS and private payers
    - FORCE –TJR feedback to surgeons/hospitals for quality improvement and real-time operational data to manage bundle payment programs
      - Patient characteristics/mix/ Charlson co-morbidity index
- Patient selection (timing of surgery)
- Medical and ortho co-morbid conditions
- Discharge location/ use of ancillaries
- TJR outcomes including post-TJR pain and function
- TJR outcomes also including adverse events/ readmissions/return to surgery/ revision surgery
  - FORCE-TJR Now open to new member enrollment

- PROs used to evaluate patient mix at the hospital/surgeon level for medical and MSK co-morbidities
  - Used to answer how do my patients compare to FORCE-TJR cohort on key risk-adjustment factors
  - Ayers, et al. Patient Reported Outcomes After TKR; Need for MSK Co-Morbidity Index  
    JBJS-A: 95(20)1833-7, 2013

- Patient Selection and Timing of Surgery; Appropriateness
  - How do my patients compare to other sites on pre-TJR pain and function?

- TJR patient reported outcomes;
  - How does my risk adjusted 1 year pain and function scores compare to FORCE-TJR national cohort?
  - Surgeons/hospitals want to improve!

- PROs improve risk adjustment models for readmissions
  - FORCE-TJR and AAHKS showed that adding pre-op function (PCS), BMI as continuous variable, smoking, modified Charlson co-morbidity score, Orthopedic co-morbidities improve readmission model from CMS C=.62 to FORCE-TJR C=.78

- PROs used to evaluate Cemented vs. Cemented TKRs; risk adjustment for PROs based on patient characteristics

- PROs already play an important role in clinical practice in TJR and will play an increasingly vital role in assessing quality and value in the future
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 7.5 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.

FDA Statement
Some pharmaceuticals and/or medical devices at the Specialty Day Meeting have not been cleared by the U.S. Food and Drug Administration (FDA) or have been cleared by the FDA for specific purposes only. The FDA has stated that it is the responsibility of the physician to determine the FDA status of each pharmaceuticals and/or medical devices he or she wishes to use in clinical practice.

The Hip Society policy provides that “off label” uses of a device or pharmaceutical may be described in The Hip Society’s CME activities so long as the “off-label” status of the device or pharmaceutical is also specifically disclosed (i.e. that the FDA has not approved labeling the device for the described purpose). Any device or pharmaceutical is being used “off label” if the described use is not set forth on the product’s approved label.

To obtain information regarding the clearance status of a device or pharmaceutical refers to the product labeling or call the FDA at 1-800-638-2041 or visit the FDA internet site at http://www.fda.gov/cdrh/510khome.html

Financial Disclosure
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. The Hip Society does not view the existence of these disclosed interests or commitments as necessarily implying bias or decreasing the value of the author’s participation in the meeting.
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Peter Keyes Sculco, MD (This individual reported nothing to disclose); Submitted on: 06/14/2016

Thomas P Sculco, MD Submitted on: 04/28/2016; American Journal of Orthopedics: Editorial or governing board; Exactech, Inc: IP royalties; Knee Society: Board or committee member

Karen Sherwood, PhD (This individual reported nothing to disclose); Submitted on: 02/10/2017

Rafael Jose Sierra, MD Submitted on: 10/07/2016; American Association of Hip and Knee Surgeons: Board or committee member; Biomet: IP royalties; Paid consultant; Paid presenter or speaker; DePuy, A Johnson & Johnson Company: Research support; Journal of Arthroplasty: Editorial or governing board; Link Orthopaedics: Paid consultant; Stryker, Biomet: Research support; Zimmer: Research support

Bryan Donald Springer, MD Submitted on: 12/05/2016; AJRR: Board or committee member; Arthroplasty Today: Editorial or governing board; Ceramtec: Paid presenter or speaker; Convatec: Paid consultant; ICJR: Board or committee member; Joint purifications systems.: Other financial or material support; Journal of Arthroplasty: Editorial or governing board; Osteoremedies: Paid consultant; PixarBio: Stock or stock Options; Stryker: IP royalties; Paid consultant

Scott M Sporer, MD Submitted on: 02/01/2017; American Association of Hip and Knee Surgeons: Board or committee member; American Joint Replacement Registy: Board or committee member; Central Dupage Hospital: Research support; DJ Orthopaedics: Paid consultant; DJO Surgical: IP royalties; Hip Society: Board or committee member; Osteoremedies: Paid consultant; Pacira: Paid consultant; Pixarbio: Paid consultant; Stock or stock Options; SLACK Incorporated: Publishing royalties, financial or material support; Stryker: Research support; Zimmer: IP royalties; Research support

Supatra Sritulanondha, MPH (This individual reported nothing to disclose); Submitted on: 01/26/2017

Michael J Taunton, MD Submitted on: 12/22/2016; AAOS: Board or committee member; DePuy, A Johnson & Johnson Company: Research support; DJ Orthopaedics: IP royalties; Paid consultant; Journal of Arthroplasty: Editorial or governing board; Minnesota Orthopedic Society: Board or committee member; Stryker: Research support

Robert T Trousdale, MD Submitted on: 10/03/2016; American Association of Hip and Knee Surgeons: Board or committee member; DePuy, A Johnson & Johnson Company: IP royalties; Paid consultant; Hip Society: Board or committee member; Journal of Arthroplasty: Editorial or governing board; Knee Society: Board or committee member; Medtronic: IP royalties

Thomas Parker Vail, MD Submitted on: 10/03/2016; American Board of Orthopaedic Surgery, Inc.: Board or committee member; DePuy, A Johnson & Johnson Company: IP royalties; Paid consultant; Knee Society: Board or committee member

Ann Williams, BS (This individual reported nothing to disclose); Submitted on: 01/27/2017

Staff

Olga Foley (This individual reported nothing to disclose); Submitted on: 01/30/2017

Austin Lugar (This individual reported nothing to disclose); Submitted on: 10/18/2016
Please complete the online evaluation at: [https://www.surveymonkey.com/r/HSWM2017](https://www.surveymonkey.com/r/HSWM2017) or use the QR code here.
The 2017 Specialty Day Program of The Knee Society

In association with the American Association of Hip and Knee Surgeons (AAHKS)

FINAL SCIENTIFIC PROGRAM

Saturday—March 18, 2017
San Diego Marriott Marquis & Marina
Marriott Grand Ballroom 8
IMPORTANT!

Ready. Set. Respond.

The following sessions of The Knee Society/AAHKS Specialty Day programming will utilize the Audience Response System (ARS) feature of *My Academy* app:

- Session V
- Session VI

We Are Streaming Live

This program is streaming live in its entirety. The live stream is not accredited for CME. Everyone who is registered to attend the program in person receives complimentary access to the live stream, and to the archived content, for one year, through March 10, 2018.

Download from Google Play or the App store.

Questions?

Email knee@aaos.org or call (847)698-1638

Thank you for attending our 2017 Specialty Day programming! We hope to see you in 2018 in New Orleans!
The Mission of The Knee Society

The Mission of The Knee Society is to promote outstanding care to patients with knee disorders through innovative research and education.

Meeting Objectives

The objectives of the Specialty Day (Open) scientific program of The Knee Society and AAHKS are to update clinical skills and basic knowledge through research findings, to discuss the various surgical and non-surgical treatments and management of conditions related to the knee joint, to determine indications and complications in total knee arthroplasty, to critique presentations of surgical techniques and demonstrations of treatment options, and to evaluate the efficacy of new treatment options through evidence-based data.

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 providership of the American Academy of Orthopaedic Surgeons and The Knee 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 7.5 AMA PRA Category 1 Credits™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Evaluation

Your opinion matters! Please complete your evaluation online at: https://www.surveymonkey.com/r/KSSD2017 or use the QR code to access with your handheld smart device:

![QR Code](image)

Photography

Please refrain from unauthorized photography and video recording of presentations. Your registration for, and attendance of, this session gives The Knee Society permission to capture images of session attendees and to use these images for internal and marketing purposes.
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1992-1993  Chitranjan S. Ranawat, MD
1994  Richard C. Johnston, MD, MS
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ACKNOWLEDGEMENTS

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Chair

Did We Hit The Mark?
In 2016, in Orlando, we conducted a comprehensive and focused survey to redefine the value and success of our Specialty Day programming. We carefully analyzed your comments, critique, and suggestions. We have implemented many of your suggestions when planning the 2017 Specialty Day program, including:

1. Topics of interest to our participants have been incorporated.
2. Session times are closely coordinated with The Hip Society.
3. Complimentary boxed lunch will be provided to all registered participants.
4. We will be using the Audience Response System through the Academy App.
5. We will be presenting one combined session on value, quality, and economics at the end of the day.

Tell us what you think. Complete the survey that will be handed out, and return it to any staff member before you leave. Thank you for your thoughts!
Contemporary Approaches to Adult Hip and Knee Reconstruction
Presented by The Hip Society and The Knee Society

PROGRAM HIGHLIGHTS:
- Small group case-based format
- Close interaction with world-renowned faculty
- Key primary hip and knee arthroplasty concepts
- Avoid and manage potential complications
- Unicompartmental knee arthroplasty, outpatient arthroplasty, bundled payment models
- Expert panel on modern perioperative management
- Video vignettes of select surgical techniques and tips

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The William N. Capello, MD Education Center, IU Health Saxony Hospital | 13000 E 136th St, Fishers, IN 46037
Visit www.hipsoc.org and click on the EDUCATION tab to learn more
Call (847) 698-1638 | Email hip@aaos.org
The Hip Society and The Knee Society invite you to join us at JAMM2018 in Park City, Utah, USA, on January 21-24, 2018. JAMM2018 is a unique learning and networking opportunity for orthopaedic surgeons specializing in the adult hip and knee arthroplasty. This highly anticipated and exclusive red-carpet event will be:

- co-chaired by Fred D. Cushner, MD, Aaron A. Hofmann, MD, Adolph V. Lombardi, Jr., MD, and Christopher L. Peters, MD, with a star-studded faculty cast drawn from members of The Hip Society and The Knee Society
- presented during the 2018 Sundance Film Festival
- limited to 100 physician attendees
- enhanced by “The Golden Hip” and “The Golden Knee” video competitions
- a dynamic blend of case-based presentations and small group discussions complemented by didactic lectures
- CME-accredited

SAVE THE DATE!
PROGRAM HIGHLIGHTS

The Knee Society’s 2017 Scientific Awards (Session IVa, 10:30 am – 11:00 am)

The 2017 John N. Insall, MD Award

*Higher Tissue Concentrations of Vancomycin with Intraosseous Regional Prophylaxis in Revision TKA*

**Presenter:** Simon W. Young, FRACS  
**Co-Authors:** Mei Zhang, PhD; Grant A. Moore, BSc; Rocco P. Pitt; Henry D. Clarke, MD; Mark J. Spangehl, MD

The 2017 Chitranjan S. Ranawat, MD Award

*Does Computer Navigation in Knee Arthroplasty Improve Functional Outcomes in Young Patients?*

**Presenter:** Young-Hoo Kim, MD  
**Co-Authors:** Jang-Won Park, MD; Jun-Shik Kim, MD

The 2017 Mark Coventry, MD Award

*A Randomized Clinical Trial on Patellofemoral vs. Total Knee Replacement for Patellofemoral Osteoarthritis*

**Presenter:** Anders Odgaard, DMed  
**Co-Authors:** Frank Madsen, MD; Per Wagner Kristensen, MD; Andreas Kappel, MD; Jesper Fabrin, MD

Congratulations to all award winners and their co-authors!

The Knee Society’s 2018 Scientific Awards


The deadline to submit your best research is December 1, 2017.
THE KNEE SOCIETY’S RESEARCH & EDUCATION FUND

Promoting outstanding care to patients with knee disorders through innovative research and education

The Knee Society thanks the following Donors for their multi-year pledges of support:

**Mentor Level ($250,000 - $499,999)**
- Dr. & Mrs. Adolph V. Lombardi, Jr.*
- Zimmer Biomet, Inc.*

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The Knee Society thanks the following Donors for their generous 2016 contributions:

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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
TRAVELING FELLOWSHIP OPPORTUNITY

John N. Insall Travelling Fellowship
Sponsored by The Knee Society

A group of four international candidates will be selected to travel to various Knee Society locations for this one month program to begin in October 2018.

This annual Fellowship will include visits to internationally recognized joint replacement and knee surgery centers.

Qualifications:

• Applicants must have completed either an Adult Reconstruction Knee Fellowship or Sports Medicine Fellowship.
• Applications must be received by October 1st, 2017.
• The candidates must be able to travel for the month of October the following year.

For Information Contact:
Kathleen E. Lenhardt
Insall Scott Kelly
260 East 66th Street, Ground Floor
New York, NY 10065
(646) 293-7520
klehardt@iskinstitute.com
www.iskinstitute.com

Congratulations, the 2017 Insall Fellows!

Matthew P. Abdel, MD
Mayo Clinic
Dept. of Orthopedic Surgery
Rochester, Minnesota

Jason Jennings, MD
Colorado Joint Replacement
Denver, Colorado

Umile G. Longo, MD
University Campus Biomedico
of Rome
Rome, Italy

Shinichiro Nakamura, MD
Kyoto University
Dept. of Orthopedic Surgery
Kyoto, Japan
CALL FOR SUBMISSIONS

ABSTRACT SUBMISSIONS
Submit high-quality scientific and socioeconomic abstracts by June 1, 2017 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@akahks.org.

SYMPOSIUM PROPOSALS
Submit proposals by June 1, 2017 covering all aspects of arthroplasty and health policy. Proposals are reviewed by the AAHKS Program Committee.

SURGICAL TECHNIQUE VIDEO PROPOSALS
Submit high quality, clinically relevant proposals for videos that will provide high educational value. Selection of videos is based on the overall quality and thoroughness of the proposal submission. The deadline for proposals is June 1, 2017.

Start your submission now by logging in to www.AAHKS.org.

RESERVE HOTEL ROOM NOW!
You can log in to www.AAHKS.org to make your hotel reservation now at the Hilton Anatole in Dallas. Meeting registration will open in June 2017.

AAHKS 2017 ANNUAL MEETING
November 2-5 | Dallas, Texas
AAHKS
2017 SPRING MEETING
MAY 5 – 6 • SAN FRANCISCO

Do you enjoy the fall meeting but miss the intimate interactions of AAHKS meetings of the past? Are you looking to get your questions answered by leading experts in a small group setting? Then the AAHKS Spring Meeting is for you!

The meeting will be centered around a case-based discussion format in small groups with a maximum of 10 participants per faculty member and symposia on important topics ranging from the business of orthopaedics to perioperative optimization and management. The meeting will facilitate the ideal learning atmosphere for the practicing hip and knee surgeon wanting to learn more about primary and revision hip and knee arthroplasty.

Friday, May 5 – Saturday, May 6, 2017
The Westin St. Francis
San Francisco on Union Square

- Limited attendance
- Instructional Course Lectures (ICL)
- Small group breakouts with faculty

Log in to register for the meeting at www.AAHKS.org
SCHEDULE
**HIP Marriott Grand Ballroom 5**

7:55 am – 8:00 am  
**WELCOME**  
Harry E. Rubash, MD (Boston, MA) – President, The Hip Society  
Kevin J. Bozic, MD, MBA (Austin, TX) – Chair, Education Committee

<table>
<thead>
<tr>
<th>Time</th>
<th>Session I: Minimizing Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 am – 8:45 am</td>
<td><em>Moderator: Kevin L. Garvin, MD (Omaha, NE)</em></td>
</tr>
</tbody>
</table>

8:01 am – 8:07 am  
The Changing Pattern of Complications After THA  
*Daniel J. Berry, MD (Rochester, MN)*

8:08 am – 8:14 am  
Modifying Risk Factors/Preventing Readmissions  
*Richard Iorio, MD (New Rochelle, NY)*

8:15 am – 8:21 am  
Avoiding Venous Thromboembolism  
*Jay R. Lieberman, MD (Los Angeles, CA)*

8:22 am – 8:28 am  
Preventing Infection  
*Craig J. Della Valle, MD (Chicago, IL)*

8:28 am – 8:45 am  
**DISCUSSION**

8:45 am – 9:30 am  
**Session II: Implant Wear: An Update**  
*Moderator: William J. Maloney, III, MD (Redwood City, CA)*

8:46 am – 8:52 am  
Long-term Results with Polythene  
*James I. Huddleston, III, MD (Redwood City, CA)*

8:53 am – 8:59 am  
Update on Ceramics  
*Adolph V. Lombardi, Jr., MD, FACS (New Albany, OH)*

9:00 am – 9:06 am  
Are There Indications for Metal-on-Metal THA and Resurfacing?  
*Robert L Barrack, MD (St. Louis, MO)*

9:07 am – 9:13 am  
Future Bearing Surfaces: What to Look For!  
*Orhun K. Muratoglu, PhD (Boston, MA)*

9:13 am – 9:30 am  
**DISCUSSION**
7:55 am – 8:00 am  
**WELCOME**  
*Thomas P. Sculco, MD (New York, NY) – President of The Knee Society*  
*Stephen J. Incavo, MD (Houston, TX) – Chair, Education Committee*

### 8:00 am – 8:45 am  
**Session I: The Difficult Primary TKA–1**  
**Moderator: Arlen D. Hanssen, MD (Rochester, MN)**

- 8:01 am – 8:07 am  
  Management of Stiff Knee  
  *Steven J. MacDonald, MD (London, ON, Canada)*  
  Page 25

- 8:08 am – 8:14 am  
  Flexion Contracture  
  *Adolph V. Lombardi, Jr., MD, FACS (New Albany, OH)*  
  Page 29

- 8:15 am – 8:21 am  
  The Valgus Knee: Is It More Difficult?  
  *Paul F. Lachiewicz, MD (Chapel Hill, NC)*  
  Page 31

- 8:22 am – 8:28 am  
  Previous Incisions: What to Do?  
  *John J. Callaghan, MD (Iowa City, IA)*  
  Page 32

- 8:28 am – 8:45 am  
  **DISCUSSION**

### 8:45 am – 9:30 am  
**Session II: The Difficult Primary TKA–2**  
**Moderator: Douglas A. Dennis (Denver, CO)**

- 8:46 am – 8:52 am  
  Extra-Articular Deformity  
  *Stephen J. Incavo, MD (Houston, TX)*  
  Page 33

- 8:53 am – 8:59 am  
  Previous ACL or Osteotomy Surgery  
  *David Backstein, MD, FRCS(C) Toronto, ON, Canada*  
  Page 35

- 9:00 am – 9:06 am  
  Prior Infection  
  *Arlen D. Hanssen, MD (Rochester, MN)*  
  Page 38

- 9:07 am – 9:13 am  
  Is Constraint Needed in Primary TKA?  
  *Mark P. Figgie, MD (New York, NY)*  
  Page 40

- 9:13 am – 9:30 am  
  **DISCUSSION**
### Session III: Taper Corrosion

**Moderator:** Wayne G. Paprosky, MD, FACS (Winfield, IL)

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
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<tr>
<td>9:31 am – 9:37 am</td>
<td>State-of-the-Art in Understanding This Issue</td>
<td>Joshua J. Jacobs, MD (Chicago, IL)</td>
<td>41</td>
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<tr>
<td>9:38 am – 9:44 am</td>
<td>Clinical Presentation/Diagnosis</td>
<td>Michael A. Mont, MD (Cleveland, OH)</td>
<td>43</td>
</tr>
<tr>
<td>9:45 am – 9:51 am</td>
<td>Fretting and Corrosion at the Head-Neck Junction of Well-Functioning THAs</td>
<td>Douglas E. Padgett, MD (New York, NY)</td>
<td>45</td>
</tr>
<tr>
<td>9:52 am – 9:58 am</td>
<td>Optimizing Clinical Treatment and Outcomes</td>
<td>Young-Min Kwon, MD, PhD, FRACS, FRCS (Boston, MA)</td>
<td>49</td>
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<tr>
<td>9:58 am – 10:15 am</td>
<td>DISCUSSION</td>
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<tr>
<td>10:15 am – 10:30 am</td>
<td>COFFEE/REFRESHMENT BREAK</td>
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### Session IV: Prevention/Management Geriatric Hip

**Moderator:** Harry E. Rubash, MD (Boston, MA)

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<th>Time</th>
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<tbody>
<tr>
<td>10:31 am – 10:37 am</td>
<td>Prevention of Geriatric Hip Fractures</td>
<td>Joseph M. Lane, MD (New York, NY)</td>
<td>51</td>
</tr>
<tr>
<td>10:38 am – 10:44 am</td>
<td>Developing and Implementing a Comprehensive Hip Fracture Program</td>
<td>Stephen L. Kates, MD (Richmond, VA)</td>
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</tr>
<tr>
<td>10:45 am – 10:51 am</td>
<td>Fix or Replace? Results from “Big Data”</td>
<td>George J. Haidukewych, MD (Orlando, FL)</td>
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</tr>
<tr>
<td>10:52 am – 10:57 am</td>
<td>Introduction of Presidential Guest Speaker</td>
<td>Harry E. Rubash, MD (Boston, MA)</td>
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<tr>
<td>10:58 am – 11:13 am</td>
<td>Presidential Guest Speaker: Outcomes of Comprehensive Hip Fracture Mgmt Programs: An International Perspective</td>
<td>Cecilia Rogmark, MD, PhD (Lund, Sweden)</td>
<td>55</td>
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<tr>
<td>11:14 am – 11:25 am</td>
<td>DISCUSSION</td>
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## Session III: Current Trends in Arthroplasty

*Moderator: Clifford W. Colwell, MD (La Jolla, CA)*

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<tr>
<th>Time</th>
<th>Topic</th>
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<tbody>
<tr>
<td>9:31 am – 9:37 am</td>
<td>Current Joint Restoration Procedures</td>
<td>Patrick C. McCulloch, MD (Houston, TX)</td>
</tr>
<tr>
<td>9:38 am – 9:44 am</td>
<td>Unicompartmental Arthroplasty in 2017</td>
<td>Craig J. Della Valle, MD (Chicago, IL)</td>
</tr>
<tr>
<td>9:45 am – 9:51 am</td>
<td>ACL/PCL Design: What the Future Holds</td>
<td>Christopher L. Peters, MD (Salt Lake City, UT)</td>
</tr>
<tr>
<td>9:52 am – 9:58 am</td>
<td>Medial Pivot Design</td>
<td>C. Lowry Barnes, MD (Little Rock, AR)</td>
</tr>
<tr>
<td>9:58 am – 10:15 am</td>
<td>DISCUSSION</td>
<td></td>
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10:15 am – 10:30 am **COFFEE/REFRESHMENT BREAK**

### Session IVa: The Knee Society’s Scientific Awards

*Moderator: Thomas P. Sculco, MD (New York, NY)*

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Presenter</th>
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<tbody>
<tr>
<td>10:31 am – 10:33 am</td>
<td>Introduction: The John N. Insall, MD Award</td>
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<tr>
<td>10:33 am – 10:39 am</td>
<td>“Higher Tissue Concentrations of Vancomycin with Intraosseous Regional Prophylaxis in Revision TKA”</td>
<td>Simon W. Young, FRACS (Auckland, New Zealand)</td>
</tr>
<tr>
<td>10:39 am – 10:40 am</td>
<td>Award Presentation</td>
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<tr>
<td>10:41 am – 10:43 am</td>
<td>Introduction: The Chitranjan S. Ranawat, MD Award</td>
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<tr>
<td>10:43 am – 10:49 am</td>
<td>“Does Computer Navigation in Knee Arthroplasty Improve Functional Outcomes in Young Patients?”</td>
<td>Young-Hoo Kim, MD (Seoul, South Korea)</td>
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<tr>
<td>10:49 am – 10:50 am</td>
<td>Award Presentation</td>
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<tr>
<td>10:51 am – 10:53 am</td>
<td>Introduction: The Mark Coventry, MD Award</td>
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<tr>
<td>10:53 am – 10:59 am</td>
<td>“A Randomized Clinical Trial on Patellofemoral vs. Total Knee Replacement for Patellofemoral Osteoarthritis”</td>
<td>Anders Odgaard, MD, DMSc (Aarhus, Denmark)</td>
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<tr>
<td>10:59 am – 11:00 am</td>
<td>Award Presentation</td>
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### Session IVb: Highlights

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<tr>
<th>Time</th>
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<tbody>
<tr>
<td>11:01 am – 11:08 am</td>
<td>AAHKS 2016 Annual Meeting</td>
<td>William A. Jiranek, MD (Richmond, VA)</td>
</tr>
<tr>
<td>11:09 am – 11:15 am</td>
<td>The John N. Insall, MD Traveling Fellowship</td>
<td>W. Norman Scott, MD (New York, NY)</td>
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</table>
### 11:25 am – 12:00 pm

**Session V: Transitioning to Outpatient THA: Point/Counterpoint**

*ARS in use*

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<tr>
<th>Time</th>
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<tbody>
<tr>
<td>11:25 am – 11:32 am</td>
<td>Building an Outpatient THA Program</td>
<td>R. Michael Meneghini, MD (Fishers, IN)</td>
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<tr>
<td>11:33 am – 11:40 am</td>
<td>Outpatient THA is a Triumph of Passion Over Reason</td>
<td>Vincent D. Pellegrini, Jr., MD (Charleston, SC)</td>
</tr>
<tr>
<td>11:41 am – 12:00 pm</td>
<td><strong>DISCUSSION</strong></td>
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</table>

**LUNCH – Box lunches provided to all participants**

### 1:00 pm – 1:34 pm

**Session VIa: The Hip Society’s Scientific Awards**

*Moderators: Paul E. Beaulé, MD, FRCSC (Ottawa, ON, Canada) & C. Anderson Engh, Jr., MD (Alexandria, VA)*

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<thead>
<tr>
<th>Time</th>
<th>Topic</th>
<th>Presenter(s)</th>
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<tbody>
<tr>
<td>1:01 pm – 1:02 pm</td>
<td><strong>Introduction:</strong> The John Charnley Award</td>
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<tr>
<td>1:02 pm – 1:08 pm</td>
<td>“A Randomized Clinical Trial of Direct Anterior Approach and Mini-Posterior Approach Total Hip Arthroplasty”</td>
<td>Michael J. Taunton, MD (Rochester, MN)</td>
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<tr>
<td>1:08 pm – 1:09 pm</td>
<td><strong>Award Presentation</strong></td>
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<tr>
<td>1:10 pm – 1:11 pm</td>
<td><strong>Introduction:</strong> The Otto Aufranc Award</td>
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<tr>
<td>1:11 pm – 1:17 pm</td>
<td>“A Prospective, Randomized Study of Crosslinked and Non-crosslinked Poly for Total Hip Arthroplasty at 15-Year Followup”</td>
<td>Robert H. Hopper, Jr., PhD (Alexandria, VA)</td>
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<tr>
<td>1:17 pm – 1:18 pm</td>
<td><strong>Award Presentation</strong></td>
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<tr>
<td>1:18 pm – 1:24 pm</td>
<td>“Dual-Mobility Constructs in Revision THA Reduced Dislocation, Re-Revision &amp; Reoperation Compared to Large Femoral Heads”</td>
<td>Matthew P. Abdel, MD (Rochester, MN)</td>
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<tr>
<td>1:24 pm – 1:25 pm</td>
<td><strong>Award Presentation</strong></td>
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<tr>
<td>1:26 pm – 1:27 pm</td>
<td><strong>Introduction:</strong> The Frank Stinchfield Award</td>
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<tr>
<td>1:27 pm – 1:33 pm</td>
<td>“Identification of the ‘At Risk’ Genotype for Development of Pseudotumours around Metal-on-Metal Total Hip Arthroplasties”</td>
<td>Andrew P. Kurnis, FRACS, MBBS, PhD (Vancouver, BC, Canada)</td>
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<tr>
<td>1:33 pm – 1:34 pm</td>
<td><strong>Award Presentation</strong></td>
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</table>
### Session V: “Lessons Learned” from Difficult Cases
** Moderator: Robert T. Trousdale, MD (Rochester, MN) **

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Speakers</th>
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<tbody>
<tr>
<td>11:16 am</td>
<td>Case 1</td>
<td></td>
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<tr>
<td>11:22 am</td>
<td>Case 2</td>
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<tr>
<td>11:28 am</td>
<td>Case 3</td>
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<tr>
<td>11:34 am</td>
<td>Case 4</td>
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<tr>
<td>11:40 am</td>
<td>Panel Discussion</td>
<td>Kevin L. Garvin, MD (Omaha, NE); William L. Griffin, MD (Charlotte, NC); Douglas D.R. Naudie, MD (London, ON, Canada); Carlos J. Lavernia, MD (South Miami, FL)</td>
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<tr>
<td>11:55 am</td>
<td>Audience Votes</td>
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** LUNCH – Box lunches provided to all participants **

### Session VI: Perioperative Issues
** Moderator: Daniel J. Berry, MD (Rochester, MN) **

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<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Speaker</th>
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<tr>
<td>1:01 pm</td>
<td>Pain Control</td>
<td>Mark W. Pagnano, MD (Rochester, MN)</td>
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<tr>
<td>1:08 pm</td>
<td>Post-Op Rehab/Physical Therapy</td>
<td>Matthew S. Austin, MD (Philadelphia, PA)</td>
</tr>
<tr>
<td>1:15 pm</td>
<td>Anticoagulation and Bleeding: Where Are We in 2017?</td>
<td>Javad Parviz, MD (Philadelphia, PA)</td>
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<tr>
<td>1:22 pm</td>
<td>Bilateral TKA: How To Do It Safely</td>
<td>Thomas P. Sculco, MD (New York, NY)</td>
</tr>
<tr>
<td>1:29 pm</td>
<td>DISCUSSION</td>
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</table>
**1:34 pm – 1:45 pm**

**Session VIb: The Hip Society’s Fellowships**

*Moderator: Chitranjan S. Ranawat, MD (New York, NY)*

- **1:35 pm – 1:36 pm**
  - Introduction of the Hip Society Fellowships
  - Chitranjan S. Ranawat, MD (New York, NY)

- **1:36 pm – 1:40 pm**
  - Highlights of the 2016 Hip Society – British Hip Society Traveling Fellowship
  - Michael Blankstein, MSc, MD, FRCS(C) (South Burlington, VT) & Joseph M. Schwab, MD, (Milwaukee, WI)

- **1:40 pm – 1:44 pm**
  - Recap of the 2016 Rothman-Ranawat Fellowship
  - Atul F. Kamath, MD (Philadelphia, PA)

- **1:44 pm – 1:45 pm**
  - Introduction of the 2017 Hip Society Rothman-Ranawat Traveling Fellows
  - Chitranjan S. Ranawat, MD (New York, NY)

**1:45 pm – 2:30 pm**

**Session VII: “Lessons Learned” from Difficult Cases**

*Moderator: Thomas P. Schmalzried, MD (Los Angeles, LA)*

**ARS in use**

- **1:46 pm – 1:51 pm**
  - Case 1

- **1:52 pm – 1:57 pm**
  - Case 2

- **1:58 pm – 2:03 pm**
  - Case 3

- **2:04 pm – 2:09 pm**
  - Case 4

- **2:10 pm – 2:23 pm**
  - Panel Discussion
  - Michael E. Berend, MD (Indianapolis, IN); John J. Callaghan, MD (Iowa City, IA); Scott M. Sporer, MD, MS (Winfield, IL); Wayne G. Paprosky, MD, FACS (Winfield, IL)

- **2:23 pm – 2:30 pm**
  - Audience Votes

- **2:30 pm – 2:45 pm**
  - **COFFEE/REFRESHMENT BREAK**
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<tr>
<th>Time</th>
<th>Session</th>
<th>Speaker</th>
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<tr>
<td>1:45 pm - 2:30 pm</td>
<td>Session VII: Instability in TKA: Causes and Prevention</td>
<td>Moderator: Robert L. Barrack, MD (St. Louis, MO)</td>
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<tr>
<td>1:46 pm - 1:52 pm</td>
<td>AP and ML Instability</td>
<td>David G. Lewallen, MD (Rochester, MN)</td>
<td>57</td>
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<td>1:53 pm - 1:59 pm</td>
<td>Patella Instability</td>
<td>Giles R. Scuderi, MD (New York, NY)</td>
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<td>2:00 pm - 2:06 pm</td>
<td>Extensor Mechanism Failure</td>
<td>Rafael J. Sierra, MD (Rochester, MN)</td>
<td>60</td>
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<tr>
<td>2:07 pm - 2:13 pm</td>
<td>The Unstable Revision TKA</td>
<td>Michael D. Ries, MD (Carson City, NV)</td>
<td>61</td>
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<tr>
<td>2:14 pm - 2:30 pm</td>
<td>DISCUSSION</td>
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<td>2:30 pm - 2:45 pm</td>
<td>COFFEE/REFRESHMENT BREAK</td>
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<tr>
<td>2:45 pm - 3:30 pm</td>
<td>Session VIII: Patient Satisfaction</td>
<td>Moderator: William J. Griffin, MD (Charlotte, NC)</td>
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<tr>
<td>2:46 pm - 2:52 pm</td>
<td>Is It Expectation?</td>
<td>Matthew J. Kraay, MD (Cleveland, OH)</td>
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<tr>
<td>2:53 pm - 2:59 pm</td>
<td>How Do We Measure It?</td>
<td>Philip C. Noble, PhD (Houston, TX)</td>
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<tr>
<td>3:00 pm - 3:06 pm</td>
<td>Can We Identify a Poor Surgical Candidate?</td>
<td>David C. Ayers, MD (Worcester, MA)</td>
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<td>3:07 pm - 3:13 pm</td>
<td>What To Do About It?</td>
<td>Jay R. Lieberman, MD (Los Angeles, CA)</td>
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<td>3:14 pm - 3:30 pm</td>
<td>DISCUSSION</td>
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Marriott Grand Ballroom 5

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<tr>
<th>Time</th>
<th>Session VIII: Surgical Approaches to the Hip</th>
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<tr>
<td>2:45 pm – 3:00 pm</td>
<td>Moderator: Daniel J. Berry, MD (Rochester, MN)</td>
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<tbody>
<tr>
<td>2:46 pm – 2:52 pm</td>
<td>Direct Anterior Approach to the Hip: The New Gold Standard or a Marketing Opportunity?</td>
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<tr>
<td></td>
<td>Keith R. Berend, MD (New Albany, OH)</td>
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<tr>
<td>2:53 pm – 2:59 pm</td>
<td>Posterior Approach: Still the “Gold Standard”?</td>
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<td>Mark W. Pagnano, MD (New Albany, OH)</td>
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<tr>
<td>3:00 pm – 3:06 pm</td>
<td>Is Surgical Approach a Risk Factor for Early Failure of Primary THA?</td>
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<td>Bryan D. Springer, MD (Charlotte, NC)</td>
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3:07 pm – 3:30 pm DISCUSSION

3:30 pm – 4:15 pm Session IX: Instability

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<tr>
<td>3:31 pm – 3:37 pm</td>
<td>Incidence and Causes of Instability in Total Hip Arthroplasty</td>
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<td>Javad Parvizi, MD, FRCS (Philadelphia, PA)</td>
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<tr>
<td>3:38 pm – 3:44 pm</td>
<td>The Solution: Large Diameter Femoral Heads</td>
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<td>Thomas P. Vail, MD (San Francisco, CA)</td>
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<tr>
<td>3:45 pm – 3:51 pm</td>
<td>The Solution: Dual Mobility Cups</td>
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<td>Arlen D. Hanssen, MD (Rochester, MN)</td>
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<tr>
<td>3:52 pm – 3:58 pm</td>
<td>The Solution: Constrained Acetabular Components</td>
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<td>Thomas P. Sculco, MD (New York, NY)</td>
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</table>

3:59 pm – 4:15 pm DISCUSSION

Session X: Transitioning to Value-Based Healthcare is a **COMBINED SESSION** with The Knee Society and will be held in Grand Ballroom 8.
3:30 pm – 4:15 pm  
**Session IX: Complications**  
* Moderator: William L. Healy, MD (Newton, MA)  

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<td>Optimizing Risk Factors and Preventing Readmissions</td>
<td>Richard Iorio, MD (New Rochelle, NY)</td>
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<td>3:38 pm – 3:44 pm</td>
<td>Infection Prevention: What Should We Do?</td>
<td>Bryan D. Springer, MD (Charlotte, NC)</td>
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<td>3:45 pm – 3:51 pm</td>
<td>When is Irrigation and Debridement Indicated for Infection?</td>
<td>David J. Mayman, MD (New York, NY)</td>
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<td>3:52 pm – 3:58 pm</td>
<td>Two Stage vs. One-Stage Treatment of Deep Infection in 2017</td>
<td>Fares S. Haddad, MD (London, United Kingdom)</td>
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<td>DISCUSSION</td>
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4:15 pm – 5:15 pm  
**COMBINED SESSION X: Transitioning to Value-Based Healthcare**  
* Moderators: Kevin J. Bozic, MD, MBA (Austin, TX) & Richard Iorio, MD (New Rochelle, NY)  

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<tr>
<td>4:16 pm – 4:22 pm</td>
<td>Optimizing Patient Health Status and Improving Outcome for TJA: Using Population Health Management to Deliver Value-Based Care</td>
<td>Joseph A. Bosco, III, MD (New York, NY)</td>
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<td>4:23 pm – 4:29 pm</td>
<td>Partnering with the Patient to Improve Outcomes in the TJA: The Role of Shared-Decision Making in Advising Patients of Risk and Comorbidity Burdens</td>
<td>Kevin J. Bozic, MD, MBA (Austin, TX)</td>
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<td>4:30 pm – 4:50 pm</td>
<td>Value-Based Payment Strategies, MACRA, and the Merit-Based Incentive Payment Program: Advanced Alternative Payment Models Are Our Best Way Forward</td>
<td>Shari M. Ling, MD, Deputy Chief Medical Officer, Centers for Medicare and Medicaid Services (Brooklyn, MD)</td>
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<td>4:51 pm – 4:57 pm</td>
<td>The Role of Registries, PROs, and Quality Measures in Improving Value and Outcomes and Determining Physician’s Payment: This is Our Future!</td>
<td>David C. Ayers, MD (Worcester, MA)</td>
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<td>4:58 pm – 5:15 pm</td>
<td>DISCUSSION</td>
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5:15 pm  
**MEETING ADJOURNED**  
* Harry E. Rubash, MD (Boston, MA) & Thomas P. Sculco, MD (New York, NY)  

23
ABSTRACTS
Management of Stiff Knee
Steven J. MacDonald, MD

Background
Achieving maximum flexion and extension is a key goal in total knee arthroplasty (TKA) surgery. It should be emphasized from the beginning however that preoperative motion is a significant determinant of postoperative motion, so realistic goals must be set by both the patient and the surgeon.

It also needs to be stated that maximal range of motion cannot be achieved with a TKA unless proper knee alignment and balancing is performed. While it is beyond the scope of this talk, there are certain common balancing scenarios that need to be understood and addressed to achieve maximal flexion and extension.

Ligament Balancing

There are various approaches to ligament balancing, and suggested orders of release from different authors. Regardless of the specific technique, the overall goals remain the same. The flexion gap should equal the extension gap. Within each gap, the medial and lateral sides of the gap should be equal.

It is this author’s preferred technique to perform all bony cuts first, remove all osteophytes, and only at that point assess the flexion and extension gaps with spacer blocks.

There are specific scenarios that are then seen clinically:

A) The Varus Knee

Tight Medially in Flexion

This is seen occasionally in the varus knee. This is addressed by releasing only the anterior portion of the medial collateral ligament. This can be done with a spacer block in place, and done very slowly under direct vision. Over-release needs to be avoided as this will lead to flexion instability. It is common though that once this release is performed, the polyethylene trial may have to be upsized one size.

Tight Medially in Extension

This is seen more commonly in the varus knee. In this scenario, it is the posterior structures that should be released, coming right around the posterior-medial corner of the tibia. Commonly there may be osteophytes that have been missed that should be resected.

B) The Valgus Knee

Traditional teaching espoused the principle of fully releasing specific structures. Most authors now prefer a more limited release of the structures that are tight. This has been described as a pie-crust technique.

Following bone cuts the knee is brought into extension and either a spacer block, or a laminar spreader is placed in the extension gap. The lateral sided structures are palpated to determine the tightest structures.
Using a #15 blade, the posterolateral capsule and arcuate ligament complex can be incised at the level of the joint line in the short interval between the fibular collateral ligament and the popliteus. The blade is then used to make multiple stab incisions in the tightest structures remaining on the lateral side, normally the iliotibial band and fibular collateral ligament. The spacer blocks or laminar spreader is placed frequently as releases are done, to titrate the releases. Popliteus can be released if there is significant tightness in the flexion gap on the lateral side only.

**C: All Knees**

Additionally there are scenarios that the surgeon will see regardless of preoperative deformity:

*Both flexion and extension gaps are tight but equal*

This is best managed normally with further tibial resection

*Tight extension gap only*

This is commonly seen with a preexistent fixed flexion contracture. It is important to not simply resect further distal femur in these cases. The surgeon must look specifically for posterior femoral osteophytes and remove them. Tight posterior capsule should be released. Most of the deformity can be corrected with soft tissue release. Resecting an additional 1-2mm of distal femur may be necessary, but excessive bone resection can lead to instability, particularly mid-flexion instability, which is very difficult to address.

Another common error in this scenario is to downsize the polyethylene to balance the extension gap, but leaving the flexion gap loose. This results also in instability and should be avoided. Patients do not tolerate well a flexion gap with excessive laxity.

*Tight flexion gap only*

In this scenario the surgeon must first check the tibial resection, ensuring that there has not been an inadvertent reverse slope cut. If the flexion gap is significantly tighter than the extension gap, then the femoral component may have been oversized, leading to an overstuffing of the flexion gap. Downsizing of the femoral component will then increase the flexion gap, resulting in a balanced knee. It should be emphasized that downsizing of the femoral component should only rarely be necessary, and that if this is done inappropriately, flexion gap instability can occur.

*Intraoperatively the TKA does not bend*

The arthroplasty surgeon must be aware of the common scenarios that lead to the potential for a knee that is limited in its flexion and be prepared to deal with them:

1) **Issues of Gap Balancing and Component Sizing**
   -discussed in detail above. This is by far the most common cause of a tight flexion gap, or in other words a TKA that does not bend well

2) **Posterior osteophytes**
   -failure to resect large posterior femoral osteophytes can limit both flexion and terminal extension. Removal of these posterior osteophytes is a critical step in most TKA procedures.

3) **Overstuffing of the Patella**
   -if the patella thickness is increased significantly then there is the potential to loose flexion. For every 2mm the patella thickness is increased, one can see the loss of 3 degrees of flexion
4) Anterior translation of the femoral component
   –if the femoral component is allowed to translate too far anteriorly, this can overstuff the extensor mechanism and lead to pain and decreased flexion. For every 1mm of excessive anterior femoral translation, one can see the loss of 2 degrees of flexion

5) Tibial slope
   -as discussed above, if there is insufficient or reversed tibial slope, this can result in limited intraoperative flexion

**Intraoperatively the TKA does not straighten out**

For the purpose of this discussion, it is assumed that the surgeon is happy with the flexion gap, but that the extension gap is too tight, preventing the TKA from coming out straight. The surgeon should then look for these scenarios:

1) Posterior femoral osteophytes
   -the inadvertent retention of posterior femoral osteophytes will act as a posterior tether and will prevent the knee from fully extending. Posterior osteophytes should always be resected with an osteotome

2) Tight posterior capsule
   -this is seen when a knee has a significant preoperative fixed flexion contracture. An excessively tight posterior capsule can limit terminal knee extension. This can be released safely from the posterior surface of the distal femur with a cautery and then a cob elevator.

3) The last step would be to resect further distal femur. Often simply resecting an additional 2mm of distal femur, thereby creating a larger extension gap, will allow the knee to come into full extension. Again caution should be used in that excessive distal femoral resection and elevation of the joint line, can result in med-flexion instability
References

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Predicting range of motion after total knee arthroplasty. Clustering, log-linear regression, and regression tree analysis

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Residual posterior femoral condyle osteophyte affects the flexion angle after total knee replacement
Int Orthop, Dec 29(6):375-9, 2005

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The effect of patellar thickness on intraoperative knee flexion and patellar tracking in total knee arthroplasty

Mihalko W, Fishkin Z, Krackow K
Patellofemoral overstuff and its relationship to flexion after total knee arthroplasty

Bellemans J, Robijns F, Duerinckx J, Banks S, Vandenneucker H
The influence of tibial slope on maximal flexion after total knee arthroplasty
The etiology of the flexion contracture is related to recurrent effusions present in a knee with end-stage degenerative joint disease secondary to the associated inflammatory process. These recurrent effusions cause increased pressure in the knee causing pain and discomfort. Patients will always seek a position of comfort, which is slight flexion. Flexion decreases the painful stimulus by reducing pressure in the knee and relaxing the posterior capsule. Unfortunately, this self-perpetuating process leads to a greater degree of contracture as the disease progresses. Furthermore, patients rarely maintain the knee in full extension. Even during the gait cycle the knee is slightly flexed. As their disease progresses, patients limit their ambulation and are more frequently in a seated position. Patients often report sleeping with a pillow under their knee or in the fetal position. All of these activities increase flexion contracture deformity. Patients with excessive deformity >40° should be counseled regarding procedural complexity and that increasing constraint may be required. Patients are seen preoperatively by a physical therapist and given a prearthroplasty conditioning program. Patients with excessive flexion contracture are specifically instructed on stretching techniques, as well as quadriceps rehabilitation exercises.

**Surgical Technique:**

Femoral nerve blocks are discouraged, because their use necessitates ambulation with an immobilizer and is counter to the need of the flexion contracture patient to have a well-functioning extensor mechanism. Prior to skin incision the surgeon should make a critical evaluation of the degree of deformity present and ability to correct the deformity. Can the varus or valgus malalignment be corrected to neutral? What is the status of the medial and lateral collateral ligaments? When holding the extremity by the heel and raising the leg, is there a flexion contracture? Does the knee come to full extension? The patient with a fixed varus deformity and associated flexion contracture can be addressed immediately with an extensive soft tissue release from the proximal medial tibia to include the deep medial collateral, meniscal capsular ligament, semimembranosus, and perhaps some of the superficial medial collateral, whereas in the patient with a fixed valgus deformity, medial exposure should not go beyond the mid-coronal plane. Osteophytes on the distal femur and proximal tibia are removed. The goals of tibial resection are similar to femoral resection - that is to re-establish the tibial joint line. In flexion contractures the flexion gap is generally greater than the extension gap and, therefore, a resection without posterior slope will facilitate balance of the flexion/extension gap. Upon completion of tibial resection, attention should be turned to completion of distal femoral preparation. To facilitate balance of the knee with flexion contracture, the largest size possible is chosen. Upon completion of femoral resections the most important part of the procedure ensues - removal of posterior osteophytes and re-establishment of the posterior recess of the knee by release of the posterior capsule accomplished by subperiosteal stripping of the capsule with a curved osteotome. Trial tibial and femoral components or spacer blocks are now placed and the appropriate polyethylene inserted to balance the flexion/extension gaps and collateral ligaments. Fine adjustment of varus and valgus structures is done and gap balance assessed. If there is continued flexion contracture and all releases have been accomplished then further distal femoral resection will be required to balance the gaps and obtain full extension. If an additional 2mm of distal femoral resection does not accomplish full extension, converting to a posterior stabilized arthroplasty and removing additional distal femur is advised. In cases of severe flexion contracture where greater amounts of distal femoral resection are required to obtain full extension, all structures anterior to the posterior capsule are somewhat lax in full extension and a posterior stabilized constrained device may be required for varus/valgus stabilization through the entire arc of motion. Wound closure follows standard techniques with the exception that patients who have a severe flexion contracture (>30°) may require a proximal realignment of the extensor
mechanism, that is a lateral and distal advancement of the vastus medialis obliquus in an effort to strengthen the extensor mechanism and place the quadriceps at a mechanical advantage.

Postoperative Regime:
The focus in the postoperative physiotherapy rehabilitation program continues toward the goal of full extension. Patients are instructed in appropriate stretching regimes. Patients are immobilized for the first 24 hours in full extension with plaster splints, such as with a modified Robert Jones dressing. This dressing is removed on postoperative day one. The patient is then placed in a knee immobilizer and instructed to wear it at bed rest, during ambulation and in the evening, only removing for ROM exercises. In cases of severe flexion deformity >30°, patients are maintained in full extension for 3-4 weeks until ROM is begun. Patients are encouraged to use a knee immobilizer for at least the first 6 weeks postoperatively.

Avoiding Pitfalls and Complications:
Treating patients with flexion involves a combination of bone resection and soft tissue balance. One must make every effort to preserve both the femoral and tibial joint line. In flexion contracture the common error is to begin by resecting additional distal femur, which may result in joint line elevation and mid-flexion instability. The distal femoral resection should remove that amount of bone being replaced with metal. Attention should be directed at careful and meticulous balance of the soft tissues and release of the contracted posterior capsule with re-establishment of the posterior recess, which will correct the majority of flexion contractures.

Suggested Reading:
The Valgus Knee: Is It More Difficult?
Paul F. Lachiewicz, MD

An excessive valgus deformity is seen in 9 to 23% of arthritic knees, with the frequency dependent on the precise definition and practice referral patterns. The pathoanatomy includes hypoplasia of the lateral femoral condyle, loss of articular cartilage, synovitis-effusion, and stretch of the medial ligamentous structures. In more advanced deformities, there is erosion of bone in the tibia and lateral femur, contracture of the posterolateral ligament complex, and eventual incompetence of the medial collateral ligament.

Lateral collateral ligament release for fixed valgus deformity was described by Insall, Scott, and Ranawat for correcting deformity with the total condylar knee prosthesis. This involved transverse division of the iliotibial band and sharp release of the lateral collateral ligament–popliteus from the epicondyle, with further posterolateral releases if necessary. However, this technique risked late devascularization of the femur and component failure. The current preferred lateral ligament release involves “pie-crusting” of the iliotibial band and contracted posterolateral capsule. The medial collateral ligament is then tensioned by a thicker polyethylene spacer. The author recommends pre-operative templating, and the use of Whitesides lines or the epicondylar axis for femoral component positioning. Spacer bar is used in extension and flexion to determine the adequacy of lateral release and the MCL before the trial components are placed. In the author’s series of 123 knees with a preoperative valgus deformity, pie crusting alone balanced the knee in 66%. At mean 7 year follow-up, there were three mechanical failures: one MCL rupture, one medial condyle fracture, and one femoral loosening. However, there are certain patients in whom the medial collateral ligament cannot be tensioned satisfactorily or there is danger of restretch, and there are several proposed strategies for this scenario, including MCL advancement, rotating hinge, and varus-valgus constrained (CCK) components. In the author’s series of 36 CCK knees, usually implanted with stem extensions, in patients with MCL incompetence, there were no mechanical failures at a mean follow-up of 6 years.

Arthritic knees with valgus deformities are more challenging because they are not as frequent as varus deformities, and usually require different techniques for component positioning and releases. However, both the “pie-crusting” lateral release technique and CCK components are successful.
Previous Incisions: What To Do?
John J. Callaghan, MD

Studies evaluating the perfusion to the anterior knee including transcutaneous oxygen tension measurements of the skin after knee incisions have all demonstrated compromised oxygenation to the lateral skin flap. The blood supply originating from the medial side is better than the lateral side. Thus a medial knee incision will result in a larger lateral area with potential for compromised circulation. It is because of this, one should consider using a previous lateral knee incision when both a lateral and medial incision are present. A second important concept is an understanding of the vascular supply to the subcutaneous tissue of the anterior knee. The deep fascial vascular network sends vessels that penetrate the subcutaneous fat to reach the epidermis. There is little communication between vessels at the superficial level. Therefore, wide dissection superficial to the deep fascia will compromise the blood supply to the skin, whereas dissection deep to the fascia will maintain the skin blood supply. This is why there is a need for elevation of full thickness skin flaps during knee dissection.

In practice, we use previous lateral knee incisions that have been used for trauma or reconstruction around the knee. Old lateral oblique incisions are not a concern. With multiple previous incisions, we use the most lateral incision, unless there has been recently successful use of a medial incision without complications. If there are multiple incisions with marked scarring of the skin and subcutaneous tissue, we consider gastrocnemius flaps and tissue expanders.
Extra-Articular Deformity  
Stephen J. Incavo, MD

Total knee arthroplasty (TKA) in the presence of extra-articular deformity is a challenging endeavor, yet the goal remains constant; a well aligned, stable TKA. To achieve satisfactory alignment and stability the surgeon must identify the coronal (medial-lateral), sagittal (anterior-posterior), and/or rotational deformity. How to achieve these goals requires consideration of multiple factors, including the degree and location of the deformity, as well as the patient’s age and functional level.

Treatment options include: intra-articular correction (one stage), simultaneous corrective extra-articular osteotomy and TKA, or two stage corrective osteotomy followed by TKA at a later date. The knee replacement literature is very limited with no method demonstrating superiority.

Intra-articular correction with ligament release and angled bone cuts are limited by the integrity of the collateral ligaments. As a starting point, bone resection of greater than or equal to 15 mm may lead to ligament imbalance. When the correction requires bone resection of this degree a corrective osteotomy or a more constrained TKA design should be considered.

Extra-articular correction is most common on the femoral side, often due to mal-united femoral fractures. Once the corrective osteotomy is calculated and cut, fixation of the osteotomy can be achieved by an intramedullary (IM) rod, plates and screws, or just by bone apposition to be stabilized by a stemmed femoral component. The distal femoral cut can then be guided by the IM rod, extramedullary alignment, or computer assistance. Importantly, the femoral osteotomy fixation must provide for a stable osteotomy. Recovery after a combined procedure will likely be longer than a routine primary knee arthroplasty, since healing of the osteotomy is critical.

Two stage osteotomy / TKA is best considered in several situations: 1.) The corrective osteotomy may delay the need for TKA; 2.) The younger, active patient expecting a “routine” recovery; and 3.) Rotational osteotomies of the femur which may require diaphyseal osteotomy and longer healing times. When fixation is used, a plan to remove the fixation at the subsequent knee arthroplasty is important.
References


Two common sources of complexity in TKA surgery is a history of prior ACL injury and prior peri-articular osteotomy.

**TKA with History of ACL Deficiency / Reconstruction**

- Patients with ACL deficient knees have altered gait mechanics (Herman, 2016)
- ACL injury in early adulthood leads to a greater lifetime risk of early knee OA and TKA (Suter, 2016)
- Even greater risk if associated with meniscal injury
- Issues (Berend, 2016):
  - greater coronal deformity
  - lower pre-operative ROM
  - greater chondral damage
  - greater osteophyte formation

- Be prepared to deal with prior scars. There are often several scars.
  a. Mark all scars
  b. Avoid small skin bridges

- Coronal deformity is due to extensive medial wear leading to varus deformity.
  a. Make a conservative cut of the medial tibia and be careful to avoid removing excessive bone laterally
  b. Remove medial osteophytes completely
  c. Be prepared to perform medial release or even reduction of medial tibial plateau to gain correction and make gaps acceptable

- Beware of potential post operative stiffness.
  a. Remove obviously scarred tissue
  b. Completely excise ACL graft tissue
  c. Err on the side of loose rather than tight TKA

**TKA with History of Osteotomy**

- Osteotomies can either be distal femoral (DFVO) or proximal tibia (HTO)
- HTO can be lateral-closing-wedge or medial-opening wedge

**DFVO**

- Not as technically challenging as post-HTO TKA
- Issues:
  1. Prior incision - Usually DFVO is performed through midline or far lateral incision so wound problems less prevalent
     - Midline incision can be used for TKA
  2. Patella baja - not usually a problem
  3. Hardware removal – either medial blade or lateral locking plate
     - Can usually remove either plate through midline incision
• Consider use of navigation and retain plate but this is not usually possible and be prepared to bypass screw holes with a stem or plan for non-weight bearing period

4. DFVO produces an extra articular varus deformity
   • Plan reduced thickness of distal medial femoral cut

5. Soft tissue balance issues
   • Will have combination of valgus features and post-surgical varus features

HTO
• Conflicting reports about outcomes in the literature
• Recent paper reveals no difference in TKA survivorship when compared to TKA without prior HTO (Badawy, 2015) contradicted by Robertsson et al (2015) which found increased risk of revision
• Also may be no difference in functional outcomes when osteotomy was proximal tibial opening wedge (Saragaglia, 2016)
• Patients tend to be:
  ✓ younger
  ✓ larger
  ✓ active

• Issues:
  1. Previous scar
     • Previous transverse incision is common with lateral closing wedge
     • Medial opening wedge scars are usually midline and not an issue
     • Cross transverse incision at right angle
     • Avoid small skin bridge
     • Use most lateral incision possible
  2. Hardware Removal
     • I tend to remove it
     • May be left in place if not interfering with component placement
     • Beware of forced malposition
  3. Patella baja: exposure, tracking
     • Be careful not to avulse the tendon
     • Consider lateralizing patella rather than everting
  4. Periarticular scarring
  5. Preoperative malalignment (due to over/under correction)
     • Lateral closing wedge technique causes bone loss laterally
     • For TKA, remove less bone laterally when cutting tibia to re-establish pre-osteoflomy level
     • 2-3mm lateral instead of usual 8-10mm
     • Will still need thicker than usual polyethylene to balance lax medial side caused by earlier valgus malalignment
  6. Proximal tibial bone deficiency & extra articular deformity
     • Consider use of intramedulary cutting guide
     • Start-point more medial on tibial plateau
     • This helps insure against inadvertent lateral tilt malposition of tibial component
     • Keep in mind posterior slope: more bone often taken anteriorly than posterior when doing the index HTO procedure
     • Results in loss of posterior slope
     • Correct to 7-10° of posterior slope when performing TKA
• Medial opening wedge HTO adds bone instead of removing so expect a larger medial tibial cut doing TKA
• Soft tissue balance may be complex due to typical findings of both varus knee (pre-HTO alignment) and valgus (post-HTO alignment)

7. Instability
• Soft tissue balance may be complex due to typical findings of both varus knee (pre-HTO alignment) and valgus (post-HTO alignment)

References:


Robertsson O, W-Dahl A. The risk of revision after TKA is affected by previous HTO or UKA. Clin Orthop Relat Res. 2015 Jan;473(1):90-3

The presence of prior or active bone or joint infection about the native knee joint is relatively uncommon in most orthopedic practices and yet is a clinical scenario that most clinicians will encounter at some time in their practice.

Typically these patients present clinically in a several different of ways:
1) ancient history of septic arthritis or osteomyelitis as a child
2) past history of infection associated with prior fracture and hardware implantation
3) past history of native joint infection treated by arthroscopic and / or open arthrotomy
4) evidence of active infection associated with any of above history

It is incumbent upon the clinician to determine whether active infection is likely or not and can be done by use of hematological screening tests, joint aspiration, occasional bone biopsy, and occasional use of nuclear imaging modalities. It is important to recognize that recent surgical intervention will often obscure these diagnostic modalities.

If it is believed that there is low evidence for active infection, we typically would treat the condition with primary knee arthroplasty using antibiotic-loaded bone cement providing that the patient is more than one year out from the most recent surgical intervention and use of any antibiotics. This one year waiting period was determined empirically and instituted in our practice several decades ago to improve the accuracy of diagnostic tests to rule out infection and allow for recurrence of infection in the absence of antibiotics if an infectious nidus remains.

It is not uncommon for a patient to present inside this one year window and have a desire for knee replacement. In this situation, the patient is counseled that if they can tolerate their symptoms to reach the one year mark and have no evidence of infection that the expectation of success with only one procedure exceeds 90%. If however, the patient is so functionally disabled due to severe arthritic changes or due to infection related bone loss and deformity, two-stage reconstruction is recommended. This is accomplished with joint resection and insertion of antibiotic-loaded cement spacers and reimplantation approximately three months later.

Presence of prior infection associated with a prior tibial plateau fracture portends the worst prognosis. In these cases, if hardware is present, open debridement with hardware removal and multiple cultures is preferred to proceeding with arthroplasty. Occasionally, with severe joint destruction it may be best to remove hardware and insert an antibiotic-laded cement spacer and treat the patient with a two-stage reimplantation protocol.

In the presence of active infection, it is important to assess the condition and function of the articular joint surfaces to determine the appropriate treatment course. If the joint function is so impaired so that the patient is severely compromised functionally, the most reasonable course is to treat the patient with a two-stage protocol.
References


Is Constraint Needed in Primary TKA?
Mark P. Figgie, MD

1. Use of constrained knees is not a substitute for ligament balancing
2. Goals of surgery should be to achieve a stable knee with the least amount of constraint required
3. Increased constraint leads to
   a. Increased polyethylene stress and wear
   b. Increased stress at the bone/cement interface
4. Knee designs with increased constraint
   a. Constrained condylar knees
   b. Rotating platform hinges
5. Biomechanics of these designs
6. Indications for increased constraint
   a. Flexion /extension mismatch with flexion gap loose
      i. CCK may not be appropriate if gap significantly larger as post capable of disassociating
      ii. Hinge may be required
   b. Flexion imbalance
      i. Lateral opening may require increased constraint
      ii. Posterior stabilized knees capable of dislocating with lateral instability
      iii. CCK may be needed
   c. Collateral ligament deficiency/absence
      i. CCK not a good option for MCL insufficiency- hinge may be required
      ii. CCK potentially could be used for lateral collateral deficiency
      iii. Hinge required when femoral resection above collateral ligament attachments
   d. Rarities
      i. Neuromuscular disorders
         1. Polio
         2. Multiple Sclerosis
      ii. Connective tissue disorders
         1. Ehlers Danlos
      iii. Charcot
      iv. Hyperextension
Joint restoration and preservation refer to biological or mechanical solutions to delay or prevent the progression to arthroplasty in younger more active patients. These patients are generally considered less than ideal candidates for arthroplasty given their age, and are looking for bridging techniques to help get them to an age that would be more suitable to arthroplasty. The therapeutic options can be broken down into three general categories: palliative, reparative, and restorative.

Advances in imaging have led to increased recognition of the presence of early evidence of chondral and meniscal abnormalities that may allow for improved detection of knees at risk. Increased field strength magnetic resonance imaging with 3 Tesla scanners allow for improved resolution of the articular surface. Fast-spin echo (FSE) sequences are best for identification of articular cartilage defects in the clinical setting. The use of T2 mapping and delayed gadolinium enhanced MRI for cartilage (dGEMRIC) allows one to assess the biologic activity of cartilage and is largely used in the research setting to evaluate the quality of tissue generated following interventions. The MOCART (magnetic resonance observation of cartilage repair tissue) scoring system is used to objectively report the findings for consistency in reporting.

There is great interest in non-surgical procedures for chondroprotection in at-risk joints as well as for palliation and/or cartilage repair in injured knees. Some have shown a reduction in COMP and other cartilage breakdown markers in acute ACL injury patients treated with aspiration and corticosteroid injection. While the initial injury that caused bone bruises cannot be undone, it is felt that the secondary inflammatory response leading to chondrocyte apoptosis may be the prime target for therapies to prevent subsequent degeneration. Finding genetic markers to detect who is at risk and who may be a candidate for interventions is a key research goal. In clinical practice, viscosupplementation, platelet-rich plasma (PRP), autologous conditioned serum, bone marrow aspirate concentrates, and stem cell injections are commonly requested by patients. The safety of such procedures has been well-documented, but their efficacy at cartilage repair is best described as unproven. However, patients may experience symptom relief, perhaps through such mechanisms as decreasing IL-1 effective levels. At present, these should be considered symptomatic treatments that would fall into the palliative category.

Surgical procedures focus on the articular surface, meniscus, ligament stability and alignment. Often, these procedures will be performed concomitantly to address not just the defect, but also to address the reason for its existence and to improve the environment for healing. Microfracture has been considered a standard against which the FDA compares newer technologies. This is a reparative technique leading to fibrocartilage tissue which may provide symptom improvement in the short-term, but there are concerns about worsening results after 2-5 years which are felt to be due to poor durability of this tissue and damage to the subchondral bone. Attempts to improve on this technique have resulted in a shift towards “nanofracture” with smaller, deeper drill holes and the use of membranes and scaffolds to trap the marrow elements (autologous matrix-induced chondrogenesis, AMIC).

Osteochondral grafting remains one of the most successful restorative techniques available today and has been increasing in popularity in the US. Autologous osteoarticular plugs (OATs) can be transferred for smaller defects with good results, but are limited by donor site morbidity in medium to large lesions. These
may be best treated with osteochondral allograft (OCA) which allows for restoration of the articular surface with mature bone and hyaline cartilage. Fresh grafts have the highest success rates in this class with many mid- to long-term studies. However, their utilization may be limited by timing and graft availability. This has led to other products designed to increase availability and potentially provide off-the-shelf alternatives. If allograft tissues are “minimally modified,” they do not require study by the FDA which has led to marketing of a number of below the bar products. The results of de-cellularized osteochondral plugs were reported in 2016 and found to have an unacceptable failure rate of 72% at 2 years. Cryopreserved grafts have not yielded viable chondrocytes in past studies, but have now returned to the market in a thinned out sheet of tissue that may allow for improved permeation of the solvent, but results are not available. Minced juvenile cartilage uses small cubes of cartilage from skeletally immature donors which have a higher chondrocyte density, are more metabolically active and further from senescence. Mid-term results are now available showing some efficacy.

Autologous chondrocyte implantation (ACI) was the first FDA-approved cell therapy in orthopedics and now has over two decades of results. While the Knutson et al. follow-up study published in 2016 failed to show an improvement over microfracture, several other studies have shown good-excellent results in a majority of appropriately selected patients. The latest generations of this 2-step cell expansion and surgical implantation involve providing the patients’ cells co-cultured in an absorbable matrix. “MACI” (Vericel, US) was approved by the FDA at the end of 2016 based on the results of several international trials showing high success rates. Studies using both autologous and allograft (amniotic) stem cell expansion and surgical implantation are underway at several centers in the US.

Scaffolds either with or without cell seeding offer another potential solution. The Holy Grail would be a scaffold which is easy to implant, has chondrogenic properties, integrates to the surrounding bone and cartilage, is stable enough to allow weight bearing, absorbs when the articular surface has been restored. Much of this research is being performed in Europe, where tissue banking is not as readily available as in the US. There are significant barriers to even getting acellular devices into clinical study in the US, much less a composite product which is both a biologic and a device.

Meniscal insufficiency is a strong predictor of progression to arthritis which highlights the importance of meniscal repair. Improved techniques and devices have made repairs of complete radial tears and root tears possible. Meniscal substitutes have been developed, but remain largely investigational. Meniscal allograft transplantation is a good bridging option in meniscal deficient patients with high 15-year survivorships reported.

References:


Unicompartmental knee arthroplasty (UKA) has a long history that extends back nearly as far as the first tricompartmental designs. While initial results were erratic, with a greater understanding of patient selection and surgical techniques, more consistent and favorable results have been reported. While there has been somewhat of a resurgence in interest in UKA, the percentage of primary knee arthroplasties that are unicompartmental hovers around 6-8%. It is my belief that you should be doing more!

Several peer review studies suggest that with both fixed and mobile bearing designs, survivorship exceeds 90% at ten year. In our own initial series of 62 fixed bearing medial UKA, survivorship was 90% at 20 years.

UKA is an outstanding option for younger patients, who are amongst the most challenging to satisfy with a TKA. In a cohort of patients < 55 years old, Biswas et. al reported a mean KSS of just over 95 points and a mean UCLA activity score of 7.5. This is opposed to the report by Parvizi et. al who suggested 1/3 of young, active patients reported residual symptoms and limitations following modern TKA.

Most data suggests that UKA is a less morbid procedure than TKA. In a retrospective review of 605 UKA compared to 2235 TKA, Brown et. al found the risk of complications was 11% vs. 4.3% favoring UKA with a shorter length of stay and risk of discharge to an extended care facility, which also translates into lower costs for our health care system.

Finally, in the only randomized study that I am aware of that has compared UKA and TKA, UKA was associated with significantly better survivorship (90% vs. 79%). Further, UKA was associated with better ROM and functional scores at 5 and 15 years. Finally, recovery with UKA was faster and the risk of perioperative complications was lower.

References:
ACL/PCL Design: What the Future Holds

Christopher L. Peters, MD

Despite the known benefits of total knee arthroplasty (TKA) up to 25% of primary TKA patients report not being entirely satisfied following surgery\[1, 3\]. Both posterior cruciate retaining (CR) and posterior stabilized (PS) knee designs have demonstrated abnormal knee kinematics in gait and fluoroscopic kinematic studies. Retention of the ACL, with either unicompartmental knee arthroplasty or TKA, has been shown to provide more normal knee kinematics. Bicruciate retaining TKA designs (BiCR) thus have the potential to improve patient satisfaction after TKA by virtue of more closely replicating normal knee kinematics.

Successful results have been reported with BiCR TKA including 82% survivorship at 22 years, with the majority of revisions due to polyethylene wear with the Cloutier Hermes 2C prosthesis\[6\]. In addition, in two separate studies, Pritchett et al.\[4, 5\] reported strong (79-83%) patient preference for BCR knees when compared to contralateral CR or PS knees.

We recently reviewed our experience with a new BiCR TKA that was introduced to the market in 2013\[2\]. The purpose of that study was to examine the patient reported, clinical, and radiographic outcomes of BiCR vs. standard CR designs. We compared 66 BiCR TKA patients with 237 CR TKA patients that underwent surgery between January 2013 and May 2014 at a single academic medical center. Both linear and logistic GEE regression models were used to examine differences between groups for PROMIS physical function T-scores (PF-CAT) and PROMIS global health scores (global health, global pain, global mental T-score, and global social). These same models were used to assess knee ROM, joint A-P laxity measures, and postoperative radiolucent lines (RLL) between implant type. Multivariable hazard ratios were estimated by shared-frailty Cox regression model for reoperations between the groups.

There were no differences for any of the PROMIS scores postoperatively (p>0.05). Clinically, there was no difference in knee ROM or A-P joint laxity between BiCR and CR TKA patients (p>0.05). The overall reoperation rate, excluding manipulations, was 5% (15/303). BiCR TKA patients had significantly higher rates of irrigation and debridement with component retention (HR=0.07, p<0.001), and also had significantly higher rates of all cause revision (HR=7.44, p=0.028). No differences were found between groups for subsequent manipulation (p=0.137). The proportion of RLL was greater in the BiCR group (HR=2.93, p<0.001) at a minimum 12-month followup.

We concluded that although survivorship of BiCR implant design have been reported to be as high as 82% at 22 year followup, our early experience with a new design demonstrated higher early reoperation rates and a greater prevalence of radiolucent lines. These results could be explained by a number of factors including early learning curve experiences, a predilection toward intervention/revision due to the novel implant, and inferior implant design/surgical technique. Nevertheless, there remains interest in the concept of bicruciate retaining TKA due to the potential for replication of more normal knee kinematics and improved patient satisfaction. Undoubtedly, as we expand the indications for TKA in younger more active individuals, patients will demand a more natural feeling and functioning TKA. Areas for future refinement will likely include identification of appropriate alignment goals with BiCR TKA (e.g. kinematic vs mechanical), improvement in tibial component fixation, and optimization of bearing surface geometry to minimize kinematic conflict with a retained ACL.
References

Medial Pivot Design
C. Lowry Barnes, MD

The available implant choices for total knee arthroplasty (TKA) today are extensive. Because of the effectiveness of TKA, it is being used to treat end-stage arthritis in an increasingly younger population. This younger generation expresses a strong desire to continue an active lifestyle with a knee that feels more “normal”. Designs continue to try to solve the problem of 15-20% of patients not being extremely satisfied with their result following TKA.

The Medial Pivot TKA has been designed in an attempt to reproduce a more normal feeling knee. This Medial Pivot Knee System and its spherical congruency in the medial compartment and less conforming lateral compartment has been found to replicate the medial pivoting behavior observed in normal knees. The knee is more compliant on the lateral side and less compliant medially. It has also been found to exhibit anterior-posterior (AP) stability in activities such as gait and deep knee bend. Theoretically, this design should result in lower tibial insert wear due to its large contact area in the medical compartment and resulting in lower contact stresses.

Multiple studies have shown clinical and radiographic outcomes of TKAs implanted with a Medial Pivot Total Knee design. The majority of Knee Society clinical scores have been excellent or good. Studies have also shown through radiographic analysis that there is no evidence of progressive radiolucencies or osteolysis in this design. It has also been shown that in patients with bilateral TKA’s, the medial pivot system was more commonly preferred over the design implanted in the contralateral knee.
References


THE JOHN N. INSALL, MD AWARD

Higher Tissue Concentrations of Vancomycin with Intraosseous Regional Prophylaxis in Revision TKA
Simon W. Young, FRACS; Mei Zhang, PhD; Grant A. Moore, BSc; Rocco P. Pitto; Henry D. Clarke, MD; Mark J. Spangehl, MD

Introduction
In primary TKA, prophylaxis with low-dose vancomycin via intraosseous regional administration (IORA) achieves tissue concentrations 6-10 times higher than systemic administration, and was shown to provide more effective prophylaxis in an animal model. However in revision TKA the presence of a tibial implant may compromise IORA injection, and tourniquet deflation during a prolonged procedure may lower tissue concentrations. This study compared tissue concentrations of vancomycin administered intravenously (IV) versus IORA in revision TKA.

Methods
Twenty patients undergoing aseptic revision TKA were randomized to two groups. The IV group received 1g of systemic IV prophylactic vancomycin. The IORA Group received 500mg vancomycin as a bolus injection into a tibial intraosseous cannula, below an inflated thigh tourniquet before skin incision. During the procedure subcutaneous fat and bone samples were taken at regular intervals. Tissue vancomycin concentrations were measured using high performance liquid chromatography (HPLC).

Results
In all IORA patients, intraosseous tibial injection was unaffected by the tibial implant. Mean procedure length was 3.5 hours in both groups. Mean initial tourniquet inflation was 1.5 hours, with a second inflation for mean 35 minutes during cementation. Overall mean tissue concentration of vancomycin in fat samples was 4.1ug/L in the IV group versus 115ug/L in the IORA group (p<0.001); tissue concentrations in femoral bone were 7.2ug/L in the IV group vs 101ug/L in the IORA group. Vancomycin concentrations in the final subcutaneous fat sample taken before closure remained 5.3 times higher in the IORA versus IV Group (p<0.001). The intra-articular concentration of vancomycin on post-operative day 1 drain samples was similar between the two groups (mean 4.6ug/L IV group vs 6.6ug/L IORA, p=0.08).

Conclusion
IORA administration of vancomycin is effective in revision TKA, resulting in tissue concentrations of vancomycin 5-20 times higher than systemic IV administration despite the lower dose. High tissue concentrations were maintained throughout the procedure, despite a period of tourniquet deflation. IORA may be more clinically important in revision TKA, where the risk of infection is higher.
Does Computer Navigation in Knee Arthroplasty Improve Functional Outcomes in Young Patients?

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Background Proponents of computer-assisted total knee arthroplasty (TKA) suggest that computer navigation will lead to improve the alignment and position of the TKA, thereby potentially improve patient function and survivorship of the implants. However, there is a little evidence in the literature whether the improved position and alignment of the TKAs by using computer-navigation improve the patient function and the longevity of TKA.

Questions/Purposes To determine whether: (1) clinical results; (2) radiographic and computer-tomographic (CT) scan results; (3) patient satisfaction; and (4) the survival rate of TKAs would be better in patients having a computer-assisted TKA than those in the patients having a TKA without computer-assisted TKA. In addition, we determined whether (5) complication rates would be less in the patients with computer-assisted TKA than those in the patients with conventional TKA.

Methods We prospectively compared the results of 282 consecutive cohorts (564 knees) with osteoarthritis. These patients had computer-assisted TKA for one knee and TKA without computer-assistance for the other. Fifty-nine men and 223 women were enrolled in the study. At the time of index arthroplasty, the mean age of patients was 59.4±6.7 years (range, 48-64) years. Patients were followed up at three months and at one year after the surgery and then two or three years thereafter. Knee Society knee score, Western Ontario and McMaster Universities Osteoarthritis (WOMAC) score, and University of California, Los Angeles (UCLA) activity score were obtained preoperatively and at each followup. The mean followup was 15.1 years (range, 14-16 years).

Results The Knee Society knee scores (93 vs 92 points), WOMAC scores (14 vs 15 points), range of knee motion (128° vs 127°), patient satisfaction (93% vs 94%) and UCLA patient activity scores (6.1 vs 6.1 points) were not significantly different between the two groups at 15.1 years followup. There were no significant differences in the radiographic parameters, including mechanical axis, femorotibial angle, position of femoral and tibial components, level of joint line, posterior condylar offset and the prevalence of radiolucent line between the two groups. Furthermore, rotational alignment of femoral and tibial components on CT scan was not significantly different between the two groups. No knee in either group had osteolysis. Two knees (0.7%) in each group had aseptic loosening of the components. Anterior femoral notching was observed in 11 knees (4%) with computer-assisted TKA group. Kaplan-Meier survivorship of the TKAs showed a 99.3% (95% CI, 93 to 100) in both groups at 16 years as the end points of revision or aseptic loosening of the components.
**Conclusions** Clinical results, radiographic and CT scan results, patient satisfaction, complication rate, and survivorship of the components were not significantly different between the TKAs with or without computer navigation. No effect of navigation has been demonstrated, except a negative one of anterior femoral notching. Comparison of bilateral TKAs may dampen differentiation regarding pain and functional scoring. This study is specific to a single navigation and total knee system.

**Level of Evidence** Level I, therapeutic study.
THE MARK COVENTRY, MD AWARD

A Randomized Clinical Trial on Patellofemoral vs. Total Knee Replacement for Patellofemoral Osteoarthritis
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Background. Controversy exists over the surgical treatment for patellofemoral osteoarthritis. We aimed to compare the outcome of patellofemoral (PFA) to total knee arthroplasty (TKA) in a double-blinded RCT. The outcome was patient-reported (SF36, OKS, KOOS) and clinical.

Questions/purposes. Do patients recover quicker after PFA than after TKA? Do patients get a better range of movement after PFA than after TKA? Do patients obtain a better disease-specific and generic quality of life after PFA than after TKA? Does PFA result in more revisions and reoperations than TKA?

Methods. The study was conducted as a multicenter trial. Patients were eligible, if they had debilitating knee symptoms and isolated patellofemoral disease. One hundred patients were randomized to PFA or TKA (double-blinded for the first year). Patients were seen for clinical follow-up and completed questionnaires. The current study reports on the full data for the first two years and 50 patients have been followed for more than five years. SF-36 bodily pain was primary outcome.

Results. The mean age at inclusion was 64.2 years (SD = 8.9), and 77% were females. Six weeks postoperatively, 93% and 46% of PFA and TKA patients, respectively, found that their knee had improved (p< 0.001). The preoperative range of movement was 132 degrees (SD=12.0), and at four months, one year and two years, the PFA group had a better range of movement than the TKA group (126 vs. 113 (p<0.001), 129 vs. 121 (p=0.002) and 130 vs. 121 (p=0.001)). The “bodily pain” and “physical functioning” of the SF-36, the “symptoms” dimension of the KOOS and the OKS showed all a significantly better result for PFA compared to TKA patients. The area under the PFA and TKA curve for the “bodily pain” was 9.4 vs. 6.6 months after two years (p=0.011). Similar figures were found for other patient-reported outcomes. During the observation period, there were three revisions (two PFA and one TKA) and no difference in reoperations.

Conclusions. PFA patients recover quicker than TKA patients, and the functional outcome is better for PFA patients. The average TKA patient loses almost three months of knee function during the first two years relative to a PFA patients. We believe that patellofemoral implants should be used rather than total knee arthroplasty for patients with patellofemoral osteoarthritis. We also believe that implant registers are unsuited for comparing implant types.

Level of Evidence. Level 1b, individual RCT
The entirety of the patient experience after contemporary total knee and total hip replacements in 2017 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 pro-actively, 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 include gabapentin. Oral and parenteral opioids are reserved for breakthrough pain.

The era of bundled payments has cast a spotlight upon the post-discharge care of patients after total joint arthroplasty (TJA). Upwards of 40-50% of the total episode-of-care for TJA may be incurred after the acute hospitalization. While the financial implications of post-discharge care are important, focusing on the needs of each individual patient should drive our decision making. Matching the needs of patients with an appropriate level of care may allow the healthcare system to balance this equation. So-called “demand matching” of implants to patient requirements has been previously reported in the literature and similar concept may be applicable to post-discharge care. The concept of demand matching requires a team approach to preoperative education, excellent pain management, and the support of the patient’s caregivers. It has being demonstrated that discharge to home without the need for home services or outpatient therapy may reduce complications and cost without compromising patient care. There may be a role for web-based modernization of the care process in order to improve patient satisfaction and engagement, particularly as the use of traditional services such as rehabilitation centers, home services, and outpatient physical therapy declines.
Anticoagulation and Bleeding: Where Are We in 2017?
Javad Parvizi, MD

Patients undergoing TJA are at risk of developing venous thromboembolism (VTE) that includes deep venous thrombosis (DVT) and pulmonary embolism (PE). Data from 1990s suggested that without prophylaxis, the rate of DVT in patients undergoing TJA is reported to be between 35-84%, although the majority of these DVTs are asymptomatic. The etiology of VTE after TJA is multifactorial. It is important to note that there is a relationship between DVT and PE, especially in the context of lower extremity surgery as they are both part of a hypercoagulable state in the patient. However there are recent studies demonstrating that DVT and PE can occur independent of each other and the traditionally believed concept that DVT may mechanically propagate to the lungs has been questioned by a few recent studies.

Because of the relatively high risk of VTE following TJA, administration of prophylaxis is recommended. However, in recent years improvements in surgical and anesthetic techniques in combination with early patient ambulation has led to a significant reduction in the background rate of VTE. This reduction has, according to an analysis of the Nationwide Inpatient Sample database, resulted in a decreased economic burden from VTE in recent years. The decline in the rate of VTE following TJA, has provided the opportunity for less potent anticoagulation agents such as aspirin as an alternative for VTE prophylaxis after orthopedic procedures.

There is a wide and expanding array of VTE prophylaxis agents that may be administered to patients undergoing TJA. It is generally accepted that the more potent agents for prophylaxis, such as low molecular weight heparin (LMWH), warfarin, or the newer anticoagulation agents, result in a higher rate of bleeding and wound related complication. Aspirin on the other hand has been shown to be an efficacious agent for prevention of VTE with a lower risk for bleeding or wound related complications. Aspirin is well tolerated, inexpensive, and easy to administer with no need for routine blood monitoring. With the endorsement of aspirin by many published guidelines and the additional emerging evidence demonstrating its efficacy, aspirin has been continuing to gain popularity among the orthopedic community as a VTE prophylaxis agent following TJA.
Bilateral one stage total knee replacement has a number of advantages. There is one operative procedure and anesthetic and overall recovery time is significantly reduced. It is a more cost effective procedure in that acute hospital stay is less and although rehabilitation time is greater in the short term overall it is less. Additionally if there is a bilateral flexion contracture present there is an inevitable loss of extension if a single knee is operated upon as this knee will assume the position of the unoperated knee. Patients greatly prefer having both knees corrected at one operative setting rather than having to have the inconvenience and pain associated with a second operative procedure at three to six months after the first one.

There are potential disadvantages to a one stage procedure. One concern has been that there is more perioperative morbidity associated with one stage bilateral total knee replacement. In a review of 501 patients undergoing bilateral one stage total knee replacement at the Hospital for Special Surgery there were no perioperative deaths, myocardial infarctions or cerebrovascular accidents. There were arrhythmias present in 5% of patients. Fat emboli were present in 3% and 2 patients (0.4%) had pulmonary emboli. The average transfusion requirement was 2.6 units and allogeneic blood was required in 42%. There were 2 deep infections, 3 hematomas and 5 patients with delayed wound healing. There was an increased incidence of major complications in patients with ASA classification 3 and with increasing age over 70 years.

New data indicates perioperative administration of hydrocortisone may mitigate lung injury as demonstrated by reduction in cytokine and desmosine levels in a randomized trial. There was also a trend toward less need for narcotic medication and better range of motion in the steroid treated group.

Patient selection is important and all patients are screened preoperatively by an internist and anesthesiologist. In over 3000 bilateral TKR at HSS infection rate and mortality were lower than in the unilateral total knee replacement patients. Much of this has is due to patient selection criteria. All patients underwent the procedure with epidural anesthesia with postoperative epidural PCA for 48 hours. All patients are discharged on warfarin and spend the operative night in the recovery room. The procedure has acceptable morbidity and great advantage in properly selected patients.

1. Pavone, V; Johnson T; Saulog PS; Sculco, TP, Boettner, F Perioperative morbidity in bilateral one stage total knee replacement, Clin Orthop Relat Res: 421:155-61, 2004
Instability currently represents one of the main causes of residual pain and symptoms following TKA and thus is a major caused of revision total knee replacement, second only to component looseness in some series (1). Instability related to ligamentous laxity can be categorized by the pattern of relative laxity of the soft tissue structures and this can lead to special attention to the overall bony alignment of the limb, component sizing or positioning issues and ligamentous abnormality which may be contributory and may require adjustment or correction.

Instability patterns associated with TKA can be categorized by the plane of the predominant excess laxity into Medial-Lateral (ML) or Anterior-Posterior (AP) instability. There can also be symmetrical (global) instability where there is laxity in all planes, or more commonly asymmetrical instability where there is excessive laxity in mainly one direction. Isolated laxity problems can be sub categorized into one of 3 patterns: ML instability (mainly in extension), AP laxity (mainly in Flexion), and much less commonly Recurvatum, which is excess laxity in the AP plane mainly in extension. (2,3) Global laxity can occur due to inadequate tibial component thickness, or globally incompetent soft tissues, and can present initially right after TKA or alternatively can develop late from slow stretch of soft tissues over time as can be seen with some pathologic states (i.e. inflammatory arthritis, Ehlers-Danlos syndrome, neurogenic conditions such as polio, etc.)

Assymetrical or Isolated ML Instability generally occurs in the sagittal plane when medial versus lateral “gaps” are unequal. This may be due to contracture of tight structures either medially or laterally or can be due to insufficiency or injury of the ligamentous structures on one side vs the normal structures on other side. Occasionally there is a combination of both contracture on one side and attenuation/stretch on the other side as seen in some patients with severe long standing genu varum or genu valgum.

AP Instability is assymetrical laxity in the frontal plane which results in unequal extension versus flexion “gaps”. This can cause either anteroposterior laxity in flexion but full extension with good stability or alternatively, there may be AP stability in flexion but a lack of full extension from the exact same pattern of imbalance when a “too thick” polyethylene insert is used to correct what would otherwise be flexion instability. In both cases the cause is an extension gap that is tighter than the flexion gap.

Isolated recurvatum occurs when the posterior capsular structures are relatively lax or deficient so that a knee that is otherwise stable in the medial lateral plane in extension, and is stable in the AP plane when in flexion, hyperextends in the fully extended position. In any TKA procedure it is critical to understand the effect of selected bone resection (or build ups) on soft tissue balancing in order to avoid or treat ligamentous laxity:

- distal femur – effects extension gap only
- posterior femur – effects flexion gap only
- proximal tibia – both flexion and extension spaces
PREVENTION of instability is preferred over treatment and this requires careful assessment during surgery of the medial/lateral balance in extension and checking of the “gaps” in both extension and flexion to be sure they are equal. This can be done using spacer blocks, laminar spreaders, tensioning devices, or the trial components (or some combination of these).

When treating instability, careful evaluation of the cause(s) of the laxity and is critically important, especially if there is associated axial malalignment which generally must be corrected or compensated for in order to have any reconstruction or revision components succeed long term. (3) Most knees revised for instability issues will require a posterior stabilized or constrained (unlinked) condylar design. Constrained condylar implants are used to compensate for residual medial–lateral imbalance still present after standard soft tissue releases medially (subperiosteal tibia) or laterally (usually via selective pie-crusting). (4,5) However, if the patient displays residual major medial-lateral or global instability that cannot be corrected, or when there is an excessive flexion gap that cannot be stabilized with adjusted component placement and sizing, a rotating hinge design may be required. Recent data has shown that rotating hinges can work reliably in restoring stability to the knee in such cases with satisfactory durability and clinical results over time.

In summary, the careful assessment of instability pattern and associated contributing factors followed by a stepwise approach to soft tissue balancing (preferred) vs increased constraint (when required) results in reliable improvements in function and symptoms during complex TKA, even in the face of major deformity or ligamentous imbalance.


Patellar instability after total knee arthroplasty (TKA) is a serious complication that impairs functional outcome and may lead to further surgical intervention or revision surgery. Its etiology can be related to the surgical technique, including mal-rotation with internal rotation of the femoral or tibial components, component positioning, extensor mechanism imbalance, and overstuffing of the patellofemoral joint with oversized components. Following TKA, the presence of anterior knee pain with mal-tracking of the patella, especially during activities requiring knee flexion, is indicative of patellar instability. Diagnosis can be made by radiological evaluation of component position and alignment. The use of CT is currently considered the gold standard to measure the degree of rotation of the femoral and tibial components. Nonsurgical management for patella subluxation or dislocation is rarely successful. Since femoral or tibial component malposition is often the etiology of patellar instability, revision of the mal-aligned or mal-rotated TKA components is usually required. Proximal realignment for patellar instability in the setting of properly positioned and sized components is associated with good results.

References


Chronic extensor mechanism insufficiency around TKA is a very challenging pathology to treat. An insufficient extensor mechanism negatively affects implant survival and patient outcomes. There are several risk factors for extensor mechanism disruption and the surgeon should be aware and avoid these problems in the perioperative period. In appropriately selected patients, reconstruction of the extensor mechanism is a valid option. Whole extensor mechanism and Achilles tendon allograft reconstruction of the deficient extensor mechanism have been proposed with good early published results. These reconstructions however are expensive and with time may stretch and lead to recurrence of an extensor lag. An alternative to allograft, is the use of marlex mesh as popularized by Browne and Hanssen. This technique uses a knitted monofilament polypropylene mesh that is secured to the patients’ native lateral tissue and covered by an appropriately dissected and distalized vastus medialis muscle. The technique can be used for both patellar and quadriceps tendon deficiencies and can be done with or without implant revision and is currently the treatment of choice at the presenters institution. The surgeon should be aware of the complexity and limitations of these three reconstructive techniques.
Instability can develop after revision TKA due to implant loosening, ligament laxity, or flexion/extension soft tissue imbalance. Instability may be associated with pain and swelling after activity, and giving way symptoms during ambulatory activity. However, extensor mechanism deficiency can also cause giving way symptoms particularly during walking down inclined surfaces, which should be differentiated from symptoms due to ligament insufficiency.

Flexion instability, which can occur after primary cruciate retaining as well as posterior stabilized TKA, can also develop after revision TKA. Instability in flexion may occur with intact collateral ligaments but imbalanced flexion and extension gaps. Flexion instability can be a consequence of revision TKA to treat patella infera if more distal augments are used on the femoral component to lower the joint line, resulting in a relatively tight extension space and loose flexion space.

Two types of constrained implants are generally available to treat instability – constrained condylar and hinge implants. The constrained condylar provides mediolateral and rotational constraint as a result of the rectangular PS post which fits into the rectangular PS box of the femoral component. The hinge includes an axle mechanism to prevent mediolateral movement. The hinge is more rigid in preventing mediolateral movement since it contains a metal axle mechanism while the constrained condylar implant relies on a polyethylene post which can deform or wear over time. Instability associated with intact but attenuated or imbalanced collateral ligaments can be treated with the constrained condylar implant while loss of one or both collateral ligaments is more effectively treated with a hinge device.
Patient satisfaction is a subjective and vague measure of outcome after total knee arthroplasty (TKR). In the past, the orthopaedic surgeon may have felt that performing a technically sound surgery that realigns the limb, restores a functional range of motion, and provides a stable joint, would result in a satisfied patient. Numerous studies have shown however that patient satisfaction with TKR typically occurs in only 80-90% of patients (1, 2). This still leaves a significant portion of patients who are unsatisfied with their TKR. There appears to be disagreement or discordance between surgeon and patient about outcome following TKR, with surgeons more frequently being satisfied with the outcome of the procedure than their patients (3). Changes in healthcare reimbursement based on patient satisfaction, and our desire to better meet the needs of our patients has, however, created a need for improved understanding about patient satisfaction after TKR.

Selecting the appropriate patient for the total knee replacement and optimizing the patient’s physical and medical condition before surgery is essential in order to minimize complications and insure a satisfied patient. Several studies have shown that patients with knee arthritis of a mild or moderate degree (Kellgren-Lawrence changes of \( \leq 3 \)) are more likely to be dissatisfied with TKR than patients with severe grade 4 OA of the knee (4,5). Addressing modifiable medical risk factors such as obesity, diabetes, smoking, depression and lack of social support before surgery have been shown to decrease risks of complications and improve outcome following TKR. This is essential since one of the strongest predictors of patient dissatisfaction after TKR are complications after surgery (1, 3, 6).

Pain relief is one of the most predictable outcomes of TKR and failure to achieve this is also one of the strongest predictors of dissatisfaction after TKR (7). Poorly controlled perioperative pain can limit the patient’s ability to mobilize and recover after surgery and can adversely impact the patient’s outcome and satisfaction after TKR. As a result, a comprehensive pain management program is recommended for all patients undergoing TKR. This should include a contemporary multimodal pain management program including regional anesthesia, periarticular blocks and minimization of narcotic analgesics.

Many patients undergoing TKR have other causes for their pain such as spinal stenosis and hip arthritis. It is important for both the patient and surgeon to have a good understanding of the potential etiologies for the patient’s pain prior to surgery, so that realistic expectations about pain relief following TKR are established. Patients with chronic pain syndrome, opiate dependence, anxiety, depression or “catastrophizing” should have these issues addressed preoperatively since they are important risk factors for dissatisfaction with pain relief from TKR and a poor surgical outcome (7, 8).

Although pain relief and development of complications are major concerns after TKR, unmet patient expectations have an even more significant effect on patient satisfaction (1-3, 7). In a prospective cohort study involving 322 TKR patients, Tilbury et al reported that 12 of 19 expectations on the Hospital for Special Surgery Knee Arthroplasty Expectation Survey were unfulfilled by more than 30% of patients at one year post-op(9). These included ability to kneel down, squat, walk for up to 1.5 km, walk up and down stairs and return to recreational and sports activities. Several others studies have demonstrated that unfulfilled expectations about functional abilities and activity after surgery are a major source of dissatisfaction with TKR (3, 11). This appears to be even more of a concern with younger patients who...
frequently expect to return to a level of activity that may not be compatible with joint replacement surgery (6, 10).

Direct to consumer marketing by physicians and orthopaedic manufacturers about the latest orthopaedic “innovations” has given many patients the unrealistic impression that knee replacement will provide them with “normal” function, a lifestyle with no activity restrictions and perhaps turn back the clock by decades. It is essential that the orthopaedic surgeon remember that the primary goal of TKR is to relieve pain, restore the TKR patient to a reasonable level of activity and educate the patient accordingly. A comprehensive preoperative patient education program is an effective mechanism to understand the patient’s expectations, provide them with realistic expectations after TKR, and minimize the discordance in expectations between patient and surgeon (12). An ongoing dialogue between surgeon, patient and family about patient specific expectations of TKR - both prior to and after surgery - is essential to understand and align the expectations of all regarding pain relief, function, appropriate activity and the surgical episode of care in general.

References:
Introduction: With the rise of patient reported outcomes as an important indicator of the success of elective procedures, “patient satisfaction” has become the benchmark for assessment of different surgeons, procedures and implant designs. This raises many different issues, not the least of which is “What is “patient satisfaction?” and “How can it be measured?”

“Satisfaction” may be defined as “fulfillment of a need or want”, “patient satisfaction as “a state of contentment with health care received from their health care provider” In measuring satisfaction with knee replacement, ambiguities arise not so much in determining whether patients are or are not contented , but what they are content with. Is it their knee symptoms, their knee function, their decision to have knee replacement surgery, the whole experience of undergoing the procedure and the post-op recovery, or the capacity of the replaced knee to live up to the patient’s preconceptions? We performed the following study to examine the hypothesis that the wording of questions measuring the satisfaction of patients after TKR has a significant effect on the responses received and thus the perceived success of the procedure.

Methods: The dilemma in assessing patient satisfaction in a valid, reliable and reproducible way has been tackled by several groups of investigators, including the developers of the New Knee Society Score. During the development of the New KSS, we administered a prototype questionnaire to 243 patients at a minimum of one year post-knee replacement. The questionnaire included a series 10 questions asking each respondent to describe their degree of satisfaction with their knee replacement surgery in terms of the degree to which it:

(i) improved their ability to lay in bed, rise from bed, get in/out of a car or bus, perform light domestic duties, perform leisure recreational activities and to ascend stairs, and
(ii) reduced knee pain when sitting or lying, walking on a flat surface, and going up and down stairs.

Patients were also asked their overall level of satisfaction with the results of their knee replacement surgery. We also explored the utility of alternative questions commonly used to assess patients’ perception of the value of elective treatments. Two such queries are: “Knowing what you know now, (i) would you recommend this procedure to your best friend or a family member? and (ii) Would you choose to undergo this procedure again?” Patients were also asked “Does your replaced knee feel normal?” The responses to these items were compared to the estimates of each patient’s degree of satisfaction based on the items within the satisfaction sub-scale of the New KSS.

Results: Analysis of the response to this part of the questionnaire showed that, when directly asked their degree of satisfaction with TKR, only 7% of patients responded that they were either dissatisfied or neutral with respect to the procedure, whereas 19% were satisfied and 74% were extremely satisfied with their overall result. However, when asked about their satisfaction with their pain relief when climbing stairs, the dissatisfaction/neutral responses increased to 16%, with only 55% of patients being very satisfied. Similarly, 17% of patients were dissatisfied or neutral about their knee function in performing leisure activities, with just over half (54%) reporting that they were “very satisfied”.

There was a highly significant correlation between response to the indirect questions and the overall satisfaction of the respondents. 47% of patients who were reported being very dissatisfied, dissatisfied, and neutral reported that they would undergo TKR again versus 95% of those who were satisfied and very satisfied (p<0.0001). A similar separation was seen in the percentage of patients who would recommend the operation to a friend or family member (53% vs 100%, p<0.0001), and the percentage of patients who indicated that their knee “never felt normal “ after TKR (41% vs 3%, p=0.0251) (Figure 1).
Discussion: Previous developers evaluating patient’s perceptions of treatment outcomes have observed that direct questions, such as “How satisfied are you with your replaced knee?” are inherently ambiguous. In practice, numerous factors influence how patients internalize their symptoms and function, no doubt weighted according to the demands and expectations of each individual. This is expected to cause subjective evaluations of the procedure to vary substantially from patient to patient, with what seem to be simple, direct enquiries acting as surrogates for confounding variables characterizing the delivery of care and not the outcome. The New Knee Society Score was developed recognizing these sources of ambiguity, and so has 5 items devoted to assessment of patient satisfaction (satisfaction with pain relief while sitting and lying in bed, and satisfaction with knee function when getting out of bed, performing light household duties, and leisure recreational activities). The responses to these items are averaged to generate the overall satisfaction score. Conversely, the Short-form version of the KSS contains only one item to assess satisfaction, namely the patient’s assessment of their knee function when performing light household duties as this item was shown to have the strongest correlation with the original 5-item satisfaction score derived from the full-length version of the New KSS.

Thus, satisfaction with the outcome of total knee replacement is expected to depend on a combination of several factors. Consequently, each patient’s objective status may be less significant than the degree to which the patient is conscious of their artificial joint, or the belief that their treatment was successful in providing the outcome that they envisioned prior to surgery.

In previous work we have demonstrated that dissatisfaction with the results of total knee replacement are strongly correlated with the presence of residual symptoms which thwart the patient’s ability to perform those activities that they consider most important.
TKR provides excellent pain relief and improved physical function in patients with advanced arthritis of the knee. Patients that will not achieve the expected improvement in physical function or pain relief; or who are at higher risk for adverse events, complications, re-admissions, or revision surgery are poorer surgical candidates.

Can we identify patients at risk for poorer outcome after TKR pre-operatively?

- 8050 primary, unilateral TKR patients enrolled in prospective registry
- Evaluated associations between function at 12 months with pre-op gender, age, BMI, emotional health (MCS), knee diagnosis, quadriceps strength, physical function (PCS) and post-op pain relief
- More than 98% reported post-op pain relief (KS score)
- At 12 months the mean PCS gain was 13.6 points, but the distribution was bimodal
- 63% of the patients with greater improvement the mean PCS gain was 21 (SD=7) and was 4.1 (SD=7) in the remaining 37%
- Increased likelihood of poor functional gain was associated with older age, BMI over 40, Lower MCS, and poor quadriceps strength.
- While 2/3rds of patients reported functional gain well above the national average at 12 months post-TKR, 37% reported limited functional gain.

Conditions associated with higher complication rate:

1. High Charlson Score; Multiple Medical or Orthopedic Co-Morbidities
   - Ayers et al. Outcomes After TKR Vary on the Basis of Preop Coexisting Disease in the Lumbar Spine and Other Nonoperatively Treated Joints; The Need for a MSK Comorbidity Index. J Bone Joint Surgery (Am), 2013 95(20)1833-1837

2. Poor nutritional status

3. Diabetes

4. Obesity or Morbid Obesity
• Thornqvist et al. BMI and risk of peri-op cardiovascular adverse events and mortality in 34,744 Danish patients undergoing hip or knee replacement. Act Orthopaedica 2014:85(5):456-462

5. Cardiac Disease
• Kumar et al. Risk of post-TK Acute MI in Patients with a history of MI or Coronary Stent, Clin Orthop Relat Res (2016) 474: 479-486
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6. Renal Failure/Dialysis
• McCleery et al. Rates of infection and revision in patients with renal disease undergoing TKR in Scotland, J Bone Joint Surg (Br) 201; 92B:1535-1539.
• Warth et al. TJR in Patients with Chronic Renal Disease: Is It Worth the Risk? J of Arthop 30 Sup1 (2015) 51-54
• Miric et al. Can TKR be safely performed in patients with chronic renal disease? Acta Orth. 2014; 85 (1) 71-78
• Cavanaugh et al. Complications and Mortality in Chronic Renal Failure Patients Undergoing TJR. J of Arthrop. 31 (2016) 465-472

7. Low SES

8. Previous Surgery
• Robertsson et al. The Risk of Revision after TKA is Affected by Previous HTO or UKA. CORR (2015) 473: 90-93.

9. Pulmonary Disease/Smoking

10. Chronic Narcotic Use
• Franklin et al. Reduction in Narcotic Use After Primary TKA and Association with Patient Pain Relief and satisfaction J Arthroplasty 2010,25(6Suppl)12-16
11. Worker's Compensation

- Mont et al. TKA in Patients with Worker's Compensation. J Bone and Joint Surg (Am) 1998; 80(9): 1285-1291

Because patients have different risk profiles there is a need for improved risk adjustment methodology when comparing TKR outcomes

Overall the majority of patients undergoing total knee arthroplasty are satisfied with their results. However, data from various joint replacement registries all demonstrate dissatisfaction rates of 15-20%. Patient satisfaction appears to be related to a variety of factors including: pre and post-operative pain and function, unmet patient expectations, duration of disease and status of health related quality of life. Psychological factors can also influence satisfaction. One way to improve satisfaction rates is to identify patients with risk factors for dissatisfaction and to discuss these issues with the patient prior to surgery.

References
While TKA generally has favorable clinical outcomes in patients with advanced OA, there remains a risk of unfavorable outcomes. This includes operative and post-operative complications potentially leading to readmissions or revision surgery. Often these suboptimal outcomes are tied to comorbidities or complications associated with their TKA. Modifiable risk factors for poor clinical outcomes following TKA include: 1. morbid obesity, 2. poorly controlled diabetes and nutrition, 3. *Staphylococcus aureus* (S. aureus) colonization, or hepatitis C and/or HIV infection, 4. cardiovascular disease, 5. venous thromboembolic disease (VTE), 6. tobacco use, 7. neurocognitive, psychological and behavioral problems (including drug or alcohol dependency) and 8. physical deconditioning, frailty and fall risk. Together, these eight modifiable risk factors significantly account for avoidable complications and poor clinical outcomes following TKA. Identifying and modifying these risk factors prior to surgery presents an opportunity to decrease avoidable complications, improve clinical outcomes, and decrease costs associated with unnecessary health services utilization following these procedures.

Although some of these modifiable risk factors may be longstanding and recalcitrant to change, patients may express a renewed interest in addressing them if they stand in the way of obtaining THA, a procedure they hope will result in dramatic changes in pain, physical function and quality of life. The prospect of undergoing TKA may therefore provide an opportunity (i.e. “teachable moment”) to identify and manage such modifiable risk factors through shared decision making. Primary care physicians, internists and specialty physician involved in the pre-admission clearance process can all participate in decreasing these risk factors preoperatively. By implementing these risk factor optimization programs, we were able to lower our complications after TKA operation and our readmission rates. The concept of a Perioperative Orthopaedic Surgical Home (POSH) to optimize patients preoperatively is the NYULMC plan to deal with these difficult patients.

**Comorbidity Prevalence in TJA patients**

<table>
<thead>
<tr>
<th>Comorbidity</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Musculoskeletal comorbidities</td>
<td>73.8%</td>
</tr>
<tr>
<td>Hypertension</td>
<td>60.1%</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>55.3%</td>
</tr>
<tr>
<td>Tobacco use</td>
<td>22.0%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>19.2%</td>
</tr>
<tr>
<td>Depressive disorders</td>
<td>14.5%</td>
</tr>
<tr>
<td>Morbid Obesity</td>
<td>13.8%</td>
</tr>
<tr>
<td>Ischemic Heart Disease</td>
<td>13.5%</td>
</tr>
<tr>
<td>Dysrhythmias</td>
<td>10.8%</td>
</tr>
<tr>
<td>Valve disease</td>
<td>7.8%</td>
</tr>
<tr>
<td>Cerebrovascular Disease</td>
<td>4.4%</td>
</tr>
<tr>
<td>CHF</td>
<td>2.8%</td>
</tr>
</tbody>
</table>
Additionally, the patients with comorbidities that did not have a readmission may have an increased risk of a complicated initial hospitalization: 506/2772 TJA patients had a length of stay of 7 days or longer with average costs of $32,609- $84,678 per admission, substantially higher than our average of $24,000 during that time period. The vast majority (95%) of increased length of stay or readmitted patients had at least 1 modifiable risk factor in their history. Additionally, about 50% had 2 or more modifiable risk factors. We have validated a POSH RRAT Readmission Scoring Tool which quantifies modifiable risk factors and predicts readmission risk, thus identifying patients who would benefit from surgery delay and risk factor optimization.
### POSH Risk Factor Scoring Tool, RRAT

#### Risk Ratio at each POSH Readmission Scoring level (for the random set)

<table>
<thead>
<tr>
<th>POSH Score</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Readmitted (A)</td>
<td>21</td>
<td>36</td>
<td>37</td>
<td>45</td>
<td>49</td>
<td>43</td>
<td>24</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>None (B)</td>
<td>89</td>
<td>95</td>
<td>39</td>
<td>31</td>
<td>12</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ratio = A/B</td>
<td>0.24</td>
<td>0.38</td>
<td>0.95</td>
<td>1.45</td>
<td>4.08</td>
<td>14.33</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>OR (Linear)</td>
<td>0.19</td>
<td>0.41</td>
<td>0.89</td>
<td>1.94</td>
<td>4.21</td>
<td>9.14</td>
<td>19.86</td>
<td>43.12</td>
<td>93.64</td>
</tr>
<tr>
<td>OR (Non-Linear)</td>
<td>0.24</td>
<td>0.38</td>
<td>0.95</td>
<td>1.45</td>
<td>4.08</td>
<td>14.33</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>OR (Linear, Age)</td>
<td>0.18</td>
<td>0.40</td>
<td>0.90</td>
<td>1.91</td>
<td>4.56</td>
<td>10.23</td>
<td>20.20</td>
<td>44.68</td>
<td>104.24</td>
</tr>
<tr>
<td>OR (NL, Age)</td>
<td>0.23</td>
<td>0.37</td>
<td>0.95</td>
<td>1.48</td>
<td>4.26</td>
<td>15.21</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Patients with a POSH Score of 3 had a 1.94 times higher risk of readmission, and with a score of 4 a 4.21 times higher risk of readmission. This represents an overwhelming opportunity for cost savings, improvement in care and improvement in quality of life for our TKA patients.

Optimization interventions based on modifiable risk factors

- MRSA Screening and Decolonization, weight based antibiotic dosing, and use of Vancomycin and Gentamycin in high risk patients
- Aggressive HIV and HCV treatment optimization
- Smoking cessation (hard stop)
- Cardiovascular Optimization and Stroke Prevention (using PT, High dose Statins, and ACE inhibitors perioperatively)
- Aggressive weight control (hard stop at a BMI of 40)
- Catastrophizing avoidance
- Drug and alcohol interventions
- Fall education prevention, Frailty screening
- Physical deconditioning physical improvement interventions
- Diabetes control and nutritional interventions
- Screening for high risk VTED patients with thrombophyllia testing and risk stratification in order to avoid aggressive anticoagulation

Modifiable risk factors do play a major role in outcomes post TKA. By addressing these issues and enrolling patients in a risk modification program prior to surgical intervention, we may be able to lower rates of complications associated with these procedures. In light of these findings, we are implementing a Peri-operative Orthopaedic Surgical Home (POSH) model that allows for risk stratification of TKA candidates and clinical treatment to mitigate modifiable risk factors in high-risk patients. At NYULMC HJD, we have incorporated a trans-departmental (anesthesia, internal medicine, pulmonary, cardiology, endocrine, nutrition, bariatics, physical therapy and psychiatry) approach to decrease perioperative morbidity and mortality and decrease readmissions. In today’s bundled payment and quality driven environment, it is no longer economically feasible to simply accept increased risk in poorly managed patients. We have chosen to take an active role in managing modifiable risk factors and will delay surgery until these risk factors are controlled. We are funding a risk stratification coordinator to facilitate management and optimization of modifiable risk factors. At NYULMC HJD we are in year 3 of the BPCI program. There were 721 Medicare primary TJA patients in year 1 (January 1, 2013 to December 31, 2013) and 785 in year 3 (June 1, 2014 to May 31, 2015) available for analysis. Average hospital length of stay was decreased from 3.58 days to 2.96 days. Discharges to inpatient facilities decreased from 44% to 28%. Number of readmissions at 30 days decreased from 7% to 5%; at 60 days decreased from 11% to 6.1%; and at 90 days decreased from 13% to 7.7%. Although improved care coordination can assist in increasing efficiency of care and controlling costs, it does not prevent all complications and readmissions. Patient selection and risk optimization is the key to decreasing readmissions and complications associated with patient related factors.
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Infection Prevention: What Should We Do?

Bryan D. Springer, MD

Surgical site infection is defined by the CDC as at or near the operative site within thirty days of the surgical procedure or within one year, if an implant is in place. There are three major sources of infection that include the patient, surgical team and the hospital environment. The most common pathogens are the normal skin flora that are present on the patient as well as the health care worker and include staph aureus and staph epidermis. There are approximately 27 million surgical cases in the United States each year and forty percent of all surgical site infections are hospital acquired infections. Colonization of a patient with bacteria preceds an infection in thirty to sixty percent of cases and oftentimes these bacteria are spread by the hands of health care workers that act as reservoirs for the bacteria. Surgical site infections are associated with prolonged hospital stays, double the rate of readmission in three times the overall health care costs compared to patients who do not develop infections.

Deep periprosthetic infections around a total joint arthroplasty remain a formidable challenge to the patient and the surgeon. The literature ranges anywhere from 0.5% to 2% after primary total hip and total knee replacement. A study by Bozic, that looked at the epidemiology of revision total knee arthroplasty showed that up to 25% of all revision knees between October 2005 and December 2006 were for deep periprosthetic infection. Kurtz has also shown that the number of revisions done for infection is on the rise and by the year 2030, over 60% of all revision total joints may be for a diagnosis of infection.

With these concerning trends for infection, it is imperative that we attempt to minimize risk factors which are known to lead to deep periprosthetic infection. This generally falls into two categories, optimizing the host and optimizing the surgical and perioperative environment. The majority of patients are in suboptimal health leading up to their surgery. Eliminating or diminishing modifiable risk factors should, however, decrease their overall risk for the development of a deep periprosthetic infection. Direct scientific evidence to make evidence based recommendations, however, does not currently exist for many of the risk factors that we deal with. There are multiple modifiable risk factors that affect patients prior to surgery.

Diabetes

Diabetes has reached epidemic proportions in the United States. It is associated with multiple comorbid health conditions and patients have demonstrated a higher complication rate and longer hospital stays following surgery. In addition, Marchant, has shown a 2.8 times increased risk of infection after total joint arthroplasty in patients with uncontrolled diabetes.

Surgical stress increases the production of counter regulatory hormones that antagonize insulin and predispose patients to hyperglycemia. Hemoglobin A1C is a marker of long term glucose control and may take three months to change. Ideally, patients with optimal blood glucose control should have a hemoglobin A1C less than 7 prior to surgery. It appears that Perioperative hyperglycemia, however, is associated with a greater risk of development of post operative infection. Post operatively, blood glucose should be maintained between 110 and 180 grams per deciliter. These patients may often require frequent blood sugar checks post operatively and it has been shown that a standard diabetic algorithm following surgery can minimize the risk of hyperglycemia.
Obesity

Obesity, likewise, has reached epidemic proportions in the United States. These patients are at high risk for the development of osteoarthritis and are increasingly requiring the need for total joint arthroplasty. Most outcome data in total joint arthroplasty, in the obese population, is comparable to the non-obese population with regards to functional improvement and longevity. However, the obese patient is susceptible for increased risk of infection secondary to longer surgical times, greater surgical dissections, poorly vascularized subcutaneous tissue, a high calorie, but poor nutritional diet, inadequate prophylactic antibiotics that are not adjusted for weight, and a pathologic relationship with Type II diabetes. Several articles in the literature have shown increased risk of deep infection on obese patients following total joint arthroplasty. Namba et al, in 2005, showed that obese patients were at a 6.7 times higher risk for the development of infection following total knee arthroplasty compared to a non-obese population. Malinzak showed that patients with a BMI of greater than 40 had a 3.3 times increased odds of developing an infection. When the BMI increased to 50 the odds increased to 21 times the risk of infection compared to the non-obese patient. In addition, Waniarsky, showed a 22% wound complication rate in the morbidly obese patient compared to 2% in a control group. It is therefore critical that we optimize a patient’s weight through education, counseling and occasionally surgical intervention to try and diminish their risk for the development of infection prior to surgical intervention.

Malnutrition

Several patient groups are at risk for malnutrition. These include the elderly population, those with gastrointestinal problems, alcohol abuse, and cancer. Green in 1991 showed that malnourished patients were at 5 to 7 time’s greater risk in the development of infection following total joint replacement. Simple blood tests can help screen patients at risk for malnutrition prior to surgery. These include a total lymphocyte count of less than 1,500, a serum albumin of less than 3.5 grams per deciliter or a transpharen level of less than 200 milligrams per deciliter. Patients with pre-operative malnutrition should be counseled and strategies implemented to improve nutritional intake prior to surgery.

Smoking

Nicotine causes micro vascular constriction and increases carboxyhemoglobin, which decreases the delivery of oxygen to tissues. This places patients at increased risk for post operative wound complications following surgery. It has been shown that a smoking cessation program, even within four to six weeks of surgery can decrease complications associated with the use of nicotine.

HIV/AIDS

The increase in longevity of patients with HIV and AIDS will introduce a new subset of patients that will require total joint arthroplasty. The literature has only a small series of patients with HIV/AIDS who have undergone total joint arthroplasty and the results have been mixed. There are specific risk factors, however, that place these patients at increased risk for infection. These include a CD four count of less than 200 and a viral load of greater than 10,000. It is important that the patient and surgeon work in conjunction with an infectious disease doctor to optimize these patients prior to surgery.

Urinary Tract Infection

The association between a pre-operative urinary tract infection and the development of a post operative infection is unclear; however, all patients in their pre-operative work up, should be asked about symptoms of a urinary tract infection prior to surgery. In general, the recommendations are that it is okay to proceed
with surgery if the patient has bacteria (greater than 10,000 cells per milliliter) without symptoms or symptoms are present and they have less than 10,000 cells per milliliter. These patients can generally be treated with a standard oral antibiotic. It is recommended that surgery be postponed in any patient that shows signs of obstruction of the urinary pathway or has a symptomatic UTI and greater than 10,000 cells per milliliter.

Poor Oral Health

It is well supported in the literature, the relationship between bacteremia and dental procedures after total joint arthroplasty and yet, there is no scientific literature on pre-operative screening. In general, one should use a common sense approach. Patients should have a dental exam and clearance if they have evidence of decayed teeth, abscess, gingivitis, or periodontitis and should have routine cleanings done prior to surgical intervention.

Pre-Operative Anemia

Post operative allergenic blood transfusions are a risk factor for the development of surgical site infection. Blood transfusion has been shown to be associated with a transfusion related immune modulation response. Every unit of blood transfused increases the risk of infection 9%. It is important therefore to establish an algorithm for blood management. Several studies have demonstrated the efficacy of the use of erythropoietin prior to surgical intervention to maximize patient’s hemoglobin level prior to surgery.

Pre-Operative Staph Screening

Molecular DNA studies have shown that the majority of infecting strains of staph are part of the patient’s resident nasal flora. These rates can be as high as 85% in an at risk patient population. The goal of screening, therefore, would be to decrease the incidence of post operative staph aureus surgical site infections by eliminating staph aureus as a nasal carrier from the patients prior to surgery.

A study by Kim in 2010 looked at the implementation of a pre-screening program for the detection and eradication of MRSA in patients undergoing elective orthopaedic surgery. Patients were identified using a rapid PCR of nasal swabs and were treated with intranasal Mupirocin and Chlorhexidine showers prior to surgery. They showed a colonization rate of 22.6% in the staph aureus group and 4.5% in the MRSA group. With this pre-screening and decolonization program, they were able to reduce their surgical site infection rate by 59%. Rao, in 2008, identified 26% of all patients undergoing orthopaedic surgery as carriers of staph aureus prior to surgery. They were also treated with a five day course of Mupirocin and Chlorhexidine baths and they reduced their surgical site infections from 2.6% to 1.5%. This resulted in an institutional savings of $231,000.00 dollars as a result of decreased surgical site infections.

Antibiotic Prophylaxis

Pre-operative prophylactic antibiotics are effective in reducing the rate of surgical site infections in orthopaedic patients. Routine prophylactic antibiotics should include a first generation cephalosporin, i.e. Ancef for patients with a known allergy to Beta lactam, Clindamycin or Vancomycin and should be administered in place of cephalosporins. Prophylactic antibiotics should be administered ideally as near to the time of the incision as possible, but within sixty minutes prior to the incision for a first generation cephalosporin or Clindamycin and within two hours of incision for Vancomycin. The routine use of Vancomycin for antibiotic prophylaxis remains controversial. It is generally recommended that Vancomycin
be the antibiotic of choice for those patients who have been shown to be colonized with Methicillin resistant staph aureus or had had a previous infection with MRSA.

Surgical Site Preparation

The current evidence based recommendations and best practice guidelines recommend the use of Chlorhexidine Gluconate based solutions for surgical site preparations prior to surgery. This has been found to be superior to both alcohol, as well as, ion based solutions at reducing or eliminating bacteria from the surgical site prior to surgery.

Operating Room Environment

There are several operating room environment factors that may or may not diminish the risk of Perioperative infection following total joint arthroplasty. These can include the use of body exhaust suits, laminar flow in the operating room, ultraviolet light, the type of gloves, and antibiotic coated suture. One factor that does appear to affect the rate of infection in the operating room is the operating room traffic. It is clear that an increasing number of personnel in the OR is directly related to increased risk of infection. It is therefore imperative that the surgeon and his operative team maintain a strict OR environment and limit the flow of operating room traffic during the procedure.

Conclusion

In conclusion, doing everything possible to minimize modifiable risk factors for the development of deep Periprosthetic infection is imperative. It is clear that an ounce of prevention is worth a pound of cure. Unfortunately, there is little in the literature to guide us on how to manage many of these issues. It is important that we use common sense and a practical approach and be vigilant in minimizing modifiable risk factors.

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Introduction: Unicompartmental knee arthroplasty (UKA) has shown to be a reliable treatment option for isolated medial osteoarthritis. Recently, a systematic review on national registries showed 91.7% survivorship at 5-year follow-up of 88,648 UKAs. Successful clinical outcomes following UKA depend on lower limb alignment, soft tissue balance and component positioning, which can be difficult to control using manual instrumentation. Although robotic-assisted surgery is more reliably controls these surgical factors, studies assessing outcomes of robotic-assisted UKA are lacking. Therefore, a retrospective single center study was performed to assess the five-year-survivorship rates of robotic-assisted medial UKA performed by two high volume UKA surgeons.

Methods: A total of 245 consecutive patients who underwent robotic-assisted medial UKA surgery from two surgeons at one institution between 2008 and 2011. All patients received a fixed-bearing metal-backed implant as tibial component. Each patient was contacted by mail, telephone or in office evaluation at a minimum five-year follow-up to determine survivorship. Of 245 patients, 178 patients were available for follow-up and included in our study. Sixty five patients were lost to follow-up.

Results: Data was collected for 178 patients at a minimum 5 year follow-up (Mean follow-up 6.5 years). At five-year follow-up, 9 patients underwent additional surgery on the operative side and 6 knees were reported revised, resulting in a survivorship of 97%.

Conclusion: In this single center study, robotic-assisted medial UKA was found to have high survivorship rates at mid-term follow-up. Larger prospective comparative studies with longer follow-up and functional outcomes are necessary in order to compare survivorship of robotic-assisted UKA to conventional UKA and total knee arthroplasty.

References
The infected joint arthroplasty continues to be a very challenging problem. Its management remains expensive, and places an increasing burden on health care systems. It also leads to a long and difficult course for the patient, and frequently a sub optimal functional outcome. The choice of a particular treatment program will be influenced by a number of factors. These include the acuteness or chronicity of the infection; the infecting organism(s), its antibiotic sensitivity profile and its ability to manufacture glycocalyx; the health of the patient; the fixation of the prosthesis; the available bone stock; and the particular philosophy and training of the surgeon.

For most patients, antibiotics alone are not an acceptable method of treatment, and surgery is necessary. The standard of care for established infection is two stage revision with antibiotic loaded cement during the interval period and parental antibiotics for six weeks.

Although there have been multiple developments to enhance our ability to effect two-stage techniques whilst limiting inpatient stay, cost and patient morbidity - these include functional spacers, the use of local as well as systemic antibiotics, and home intravenous therapy programmes - there is nevertheless still a considerable morbidity and mortality to the two-stage process, and a massive cost to the patient who has to have two operations with an unpredictable interval period in between and to the local tissues which have already been damaged and are violated on two occasions.

The push for one-stage surgery has generally been from centres who are passionate about that technique and has involved a combination of knowing the organism in question prior to surgery, a very radical debridement, the use of hinge / tumour-type implants and prolonged antibiotic therapy post-surgery.

The last decade has seen an evolution whereby we have recognised that treatment may be tailored to the patient. There is a big difference between a relatively healthy host and someone with multiple comorbidities, and a big difference between infection with a relatively benign organism and polymicrobial infection with multi-resistant bacteria or fungi.

There has, therefore, been increased interest in the use of single-stage revision in order to decrease morbidity, potentially decrease mortality and to decrease cost to the healthcare system. Single stage revision may have economic and functional advantages. We have devised a protocol that dictates the type of revision to be undertaken based on host, organism and local factors.

Whilst we believe that there is a role for both single and two-stage techniques in our armamentarium, we have gradually evolved to increasing use of single-stage surgery. Our protocol has included single stage revision using antibiotic loaded cement / local antibiotic delivery in both THA and TKA. This was only undertaken when sensitive organisms were identified preoperatively by aspiration and appropriate antibiotics were available to use locally. Patients with immune-compromise, multiple infecting organisms or recurrent infection were excluded. Patients with extensive soft tissues defect that required flaps were also excluded.

The analysis of single versus two stage revision for the infected arthroplasty will be enhanced by having a uniform definition of infection, agreed outcome measures and by the funding of prospective randomized studies both in the UK and in the USA to study this subject.
References:


Optimizing Patient Health Status and Improving Outcome for TJA: Using Population Health Management to Deliver Value-Based Care

Joseph A. Bosco, III, MD

Population Health: The health outcomes of a group of individuals, including the distribution of such outcomes within the group. (Kindig and Stoddart 2003)

Population Health Management: The aggregation of patient data across multiple health information technology resources, the analysis of that data into a single, actionable patient record, and the actions through which care providers can improve both clinical and financial outcomes. (https://www.wellcentive.com/what-is-population-health-management/)

The following road map has been suggested for helping healthcare organizations navigate the path toward implementing effective population health management.

- Establish precise patient registries
- Determine patient-provider attribution
- Define precise numerators in the patient registries
- Monitor and measure clinical and cost metrics
- Adhere to basic clinical practice guidelines
- Engage in risk-management outreach
- Acquire external data
- Communicate with patients
- Educate patients and engage with them
- Establish and adhere to complex clinical practice guidelines
- Coordinate effectively between care team and patient
- Track specific outcomes

(Sanders, Dale A Landmark, 12-Point Review of Population Health Management Companies. Retrieved 2014-03-17)

How is Population Health and Population Management applied to enhance value in total joint arthroplasty; Identifying patients at risk for complications prior to surgery enables providers to address and mitigate these risk factors, thus decreasing the risk of complications. Potentially modifiable risk factors include tobacco use, obesity, poorly controlled diabetes and nasal colonization with staphylococcus aureus species. (5). It is ethically acceptable for providers to insist that these risk factors are addressed prior to performing an elective procedure, even if it results in a delay of a procedure. (3) Additionally, identifying these risk factors allows surgeons to provide a more accurate estimation of the magnitude of risk to potential patients, thus improving the patient's ability to make an informed decision as to whether to proceed with the surgery. This is the hallmark of shared decision making. (1) For example Maoz and colleagues determined that patients who smoke, are obese and have nasal staph aureus nasal colonization are at a tenfold higher risk of developing a surgical site infection following hip replacement. (4) This data may dissuade a patient from undergoing a joint replacement, or may motivate them to modify these risk factors prior to surgery.

Risk factor identification also allows the more effective use of finite resources. The Readmission risk assessment tool (RRAT) is a questioner which identifies patients at risk for readmission following joint
replacements. Identifying patient at high and low risk for readmission allows providers to shift resources from low risk to high risk patients, thus making more efficient use of available resources. (6) Risk factor identification allows for more accurate risk stratification. For example the CJR stratifies risks by diagnosis and also by the presence of major co-morbidities. Identifying major co-morbidities places these patients into a different DRG (469 vs. 470) and allows for higher reimbursement. As a result of our understanding of the different costs and outcomes associated with hip replacement for fractures vs., hip replacement for arthritis, the hip fracture patients are no longer compared to the non-fracture arthroplasty patients when the bundled costs are calculated.

Adopting and utilizing evidence based clinical pathways (EBCPs) is essential to managing patients attributed to a bundled payment episode of care. Adhering to EBCPs decreases variation in care and outcomes both on an individual provider and institutional based level. To maximize utilization of EBCPs each stakeholder should be allowed to the development and application of the pathways. Thus, each stakeholder assumes ownership of these pathways. This becomes important as most bundled care arrangements involve a large number of providers whose practices vary based on their different experience and knowledge levels. Using accepted EBCPs decreases the care and outcome variation inherent in large groups of providers. Equally as important, the collective expertise and experience amassed by high volume providers, both at an individual provider and institutional level, is incorporated into EBCPs. Once developed, these EBCPs can be adopted by low volume providers including both physicians and institutions, thus transferring the experience, expertise and improved outcomes achieved by high volume providers to low volume providers. (2,8,10)

Examples of EBCPs which result in improved outcomes at a reduced cost include institutional wide venous thromboembolism (VTE) prevention and blood management clinical pathways. Institutional wide VTE prophylaxis pathways ensures that each patient receives the most appropriate level of VTE prophylaxis in order to best balance the risk and rewards of VTE prevention in total joint arthroplasty. These pathways insure that patients of low volume providers, who may not have the experience in VTE prophylaxis receive the same quality prophylaxis as the patients of more experienced providers. This decreases the variation in care and leads to improved outcomes and more cost effective care. (13)

A comprehensive evidenced based blood management pathway in which decision making and transfusion ordering is controlled by an electronic medical record creates value by decreasing transfusion rates. These pathways incorporate the latest evidence based transfusion triggers in addition to incorporating the use of tranexamic acid to decrease blood loss. Value is created when costly blood transfusions and the increased complication rates associated with these transfusions are avoided. (10,14) Post-operative pain management EBCPs decrease physician specific variation and result in reduced opioid consumption, decreased length of stay and enhanced functional recovery. (11,12)

Accurate, actionable and contemporary data is essential for the cost effective management of a bundled episode of care. The federal government’s voluntary BPCI and its mandatory CJR and SHFFT bundled programs are reconciled retrospectively. This means that all costs are paid by the federal government in the traditional fashion. Then the total episode associated costs are compared against a target price. If the total paid costs fall below the target price than the providers receive a portion of the difference in a bonus payment (provided they have met certain quality metrics). If the total episode costs are in excess of the target price, then the providers must pay the government a portion of the difference. The issue is that the government reconciles these costs months after the episode of care is over. (30) Thus any issues that increase the cost of care, such as high readmission rates and high utilization of post-acute inpatient rehabilitation need to be addressed as they occur in order to avoid increased cost and decreased quality. Those providers who rely on the government’s reconciliation to track readmissions and post-acute costs must wait months to get this data. This precludes these providers from addressing these issues in real time. Those providers who have invested and developed a robust data collection and dissemination
infrastructure, are at a competitive advantage as they learn about problems soon enough to correct them. (31)

This data must be readily accessible to all providers involved in the bundle. It also must be transparent and provider specific. If used correctly, transparent, provider specific data identifies outliers and fosters changes in behavior. Additionally, accurate, transparent data identifies outliers and fosters changes in behavior. For example, providers with high readmission rates are readily identified and resources can be applied to understanding and correcting the reasons for these rates. Institution wide and provider specific SSI rates are time sensitive. The soon issues with SSIs are identified, the quicker they can be corrected. Those providers with the fastest access to this data have a competitive advantage over their peers. This is important as both the CJR and SHFFT programs will eventually compare costs between institutions located in geographic regions in order to determine which institutions are financially rewarded and which are penalized.

Using data to identify variations in outcomes and costs is the hallmark of quality programs. Variations in outcomes present an opportunity for quality improvement. For example, the costs of hip and knee prosthesis can vary widely between providers. Rarely if ever do the providers with highest implant cost have the improved outcomes to justify these costs. Programs which identify high implant cost surgeons and which use reference pricing to decrease total cost and cost variation have been successfully used for both total joint prostheses and spine implants (15,16). Additionally, tracking implant waste allows identification of waste patterns, and increases awareness of the value lost when implants are wasted. (17). Data which tracks VTE rates, SSI rates, readmission rates, post discharge costs is an essential component to managing bundles. As stated above, those providers who have access to the most accurate, timely data, and who use it to drive decision making enjoy a competitive advantage over their peers who do not have access to high quality, actionable data. (20,22)


Partnering with the Patient to Improve Outcomes in TJA: The Role of Shared-Decision Making in Advising Patients of Risk and Comorbidity Burdens

Kevin J. Bozic, MD, MBA

In shared decision making (SDM), both physicians and patients make necessary contributions to the dialogue about a patient’s condition and best way to achieve the optimal outcome for that patient. The physician provides expert clinical knowledge of conditions, treatment options and associated risks and benefits, and limitations of evidence. The patient contributes their goals, preferences, and values (Wennberg 2009).

There are tools and strategies that can help clinicians and patients engage in shared decision making. Decision aids, which can be various formats including DVDs, booklets, and web-based tools, present patients with information on their condition, treatment options and associated risks and benefits, and help patients assess their goals and preferences. Communication aids can take the form of prompt sheets or health coaches. One example is a health coach that helps patients develop question lists for their health care provider to ensure they get information that is important for their decision making process. Questionnaires can be used to assess patients’ knowledge of their condition or treatment options, their values and preferences, and their decision status.

The use of decision aids has been shown to improve knowledge and lead to more accurate perception of risks (Stacey 2014). Decision aids have also been found to lower decisional conflict, reduce proportions of people who were passive in decision making, and reduce the proportion who were undecided (Stacey 2014).

In a randomized trial of SDM in patients with osteoarthritis of the hip and knee, patients in the intervention group received decision aid in the form of a DVD with an accompanying booklet that provided information on treatment choices for hip and knee osteoarthritis. Prior to their visit, patients had a question listing consultation with a pre-medical intern to develop a focused written list of questions for their surgeon. After their visit, patients received an audio recording of their office visit and a copy of their surgeon’s dictated note (Bozic JBJS 2013). Patients in the intervention group were more likely to reach an informed decision during the first visit, and had higher confidence in knowing what questions to ask their doctor. Surgeons reported higher satisfaction with the intervention group visits. There were no significant differences in the duration of the office visits or the proportion of patients choosing surgery for the treatment of their hip or knee osteoarthritis. (Bozic JBJS 2013)

Patient-reported outcomes (PROs)—assessments of symptoms and function directly from the patient—can inform the shared decision making process. PROs may be used to allow clinicians to better predict post-operative patient outcomes. In one study, pre-operative PROs (Knee Injury and Osteoarthritis Outcome Score [KOOS] score) predicted whether patients achieved minimally clinically important difference (MCID) in post-operative KOOS score (Berliner 2016). A threshold effect was detected; above a certain level of pre-operative function, the patient’s chance of achieving a MCID in function post-operatively fell. Mental health scores also played a role. With lower mental component scores, patients had lower thresholds for achieving MCID—i.e., these patients have lower probability of achieving a MCID for a given level of preoperative function (Berliner 2016). Collecting and using PROs in clinical decision making could also improve patient engagement (involving patients in their own care through collaboration, behavior change, and new technologies), if patients’ data are shared with them and used to engage patients in shared decision making.
Using PROs in the decision making process can help ensure appropriate treatment is offered, based on patients’ function and symptoms. A patient’s physical and mental health may show that they have a substantial impairment in physical function, but poor coping skills, and therefore may benefit from cognitive and/or behavioral therapy before considering surgery. Another patient may have moderately impaired physical function, good coping skills, and decide to proceed with surgery. At some point after surgery, their scores could be used to evaluate the success of the procedure in terms of reducing pain, improving physical and mental health, and quality of life.

Shared decision making using patient-reported outcomes should be incorporated into routine clinical care. Tools such as decision aids, personalized for each patient, could allow more precise estimates of the potential risks and benefits of treatment options and help ensure appropriate treatment. Incorporating SDM tools and use of PROs into practice will require training and careful attention to implementation, but the benefits to patients and providers could be substantial in terms of enhancing knowledge and decision quality and confidence, improving the efficiency of the consultation, and identifying appropriate candidates for surgery.

References


Through listening to clinicians and engaging as partners, the Centers for Medicare and Medicaid Services (CMS) has been able to develop innovative payment reforms. Collectively we have made great progress on transforming our delivery system into one that provides better quality of care for patients and pays for care in a smarter way.

This presentation will provide a high level overview of current policies such as the Medicare and CHIP Reauthorization Act (MACRA) Quality Payment Program (QPP). The QPP is centered on clinician choice and accountability, allowing clinicians to choose the best way to deliver quality care and to participate in the program based on their practice size, specialty, location or patient population, while rewarding them based on the quality of care they provide. It has 2 tracks: 1. The Merit-based Incentive Payment System (MIPS) and 2. Advanced Alternative Payment Models (APMs). We will discuss it in the broad context and more specifically as it relates to hip and knee surgeons. Finally, we will open for a discussion about some challenges to participating in these emerging opportunities.
The Role of Registries, PROs, and Quality Measures in Improving Value and Outcomes and Determining Physician’s Payment: This is Our Future!

David C. Ayers, MD

- PROs support the IOM vision for 21st Century to use information technology to support patient-centered, evidence based decisions
- As healthcare moves to a value based reimbursement system PROs are used to define outcomes and quality and therefore are the numerator of the value equation
- PROs have moved into clinical Practice In TJR
  - Ayers, Bozic. *The Importance of Outcome Measurement in Orthopedics* 
    CORR 471: 3409-3411, 2013
  - Orthopedic surgeon reimbursement in US increased by PRO reporting in PQRS through FORCE-TJR
  - Pay for Performance Quality Reporting; Pilot project by BC of MA
  - PROs used for negotiations with insurance companies, ACOs and referring MDs as a measure of quality
- PROs can be collected in a busy practice with >85% follow-up at 1 year
  - Ayers, Franklin. *Integrating PRO into Ortho.Practice; Proof of Concept from FORCE-TJR* 
    CORR: 471(11) 3482-3488, 2013
- PRO must bring value to visit ; real time scoring; CAT enabled
- PRO used for Shared Decision Making and part of routine clinical care , not “research”
  - Ayers. *Patient-Reported Outcomes Move into Clinical Practice.*
    Orthopedics Today. August 2014
- FORCE-TJR has collected >35,000 patients PROs (Pre-op, 6M and 1 Yr Post-op with 86% collection rate).
  1. Franklin, Allison, Ayers. *Beyond Implant Registries; a Patient-Centered Approach to TJR.* 
  - National TJR research registry and Comparative effectiveness consortium based at University of Massachusetts Medical School
  - Currently includes >225 sites in >28 states in the US
  - Established by a $12 Million P50 Grant from AHRQ
  - Currently collects and measures Level 1,2,3, and 4 data
  - Establish PRO standards at the surgeon and hospital level
  - Now using FORCE platform and infra-structure members manage bundled payment programs with CMS and private payers
  - FORCE –TJR feedback to surgeons/hospitals for quality improvement and real-time operational data to manage bundle payment programs
    - Patient characteristics/mix/ Charlson co-morbidity index
- Patient selection (timing of surgery)
- Medical and ortho co-morbid conditions
- Discharge location/ use of ancillaries
- TJR outcomes including post-TJR pain and function
- TJR outcomes also including adverse events/ readmissions/return to surgery/ revision surgery
  - FORCE-TJR Now open to new member enrollment

- PROs used to evaluate patient mix at the hospital/surgeon level for medical and MSK co-morbidities
  - Used to answer how do my patients compare to FORCE-TJR cohort on key risk-adjustment factors
  - Ayers, et al. *Patient Reported Outcomes After TKR; Need for MSK Co-Morbidity Index* 
    *JBJS-A: 95(20)1833-7, 2013*

- Patient Selection and Timing of Surgery; Appropriateness
  - How do my patients compare to other sites on pre-TJR pain and function?
    *CORR: Jan 2015, 473(1) p76-81*

- TJR patient reported outcomes;
  - How does my risk adjusted 1 year pain and function scores compare to FORCE-TJR national cohort?
  - Surgeons/hospitals want to improve!

- PROs improve risk adjustment models for readmissions
  - FORCE-TJR and AAHKS showed that adding pre-op function (PCS), BMI as continuous variable, smoking, modified Charlson co-morbidity score, Orthopedic co-morbidities improve readmission model from CMS C=.62 to FORCE-TJR C=.78
    *JBJS: 97(88) 668-71, 2015*

- PROs used to evaluate Cemented vs. Cemented TKRs; risk adjustment for PROs based on patient characteristics
  - Ayers, Li, Zheng, Franklin. *Does Pain and Function Differ After TKR with Cementless vs. Cemented Fixation?*  
    *Proceeding of the Knee Society. September 2015*

- PROs already play an important role in clinical practice in TJR and will play an increasingly vital role in assessing quality and value in the future
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 Knee Society. The American Academy of Orthopaedic Surgeons is accredited by the ACCME to provide continuing medical education for physicians.

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Upon completion of this activity, participants will 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 knee joint.
• Determine indications and complications in total knee 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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