CCJR® 2021

DECEMBER 8 – 11, 2021

HYATT REGENCY GRAND CYPRESS
ORLANDO, FL

HANDOUTS

CURRENT CONCEPTS
IN JOINT REPLACEMENT®

Reaffirmed. Reimagined.

CCJR® meetings are presented by The Hip Society and The Knee Society
in honor of Charles A. Engh, Sr., MD and Gerard A. Engh, MD

www.**CCJR**.com

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 The Knee Society's 2021 Current Concepts in Joint Replacement, December 8 – 11, 2021 to be held in Orlando, Florida for a maximum of **21 *AMA PRA Category 1 Credits™***. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

SOCIAL MEDIA INFORMATION

#CCJR2021 #THISISCCJR #CCJR

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CURRENT CONCEPTS IN JOINT REPLACEMENT

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ABOUT CURRENT CONCEPTS IN JOINT REPLACEMENT® (CCJR®)

www.ccjr.com

Current Concepts in Joint Replacement® (CCJR®) is a premier educational event, and a not-to-be-missed global arthroplasty forum presented by two esteemed academic organizations: The Hip Society and The Knee Society. CCJR® offers a unique learning format that has contributed to the education of thousands of orthopaedic surgeons around the world over the last three decades. CCJR® faculty consist of contemporary thought leaders discussing topics related to hip and knee arthroplasty.

ABOUT THE HIP SOCIETY

www.hipsoc.org

The Hip Society was established in 1968, by Frank Stinchfield, MD, as a by-invitation only academic society together with twenty elite hip surgeons. The mission of The Hip Society is to advance the knowledge and treatment of hip disorders to improve the lives of our patients.

ABOUT THE KNEE SOCIETY

www.kneesociety.org

The Knee Society was established in 1983, as a forum for intellectual exchange of concepts in total knee arthroplasty. The main initial goal of the founding group was to bring together the scientific information related to total knee arthroplasty. The mission of The Knee Society is to promote outstanding care to patients with knee disorders through innovative research and education.

DISCLAIMER

The material presented in this continuing medical education program is being made available by The Hip Society and The Knee Society for educational purposes only. This material is not intended to represent the best or the only methods or procedures appropriate for the medical situations discussed; rather the material is intended to present an approach, view, statement or opinion of the authors or presenters, which may be helpful, or of interest to other practitioners. The attendees agree to participate in this medical education program, organized by The Hip Society and The Knee Society with full knowledge and awareness that they waive any claim they may have against The Hip Society and The Knee Society for reliance on any information presented in this educational program. In addition, the attendees also waive any claim they have against The Hip Society and The Knee Society for injury or other damage that may result in any way from their participation in this program.

HEALTH AND SAFETY INFORMATION

We are committed to creating a safe and healthy environment for everyone attending CCJR®. We are following best practices recommended by the Centers for Disease Control (CDC) and will abide by the legal mandates from the State of Florida in addition to those instituted by the Hyatt Regency Grand Cypress.

DO NOT attend if you are experiencing symptoms of COVID-19

DO NOT attend if you have been exposed to COVID-19

6' **Maintain social distancing whenever possible**

Masks are required

CCJR® APPAREL

This has never been offered before in the entire history of CCJR®. Be the first one to proudly wear CCJR® Apparel. Take advantage of the exclusive opportunity to take CCJR® home with you. Visit our Apparel Store and purchase quality items with the iconic CCJR logo.

EXHIBITS

Please give our exhibitors and supporters the time and attention they deserve. Pick up your exhibitor passport at registration and use it to visit all exhibitors, collect hole-punches for your visits, and enter a raffle to win one of two complimentary CCJR® 2022 registrations. Only those who have collected hole-punches from all exhibitors are eligible to enter the raffle. One entry per person, please.

WiFi

Network: CCJR2021

Password: 2021CCJR

BADGES

Valid badges are required for everyone entering the CCJR® 2021 designated space, participating in educational events, and partaking of the food and beverage functions. This includes guests of all ages. This policy will be strictly reinforced.

PHOTOGRAPHY

Photographs of CCJR® 2021 may be taken throughout the program by authorized staff. By registering for, and attending the events scheduled within the framework of the meeting, participants and their guests agree that their photograph may be used by The Hip Society and The Knee Society, in electronic and print promotional materials and other professional communications including web-based publications, without payment or other consideration.

VIRTUAL QUESTIONS

Participate in Polls

- Scan QR code below
- OR – respond to polls at pollev.com/ccjr
- OR – text **CCJR** to **22333** once to join, then vote

Submit Your Questions

- Scan QR code below
- Ask your question at pollev.com/ccjr
- To participage in the **Best Question of the Day Contest**, please enter your name when prompted

← SCAN FOR POLLS AND AUDIENCE QUESTIONS

CCJR® 2021 LIVE STREAMING ACCESS

CCJR® 2021 will be streamed live in real time, December 9–11, 2021, according to the US Eastern Standard Time Zone (Orlando, FL).

ALREADY REGISTERED? You should have received an email with access titled "Welcome to your new CCJR – Current Concepts in Joint Replacement account".

No email, please click here

TO REGISTER PLEASE CLICK HERE

Or visit www.CCJR.com

CCJR® 2021

CCJR® meetings are proudly presented by The Hip Society and The Knee Society

Visit **www.hipsoc.org** or **www.kneesociety.org** for the best in arthroplasty education

SAVE THE DATE

CCJR® 2022

December 7–10, 2022, Orlando, FL

DAILY SCHEDULE

THURSDAY, DECEMBER 9, 2021

6:00-7:15AM	**BREAKFAST**	Exhibit Hall (Grand Cypress Ballroom)
6:00-7:15AM	**Non-CME Industry Supported Education Session** ATTUNE® Knee System Tibia First Patient Specific Alignment Technique with VELYS™ Robotic Assisted Solution presented by DePuy Synthes, the Orthopaedics Company of Johnson & Johnson	Innovation Theater
7:30-7:35AM	**Welcome and Opening Remarks** Daniel J. Berry, MD	All CME Sessions presented in Windsong

SESSION I
OUTPATIENT SURGERY

Session Moderators:
1. William J. Maloney, III, MD
2. Matthew P. Abdel, MD, MS

7:35-7:45AM	**Keynote: Making a Safe Transition to Outpatient Total Joint Arthroplasty** Kevin J. Bozic, MD, MBA
7:45-8:00AM	**DEBATE: Outpatient Surgery** **Strict Patient Selection Criteria** R. Michael Meneghini, MD | **General Criteria, but No Strict Checklist** Adolph V. Lombardi, Jr., MD
8:00-8:06AM	**Outpatient Surgery: Pregame – Choosing the Patient, Getting the Patient Ready** William G. Hamilton, MD
8:07-8:13AM	**Outpatient Surgery: In the OR – Tips on Anesthesia, Instrumentation Choice, Problem Solving** Keith R. Berend, MD
8:14-8:20AM	**Outpatient Surgery: Postgame – Protocols for Patient Contact, Pain Management, Backup for Problems** Scott M. Sporer, MD
8:20-8:35AM	**Panel Discussion / Audience Questions** Panel: Keith R. Berend, MD, Kevin J. Bozic, MD, MBA, William G. Hamilton, MD, Adolph V. Lombardi, Jr., MD, R. Michael Meneghini, MD, Scott M. Sporer, MD
8:35-9:05AM	**S-1 Pre-Recorded Live Surgery: A Patient's Journey Through an ASC for Revision TKA** Surgeon: Adolph V. Lombardi, Jr., MD Moderator: Scott M. Sporer, MD
9:05-9:10AM	**Panel Discussion / Audience Questions** Panel: Keith R. Berend, MD, Kevin J. Bozic, MD, MBA, William G. Hamilton, MD, Adolph V. Lombardi, Jr., MD, R. Michael Meneghini, MD, Scott M. Sporer, MD
9:10-9:14AM 9:14-9:18AM 9:18-9:22AM 9:22-9:26AM	**Outpatient Surgery Missteps: I Am Never Doing That Again!** Speaker 1: Fares S. Haddad, MD (Res), FRCS (Orth) Speaker 2: Matthew S. Austin, MD Speaker 3: Carlos J. Lavernia, MD Speaker 4: Fred D. Cushner, MD
9:27-9:28AM 9:28-9:38AM	**The Gerard A. Engh, Md Keynote Lecture** Introduction: Adolph V. Lombardi, Jr., MD, **New Technologies to Follow Your Arthroplasty Patient Remotely: What's Out There? Will You Really Use It?** Fares S. Haddad, MD (Res), FRCS (Orth)
9:38-9:45AM	**Panel Discussion / Audience Questions** Panel: Matthew S. Austin, MD, Keith R. Berend, MD, Kevin J. Bozic, MD, MBA, Fred D. Cushner, MD Fares S. Haddad, MD (Res), FRCS (Orth), Carlos J. Lavernia, MD, Christopher L. Peters, MD
9:45-10:20AM	**BREAK** • Visit the Exhibit Hall • Meet Faculty in the Hub

SESSION II
PRIMARY TKA: ALIGNMENT AND BALANCING

Session Moderators:
1. Henry D. Clarke, MD
2. Matthew S. Austin, MD

10:20-10:30AM	**Understanding the Terms and the Implications: Kinematic vs Mechanical vs Functional vs Anatomical Alignment; Gap Balancing vs Measured Resection** Simon Young, MBChB, FRACS, MD
10:30-10:35AM	**My Top 5 Technical Tips for a Better Primary TKA** Christopher Dodd, MD

10:35-10:47AM	**DEBATE: Knee Alignment Targets** **Kinematic/Anatomic Alignment Has Real Advantages** Mark W. Pagnano, MD	**Show Me the Money: Where Is the Proof?** **Stick with Mechanical Alignment** Steven B. Haas, MD
10:47-11:07AM	**S-2 Pre-Recorded Live Surgery: Improve Your Outcomes with Sensor Balancing of TKA** Surgeon: Martin W. Roche, MD Moderator: Henry D. Clarke, MD or TBD	
11:07-11:19AM	**DEBATE: Uncemented TKA** **The Time Has Come for Uncemented TKA** Robert L. Barrack, MD	**Cemented TKA Is More Reliable: Why Switch?** Robert T. Trousdale, MD
11:19-11:39AM	**S-3 Pre-Recorded Live Surgery: Technical Tips and Tricks for Uncemented TKA** Surgeon: Ran Schwarzkopf, MD Moderator: R. Michael Meneghini, MD	
11:39-11:48AM	**PANEL DISCUSSION / AUDIENCE QUESTIONS** Panel: Matthew S. Austin, MD, Steven B. Haas, MD, Mark W. Pagnano, MD, Martin W. Roche, MD	

SESSION III
KNEE KINEMATICS AND IMPLANT CHOICE: WHAT IS BEST IN 2021?

Session Moderators:
1. Bryan D. Springer, MD
2. Michael P. Bolognesi, MD

11:48-11:50AM	**CASE PRESENTATION: Routine Varus Knee with Tricompartmental Arthritis** Bryan D. Springer, MD
	FOUR-WAY DEBATE: Best Implant Choice for Routine TKA in a Patient Like This...
11:50-11:55AM	**I Would Do a Posterior Cruciate Retaining TKA: Why It Is Better and Other Choices Worse** William A. Jiranek, MD
11:55-12:00PM	**I Would Do a Posterior Stabilized TKA with CAM/Post: Why It Is Better and Other Choices Worse** Giles R. Scuderi, MD
12:00-12:05PM	**I Would Do a Medial Stabilized TKA: Why It Is Better and Other Choices Worse** Andrew J. Shimmin, MD
12:05-12:10PM	**I Would Do an Ultra-Congruent TKA: Why It Is Better and Other Choices Worse** Aaron A. Hofmann, MD
12:10-12:20PM	**SOUNDING PANEL DISCUSSION / AUDIENCE QUESTIONS** **• Is One Choice Really Better Than Another? • Does Lateral Rollback Matter? • What Direction Is the Future?** Panel: Keith R. Berend, MD, Henry D. Clarke, MD, Steven B. Haas, MD, Douglas E. Padgett, MD
12:20-1:20PM	**LUNCH** — Exhibit Hall
12:25-1:10PM	Non-CME Industry Supported Concurrent Session — Palm Room **Enter a New World of Postoperative Pain Management** presented by Heron Therapeutics
12:25-1:10PM	Non-CME Industry Supported Concurrent Session — Innovation Theater **Biofilms and Surgical Site Infections** presented by Next Science

SESSION IV
UNICOMPARTMENTAL ARTHRITIS

Session Moderators:
1. Mark W. Pagnano, MD
2. William G. Hamilton, MD

1:20-1:22PM	**CASE PRESENTATION: Medial Compartment Disease** Presented by: Mark W. Pagnano, MD	
1:22-1:35PM	**DEBATE: Uni vs Total for Predominantly Medial Compartment Disease** **Unicompartmental Arthroplasty for This Patient** Keith R. Berend, MD	**Total Knee Arthroplasty for This Patient** Henry D. Clarke, MD
1:35-1:55PM	**S-4 Pre-Recorded Live Surgery: Implanting a Device That Will Tell You Exactly What Your Knee Arthroplasty Patient is Accomplishing** Surgeon: Peter K. Sculco, MD Moderator: Fred D. Cushner, MD	
1:55-2:02PM	**PANEL DISCUSSION / AUDIENCE QUESTIONS** **State of Unis: Fixed vs Mobile Bearing, Cemented vs Uncemented, Robotic vs Hand Instruments** Panel: Fred D. Cushner, MD, Christopher Dodd, MD, C. Anderson Engh, Jr., MD, William A. Jiranek, MD, Martin W. Roche, MD	

SESSION V
PRIMARY TKA: THE ROBOTS ARE COMING

Session Moderators:
1. Steven J. MacDonald, MD, FRCSC
2. Martin W. Roche, MD

2:02-2:12PM	**KEYNOTE: Shopping for Robotic TKA Systems: What Is Being Offered Out There? What Are the Pluses and Minuses of the Main Features?** Jan Victor, MD	
2:12-2:32PM	**S-5 Pre-Recorded Live Surgery: Precision TKA with Robotic Assistance** Surgeon: Robert T. Trousdale, MD Moderator: Mark W. Pagnano, MD	
2:32-2:45PM	**DEBATE: Robotics in Hip and Knee Arthroplasty** **A Wine Before Its Time** R. Michael Meneghini, MD	**It Is Time Already** Robert L. Barrack, MD
2:45-3:05PM	**S-6 Pre-Recorded Live Surgery: TKA with Real-Time Soft Tissue Balancing and Robotic Assistance** Surgeon: Matthew S. Austin, MD Moderator: Martin W. Roche, MD	

3:05-3:20PM	**PANEL DISCUSSION / AUDIENCE QUESTIONS** Panel: James A. Browne, MD, Thomas K. Fehring, MD, William J. Maloney, III, MD, Michael A. Mont, MD, Thomas P. Sculco, MD
3:20-3:45PM	**BREAK** • Visit the Exhibit Hall • Meet Faculty in the Hub

SESSION VI
COMPLEX PRIMARY TKA: TECHNIQUES, TIPS AND VIDEO TECHNIQUES

Session Moderators:
1. Christopher L. Peters, MD
2. William A. Jiranek, MD

3:45-3:51PM	**Previous Incisions: When Should You Be Worried? Methods to Avoid Trouble? What if There Are Problems?** Douglas A. Dennis, MD
3:51- 3:55PM	**CASE PRESENTATION: Patient with Problem Incisions** Presented by: Christopher L. Peters, MD Panel: Douglas A. Dennis, MD, George J. Haidukewych, MD, Adolph V. Lombardi, Jr., MD, Giles R. Scuderi, MD
3:55-4:01PM	**Retained Hardware: Tips and Tricks** George J. Haidukewych, MD
4:01-4:05PM	**CASE PRESENTATION: Patient with Problem Hardware** Presented by: Christopher L. Peters, MD Panel: Douglas A. Dennis, MD, George J. Haidukewych, MD, Adolph V. Lombardi, Jr., MD, Giles R. Scuderi, MD
4:05-4:11PM	**Extra-Articular Deformity: Technical Elements** Arun B. Mullaji, MD
4:11-4:15PM	**CASE PRESENTATION: Patient with Extra-Articular Deformity** Presented by: Christopher L. Peters, MD Panel: Douglas A. Dennis, MD, George J. Haidukewych, MD, Adolph V. Lombardi, Jr., MD, Giles R. Scuderi, MD
4:15-4:21PM	**Pre-op Flexion Contracture: Technical Tips** Adolph V. Lombardi, Jr., MD, FACS
4:21-4:25PM	**CASE PRESENTATION: Patient with Flexion Contracture** Presented by: Christopher L. Peters, MD Panel: Douglas A. Dennis, MD, George J. Haidukewych, MD, Adolph V. Lombardi, Jr., MD, Giles R. Scuderi, MD
4:25-4:31PM	**Previous ACL Surgery with Chronic Flexion Laxity** Giles R. Scuderi, MD
4:31-4:35PM	**CASE PRESENTATION: Patient with Previous ACL Reconstruction** Presented by: Christopher L. Peters, MD Panel: Douglas A. Dennis, MD, George J. Haidukewych, MD, Adolph V. Lombardi, Jr., MD, Giles R. Scuderi, MD
4:35-4:45PM	**PANEL DISCUSSION / AUDIENCE QUESTIONS** Panel: Douglas A. Dennis, MD, George J. Haidukewych, MD, Adolph V. Lombardi, Jr., MD, Giles R. Scuderi, MD
	Most Valuable Knee Arthroplasty Paper in the Last 2 Years Moderators: Adolph V. Lombardi, Jr., MD • Douglas A. Dennis, MD
4:45-4:49PM	Paper 1: Jean-Noël Argenson, MD
4:49-4:53PM	Paper 2: Fred D. Cushner, MD
4:53-4:57PM	Paper 3: Antonia F. Chen, MD
4:57-5:01PM	Paper 4: Jan Victor, MD
5:01-5:10PM	**AUDIENCE VOTE, PANEL DISCUSSION ON MOST VALUABLE PAPER, AUDIENCE QUESTIONS** Panel: Matthew S. Austin, MD, Kevin J. Bozic, MD, MBA, Steven B. Haas, MD, Jay R. Lieberman, MD

SESSION VI-A
CASE-BASED MINI-SESSION: COMPLICATIONS OF TKA

Session Moderators:
1. Thomas K. Fehring, MD
2. Keith R. Berend, MD

5:10-5:15PM	**CASE PRESENTATION: The Red Knee: When Do You Get Worried? What Do You Do?** Presented by: Thomas K. Fehring, MD Panel: Steven B. Haas, MD, Aaron A. Hofmann, MD, Carlos J. Lavernia, MD, Scott M. Sporer, MD AUDIENCE RESPONSE
5:15-5:20PM	**CASE PRESENTATION: Wound Drainage: When Do You Get Worried? What Do You Do? When Do You Reoperate?** Presented by: Thomas K. Fehring, MD Panel: Steven B. Haas, MD, Aaron A. Hofmann, MD, Carlos J. Lavernia, MD, Scott M. Sporer, MD AUDIENCE RESPONSE
5:20-5:25PM	**CASE PRESENTATION: Early Lack of Flexion: How Soon Do You Get Worried? What Do You Do? When Do You Manipulate? When Do You Reoperate?** Presented by: Thomas K. Fehring, MD Panel: Panel: Steven B. Haas, MD, Aaron A. Hofmann, MD, Carlos J. Lavernia, MD, Scott M. Sporer, MD AUDIENCE RESPONSE
5:25-5:30PM	**CASE PRESENTATION: Early Lack of Extension: How Soon Do you Get Worried? What Do you Do? When Do you Reoperate?** Presented by: Thomas K. Fehring, MD Panel: Steven B. Haas, MD, Aaron A. Hofmann, MD, Carlos J. Lavernia, MD, Scott M. Sporer, MD AUDIENCE RESPONSE
5:30-5:45PM	**AUDIENCE QUESTIONS FROM THE DAY; BEST QUESTION OF THE DAY AWARD** Moderators: Adolph V. Lombardi, Jr., MD • William J. Maloney, III, MD Panel: Steven B. Haas, MD, Aaron A. Hofmann, MD, Carlos J. Lavernia, MD, Scott M. Sporer, MD

5:45-6:30PM	**POSTER TOUR**	
6:30-8:00PM	**Sesión Educativa en Español** **Non-CME Case-Based Round Table Discussion Session** **For Spanish-speaking attendees, presented in Spanish** Moderators: Carlos J. Lavernia, MD, Rafael J. Sierra, MD, Claudio Diaz Ledezma, MD	Innovation Theater

FRIDAY, DECEMBER 10, 2021

6:00-7:15AM	**BREAKFAST**	Exhibit Hall
6:00-7:15AM	Non-CME Industry Supported Education Session **Revision Knee Arthroplasty – As Easy as 1, 2, 3?** presented by Zimmer Biomet	Innovation Theater
7:30-7:35AM	**Welcome and Announcements** Daniel J. Berry, MD	All CME Sessions presented in Windsong

SESSION VII
CONTROVERSIES IN PRIMARY TKA AND THA

Session Moderators:
1. Robert L. Barrack, MD
2. Mathias P.G. Bostrom, MD

7:35-7:45AM	**KEYNOTE: Biologics and Other Things You Can Inject into a Joint: What Really Works and What Has No Proof?** Jay R. Lieberman, MD
7:45-8:00AM	**DEBATE: Use Dual Mobility in All High-Risk THA Patients** **Absolutely Yes, Why Risk the Grief?** Rafael J. Sierra, MD **Absolutely Not, Are You Kidding?** Stephen B. Murphy, MD
8:00-8:30AM	**S-7 Pre-Recorded Live Surgery: The Advanced Anterior Approach With Dual Mobility for Complex THA** Surgeon: Jeffrey A. Geller, MD Moderator: William G. Hamilton, MD
8:30-8:31AM 8:31-8:41AM	**THE CHARLES A. ENGH, MD KEYNOTE LECTURE** Introduction by William J. Maloney, III, MD **Understanding the Hip-Spine Relationship – And Does It Matter?** Matthew P. Abdel, MD, MS
8:41-8:55AM	**PANEL DISCUSSION / AUDIENCE QUESTIONS** Panel: C. Anderson Engh, MD, Jay R. Lieberman, MD, Douglas E. Padgett, MD, Wayne G. Paprosky, MD, FACS
8:55-9:10AM	**DEBATE: Hard-on-Hard Surfaces are Dead in THA** **Yes, Dead as a Door Nail** William J. Maloney, III, MD **No, Still Alive with Good Indications** Douglas A. Dennis, MD
9:10-9:20AM	**PANEL DISCUSSION / AUDIENCE QUESTIONS** Panel: Matthew P. Abdel, MD, MS, Mathias P.G. Bostrom, MD, Kevin J. Bozic, MD, MBA, John J. Callaghan, MD, Jay R. Lieberman, MD, Thomas P. Sculco, MD
9:20-9:45AM	**CONFIRM OR DENY: Controversies in Total Hip and Total Knee Arthroplasty** Moderator: Daniel J. Berry, MD Panel: Michael P. Bolognesi, MD, James A. Browne, MD, Steven J. MacDonald, MD, FRCSC, Robert T. Trousdale, MD
9:45-10:30AM	**BREAK** • Visit the Exhibit Hall • Meet Faculty in the Hub

SESSION VIII
COMPLEX PRIMARY THA: TECHNIQUES, TIPS, AND VIDEO TECHNIQUES

Session Moderators:
1. Rafael J. Sierra, MD
2. Scott M. Sporer, MD

10:30-10:36AM	**DDH Crowe 1-3: Strategy, Technique, Pitfalls** Christopher L. Peters, MD
10:36-10:40AM	**CASE PRESENTATION: Crowe 2 DDH** Presented by: Rafael J. Sierra, MD Panel: Daniel J. Berry, MD, James A. Browne, MD, George J. Haidukewych, MD, Douglas E. Padgett, MD, Christopher L. Peters, MD
10:40-10:46AM	**DDH Crowe 4: Strategy, Technique, Pitfalls** Daniel J. Berry, MD
10:46-10:50AM	**CASE PRESENTATION: Crowe 4 DDH** Presented by: Rafael J. Sierra, MD Panel: Daniel J. Berry, MD, James A. Browne, MD, George J. Haidukewych, MD, Douglas E. Padgett, MD, Christopher L. Peters, MD
10:50-10:56AM	**Acetabular Protrusio: Strategy, Technique, Pitfalls** Douglas E. Padgett, MD
10:56-11:00AM	**CASE PRESENTATION: Acetabular Protrusio** Presented by: Rafael J. Sierra, MD Panel: Daniel J. Berry, MD, James A. Browne, MD, George J. Haidukewych, MD, Douglas E. Padgett, MD, Christopher L. Peters, MD
11:00-11:06AM	**Conversion Failed Intertrochanteric Fracture to THA: Strategy, Technique, Pitfalls** George J. Haidukewych, MD
11:06-11:10AM	**CASE PRESENTATION: Failed Intertrochanteric Fracture** Presented by: Rafael J. Sierra, MD Panel: Daniel J. Berry, MD, James A. Browne, MD, George J. Haidukewych, MD, Douglas E. Padgett, MD, Christopher L. Peters, MD
11:10-11:16AM	**THA in Proximal Femoral Deformity: Strategy, Technique, Pitfalls** James A. Browne, MD

11:16-11:20AM	**CASE PRESENTATION: Proximal Femoral Deformity** Presented by: Rafael J. Sierra, MD Panel: Daniel J. Berry, MD, James A. Browne, MD, George J. Haidukewych, MD, Douglas E. Padgett, MD, Christopher L. Peters, MD	
11:20-11:30AM	**PANEL DISCUSSION / AUDIENCE QUESTIONS** Panel: Daniel J. Berry, MD, James A. Browne, MD, George J. Haidukewych, MD, Douglas E. Padgett, MD, Christopher L. Peters, MD	
11:30-12:00PM	**S-8 Pre-Recorded Live Surgery: Prevention of Infection in Joint Arthroplasty: Role of Sterile Povidone Iodine** Surgeon: Javad Parvizi, MD Moderator: Adolph V. Lombardi, Jr., MD	
12:00-12:04PM 12:04-12:08PM 12:08-12:12PM 12:12-12:16PM	**Most Valuable Hip Arthroplasty Paper in the Last 2 Years** Moderators: Michael P. Bolognesi, MD • Antonia F. Chen, MD Paper 1: Charles L. Nelson, MD Paper 2: Michael A. Mont, MD Paper 3: Kevin J. Bozic, MD, MBA Paper 4: Scott M. Sporer, MD	
12:16-12:30PM	**AUDIENCE VOTE, PANEL DISCUSSION ON MOST VALUABLE PAPER, AUDIENCE QUESTIONS** Panel: Matthew P. Abdel, MD, MS, John J. Callaghan, MD, Stephen B. Murphy, MD, Thomas P. Sculco, MD	
12:40-1:25PM	**LUNCH**	Exhibit Hall
12:40-1:25PM	Non-CME Industry Supported Education Session **New Technologies in the Treatment of Peri-Prosthetic Femur Fractures** Presented by DePuy Synthes, the Orthopaedic Company of Johnson & Johnson	Palm Room
12:40-1:25PM	Non-CME Industry Supported Education Session **Leading Technologies With Efficiencies for Your ASC** presented by Zimmer Biomet	Innovation Theater
SESSION IX **CONTROVERSIES IN THA: OPERATIVE APPROACHES**		Session Moderators: *1. Daniel J. Berry, MD* *2. C. Anderson Engh, MD*
1:30-2:00PM	**THREE-WAY DEBATE** Points of Contention: • The Posterior Approach has an unacceptably high dislocation rate! • The DA approach has too many loose implants and periprosthetic fractures! • The Anterolateral approach causes unacceptable frequency of abductor problems and is on life support: time to pull the plug! **RED TEAM: Posterior Approach – Why this approach is best and the others are worse** R. Michael Meneghini, MD (Team Captain), Mathias P.G. Bostrom, MD, Thomas K. Fehring, MD **BLUE TEAM: Direct Anterior Approach – Why this approach is best and the others are worse** William G. Hamilton, MD (Team Captain), Keith R. Berend, MD, Christopher L. Peters, MD **GREEN TEAM: Anterolateral Approach – Why this approach is best and the others are worse** David G. Lewallen, MD (Team Captain), George J. Haidukewych, MD, Steven J. MacDonald, MD, FRCSC **AUDIENCE VOTE TO DECLARE THE WINNING TEAM**	
2:00-2:06PM	**My 5 Best Technical Tips for a Better Posterior Approach** C. Anderson Engh, MD	
2:07-2:13PM	**My 5 Best Technical Tips for a Better Direct Anterior Approach** Adolph V. Lombardi, Jr., MD	
2:13-2:20PM	**PANEL DISCUSSION / AUDIENCE QUESTIONS** Panel: John J. Callaghan, MD, Antonia F. Chen, MD, Charles L. Nelson, MD, Thomas P. Sculco, MD	
SESSION X **COMPLICATIONS OF THA: CASE DISCUSSIONS**		Session Moderators: *1. Steven J. MacDonald, MD, FRCSC* *2. Craig J. Della Valle, MD*
2:20-2:28PM	**CASE PRESENTATION: Early Fx – Why Did It Happen? How to Avoid? How to Treat?** Presented by: Steven J. MacDonald, MD, FRCSC Panel: John J. Callaghan, MD, Don S. Garbuz, MD, MHSc, Carlos J. Lavernia, MD, Douglas E. Padgett, MD, Scott M. Sporer, MD AUDIENCE RESPONSE	
2:28-2:36PM	**CASE PRESENTATION: Leg Length Problem – Why Did It Happen? How to Avoid? How to Treat?** Presented by: Steven J. MacDonald, MD, FRCSC Panel: John J. Callaghan, MD, Don S. Garbuz, MD, MHSc, Carlos J. Lavernia, MD, Douglas E. Padgett, MD, Scott M. Sporer, MD AUDIENCE RESPONSE	
2:36-2:44PM	**CASE PRESENTATION: Recurrent Instability – Why Did It Happen? How to Avoid? How to Treat?** Presented by: Steven J. MacDonald, MD, FRCSC Panel: John J. Callaghan, MD, Don S. Garbuz, MD, MHSc, Carlos J. Lavernia, MD, Douglas E. Padgett, MD, Scott M. Sporer, MD AUDIENCE RESPONSE	
2:44-2:52PM	**CASE PRESENTATION: Draining Wound – Why Did It Happen? How to Avoid? How to Treat?** Presented by: Steven J. MacDonald, MD, FRCSC Panel: John J. Callaghan, MD, Don S. Garbuz, MD, MHSc, Carlos J. Lavernia, MD, Douglas E. Padgett, MD, Scott M. Sporer, MD AUDIENCE RESPONSE	
2:52-3:00PM	**CASE PRESENTATION: Psoas Tendinitis – Why Did It Happen? How to Avoid? How to Treat?** Presented by: Steven J. MacDonald, MD, FRCSC Panel: John J. Callaghan, MD, Don S. Garbuz, MD, MHSc, Carlos J. Lavernia, MD, Douglas E. Padgett, MD, Scott M. Sporer, MD AUDIENCE RESPONSE	
3:00-3:10PM	**PANEL DISCUSSION / AUDIENCE QUESTIONS** Panel: John J. Callaghan, MD, Don S. Garbuz, MD, MHSc, Carlos J. Lavernia, MD, Douglas E. Padgett, MD, Scott M. Sporer, MD	

3:10-3:20PM	**KEYNOTE: New Technologies to Reduce Hip Dislocation. What Can Help Now? What Is Coming?** Andrew J. Shimmin, MD	
3:20-3:45PM	**BREAK** • Visit Exhibit Hall • Meet the Faculty in the Hub	
SESSION XI THE ENEMY: INFECTION		Session Moderators: *1. Charles L. Nelson, MD* *2. James A. Browne, MD*
3:45-3:52PM	**Diagnosing the Infected Arthroplasty in 2021: Who Needs Advanced Molecular Testing? What Is Available? How Good Is It? What Are the Pitfalls?** Javad Parvizi, MD, FRCS	
3:53-3:59PM	**Preventing Pre-op Infection in 2021: What Is Worthwhile, What Is Not? Staph Screening, BMI Reduction, Urinalysis, etc.** Bryan D. Springer, MD	
4:00-4:15PM	**DEBATE: Antimicrobial Irrigation (Dilute Betadine or Something Else) for Infection Prevention** **Always – What Do You Have to Lose?** Craig J. Della Valle, MD **No Value, Waste of Time and Money** Rafael J. Sierra, MD	
4:15-4:24PM	**PANEL DISCUSSION / AUDIENCE QUESTIONS** Panel: Thomas K. Fehring, MD, Michael A. Mont, MD, Javad Parvizi, MD, FRCS, Thomas P. Sculco, MD, Bryan D. Springer, MD	
SESSION XII TREATMENT OF INFECTION		Session Moderators: *1. C. Anderson Engh, MD* *2. James A. Browne, MD*
4:24-4:44PM	**S-9 Pre-Recorded Live Surgery: Articulating Spacer to Treat Periprosthetic Hip Infection** Surgeon: R. Michael Meneghini, MD Moderator: James A. Browne, MD	
4:44-4:50PM	**Debridement, Antibiotics and Implant Retention in 2021: Indications and Technical Points** Simon Young, MD, FRACS	
4:51-4:57PM	**How I Do a One-Stage: Principles and Technical Tips** Thorsten Gehrke, MD	
4:58-5:04PM	**How I Do a Two-Stage TKA: Spacer Choice, Technical Tips** Thomas K. Fehring, MD	
5:05-5:11PM	**How I Do a Two-Stage THA: Spacer Choice, Technical Tips** Carsten Perka, MD	
5:11-5:20PM	**PANEL DISCUSSION / AUDIENCE QUESTIONS** Panel: Craig J. Della Valle, MD, Thomas K. Fehring, MD, Charles L. Nelson, MD, Michael A. Mont, MD, Bryan D. Springer, MD	
5:20-5:30PM	**AUDIENCE QUESTIONS FROM THE DAY; BEST QUESTION OF THE DAY AWARD** Moderators: Adolph V. Lombardi, Jr., MD • William J. Maloney, III, MD Panel: Craig J. Della Valle, MD, Thomas K. Fehring, MD, Charles L. Nelson, MD, Michael A. Mont, MD, Bryan D. Springer, MD	
5:30-7:00PM	**RECEPTION** All attendees with badges are welcome to attend. Please no children under age of 10.	Exhibit Hall
7:00-9:00PM	Non-CME Industry Supported Education Session **ROSA® Robotics Platform Showcase** Presented by Zimmer Biomet	Regency Hall

SATURDAY, DECEMBER 11, 2021

6:00-7:15AM	**BREAKFAST**	Portico Foyer
6:00-7:15AM	Non-CME Industry Supported Education Session **Experience Functional Knee Positioning with Mako SmartRobotics™** presented by Stryker Joint Replacement	Innovation Theater
7:30-7:35AM	**Welcome and Announcements** Daniel J. Berry, MD	All CME Sessions presented in Windsong
SESSION XIII REVISION THA		Session Moderators: *1. Robert T. Trousdale, MD* *2. Douglas E. Padgett, MD*
7:35-7:41AM	**Exposure: How to Do an Extended Greater Trochanteric Osteotomy** Wayne G. Paprosky, MD	
7:41-7:49AM	**CASE PRESENTATION • Case 1: Exposure Challenge • Case 2: Exposure Challenge** Presented by Robert T. Trousdale, MD Panel: Mathias P.G. Bostrom, MD, Jay R. Lieberman, MD, Charles L. Nelson, MD, Wayne G. Paprosky, MD	
7:49-7:55AM	**Implant Removal: My Tips for Well Fixed Cup and Stem Extraction** Carsten Perka, MD	
7:55-8:02AM	**CASE PRESENTATION • Case 1: Cup Removal (For Instability) • Case 2: Stem Removal (For Infection)** Presented by Robert T. Trousdale, MD Panel: Mathias P.G. Bostrom, MD, Jay R. Lieberman, MD, Charles L. Nelson, MD, Wayne G. Paprosky, MD	
8:02-8:07AM	**PANEL DISCUSSION / AUDIENCE QUESTIONS** Panel: Mathias P.G. Bostrom, MD, Jay R. Lieberman, MD, Charles L. Nelson, MD, Wayne G. Paprosky, MD	

SESSION XIV
ACETABULAR REVISION

Session Moderators:
1. C. Anderson Engh, MD
2. Douglas E. Padgett, MD

8:07-8:13AM	**Large Diameter Hemispherical Cup with Screws: The Workhorse; Technical Tips for Success** Don S. Garbuz, MD, MHSc
8:14-8:20AM	**Porous Metal Augments: Best Indications; Technical Tips** David G. Lewallen, MD
8:21-8:27AM	**Custom Triflange Cup: Why and How?** Mathias P.G. Bostrom, MD
8:28-8:34AM	**Pelvic Discontinuity: Distraction Technique** Wayne G. Paprosky, MD
8:35-8:43AM	**CASE PRESENTATION** **Case 1: Acetabular Revision With Moderate Bone Loss** **Case 2: Acetabular Revision With Severe Bone Loss** Presented by: C. Anderson Engh, MD Panel: Mathias P.G. Bostrom, MD, Don S. Garbuz, MD, MHSc, David G. Lewallen, MD, Wayne G. Paprosky, MD
8:43-8:48AM	**PANEL DISCUSSION / AUDIENCE QUESTIONS** Panel: Mathias P.G. Bostrom, MD, Don S. Garbuz, MD, MHSc, David G. Lewallen, MD, Wayne G. Paprosky, MD, FACS

SESSION XV
FEMORAL REVISION

Session Moderators:
1. Don S. Garbuz, MD, MHSc
2. Douglas E. Padgett, MD

8:48-9:13AM	**S-10 Pre-Recorded Live Surgery: Concepts of Femoral Revision in 2021** Surgeon: Christopher L. Peters, MD Moderator: Don S. Garbuz, MD, MHSc
9:13-9:19AM	**Fluted Tapered Stems: Modular and Non-Modular: Making Them Work** Steven J. MacDonald, MD, FRCSC
9:20-9:35AM	**CASE PRESENTATION** Case 1: Femoral Revision with Moderate Bone Loss Case 2: Femoral Revision with Severe Bone Loss Case 3: Femoral Revision for Periprosthetic Femur Fracture Presented by: Don S. Garbuz, MD, MHSc Panel: C. Anderson Engh, MD, Steven J. MacDonald, MD, FRCSC, Stephen B. Murphy, MD, Scott M. Sporer, MD
9:35-9:45AM	**PANEL DISCUSSION / AUDIENCE QUESTIONS** Panel: C. Anderson Engh, MD, Steven J. MacDonald, MD, FRCSC, Stephen B. Murphy, MD, Scott M. Sporer, MD
9:45-10:15AM	**BREAK**

SESSION XVI
REVISION TKA TECHNIQUES

Session Moderators:
1. Steven B. Haas, MD
2. Henry D. Clarke, MD

10:15-10:21AM	**Exposure Challenges in Revision TKA: What To Do Before Reverting to Extensile Exposure; How to Do Quadriceps Snip; How to Do Tibial Tubercle Osteotomy.** Giles R. Scuderi, MD
10:22-10:27AM	**Implant Removal in TKA; My Favorite Technical Tips** Arun B. Mullaji, MD
10:28-10:33AM	**Implant Removal in TKA; My Favorite Technical Tips** Jean-Noël Argenson, MD
10:34-10:45AM	**PANEL DISCUSSION / AUDIENCE QUESTIONS** Panel: Henry D. Clarke, MD, Don S. Garbuz, MD, MHSc, FRCSC, Giles R. Scuderi, MD, Thomas P. Sculco, MD

SESSION XVII
REVISION TKA

Session Moderators:
1. Matthew S. Austin, MD
2. Henry D. Clarke, MD

10:45-10:51AM	**Biologic Metaphyseal Fixation with Cones: How To, Technique Tips** David G. Lewallen, MD
10:52-10:58AM	**Biologic Metaphyseal Fixation with Sleeves: How To, Technique Tips** Carsten Perka, MD
10:59-11:05AM	**Extensor Mechanism Reconstruction With Marlex Mesh** Matthew P. Abdel, MD, MS
11:05-11:20AM	**DEBATE: Stems in Revision TKA** **Uncemented Diaphyseal Engaging Stems Are Easiest and Best** Steven J. MacDonald, MD, FRCSC **Cemented Stems Are More Reliable** James A. Browne, MD
11:20-11:30AM	**PANEL DISCUSSION / AUDIENCE QUESTIONS** Panel: Matthew P. Abdel, MD, MS, William A. Jiranek, MD, David G. Lewallen, MD, Carsten Perka, MD
11:30-12:00PM	**S-11 Pre-Recorded Live Surgery: Balancing and Fixation Principles in Revision TKA** Surgeon: Thomas K. Fehring, MD Moderator: Douglas A. Dennis, MD

SESSION XVII-A CASE-BASED MINI-SESSION	Session Moderators: *1. Bryan D. Springer, MD* *2. Matthew S. Austin, MD*
12:00-12:04PM	**CASE PRESENTATION** Revision for Bone Loss/Loosening Presented by: Bryan D. Springer, MD Panel: Keith R. Berend, MD, Antonia F. Chen, MD, Douglas A. Dennis, MD, Christopher L. Peters, MD
12:04-12:08PM	**CASE PRESENTATION** Flexion Instability, Stiffness Presented by: Bryan D. Springer, MD Panel: Keith R. Berend, MD, Antonia F. Chen, MD, Douglas A. Dennis, MD, Christopher L. Peters, MD
12:08-12:12PM	**CASE PRESENTATION** Varus/Valgus Instability Presented by: Bryan D. Springer, MD Panel: Keith R. Berend, MD, Antonia F. Chen, MD, Douglas A. Dennis, MD, Christopher L. Peters, MD
12:12-12:16PM	**CASE PRESENTATION** Periprosthetic Fracture Presented by: Bryan D. Springer, MD Panel: Keith R. Berend, MD, Antonia F. Chen, MD, Douglas A. Dennis, MD, Christopher L. Peters, MD
12:16-12:30PM	**AUDIENCE QUESTIONS FROM THE DAY; BEST QUESTION OF THE DAY AWARD** Moderators: Adolph V. Lombardi, Jr., MD • William J. Maloney, III, MD Panel: Keith R. Berend, MD, Antonia F. Chen, MD, Douglas A. Dennis, MD, Christopher L. Peters, MD
12:30PM	**Closing Remarks and Adjourn** Daniel J. Berry, MD

SESSION I: OUTPATIENT SURGERY

DEBATE: Outpatient Surgery

Strict Patient Selection Criteria

R. Michael Meneghini, MD

TAKE HOME KEY POINTS:

- Due to COVID-19 and other factors related to government regulations, patients who are older and with substantial medical co-morbidities are now able to undergo total hip and knee arthroplasty in the outpatient setting, including same day discharge from a free-standing ambulatory surgery center
- Over the past few years, many surgeons and institutions have performed large numbers of outpatient same day discharge with "general selection criteria"; however, we do not have data to support proper patient selection of older and higher risk patients and existing tools such as ASA are too rudimentary and were never designed to select patients for outpatient TJA surgery
- Orthopaedic surgeons do not have the experience or skills in medical science to appropriately risk stratify higher risk patients from a medical perspective. Rather, experts in medicine or perioperative medicine, should be involved in developing strict selection criteria until we have more data to guide us safely through this transition from inpatient to outpatient setting for hip and knee arthroplasty.
- **Strict patient selection criteria provide surgeons and patients the assurance of safety backed by scientific algorithms that are data-driven.**

General Criteria, But No Strict Checklist

Adolph V. Lombardi, Jr., MD, FACS

TAKE HOME KEY POINTS:

- We follow a simple algorithm at JIS Orthopedics: 1) Does the patient have an ongoing medical issue that cannot be optimized? If yes, postpone surgery until medically optimized. If no, 2) Does the patient have an organ failure? If yes, patient is not a candidate for outpatient surgery, and if medically stable, surgery should be performed at a hospital and the patient observed for 23 hours. If no, 3) Does the patient have adequate support upon discharge? If no, consider surgery at hospital. If yes, surgery can be performed safely as an outpatient
- Develop a system that helps you determine who is a candidate for outpatient TJA
- Verify the patient's insurance benefits to identify those with and without benefits to cover surgery in your Ambulatory Surgery Center
- The 10 elements of success
- Orthopedic assessment
- Medical optimization versus "clearance"

Continued...

- Location of Surgery: Ambulatory Surgery Center vs. Orthopedic Specialty Hospital vs. Full Service Hospital
- Review of JIS Orthopedics outpatient arthroplasty experience to date
- What have I learned?
- The joint reconstruction team must understand that you are operating on a healthy patient
- Outpatient TJA pros: Huge proportion of patients are eligible, complications and readmissions are low, we have 98% good/excellent patient satisfaction, outpatient TJA is scalable and applicable, and beneficial for all stakeholders.

Outpatient Surgery: Pregame – Choosing the Patient, Getting the Patient Ready

William G. Hamilton, MD

SUMMARY:

- **Choosing the patient:** Successful outpatient total joint replacement depends on proper preparation. Initially, should appropriately select your patients to successfully discharge home on the day of surgery. I contend that there are a now only a few criteria that I use to determine if a patient will go home or stay overnight following surgery:
  1. Does the patient want to go home? If they (or family) are adamant about staying the night, they stay the night.
  2. Does the patient have a safe environment and the support to go home? It's strongly preferable to have home support (family or friend) who can assist during the early recovery.
  3. Does the patient have a medical condition that requires in-hospital care. These are less common but include conditions that pose a danger to patients such as:
     a. High Fall risk: deconditioning, imbalance, orthostasis, delirium, etc; conditions that put patient at high risk for falling
     b. Compromise of airway- obstructive sleep apnea (untreated), Pulmonary dz causing poor oxygenation, excessive somnolence
     c. Medical condition that requires acute monitoring- rapid afib, renal failure requiring dialysis, brittle diabetes requiring constant glucose monitoring or insulin drips, etc
- **Getting the patient ready:** Ideally the patient is prepared with all the education and equipment before they come to the facility. This allows for smooth transition to home. Checklist includes:
  1. Patient education – what to expect throughout surgical process. Eliminating surprises and explaining the process helps reduce anxiety
  2. Equipment – Anything that patient needs postop should be procured preop and tested and practiced – walker/crutches/cane, ice machine, reachers/grabbers, high toilet seats, etc
  3. Medication prescriptions – send all prescriptions electronically to pharmacy in advance of surgery so they have been picked up prior to coming to facility
  4. Exercise and activity – Have patients practice exercises to learn how to do them and start to condition muscles. Practice stairs, in/out of vehicles
  5. Schedule PT or sign up for patient engagement apps
  6. Make sure patient knows how they are getting to and from facility

Outpatient Surgery: In the OR – Tips on Anesthesia, Instrumentation Choice, Problem Solving

Keith R. Berend, MD

SUMMARY:

Day of Surgery: Preoperative, Medications:

- Cefazolin IVPB (weight based)
  - Give 2 gm if patient weighs <100 kg
  - Give 3 gm if patient weighs >101 kg
- If allergic to PCN (true allergy)
  - Give Clindamycin 600mg if patient <80 kg
  - Give Clindamycin 900 mg if patient > 100kg
- Scopolamine 1.5 mg patient transdermally (hold for history of BPH, glaucoma, or greater than 70 years of age) per anesthesia
- Midazolam 1mg/1ml IVP titrated to maximum of 5 mg pre block
- Beta Blocker if indicated
- Decadron 10mg IV
- Celebrex 400mg PO x1 unless CR>1.3 and if not allergic to NSAIDS
- Acetaminophen 1gm PO x 1
- Tranexamic acid 1300mg PO within 2 hours of incision

Day of Surgery: Preoperative, Nursing

- Initiate LR IV, may utilize Lidocaine intradermally
- Elastic stocking-thigh high - to unaffected extremity preoperatively
- Sequential compression device - to unaffected extremity preoperatively
- Clip one hand breath above and below the operative knee for TKR or pelvic bone iliac crest down to mid thigh
- Chlorhexadine wipe to surgical site after clipping

Continued...

Day of Surgery: Preoperative, Regional Anesthesia: THA / TKA

- Performed in the preoperative area
- Patient receives Midazolam for sedation
- THA: Spinal is placed utilizing Chloroprocaine 55mg
- TKA: Adductor canal block utilizing 15-30ml 0.5% Ropivacaine and IPACK block utilizing 10-20ml 0.5% Ropivacaine
- Appropriate monitoring for conscious sedation

Day of Surgery: Preoperative, Operating Room

- Induction of Anesthesia with Propofol drip up to 150 mcg/kg/min
- Propofol and Midazolam agents of choice for maintenance of Anesthesia
- Anti-emetics
  - Ondansetron 8mg IV given 15 minutes before closure
  - 2000-2500ml of Lactated Ringers or Normal Saline throughout the perioperative period.

Day of Surgery: Intraoperative

- Nursing
  - Continue with mechanical sequential device
  - Skin prep with Iodine Povacrylex solution
- Pain Injection
  - Surgeon infiltrates surrounding surgical site
  - Medicare patients: Liposomal Bupivacaine (20ml 1.3%), Bupivacaine (25ml 0.5%) and Epinephrine (0.5ml of 1:1000)
  - Non-Medicare: Ropivacaine (60ml 0.5%) and Epinephrine (0.5ml of 1:1000)
- Skin Closure
  - Barbed suture, cyanoacrylate skin glue

Planning for the OR – Must Recognize Some Key Limitations to the ASC

- Not EVERY implant option is available
- Blood transfusions are not readily available
- DME options are not robust
- Physical therapists are not always there
- Transfers to advanced levels of care is not always easy
- Plan for these limitations

Continued...

Develop an Efficient Implant and Instrument Delivery System

- No Flash Sterilization
  - "Mini Bar" is the answer to gravity

Postoperative Team Approach – Anesthesia

- Fentanyl 25 – 150 mg IV severe pain
- Ketorolac 15 – 30 mg IV moderate pain

Complications

In spite of adhering to all best practices, know that complications may occur and have a procedural plan for handling medical emergencies. Required policy is to maintain a written transfer agreement with a Medicare-certified local hospital or, if there is no transfer agreement with a local hospital, all physicians on the medical staff will have admitting privileges at a Medicare-certified hospital. Procedure in the event of an emergency is as follows:

a) Alert the patient's family;
b) Initiate arrangements for transfer of patient,
c) Prepare the patient for transfer,
d) Instruct emergency team which entrance to use,
e) Call report to hospital, f) Copy medical record for transport with patient,
g) Send patient's belongings with patient or family,
h) Document all events associated with the transfer in the patient's medical records.

Detailed protocols, well-trained staff, a superb anesthesia team, and readily available general medical consultants ensure a rapid response and best possible outcomes for patients when unexpected complications occur.

Outpatient Surgery: Postgame Protocols for Patient Contact, Pain Management and Backup for Problems

Scott M. Sporer, MD

SUMMARY:

The incidence of outpatient surgery has continued to rise over the past decade and is projected to maintain this trajectory over the next decade. Outpatient elective total hip and knee replacement has been shown to be a safe and highly cost-effective alternative to traditional inpatient facilities. It is paramount that established protocols are established and followed in order to successfully achieve top decile quality outcomes and patient satisfaction scores.

The hours immediately following discharge from an ambulatory center have the potential to provoke anxiety for both the patient and the surgeon if well-established postoperative protocols have not been established. Patient communication with a consistent message is critical for any successful outpatient program. These postoperative protocols should include methods to manage patient contact, ensure adequate pain control and minimize the risk of common immediate postoperative complications.

Patients discharged the same day need to have a clear understanding of what the engagement with the medial team will look like over the first several weeks. Patient communication and education can occur on multiple platforms. These tools should be looked at as complimentary to one another rather than stand alone options. Web-based, smart phone application-based text messaging and printed materials are examples of patient education tools that can inform patients exactly what will happen the first few days after surgery. We also suggest a scheduled phone call on the first postoperative day. When patients are aware they will be hearing from the team less than 24 hours after surgery, they can compile their list of questions.

Postoperative pain control is often a concern for patients. Current multimodal approaches can minimize patient discomfort and as a result this is now rarely a patient concern in the first several days after surgery. Postoperative pain control is heavily dependent upon intraoperative pain management and anesthesia technique. Techniques should be used that minimize nausea/vomiting, prolonged lower extremity weakness, urinary retention, and drowsiness. Preoperatively, patients are given gabapentinoids, NSAIDS, Acetaminophen, Dexamethasone, and limited opioids. Regional anesthesia with a Lidocaine or Mepivicaine spinal is used for the shorter acting duration. Avoiding narcotics in the spinal will also minimize nausea and postoperative urinary retention. Tranexemic Acid (TXA) will also minimize blood loss, fluid shifts and can minimize postoperative hematoma formation and pain. A periarticular block consisting of Bupivicaine, Epinephrine, Clonidine and Ketoralac is use on both hips and knees. Patients are discharged home with Aspirin for DVT prophylaxis and an NSAID, Tylenol, Tramdol and 30 tablets of oxycodone. A single prescription for 30 pills is sufficient for most patients.

Continued...

Postoperative protocols should also be designed to minimize the most common complications resulting in readmission. These complications include hypotension, pain, nausea, and postoperative urinary retention. Hypotension, pain, and nausea are minimized used the above protocols. Postoperative urinary retention (POUR) can be minimized be avoiding the use of intrathecal narcotic or the routine use of a urinary catheter. Prophylactic Tamsulosin has not been shown to decrease the risk of POUR yet patients with prosthetic hypertrophy have been shown to be at an increased risk for this complication. Appropriate postoperative counseling is critical to ensure emergency room evaluation if they remain unable to void.

Outpatient Surgery Missteps: I Am Never Doing That Again!

Fares S. Haddad, MD (Res), FRCS (Orth)

TAKE HOME KEY POINTS:

- Outpatient surgery is increasing attractive to hip and knee surgeons, and to their patients.
- Patient screening and education are critical, and good communication and teamwork are at the heart of a successful outpatient surgery program. Patients must be optimized and they, and their family must understand the journey that they are embarking on. The entire team must be signed up to the process in order to avoid mixed messages.
- Our program started with UKA and progressed to THA and then onto TKA and some straightforward revision. Covid has been a strong catalyst for reducing inpatient bed usage for elective surgery. As the program expands there is a desire to push the boundaries / indications. This case presentation highlights the importance of psychosocial factors in outpatient surgery, and the need for the entire team to participate in the pathway.

Outpatient Surgery Missteps: Lessons Learned

Fred D. Cushner, MD

SUMMARY:

My biggest fear was fear itself. As a hospital-employed surgeon, I was quite comfortable with the status quo. Hospital is happy with my case volume. I am happy with patients rounded on by residents, PAs and fellows. Calls from patients were addressed by others. The lessons I learned are the following benefits of an ambulatory total joint program:

Benefits of ambulatory total joint program:

1. Many patients want to go home to recover from surgery
2. Efficiency
3. Increased surgical time options
4. Economic benefits
5. Can be done safely

The Gerard A. Engh, MD, Keynote Lecture
New Technologies to Follow Your Arthroplasty Patient Remotely: What's Out There?

Fares S. Haddad, MD (Res), FRCS (Orth)

SUMMARY:

The digital world was already in the process of taking over prior to Covid, and this process has been accelerated in every facet of life.

Our interactions with our patients will now change in that we will be doing more consultations and more interactions virtually. This will replace some pre-existing evaluations and interventions and will enhance others.

Sensors and new technologies are increasingly used throughout the pathway from pre-operative evaluation of patients, though to intraoperative monitoring of various parameters, and onto follow-up and rehabilitation after surgery. There are even sensors now within implants that will allow us to evaluate detailed information for that individual patient.

There is a new generation of sensors and devices that allow us to monitor patients. These can gain data from the patient or the environment and will allow us to look at activity profiles and to evaluate joint function remotely. In the most impressive scenarios, the patients can be evaluated remotely after major surgery and any untoward outcomes picked up early in order to bring appropriate patients back for face to face follow-up.

Monitoring patients is a complex interplay between those sensors/variable that they can use and the mobile devices and apps that interface with that and ultimate with the outcome measures that can be collected. As an example, our arthroplasty patients are encouraged to wear motion sensors that will capture activities of daily living including steps, range of motion and weight bearing time. We also measure their rehabilitation compliance. From a patient perspective there are different elements of benefit that can be gleamed from these devices in terms of patient engagement and self-motivation and indeed self-understanding. We can build a patient profile and patients themselves can monitor what they are doing and learn from it.

There is a hierarchy of types of sensors and the measurements that they can pick up. Commercially available options can provide a versatile way of looking at gait / function / activity levels and will allow the patients to link-in to their treating units by smartphones or computers so that they can interchange information with their doctors / hospitals. The most obvious use is patient monitoring, the avoidance of face to face appointments and facilitation or replacement of face to face physiotherapy.

Ultimately these technologies will use sensors to allow both acute phase monitoring and subsequent recovery and allow us to evaluate the patient's journey and to target those patients who need more intervention and to look at outcomes more critically.

Continued...

Digital patient engagement platforms will ultimately fail or succeed based on whether they can avoid costs to the healthcare system by limiting hospital visits, physical therapy needs and/or complications. Some studies have already demonstrated a significant reduction in 90-day costs. A smartwatch with a self-directed rehabilitation programme has already been shown to be equivalent to traditional physiotherapy with no ill effects as a result of that. This technology could ultimately help us by decreasing post-operative costs improving, patient engagement and compliance and aiding communication with the healthcare team.

In due course the data from sensors and apps will be managed with automated data analytics / artificial intelligence and streamline and facilitate the interaction with carers and hospitals. We are going to have a great deal of data That data will undoubtedly be useful for some patients and less useful for others. Integrating that data into day to day care and providing software analytics that can help patients in an automated way, will turn this into a useful tool.

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SESSION II: PRIMARY TKA: ALIGNMENT AND BALANCING

Understanding the Terms and the Implications: Kinematic vs Mechanical vs Functional vs Anatomical Alignment; Gap Balancing vs Measured Resection

Simon W. Young, MD, FRACS

SUMMARY:

- During the early development of TKA, priority was given to achieving neutral mechanical alignment of the prosthetic joint
- Femoral and tibial components were therefore implanted perpendicular to the mechanical axis of the limb
- As lack of durability was the main problem with early TKA, it was believe a neutral mechanical axis would reduce shear and bending forces and improve implant longevity
- However, this approach differs from the anatomy of the native joint, and does not account for individual patient variability
- Mismatches between prosthetic and native joint kinematics can impair soft tissue balance, and potentially affect clinical outcome.
- Literature tends to focus on coronal alignment and femoral component rotation; tibial rotation and sagittal alignment (tibial slope and femoral component flexion) are less well studied
- Alternative targets for implantation aim to harmonise the relationship between individual patient alignment and soft tissue balance
- Several such techniques have been described, and the need for some standardization in the language used to describe them.

Native knee alignment

- There is significant individual variation
- Average coronal alignment is neutral to slight varus (0° to 4°)
- The native knee has a small valgus alignment of the distal femur (0° to 4°) and a slight varus alignment of the proximal tibia (1° to 5°)
- Native varus alignment is associated with subsequent development and progression of osteoarthritis; it is unclear what degree of variation from 'average' alignment might be considered abnormal or pathological

Continued...

Mechanical alignment

- Mechanical alignment. Femoral and tibial components are implanted perpendicular to the mechanical axis of the limb, with the aim of achieving a neutral overall alignment
- Femoral rotational targets are defined by reference to the flexion gap (gap-balancing technique) or femoral anatomy (measured resection technique).

Anatomical alignment

- This technique aims to reproduce the 'average' knee joint line obliquity, typically using a measured resection technique.
- Component positioning is 3° of femoral valgus and 3° of tibial varus, with femoral component rotation aligned to the posterior condylar axis (PCA)
- Early in the development of TKA the technique was criticized due to the technical difficulty in performing the 3° varus tibia cut in a precise and reproducible way

Kinematic alignment

- This technique aims to reproduce the anatomy of a patient's native knee
- It has been described using manual instrumentation with calipers, patient specific cutting blocks with preop MRI, and navigation/robotic systems
- It aims for 'symmetrical' resections of the medial and lateral femoral condyles, and medial and lateral tibial plateaus, after compensating for wear, thus typically ustilises a measured resection technique.
- Tibial slope is matched to the patient's native slope, the axial rotation of the femur is set to the PCA
- What constitutes safe 'boundaries' for kinematic alignment parameters is unclear. While long term results of KA are not yet known, mid-term studies do not show a higher failure rate

Functional Alignment

- Advanced computer navigation and robotic-assisted TKA allow intra-operative assessment of component alignment, resections thickness, and joint gaps
- Initial component positioning may be according to Mechanical or Kinematic alignment principles
- Adjustments to component alignment can be made virtually, aiming to optimize soft tissue balancing before bony cuts are made – so called 'bony balancing'
- These techniques combine elements of gap balancing and measured resection, aimoing to minimize the need for soft tissue releases
- The additional precision of advanced navigation/robotic systems may allow non-neutral alignment targets to be achieved more reproducibly

Continued...

- 'Safe' boundaries within which alignment adjustments can be made are still to be determined; Coronal boundaries of 0° +/- 3° for 'adjusted' mechanical alignment with bony balancing are commonly described.
- For Functional alignment with a Kinematic start point, tibial coronal boundaries of 6°varus to 3° valgus, and femoral alignment of 3° varus to 6° valgus have been proposed
- Terms such as 'Personalised alignment' and 'Patient specific alignment' describe similar techniques, with terminology often aligned to a specific robotic or navigation system
- Controversies include: what constitutes 'safe' boundaries; whether 'starting' component position should be kinematic (matching individual patient anatomy) or in mechanical alignment; whether femoral or tibial component adjustments should be prioritised to achieve balanced gaps; and what constitutes and an 'ideal' gap 'balance.

Recommended Reading: Oussedik, S., Abdel, M. P., Victor, J., Pagnano, M. W., & Haddad, F. S. (2020). Alignment in total knee arthroplasty. *The Bone & Joint Journal*, 102-B(3), 276–279.

My Top 5 Technical Tips for a Better Primary TKA

Christopher A.F. Dodd, MD

SUMMARY:

Clearly there are many important technical tips to performing a better primary TKA. I perform both CR and PS implants and my 5 tips are important and can be used in both techniques.

Tip 1: Exposure

Adequate exposure is key and there is no place for MIS TKA. Use a medial Parapatellar approach and ensure there is adequate exposure particularly of the tibia.

Tip 2: Medial release

Part of the release is performed as part of the exposure. The MCL is a broad structure and selective release is key. Anterior release is required if the knee is tight principally in flexion whereas a posterior release is required if the gap is tight principally in extension. Bony reduction may be required if there is a severe deformity.

Tip 3: Lateral release

Unusual as occurs in 10% of cases. Iliotibial band and posterolateral structures are usually contracted and require selective release. Pie crusting technique using a laminar spreader and a 15-gauge knife work effectively. Try and preserve Popliteus.

Tip 4: Test for flexion stability

Mid flexion instability is a not uncommon cause of unhappy TKA patients. This is a dynamic phenomenon and stability should be tested at 90 degrees flexion with the patella relocated. Successively increasing the thickness of tibial inserts is required until sagittal stability is achieved.

Tip 5: Tibial component rotation

Tibial component mal-rotation is fundamental to patella tracking and can cause post operative pain and stiffness. Whilst there is no real consensus as to best the reference method, using 2 or more can optimize rotation. Aligning the component with the Anterior Tibial Crest (ATC) works predictably well as the first reference method and the correct rotation can be confirmed by assessment to Akagi's line.

DEBATE: Knee Alignment Targets

Kinematic/Anatomic Alignment has Real Advantages

Mark W. Pagnano, MD

Most discussions of alignment after TKA focus on defining "mal-alignment"; the prefix mal- is derived from Latin and refers to bad, abnormal or defective and thus by definition mal-alignment is bad, abnormal or defective alignment. No one then wants a "mal-aligned" knee. The intellectually curious, however, might switch the focus to the other end of the spectrum and ask what does an ideally aligned knee look like in 2021? Is there really one simple target value for alignment in all patients undergoing TKA? Is that target broad (zero +/-3 degrees mechanical axis) or is it a narrow target in which a penalty, in regard to durability or function, is incurred as soon as you deviate even 1 degree? Is that ideal target the same if we are evaluating the functional performance of the TKA versus the durability of the TKA or could there be 2 different targets, one that maximizes function and one that maximizes durability? Is that target adequately described by a single 2-dimensional value (varus/valgus alignment in the frontal plane) as measured on a static radiograph? Is that value the same if the patient has a fixed pelvic obliquity, a varus thrust in the contralateral knee or an abnormal foot progression angle?

It is revealing to ask "do we understand TKA alignment better in 2021 than in 1979…?" Maybe not. We allowed ourselves over the past 2 decades to be intellectually complacent in regard to questions of ideal alignment after TKA. The constraints on accuracy imposed by our standard total knee instruments and the constraints on assessment imposed by 2-dimensional radiographs made broad, simple targets like a mechanical axis +/- 3 degrees reasonable starting points yet we have not further worked to verify if we can do better. It is naïve to think that the complex motion at the knee occurring in 6-dimensions over time can be reduced to a single static target value like a neutral mechanical axis and have strong predictive value in regard to the success or failure of an individual TKA. We assessed 399 knees of 3 different modern cemented designs at 15 years and found that factors other than mechanical axis alignment were more important than alignment in determining the 15 year survival.

Until more precise alignment targets can be identified for individual patients or sub-groups of patients then a neutral mechanical axis remains a reasonable surgical goal. However, the traditional description of TKA alignment as a dichotomous variable (aligned versus mal-aligned) defined around the broad, generic target value of 0 +/- 3 degrees relative to the mechanical axis is of little practical value in predicting the durability or function of modern TKA. Many surgeons have seemed to find reasonably safe ways to explore new, more anatomic alignment targets in 2021.

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Continued…

Show Me the Money: Where Is the Proof? Stick with Mechanical Alignment

Steven B. Haas, MD

Take Home Key Points:

Total knee arthroplasty has been shown to be highly successful and reproducible, with excellent long-term survivorship. The Australian registry shows 10-year revision rate of less than 5%. Numerous studies indicate 15 – 23 year survivorship rates of 91-97% survivorship. Long et al reported outcomes of active young patients at 30 years and showed a 70-80% survivorship with early implant designs performed with basic instrumentation.

Kinematic alignment was popularized by Stephen Howell. The technique seeks to align the patient's knee / limb in their pre-arthritic alignment regardless of its deviation from mechanically neutral alignment. Numerous studies have, however, shown that large deviations from mechanically neutral alignment, especially of the tibia, can lead to failure of the implant. Biomechanical studies also show significantly increased stress in the bone when large deviations occur. The few studies indicating good survivorship in ""mal-aligned" knees often have few patients beyond 1-2 degrees of "mal-alignment".

The clinical literature on kinematic alignment outcomes is mixed with numerous studies, including randomized trials, showing no difference and some showing small differences. In addition, many of the implants used in kinematically aligned knee result in internal rotation of the femoral implants. Internal rotation of the femoral implant places the trochlear groove in a suboptimal position for the patella. Some newer anatomic implant designs may avoid this.

Mechanically neutral alignment is the Gold Standard for TKA. Small (1-4) degree deviations are well tolerated. The kinematic alignment literature is mixed and does not clearly show increased satisfaction. Large deviations from mechanical alignment may increase long term failure.

Debate: Uncemented TKA

The Time Has Come for Uncemented TKA

Robert L. Barrack, MD

TAKE HOME KEY POINTS:

- Long-term fixation remains an issue with cemented TKA with revision rates five times higher in the young versus the old, and 3-5x higher in the obese.
- This is particularly a problem since the young and the obese are the largest growing portion of the total knee population.
- Studies comparing cementless versus cemented TKA showed that cementless out performs cemented TKA in the obese.
- RSA studies show that cementless knees are more stable at 5-10 years while cemented TKA has a disturbing percentage of late tibial migration.
- Fundamental issues with PMMA include the high degree of variability in cement properties, cement techniques, and the interaction between tibial component design and cement technique.
- Clusters of early failures of cemented TKA have occurred throughout the country particularly with the use of high viscosity cement.
- Cement is a problem with the patella components with recent MRI studies showing concerning rates loosening, avascular necrosis, and fragmentation.
- New technology that has enhanced cementless total knee replacement includes highly porous surfaces with 3-D printed titanium and optimized component designs that minimize micromotion.
- A level 1 RCT showed cementless TKA to have equivalent EBL and clinical outcomes at 4-6 weeks and 2-4 years with 13 min less operative time on average.
- Recent AJRR data reveals that cementless TKA outperformed cemented in the highest risk group, young males.
- When the cost of cement and accessories are considered cementless procedures actually are less in total than their cemented counterpart.
- This constellation of factors has resulted in exponential increase in the use of cementless TKA in the last 5 years and indicates that like THA, most (but not all) TKA's will be performed cementless, in the near future.

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The Cemented All-Poly Tibia: Regardless of Age or BMI

Robert T. Trousdale, MD

Background:

Total knee arthroplasty (TKA) overall is a very reliable, durable procedure. Biomechanical studies have suggested superior stress distribution in metal-backed tibial trays, however, these results have not been universally observed clinically. Currently there is a paucity of information examining the survival and outcomes of all polyethylene tibial components.

Methods:

We reviewed 31,939 patients undergoing a primary TKA over a 43-year period (1970-2013). There were 28,224 (88%) metal-backed and 3,715 (12%) all-polyethylene tibial components. The metal-backed and all-polyethylene groups had comparable demographics with respect to sex distribution (57% female for both) mean age (67 vs 71 years), and mean BMI (31.6 vs 31.1). Mean follow-up was 7 years (maximum 40 years).

Results:

The purpose of this investigation was to analyze the outcomes of all-polyethylene compared to metal backed components in TKA and to determine (1) is there a difference in overall survival? All-polyethylene tibial components had improved survivorship (P<0.0001) and metal backed tibias were at increased risk of revision (**HR** 3.41, P<0.0001). (2) Does body mass index (**BMI**) or age have an effect on survival of all-polyethylene compared to metal-backed tibial components? All-polyethylene tibias had improved survival (P<0.01) in all ages groups except in patients 85 years or greater, where there was no difference (P=0.16). All-polyethylene tibial components had improved survival (P<0.005) for all BMI's except in the morbidly obese (BMI 40) where there was no difference (P=0.20). (3) Is there an increased risk of postoperative infection? Metal backed tibial components were found to have an increased risk of infection (**HR** 1.60, *P=0.003*). (4) Is there a difference in the rate of reoperation and postoperative complications? Metal backed tibial components were found to have an increased risk of reoperation (**HR** 1.84, P<0.0001).

Conclusions:

The use of all-polyethylene tibias should be considered for the majority of patients, regardless of age and BMI.

SESSION III: KNEE KINEMATICS AND IMPLANT CHOICE: WHAT IS BEST IN 2021?

DEBATE: Best Implant Choice for Routine TKA in a Patient Like This

I Would Do a Posterior Cruciate Retaining TKA: Why It Is Better and Other Choices Worse

William A. Jiranek, MD

TAKE HOME KEY POINTS:

1. CR is less work: you don't have to cut out a box
2. CR is more bone preserving, and less risky to the femur (periprosthetic fracture)
3. CR is more stable in the coronal plane –particularly in flexion
4. CR is more durable – long term (15 yrs or >) results show a reduced revision rate
5. CR doesn't risk patella clunk
6. CR doesn't have a post which can wear, deform, break, or dislocate
7. But if you choose cruciate retaining design – you have to retain the cruciate! Protect it from the saw!

I Would Do a Posterior Stabilized TKA with CAM/Post: Why It Is Better and Other Choices Worse

Giles R. Scuderi, MD

TAKE HOME KEY POINTS:

- Posterior stabilized designs have reported improved and reproducible results; with consistent femoral roll-back and axial rotation, overall stability and improvement in post-operative knee range of motion.
- When implanted with appropriate gap balancing, the occurrence of flexion instability is less frequent with a posterior stabilized TKA when compared to other designs.
- The benefits of posterior stabilized TKA include ease of ligament balance; greater utility with various pathologic deformities; increased predictability in restoring knee kinematics; improved range of motion; and minimal tibial polyethylene wear with a more congruent articular surface.
- The interaction of the tibial spine and femoral cam mechanism maintains femoral rollback, provides flexion stability and restores normal knee kinematics. Fluoroscopic kinematic studies have shown AP femoral tibial translation similar to the normal knee.
- On the basis of the aforementioned advantages of posterior stabilized TKA, it is my belief that it is the prosthesis of choice for primary TKA. This is further supported by the marked increase in posterior stabilized TKA in the United States and around the world.

Continued...

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I would use a medially stabilized TKA: Why Its Better and Other Choices Worse

Andrew J. Shimmin, MD

TAKE HOME KEY POINTS:

1. The human knee is not a symmetrical structure
2. The medial and lateral sides of the native knee, look and behave differently
3. Both alignment AND implant GEOMETRY determine the kinematic outcome of a TKA
4. Medial stabilized TKA design in vivo show similar kinematics to the native knee with the medial and lateral sides of the knee behaving differently
5. Sagittal (Anterior-Posterior) stability is vital to a successful TKA
6. Medially stabilized TKA designs are the most sagittally stable and do not display paradoxical anterior translation
7. Published clinical results show excellent outcome with no comprise to ROM
8. Registry results reveal no increase in wear related failure and medially stabilized TKA designs are displaying some of the best results in major joint replacement registries

I Would Do an Ultra-Congruent TKA: Why It Is Better and Other Choices Worse

Aaron A. Hofmann, MD

The ultracongruent insert has been used since 1991 beginning with the Natural- Knee, then manufactured by Sulzermedica. It is posterior stabilizing with the 12 1/2 mm anterior build up with a significantly more congruent articulation. This translates to higher contact areas and theoretically lower wear. The higher central eminence provides medial lateral stability. This style insert is now available from at least seven different manufacturers.

The first study was reported in the 2000 Journal of Arthroplasty with Hofmann et al., comparing 100 ultracongruent inserts with 100 PCL sparing inserts with an average five-year follow-up. Knee scores and range of motion were similar or no dislocations or subluxations were noted. We found this bone sparing since there is no box cut and requires less time for surgery. This insert provided excellent stability in all ranges of motion.

Continued...

Indications for this surgery is deficiency or compromise of the PCL.

Contraindications are attenuation or absence of either one or both collateral ligaments where a more constrained device is suggested.

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SESSION IV: UNICOMPARTMENTAL ARTHRITIS

DEBATE: Uni vs Total for Predominantly Medial Compartment Disease

Unicompartmental Arthroplasty for This Patient

Keith R. Berend, MD

TAKE HOME KEY POINTS:

- Over the past two decades, the advantages of unicompartmental (UKA) over total knee arthroplasty (TKA) have become increasingly evident. Studies show that UKA provides better range of motion, a higher level of activity, and increased patient satisfaction compared with TKA.
- More Liberal Indications Advocated by Nuffield Orthopaedic Care Centre (Berend KR 2007)
  - Full thickness medial cartilage loss
  - Anterior disease with preserved posterior bone
  - Fully correctable, full thickness lateral cartilage
  - Intact ACL
  - Applying these more liberal indications, the percentage of patients with osteoarthritic knees who may be candidates for UKA is approximately 35%.
- Consensus Statement on Indications and Contraindications for Medial Unicompartmental Knee Arthroplasty (Berend KR et al. 2015) - Six surgeons with a combined experience of performing more than 8,000 partial knee arthroplasties were surveyed. Surgeons then participated in a discussion, emerging proposal, collaborative modification, and final consensus phase. The final consensus on primary indications and contraindications is presented.
  - Primary Indication: Anteromedial Osteoarthritis (AMOA) – is a bone-on-bone grade IV disease or >75% loss of medial compartment joint space and eburnated none on the medial femoral condyle and tibial plateau. A functionally intact lateral compartment is defined as <25% loss of joint space on stress radiographs, and visual exam of articular cartilage appears normal following medial arthrotomy.
  - Secondary Indication: Avascular Necrosis (AVN) – involving and isolated to the medial compartment is a secondary indication for medial UKA whether spontaneous or following previous surgical intervention.
  - No longer considered contraindications:
    - Obesity
    - Age
    - Patellofemoral disease
    - Chondrocalcinosis
  - Contraindications:
    - Inflammatory disease
    - Previous high tibial osteotomy
    - Anterior cruciate ligament deficiency

Continued...

Total Knee Arthroplasty for This Patient

Henry D. Clarke, MD

TAKE HOME KEY POINTS:

- Both UKA and TKA are appropriate choices for unicompartmental medial arthritis of the knee
- The debate is about the relative importance of complications, PROMS, and risk of reoperation
- Informed consent for any patient must consider these issues
- TKA has a modest increased risk of post-operative complications
- PROMs are slightly better after UKA (statistically significant but not clinically significant).
- Revision rates for UKA are 2-3X higher than for TKA: 25-30% vs 10% at 20 years
- High UKA revision rates are due to progression of disease and loosening, NOT unknown pain
- Revision of UKA to TKA produces outcomes similar to Revision TKA, not primary TKA
- Increased usage of UKA by an individual surgeon reduces their UKA revision rate but increases the risk of revision for TKAs that they perform
- In summary, UKA for medial unicompartmental knee arthritis is associated with slightly lower complications, similar PROMs, and a markedly higher risk of revision. Patients should be aware of the surgical options for unicompartmental DJD knee and make an informed decision

SESSION V: PRIMARY TKA: THE ROBOTS ARE COMING

KEYNOTE

Shopping for Robotic TKA Systems: What is Being Offered Out There? What Are the Pluses and Minuses of the main Features?

Jan Victor, MD

SUMMARY:

Robotics are part of the so-called assistive technologies for TKA. They are often considered as machines that can improve precision in complex surgery. Their potential however is much greater. They could help to predict the optimal surgical target for implant position for a given patient (improved accuracy), evaluate and improve stability of the joint, help protect the soft tissues and serve as a major data source. The systems that are covered in the presentation are Mako, Navio/ Cori, Omnibot, Rosa, Velys and TSolution. The following parameters are discussed for each system: image-based or image-less, control of execution of the cuts, boundary control, dependent gap analysis, footprint, brand restriction of implant and published outcomes.

DEBATE: Robotics in Hip and Knee Arthroplasty

A Wine Before its Time

R. Michael Meneghini, MD

TAKE HOME KEY POINTS:

- Robotic-assisted surgery is the latest expensive technology that lacks data-derived value and is prematurely driven by industry. For robotic assistance to provide value over less expensive advanced technology options like computer assistance, the exact component placement target must be known.
- Unfortunately, the peer-reviewed literature on robotic-assisted knee arthroplasty is replete with industry bias. In a recent meta-analysis of peer-reviewed studies on robotic-assisted knee arthroplasty, the authors reported that robotic-assisted manuscripts were more likely to be industry funded or be written by authors with financial conflicts of interest and published in less prestigious journals without an impact factor.
- Further, multiple recent non-biased meta-analyses have demonstrated that robotic assistance has not translated into improved functional or patient outcomes, as has been purported by the proponents of robotic assistance.
- As with all emerging technology, the potential downsides and increased risks associated with robotic assistance are now becoming known. Increased surgical time and surgical team stress is consistently observed during the "robotic learning curve" and has been reported to last the first 6 to 36 surgical cases. Potentially a sequela of increased operative time for robotic assistance, a recent study has also demonstrated an increased infection rate compared to manual knee arthroplasty with a hazard ratio of 3-5.5 depending on the comparison cohort.
- Finally, the post-COVID world mandates procedural efficiency to optimize access, as well as dramatic cost-containment to offset both the economic downturn and severe hospital losses from lack of profitable elective surgical procedures and bearing the financial burden of COVID-19 treatment. Robotic-assisted surgery for TKA provides negligible value in 2022 and for the foreseeable future, especially with the emergence of data suggesting increasing operative time and increase risk of early revision for infection.
- **While robotic-assisted surgery will certainly have a role in the future, currently and unfortunately, robotics for TKA remains an expensive industry, surgeon and hospital promoted marketing tool…clearly a "wine before its time"!**

Continued…

It Is Time Already

Robert L. Barrack, MD

TAKE HOME KEY POINTS:

- The major issue leading to suboptimal results in total joint arthroplasty is inconsistency in component placement.
- There is a substantial learning curve, results are better with high volume surgeons yet most procedures are performed by low volume surgeons.
- UKA is a prototype of this problem with 5-10 year results showing revision rates of 15-20% even in the hands of experienced surgeons.
- This data is consistent throughout numerous national registries outside of the US as well as the Medicare database and private insurance databases.
- Robotics solves the problem with inconsistency of component placement.
- This has resulted in much lower revision rates at major centers as well as in national datasets such as Pearl Diver.
- The same pattern has been seen in TKA where there is a striking percentage of outliers even among high volume surgeons with manual instruments.
- There is evidence that hitting multiple targets results in higher quality results in terms of patient reported outcomes as well as in lower revision rates.
- Robotic TKA is highly more accurate and eliminates almost all outliers.
- The same pattern is seen also with hip replacement which. Robotic cases achieve optimal cup position much more accurately including in complex spine deformity cases which are most prone to dislocation.
- A large scale study from HSS has shown a much lower dislocation rate for robotic THA compared to navigated or manual instrumented TKA.
- Manual instruments are crude and inaccurate resulting in inconsistency in component placement in the hands of most surgeons. This is largely avoidable with current generation robotics and it is therefore past time to consider adoption of robotic technology for total joint replacement.

SESSION VI: TECHNIQUES, TIPS, AND VIDEO TECHNIQUES

Previous Incisions: When Should You Be Worried? Methods to Avoid Trouble? What If There Are Problems?

Douglas A. Dennis, MD

SUMMARY:

Wound complications following a total knee arthroplasty (TKA) have a variable incidence of 16% to 22%. Risk factors of wound complications include patients receiving corticosteroids or high-dose nonsteroidal anti-inflammatory drugs as well as those that smoke tobacco. Additional risk factors include those with rheumatoid arthritis, malnutrition, burned or irradiated skin, multiple previous surgical incisions, or patients receiving chemotherapy. The best treatment is PREVENTION through proper choice of the skin incision, gentle handling of the soft tissues intraoperatively, and avoidance of excessive tension at wound closure. In patients in which a previous skin incision is present, utilization of the previous skin incision is generally recommended. It is usually safe to ignore previous short medial or lateral peripatellar skin incisions and to cross transverse incisions at a 90° angle. If long parallel skin incisions exist, choice of the lateral most skin incision is favorable to avoid a large lateral skin flap. Transcutaneous oxygen measurements, both before and after TKA, have demonstrated reduced oxygenation of the lateral skin region. In complex situations with multiple previous skin incisions and marked contracture of soft tissues, soft tissue expansion techniques can be utilized to mobilize the contracted soft tissues. Plastic surgery consultation is wise in complex cases, both for guidance on proper incision choice and determining if the risk of necrosis is high enough to merit rotation of a vascularized flap at the time of TKA. Early CPM greater than 40 degrees of flexion and performing a lateral retinacular release have been shown to further lessen transcutaneous oxygen levels. Lastly, it is critical to understand that the arterial supply to much of the anterior skin covering the knee travels via the subcutaneous fascia. If skin flap elevation is required, it is imperative that the flap be dissected in a subfascial fashion.

Complications which may occur include prolonged serous drainage, superficial necrosis, and full-thickness necrosis. Prolonged serous drainage, persisting beyond 5 to 7 days, often indicates the presence of a subcutaneous hematoma or large intra-articular hemarthrosis. Spontaneous cessation of drainage in these cases is unlikely, and surgical debridement is indicated. Small superficial necrotic areas may heal with local wound care or delayed secondary closure. Necrotic areas greater than 3 cm often merit additional soft tissue coverage procedures (split-thickness skin grafting or fascio-cutaneous flaps). Full-thickness necrosis is usually associated with exposed prosthetic components, and requires

immediate, aggressive debridement. Secondary closure procedures are often unsuccessful and myocutaneous flap coverage is usually required. The medial gastrocnemius myocutaneous flap is often preferred, due to its larger size and arc of rotation and excellent coverage of the prepatellar region of the knee. Free myocutaneous flaps are rarely required, typically only in cases with massive soft tissue necrosis.

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Retained Hardware: Tips and Tricks

George J. Haidukewych, MD

SUMMARY:

Fractures around the knee are commonly treated with internal fixation, and many will progress to post traumatic DJD requiring TKA. Effective treatment strategies to deal with retained hardware are important to avoid complications.

Preoperatively, rule out infection with labs and selected aspirations. Obtain high quality imaging, CT if necessary to determine status of fracture healing and presence of any bony defects or malunion.

Position the patient on a radiolucent table and have C ARM available to locate hardware. A sterile tourniquet may be necessary for longer femoral plates or retrograde nails.

Have a high-speed metal cutting burr and a broken screw removal set available.. Having hardware specific extraction tools, i.e. screwdrivers and nail extraction cones can be a time saver.

Decide whether to ignore, remove some, or whether remove all of the hardware. If multiple incisions or extensive dissection is needed to remove hardware, consider a staged approach to allow soft tissue recovery before TKA. In my practice, 6-12 weeks is a reasonable time frame, but this depends on the extent of the incisions and the patient's healing potential.

Be prepared to handle bony defects, malalignment, and unpredictable ligament stability after hardware removal and prepare for a "revision-like" primary TKA.

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Extra-Articular Deformity: Technical Elements

Arun B. Mullaji, MD

SUMMARY:

Extra-articular deformities (EAD) in the femur, tibia or both bones can pose a substantial technical challenge during TKA. In this presentation, the approach to managing them will be presented in 5 steps.

Step1: Extra-articular deformities are often seen and must be actively sought. Recent studies have shown that not all limbs are straight and have similar femoro-tibial morphology. In fact there are 7 distinct phenotypes of varus osteoarthritic knees and type 3 which is EAD is seen in 41% knees. 9 distinct phenotypes of valgus knees have been shown, and type 3 (EAD) is seen in 35% knees.

Step 2: Imaging is critical, and this includes full-length scanograms to show both hips, knees and ankles in the weightbearing position. A CT scan may be requested for suspected rotational or torsional deformities especially post-trauma and post-osteotomy.

Step 3: Decide surgeon/patient preferences regarding alignment philosophy (classical mechanical/anatomical, kinematic, or variations of these), whether one would prefer soft-tissue balancing vs use of constrained designs, which tools are to be used - conventional/CAS/PSI, and whether the correction of EAD should be done concomitantly with TKA in the same sitting, or should precede it several months beforehand, i.e., in 1 or 2 stages. Examples of EAD will be illustrated based on the author's preferences.

Step 4: Initial assessment whether correction is likely to be required only intra-articularly (IA) or extra-articularly (EA). This is done by planning the femoral and tibial resection lines and the resultant divergence angle (DA) based on one's alignment goals. A very large DA may lead to possible damage to collateral ligament insertions and require very large release to balance the extension gap. These would likely require EA correction.

Step 5: Intra-operative assessment of IA *vs* EA: This is done by applying stress in the opposite direction to the deformity after resection of menisci, cruciates, osteophytes. The residual coronal deformity or DA are determined: if mild, with a standard exposure, and osteophyte excision correction and balance are achieved in most cases; valgus knees may require ITB release. If moderate, reduction osteotomy, posterior capsular release, upsizing/posteriorizing the femoral component, and sliding epicondylar osteotomy, may be required. If severe, closed-wedge meta/diaphyseal osteotomy may be required, followed by fixation with stem, IM Nail, plate, and a same-stage TKA.

Continued...

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Preoperative Flexion Contracture: Technical Tips

Adolph V. Lombardi, Jr., MD, FACS

SUMMARY:

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 pre-arthroplasty 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

Continued...

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 contracture 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.

Residual Flexion Contracture: Inability to achieve ROM after TKA represents a frustrating complication for both patient and surgeon. Non-operative treatments for the stiff TKA include shoe lift in contralateral limb, stationary bicycle with elevated seat position, extension bracing, topical application of hand-held instruments to areas of soft tissue-dysfunction by a trained physical therapist over several outpatient sessions, and use of a low load stretch device. Manipulation under anesthesia is indicated in patients after TKA having less than 90 degrees ROM after 6 weeks, with no progression or regression in ROM. Other operative treatments range from a downsizing exchange of the polyethylene bearing to revision with a constrained device and low-dose irradiation in cases of severe arthrofibrosis.

Continued...

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Previous ACL Surgery with Chronic Flexion Laxity

Giles R. Scuderi, MD

- Osteoarthritis after ACL reconstruction is common with symptoms necessitating TKA.
  - Rate higher than the uninjured population
  - Influencing factors include prior meniscetomy, cartilage injury and loss of motion.
- Surgical considerations
  - Prior surgical incisions
  - Patella baja may necessitate extensile exposure
  - Fixed coronal deformity may necessitate soft tissue release
    - Higher levels of constraint when instability present
  - Retained hardware may interfere with component position
  - Longer operative time
- Prior ACL reconstruction has no significant impact on the functional outcome of TKA, however complication rates may be higher.
  - Periprosthetic infection
  - Arthrofibrosis
  - Instability
  - Extensor mechanism dysfunction
    - Related to graft choice

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Most Valuable Knee Arthroplasty Paper

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2. Fred D. Cushner, MD: *JOA:* **The Effectiveness of Closed-Incision Negative-Pressure Therapy Versus Silver-Impregnated Dressings in Mitigating Surgical Site Complications in High-Risk Patients After Revision Knee Arthroplasty** https://www.arthroplastyjournal.org/article/S0883-5403(21)00236-9/fulltext
3. Antonia F. Chen, MD: *JBJS* **More predictable return of motor function with mepivacaine versus bupivacaine spinal anesthetic in total hip and total knee arthroplasty: a double-blinded, randomized clinical trial** https://jbjs.org/reader.php?id=206462&rsuite_id=2507313&native=1&source=The_Journal_of_Bone_and_Joint_Surgery/102/18/1609/abstract&topics=hp%2Bkn#info
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SESSION VII: CONTROVERSIES IN PRIMARY TKA AND THA

KEYNOTE

Biologics and Other Things You Can Inject Into a Knee Joint

Jay R. Lieberman, M.D.

The treatment goal of osteoarthritis of the knee is to eliminate pain, reduce inflammation and hopefully, induce a proliferation of mesenchymal stem cells which can promote chondrogenesis and cartilage repair. At the present time, there is no therapy that has definitively demonstrated the ability to consistently induce chondrogenesis and cartilage repair particularly if a large area of the knee joint is involved.

This talk will focus on agents that can be injected in the knee. However, more conservative treatment modalities such as anti-inflammatory agents, physical therapy and weight loss are critical elements of non-operative management. Agents that can be injected in the knee to treat OA include: corticosteroids, viscosupplementation (hyaluronic acid) and recently there is interest in using biologic therapies such as platelet rich plasma (PRP) and mesenchymal stem cells. Mesenchymal stem cell therapy can either be a bone marrow aspirate, stromal vascular fraction harvested from adipose tissue or adipose derived stem cells expanded in tissue culture (not approved for use in the United States). The hope is that these biologic agents will reduce the persistent inflammation and also induce cartilage repair in the knee.

Corticosteroids (CS) are frequently used to manage patients with knee pain. The data shows that CS can provide short term symptomatic pain relief. Recently, longer acting agents have become available and the hope is that these agents can provide more prolonged pain relief and be cost-effective.

The goal of viscosupplementation is to restore the physiologic viscoelasticity in the synovial fluid. Hyaluronic acids (HA) or a derivative are commonly used to treat knee OA. These agents are suppose to reduce pro-inflammatory cytokines such as PGE2 and NFkB and a variety of proteases. HA may be native or crosslinked and it may be of low or high molecular weight. The efficacy of HA has been variable in a variety of studies but more recent data (meta analysis) suggests that viscosupplementation is more effective than placebo in treating knee OA.

There is a great interest in the use of biologic agents such as platelet rich plasma (PRP) and mesenchymal stem cell therapies to treat knee OA. The biologic activity of PRP comes from the release of a variety of growth factors from degranulating platelets. PRP can be prepared in a number of different ways and this can impact the biologic activity. In a recent meta analysis of 43 randomized control trials Leukocyte poor – PRP (LP-PRP) was noted to provide more functional improvement than either adipose derived stem cells or bone marrow aspirate in the treatment of patients with knee OA.

Mesenchymal stem cells (MSCs) have been demonstrated to have immunomodulatory and anti-inflammatory activity. In the United States, these cells must be “minimally” manipulated and not culture expanded. There is a significant interest in using either concentrated bone marrow aspirate (BMAC) or adipose derived stem cells (ADSCs) to treat knee OA. In a systematic review of 8 studies BMAC was noted to lead to significant improvements in knee pain. The stromal vascular fraction which is generated from adipose tissue contains a variety of cell types including ADSCs, adventitial cells, fibroblasts, etc. Studies have demonstrated that injection of ADSCs into the knee can lead to improvements in pain and function.

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There is a great deal of excitement surrounding the potential of biologic agents to treat knee OA. The hope is not only to provide short term pain relief but to promote chondrogenesis and actually reverse the cartilage deterioration. It is essential that future studies provide detailed protocols related to preparation of these agents (i.e. number of centrifuge spins, duration of spins) and the volume of cells used to treat the knee OA. In addition, RCTs need to carefully delineate the population being studied and the outcome measures must be appropriate. The study duration must also be long enough to determine if disease modification has occurred.

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DEBATE: Use Dual Mobility in All High-Risk THA Patients

Absolutely Yes, Why Risk the Grief

Rafael J. Sierra, MD

TAKE HOME KEY POINTS:

- AJRR 2021 report: Instability second most common reason for revision THA.
- Extensive literature demonstrating dual mobility components decrease dislocation rates after primary but particularly revision THA.
- Dual mobility use is on the rise: AJRR 2021:
  - 10.2% of Primary THA. Similar use throughout age groups (8 to 9%)
  - Younger than 50 increased.
- Dual mobility is particularly attractive in high risk patients: Spine disease or previous fusion, neuromuscular disorders, abductor insufficiency, or preoperative diagnosis of femoral neck fracture.
- Approach used is a modifiable risk factor under the surgeons control to decrease dislocation rates. Anterior based approach have lowest risk of dislocation compared to posterior based approaches. High risk patients, especially with previous spine pathology are still at risk of dislocation with the DAA.
- Selected previous studies on high risk patients:
  - Kaiser et al: DA or direct lateral in patients with abductor insufficiency, cognitive impairment and neuromuscular insufficiency. 0 dislocations at 2 years.
  - Luthra et al : 30 patients identified as high risk. 0 dislocations in their DM THA cohort at a mean of five years follow-up
  - Harwin et al 249 patients at high risk for dislocation: two patients revised none for instability.
  - Jones et al: 151 High risk patients posterolateral approach. 1 dislocation.
- Concerns:
  - Majority of data available for monoblock dual mobility. Mayo series of modular dual mobility 10/695= 1.4%.
  - Monoblock dual mobility not the same as modular dual mobility
    - Liner malseating
    - Corrosion
    - Neck impingement
  - AJRR 2021 shows higher rate of revision of modular dual mobility vs standard heads: "Association and not causal relationship, not account for patient cofounders"
- Recommendations:
  - Balance the hip with standard head and liner, check for impingement free ROM, restoring leg length and offset.
  - Subsequent incorporation of dual mobility liner and head for additional stability

Continued...

Absolutely Not, Are You Kidding?

Stephen B. Murphy, MD

SUMMARY:

Complex primary total hip arthroplasty can and should be treated without using dual-mobility components. Evidence is clear that modern ceramic-on-polyethylene bearings are highly successful. These articulations have larger bearing diameters than ever before and the implant-implant impingement-free range of motion is greater than the normal native hip joint. Back-side wear on the cup side and corrosion on the head taper side are so well addressed now that constructs can easily last several decades or more. Even hips with spine fusions above and neuromuscular imbalance can be reliably treated with proper total hip arthroplasty now that soft-tissue preserving surgical techniques and technologies allowing for accurate and patient-individualized complent placement are available.

By contrast, dual mobility constructs are well-known to be unnecessarily complex with additional bearing interfaces and larger bearing surface areas. Corrosion and locking mechanism problems occur now again which are problems that have largely been solved with proper total hip arthroplasty and the use of CoCr has been eliminated from total hip arthroplasty constructs. Even non-CoCr alloy substitutes have very limited track record and concerns remain about material behavior if fretting occurs through oxidized diffusion later. Finally, dislocation of a dual mobility construct requires revision surgery whereas most THR dislocations are non-recurrent and can be managed with closed reduction. Dual Mobility use should largely remain firmly in cases of salvage revision THR alongside constrained liners when no addressable issue can be identified.

The Charles A. Engh, M.D. Keynote Lecture
Understanding the Hip-Spine Relationship – And Does it Matter?

Matthew P. Abdel, M.D.

SUMMARY:

Dislocation after primary total hip arthroplasty (THA) is a dramatic and disconcerting problem for the patient and surgeon alike. Multiple series have indicated a contemporary prevalence of 2 – 4%. However, recent data indicate that the contemporary prevalence of dislocation is up to 5-10 fold greater in those patients with spinal deformities that lead to stiffness and/or significant pelvic tilt. As such, the dislocation risk approaches that of revision THAs, making it one of the most common complications after primary THAs in this subset of patients.

The interplay between the hip and spine is complex, dynamic, and changes over the lifetime of a patient. In addition, the interplay is not fully understood. When considering a THA in a patient with a spinal deformity, there are three main considerations. Foremost, the surgeon needs to understand if the deformity is stiff or flexible. Thereafter, it is important to understand if the patient has lumbar lordosis or flat-back deformity. Finally, it is important to fundamentally understand the neuromuscular control patients have over their spine and hip.

The above three considerations allow for individualized assessment of pelvic tilt and spinal stiffness in each patient. In general, when patients have anterior pelvic tilt due to their spinal deformity, the surgeon may consider increased acetabular anteversion at the time of THA. This is particularly true if the patient has a stiff spine. On the other hand, if the patient has posterior pelvic tilt, their targeted anteversion target at the time of THA should be decreased, particularly if they have a flexible spine. However, if a patient has a stiff spine, and posterior pelvic tilt, then standard anteversion targets should be applied.

The natural question then arises- is that enough to mitigate the risk of the dislocation? The clear answer is no for several reasons. Foremost, the above oversimplified algorithm ignores the fact that changes to the spine occur over time. Patients can develop deformities later in life, and may indeed have instrumented and non-instrumented fusions well after they have a THA. Second, it is impossible to predict the innumerable activities that patients participate in, and thus the innumerable combinations of hip positions. Next, we have no way to accurately, reliability, and efficiently determine the true neuromuscular control patients have over their hips when participating in dynamic activities. Finally, there are several factors that influence hip stability including surgical approach, soft-tissue tensioning, impingement, abductor status, and component positioning. Nevertheless, current literature has yet to elucidate which parameters are most deterministic.

Continued...

Given the above, several have proposed the expanded use of dual-mobility constructs at the time of index THA in the subset of patients who have stiff spines either due to pathologic processes or surgical fusions (whether instrumented or non-instrumented). The main benefits of a dual-mobility construct are two-fold. First, a larger effective head size is achieved, improving the head-neck ratio and thus minimizing the risk of dislocation. Second, the dual articulations allow a greater overall range of motion prior to impingement and dislocation. While these benefits of dual-mobility constructs certainly help mitigate the risk of dislocation, pristine surgical technique, accurate acetabular component positioning, and refined femoral component positioning all remain essential.

In summary, the relationship between the hip and spine is one of the single timeliest topics in the field of hip arthroplasty. Without question, there is a complex interplay that is dependent on the stiffness of patient's spine, the direction and amount of pelvic tilt, and the dynamic positions patients place their hips in during routine activities of daily living. I suspect that over the next several years, we will see an explosion in the understanding of the hip-spine interplay.

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DEBATE: Hard-on-Hard Surfaces are Dead in THA

Yes, Dead as a Door Nail

William J. Maloney, III, MD

The osteolysis seen around cemented devices that lead to cemented socket loosening was felt to be secondary to cement and thus the term cement disease. Cementless implants gained popularity rapidly with cementless sockets predominating by the late 1980s. We first reported osteolysis around stable cemented and cementless hip replacements in the early 1990s. By the mid -1990s, osteolysis around well fixed cementless components was the most common problem leading to the need for revision hip surgery. It soon became evident that the osteolytic process was driven by a foreign body reaction to sub-micron polyethylene particles and that a better articulation was needed.

Industry and academic research labs worked to develop low wear bearing surfaces. By the late 1990's, the FDA approved in the USA three new bearing surfaces. These included ceramic on ceramic which had been introduced into the USA in the 1980s and was removed from the market because of the high failure rates of the Mittlemeier THAs, metal on metal and highly cross-linked polyethylene manufactured by several companies.

The race was on. By 2008, approximately 35% of the total hip replacements in the USA were metal on metal, 15% ceramic on ceramic and 50% metal on highly cross-linked polyethylene. Multiple studies demonstrated low wear of the highly cross-linked polyethylene validating the laboratory wear studies. Clinical studies showed that the reduction in wear lead to a reduction in osteolysis. Now more than 20 years later I have yet to see a single case of periprosthetic osteolysis attributed to wear of the new polyethylene. In a large registry study using the Australian Registry data, the revision burden was reduced from about 18% at 16 years to about 6%. Metal-on-metal articulations did not fare as well. Adverse local tissue reactions often referred to as pseudotumors were attributed to wear of these articulations and lead to the withdrawal of large head metal on metal total hip replacements in the United States. Although ceramic on ceramic hip replacements performed relatively well in the IDE studies, concerns over fracture, squeaking and cost limited their adoption.

The race that started in the 1990's is over. Highly crosslinked polyethylene is the clear winner. This material is relatively insensitive to head size and clearly more forgiving than hard bearings. Hard bearings in total hip are dead – dead as a door nail!!

NO!! Still Alive with Good Indications

Douglas A. Dennis, MD

TAKE HOME KEY POINTS:

- Agree that large head MOM THA is deader than a doornail. Other hard-on-hard designs have performed very well in selected patient cohorts.
  - Ceramic-on-Ceramic (CoC) and Hip Resurfacing Arthroplasty (HRA)
- Mean age of THA is dropping. Highly cross-linked polyethylene works well out to 20 years. Will it perform well in younger, active subjects with life expectancies greater than 30 years? How about in the young athlete who wants to ski or run marathons?

Continued...

- Ceramic-on-Ceramic THA
  - Dramatic improvements in ceramic quality and CoC THA design features over the last five decades.
  - Many previous CoC THA complications (fracture, squeaking) are associated with inferior precision of implantation.
  - Preoperative spinopelvic evaluation to determine the ideal functional cup position should lessen prosthetic impingement and improve results of al Hard-on-Hard bearings.
  - Advantages include a lower wetting angle, better lubricity, and substantially lower wear rates. The extreme hardness of ceramic materials resists scratching and third body wear. Ceramic microparticulate is much more bioinert than polyethylene microparticulate. Studies show 8-10 times less inflammatory cytokine production from exposure to ceramic than polyethylene microparticulate[1].
  - Ceramic surfaces are more resistant to bacterial adhesion and biofilm. Some studies suggest lower infection rates in CoC THA[2].
  - CoC THA design is critical to obtain superior results (use of Biolox Delta material, larger head diameter [32/36mm], liner taper angle of 18°, and lesser femoral neck geometry).
  - Ceramic fracture rates are extremely low with Biolox Delta material (UK National Joint Registry: femoral head, 0.0009%; acetabular liner, 0.126%).
  - Published survivorship at 20 years is >99% in some reports[3].
- Hip Resurfacing Arthroplasty
  - Results overall inferior to THA. However, superior results reported in certain patient populations (young osteoarthritic males, cup size > 48mm, high activity levels).
  - 646 Birmingham HRA in osteoarthritic males less than 50 years: 99% 10-year survivorship[4].
  - Less proximal stress shielding than THA[5].
  - Less perceived leg length discrepancy, thigh pain, and limp with superior functional results[6].
  - Now available with Biolox Delta CoC bearing surfaces in some countries

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Confirm or Deny: Controversies in Total Hip and Total Knee Arthroplasty

Daniel J. Berry, MD

Panelists with confirm or deny a number of provocative statements related to the following topics and provide succinct evidence for their opinion:

- Perioperative management of primary TKA
- Perioperative management of primary THA
- Intraoperative management decisions in primary TKA
- Intraoperative management decisions in primary THA

SESSION VIII: COMPLEX PRIMARY THA: TECHNIQUES, TIPS, AND VIDEO TECHNIQUES

DDH Crowe 1-3: Strategy, Technique, Pitfalls

Christopher L. Peters, MD

SUMMARY:

Developmental dysplasia of the hip (DDH) is a recognized cause of secondary arthritis which may lead to eventual total hip arthroplasty (THA). We present the challenges associated with both acetabular and femoral morphologies when performing THA on the DDH patient population. Additionally, we report the common complications associated with this population. Given the deficiency of bone often encountered on the acetabular side, efforts to restore the anatomical hip center are often necessary. Common mistakes in placement of the acetabular component in the dysplastic hip include chasing the pseudoacetabulum, often resulting in an oversized cup place in a supero-lateral position. These mistakes often lead to challenges with fixation, stability, and restoration of appropriate hip biomechanics. On the femoral side, excess anteversion and high valgus neck angles can create nuanced challenges. The proper selection of either primary or modular stem designs may aid in the correction and restoration of appropriate femoral version and hip mechanics. In more severe dysplasia (Crowe III or IV), femoral shortening may be necessary in order to safely reduce the hip to the anatomic hip center. Contemporary bearing surface options offer improved wear resistance and may decrease complication rates. Complications may occur at a higher rate following THA for DDH, and have included aseptic loosening, hip instability, polyethylene wear, and intraoperative femoral fractures. Many of these complications may be mitigated with careful planning and surgical technique. Ultimately THA for DDH can yield outstanding results in this complex patient population.

Developmental Dysplasia of the Hip Crowe 4: Strategy, Technique, Pitfalls

Daniel J. Berry, MD

SUMMARY:

I. Introduction

Management of high dislocation has progressed substantially in the last decade. Most prefer to place the socket in an anatomic position and then shorten the femur to allow reduction of the hip and avoid excessive tension on the sciatic nerve. Shortening the femur through a subtrochanteric osteotomy has the benefits of maintaining a fairly normal femoral geometry and avoiding greater trochanteric osteotomy.

II. Technique

A. Careful preoperative planning is performed to estimate amount of shortening that will be required once the new hip center of rotation is established.

B. The hip is approached usually using a posterior approach. A femoral neck osteotomy is performed. Preliminary preparation of the femur is performed. A transverse subtrochanteric osteotomy (usually about 10 cm distal to tip of greater trochanter) is made allowing the proximal segment of the femur to be translocated anteriorly exposing the acetabulum. A small cup is placed in the native socket.

C. The femoral subtrochanteric osteotomy: An intercalary segment of bone of appropriate length (usually 4-5 cm) is removed. A transverse osteotomy configuration is simplest. Final femoral preparation is performed for stabilization of the osteotomy with the intramedullary implant. Rigid fixation of both the proximal and distal fragments and the implant must be obtained. With a transverse osteotomy an implant that achieves implant fixation in the proximal and distal bone fragments is preferred and a modular sleeve implant with distal flutes is particularly effective.

D. Details of the technique will be discussed during the presentation and are published in JBJS (see refs below). Furthermore, a very detailed illustrated technique is available in the book Illustrated Tips and Tricks in Hip and Knee Reconstruction (ref below).

E. Technique tips: (1) Prophylactic cerclage of proximal and distal segments. (2) Judge length of bone – resection based on preop plan and intraoperative findings. (3) Pay attention to sciatic nerve tension. (4) Don't underestimate challenges of cup fixation.

III. Results

A. Numerous centers have now reported favorable results of this technique. Nonunion and implant loosening rates have been modest, but the technique is technically challenging. Sciatic neuropathy is uncommon. Favorable functional results have been reported.

IV. Conclusions

A. Elegant technique

B. Preserves abductor attachments and proximal femoral anatomy

Continued...

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Acetabular Protrusio: Strategy, Technique, Pitfalls

Douglas E. Padgett, MD

SUMMARY:

Acetabular protrusio is defined by the femoral head being located medial to the ilioischial line. Protrusio acetabulae can be considered either primary (due to a developmental abnormality associated with the triradiate cartilage) or secondary due to a number of conditions including inflammatory diseases, traumatic conditions or metabolic conditions.

The signs and symptoms of protrusion include groin pain, limited range of motion and often secondary findings of hyperlordosis of the lumbar spine due to hip flexion contracture.

The goal of THA in the setting of protrusion is to ensure that the socket is sufficiently lateralized in order to improve the kinematics of the hip (avoiding bone impingement).

The key steps is accomplishing successful THA in the setting of protrusion acetabulae are:

1. Exposure
   a. Dislocation of the native hip may be difficult or even impossible! Forceful dislocation can lead to fracture or even severe soft tissue trauma. In situ neck osteotomy reduces this risk.
2. Avoidance of "over-reaming" medially.
   a. The key is denude any remaining acetabular cartilage but…Focus on lateralizing the socket by using the acetabular rim as a landmark.
3. Medial buttress support:
   a. The most effective manner to provide medial support in order to "lateralize" the cup is to use autologous bone graft from the femoral head. Alternative use of metallic augments have been used but are an expensive alternative.
4. Socket insertion with emphasis on "rim fit"!
   a. Use of supplemental screws with cementless hemispherical cup.

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Conversion of Failed Intertochanteric Fractures to THA: Strategy, Technique, Pitfalls

George J. Haidukewych, MD

SUMMARY:

Although the vast majority of fractures of the proximal femur will heal with well-done internal fixation, occasionally failure of fixation will occur. Having effective salvage options is important to restore function and minimize complications. Patient age and remaining bone stock should be considered. In order to minimize failures careful initial ORIF attempts with the goal of obtaining excellent reduction and accurate implant placement is recommended.

Intertochanteric fracture fixation failure salvage, young patients: Very rare, but pertinent to the discussion. Repeat internal fixation attempts with fixed angle devices (such as a 95 degree blade plate) and bone grafting generally preferred. Avoid varus of the proximal fragment and target the inferior femoral head bone.

Basi-cervical fracture failures: Rarely discussed but also pertinent to this topic. Generally the greater trochanter intact and medial calcar loss minor.. Bypass of distal stress risers wise but can often be managed by more "routine" stems depending on the index internal fixation device.

Intertrochanteric fracture fixation failure salvage, older patients: Total hip arthroplasty preferred. Dislocate the hip once before removing hardware to avoid iatrogenic fracture. It is wise to have hardware specific removal tools. Not all hip screws or nails are alike. Expose the hip with the status of the greater trochanter in mind. A trochanteric "slide" may be necessary if it is un-united or mal-united preventing access to the femoral canal. Long stems to bypass femoral shaft stress risers such as "calcar replacement" stems or modular stems may be necessary due to proximal bone defects. Trochanteric fixation must be stable. Results are generally good but trochanteric complaints are common.

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THA in Proximal Femoral Deformity: Strategy, Technique, Pitfalls

James A. Browne, MD

SUMMARY:

Primary total hip arthroplasty in the presence of deformities of the proximal femur can present a technical challenge for the orthopedic surgeon. Treatment strategies must be individually tailored to the individual deformity and take into account bone quality, soft tissue quality, previous hardware, and comorbidities.

A classification system based on anatomic site has been proposed by Berry (Fig 1). This classification system can help guide treatment as the anatomic site and the type of deformity affect choice of implant, implant sizing and positioning, and need for corrective osteotomy.

Careful preoperative planning is critical. Choices must be made regarding approach, exposure, and implant based upon the particulars of the deformity. Examples will be given in this lecture demonstrating the use of different techniques and implants to address deformities, including osteotomies, short femoral stems, modular femoral stems, and diaphyseal-engaging femoral stems. Intraoperative imaging is strongly recommended for these complex procedures.

Fig 1. Classification of Proximal Femoral Deformities (from Berry DJ. Total hip arthroplasty in patients with proximal femoral deformity. *Clin Orthop Relat Res*. 1999 Dec;(369):262-72.)

- Site of deformity
  - Greater trochanter
  - Femoral neck
  - Metaphysis
  - Diaphysis
- Geometry of deformity
  - Torsional
  - Angular
  - Translational
  - Size abnormality
- Etiology of deformity
  - Developmental (for example, developmental hip dysplasia)
  - Metabolic (for example, Paget's)
  - Previous osteotomy
  - Previous fracture

Most Valuable Hip Arthroplasty Paper in the Last 2 Years:

1. Charles L. Nelson, MD: **A Repeat Dose of Perioperative Dexamethasone Can Effectively Reduce Pain, Opioid Requirement, Time to Ambulation, and In-Hospital Stay After Total Hip Arthroplasty: A Prospective Randomized Controlled Trial**
   https://www.arthroplastyjournal.org/article/S0883-5403(21)00672-0/pdf
2. Michael A. Mont, MD: **Association Between Surgical Approach and Major Surgical Complications in Patients Undergoing Total Hip Arthroplasty**
   https://pubmed.ncbi.nlm.nih.gov/32181847/
3. Kevin J. Bozic, MD: **Patient Satisfaction After Total Hip Arthroplasty Is Not Influenced by Reductions in Opioid Prescribing**
   https://pubmed.ncbi.nlm.nih.gov/33640183/
4. Scott M. Sporer, MD: **Increased risk of prosthetic joint infection following primary total knee and hip arthroplasty with the use of alternative antibiotics to cefazolin the value of allergy testing for antibiotic prophylaxis**
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SESSION IX: CONTROVERSIES IN THA: OPERATIVE APPROACHES

DEBATE: Operative Approaches

Direct Anterior Approach: Why This Approach Is Best and the Others Are Worse

William G. Hamilton, MD (Team Captain), Keith R. Berend, MD, Christopher L. Peters, MD

TAKE HOME KEY POINTS:

- **Pain, Function, and Recovery:** The Anterior approach has been shown to have the fastest recovery of the 3 approaches with lowest levels of pain, fastest functional return (as measured by # of steps), and fastest to eliminate assistive devices. Clearly the anterolateral is the worst in this measure because it violates the abductor. Occasional catastrophic outcomes are observed with abductor dehiscence.
- **Postoperative Dislocation:** Anterior based approaches have been shown to have the lowest rate of dislocation. While anterolateral may have the lowest rate of dislocation, direct anterior is close behind, and posterior is clearly the highest risk of dislocation
- **Femoral Implant Loosening and Periprosthetic Fracture:** Because femoral access is challenging part of Anterior approach, lowering these complications requires understanding of femoral exposure/releases, retractor placement, accessory tools (specialized table, table mounted lift), and implants optimized for anterior approach. Implants that are shorter, curved profile, cutout shoulder, are preferable. Improved early implant stability can be achieved with design features such as implant geometry, coating and/or collars and consideration of cement
- **Implant Positioning:** Because the supine positioning easily lends itself to intraoperative imaging modalities, implant positioning can be optimized with this approach
- **Patient Demand:** Due to the improved outcomes of the direct anterior approach surgery, patients seek out surgeons who offer this approach

Anterolateral Approach: Why This Approach is Best and the Others are Worse

David G. Lewallen, MD (Team Captain), Steven J. MacDonald, MD, George J. Haidukewych, MD

TAKE HOME KEY POINTS:

- Current versions of the anterolateral approach preserve the more vertical posterior 2/3 of the Gluteus medius and release only the oblique anterior 1/3 of gluteus minimus better preserving abductor function
- The anterolateral approach is an extremely utilitarian approach and is used by proponents for virtually all primary and the vast majority of revision cases (unless a prior “improved” posterior approach repair has not healed back: a common problem!)

Continued...

- For occasional revision surgeons, every primary case is a practice case for the next more difficult revision. This is lost if surgeons switch from one approach for primaries to another for revisions
- No need for the surgeon to switch surgical approaches or implants on “high risk” primary patients due to fear of dislocation (parkinsonism, spinal deformity, subcapital fracture and the posterior approach) or fears of infection (obesity and the DA approach)
- Has allowed most anterolateral approach surgeons to avoid many of the historical implant and technology “misadventures” that have occurred with usage often driven to a major degree by FEAR of dislocation among posterior approach surgeons.
- There is a temporary early functional lag over the early days to weeks postop in return to ambulation with out limp or cane which has been shown to disappear by 6 weeks with **no long term difference** vs PA or DA.
- Allows repair of pre-existent degenerative gluteus medius tendon tearing due to tendinopathy (which is often not visible to initial inspection and otherwise missed).
- Current trends toward DA approach uniquely a US phenomenon driven by marketing and competition. With social media driven patient mis perceptions about the presence and magnitude of supposed advantages, and without clear information to patients on the documented higher risks of fracture, femoral loosening and infection.
- Reported results and anectdotal experience reported from many DA series unreliable due to selection bias related to routine avoidance (by most proponents) of higher risk, elderly, obese, debilitated, and low income patients in whom an alternative approach is often used.
- Most cost effective approach due to reduced revision burden vs both of the other.
- **BOTTOM LINE:** The anterolateral approach is the safest of the three approaches with the lowest overall complication rate

My 5 Best Technical Tips for a Better Posterior Approach

C. Anderson, Engh, Jr., MD

1) Tag and repair external rotators
2) Femur first
   i) Correct neck resection level influences acetabular exposure.
      (i) High neck resection more difficult acetabular exposure
   ii) Femoral anteversion can influence acetabular orientation – Combined anteversion concept.
      (i) High femoral anteversion implies lower acetabular anteversion (DDH)
      (ii) Low femoral anteversion implies higher acetabular anteversion. (SCFE, Coxa Vara)
3) Extensile measures
   i) Obesity and stiffness - Release
      (a) Gluteus maximus femoral insertion
   ii) Acetabular Exposure - Release
      (a) Superior anterior capsule – allows femur to move forward
      (b) Inferior capsule incision – only if difficult to get reamer into socket
4) Combined anteversion – Combined anteversion is a posterior approach conversation.
   i) DA with Hanna table: These surgeons do not test stability.
   ii) Anterior based approaches have difficulty visualizing combined anteversion.
      (a) Native femoral anteversion requires internal femoral rotation to position the femoral neck perpendicular to face of acetabular component. In this position greater trochanter obscures the view.
      (b) A tight posterior capsule will not allow enough internal rotation to measure combined version.
   iii) My goal is 30-40 degrees of combined anteversion.
      (a) Knowing combined anteversion with a posterior approach keeps me from over anteverting the acetabular component which could lead to anterior instability.
5) Impingement of femur on anterior structures is a cause of posterior instability.
   i) Increased offset can reduce anterior impingement
      (i) High offset femur or lateralized liner
   ii) Removal of anterior impinging structures
      (i) Residual neck
      (ii) Anterior portion of greater trochanter
      (iii) Thin or remove anterior superior capsule
      (iv) Anterior superior acetabular osteophytes

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My Best Technical Tips for a Better Direct Anterior Approach

Adolph V. Lombardi, Jr., MD, FACS

SUMMARY:

#1 - Appropriately position the patient on the table. Position the patient optimally on the OR table. Appropriately retract abdominal soft tissues from the planned wound site. The team must perform careful prepping and draping, with draping out of both lower extremities to facilitate assessment of leg length.

#2 - Proper placement of skin incision. The anterior superior iliac spine (ASIS) is identified and used as a reference for positioning of the skin incision. Using the skin marker, a line is drawn from the ASIS to the center of the patella. The incision commences two finger breadths distal and two finger breadths lateral to the ASIS and is made parallel to the marked line for 8 to 10 cm distally. Fluoroscopic guidance is used to draw a line along the superior aspect of the femoral neck. This line should bisect the previously marked incision.

#3 - Meticulous hemostatis. Get control of all bleeders from the ascending branch of the lateral circumflex femoral artery.

#4 - Create a "napkin ring" of bone to assist in removal of the femoral head. Use 5mm thread external fixation pins to remove the napkin ring and femoral head.

#5 - Use fluoroscopic navigation to assist in cup positioning. Be mindful of appropriate anteversion, inclination, and medialization.

#6 - Use a table-mounted hook to help expose the femur.

#7 - Proceed slowly and cautiously with femoral release.

#8 - Use fluoroscopic imaging / "navigation" to assess leg length and femoral offset.

SESSION X: COMPLICATIONS OF THA: CASE DISCUSSIONS

KEYNOTE

New Technologies to Reduce Hip Dislocation. What Can Help Now? What Is Coming?

Andrew J. Shimmin, MD

SUMMARY:

1. Wear related failures are now uncommon in THA
2. Dislocation, fracture and leg length issues remain and in most cases are avoidable
3. Technology can help avoid these complications via patient specific planning and methods to accurately carry out that plan
4. Modern planning software can identify those patients at risk of these common complications
5. There are already many available technologies such as camera or sensor based navigation, patient specific guides, intra operative fluoroscopy and robotics that can all assist in implantation accuracy
6. The future will require user friendly, affordable, accurate and scalable technology

SESSION XI: THE ENEMY: INFECTION

Diagnosing the Infected Arthroplasty in 2021: Who Needs Advanced Molecular Testing? What is Available? How Good is It? What are the Pitfalls?

Javad Parvizi, MD

SUMMARY:

In this talk I will discuss the limitations of traditional cultures for identification of implant related infection which will include the issue of biofilm, cellular internalization, Trojan horse theory will be discussed in this context. I will then discuss why we SHOULD NOT have culture negative infections and touch on the issue of antibiotic stewardship and the rise in antimicrobial resistance. The latter part of my talk will concentrate on discussing strategies that we can use to improve the yield of traditional cultures (such as long incubation periods, use of blood culture bottles and so on). Finally, I will discuss the recommendations of the International Consensus Meeting on how to address the issue of culture negatives both in terms of treatment and also strategies that can help isolate infective pathogens. The latter includes the use of sonification, DTT, and metagenomics. A brief mention of the data on these technologies will be provided.

Preventing Preop Infection in 2021: What Is Worthwhile, What Is Not?

Bryan D. Springer, MD

SUMMARY:

Periprosthetic Joint Infection (PJI) following total knee arthroplasty (TKA) is a devastating complication. It is associated with high morbidity and mortality. It remains, unfortunately, one of the most common modes of failure in TKA. Much attention has been paid to the treatment of PJI once it occurs. Our attention however should focus on how to reduce the risk of PJI from developing in the first place. Infection prevention should focus on reducing modifiable risk factors that place patients at increasing risk for developing PJI. These areas include preoperative patient optimization and intraoperative measures to reduce risk.

Preoperative Modifiable Risk Factors:

There are several patient related factors that have been shown to increase patient's risk of developing PJI. Many of these are modifiable risk factors that can and should be optimized prior to surgery. Obesity and in particular Morbid obesity (BMI >40) has a strong association with increased risk of PJI. Appropriate and health weight loss strategies should be instituted prior to elective TKA. Uncontrolled Diabetes (Hgb A1C >8) and poor glycemic control around the time of surgery increases the risk for complications, especially PJI. Malnutrition should be screened for in at risk patients. Low Albumin levels are a risk factor for PJI and should be corrected. Patients should be required to stop smoking 6 weeks prior to surgery to lower risk. Low Vit D levels have been show to increase risk of PJI. Reduction of colonization of patients nares with methicillin sensitive (MSSA) and resistant (MRSA) staphylococcus should be addressed with a screen and treat program.

Intraoperative Measures to Reduce PJI:

During surgery, several steps should be taken to reduce risk of infection. Appropriate dosing and timing of antibiotics is critical and a 1st generation cephalosporin remains the antibiotic of choice. The use of antibiotic cement remains controversial with regards to its PJI prophylactic effectiveness. The utilization of a dilute betadine lavage has demonstrated decreased rate of PJI[6]. Maintaining normothermia is critical to improve the body's ability to fight infection. An alcohol based skin preparation can reduce skin flora as a cause of PJI. Appropriate selection of skin incisions and soft tissue handling can reduce wound healing problems and reduce development of PJI. Likewise, the use of occlusive dressing has been shown to promote wound healing and reduce PJI rates.

DEBATE: Antimicrobial Irrigation (Dilute Betadine or Something Else) for Infection Prevention

Always – What Do You Have to Lose?

Craig J. Della Valle, MD

TAKE HOME KEY POINTS:

- In a retrospective review of my own cases, we found that the use of dilute betadine prior to wound closure reduced the risk of acute postoperative PJI from just under 1% (18/1862) to 0.15% (1/688; p=0.04)
- In a subsequent randomized controlled trial of 457 patients undergoing aseptic revision hip and knee arthroplasty, there were 8 acute postoperative infections (within 90 days) in the saline group and one in the dilute betadine group (3.4% vs. 0.4%; p= 0.038)
- In a basic science study, Goswami et. Al found that Povidine-iodine, chlorhexidine and sodium hypoclorite were effective against both S. Auereus and E. Coli however chlorhexidine was found to be cytotoxic to fibroblasts. Povidine-iodine was the least cytotoxic amongst the agents that were efficacious.
- Dilute betadine offers a simple, effective and safe option for reducing the risk of acute postoperative PJI

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*****Dr. Della Valle has a relevant financial Conflict of Interest with this topic as he obtains royalties from BD related to the sale of Surgiphor**

No Value, Waste of Time and Money

Rafael J. Sierra, MD

TAKE HOME KEY POINTS:

- Surgical site infection is a devastating complication after primary and revision TKA and THA. (1-2% after primary, up to 5% after revision)
- Multiple strategies have been implemented to reduce SSI and deep infection throughout the process of arthroplasty. Multiple Strategies to mitigate infection should be implemented.
- Patient optimization (BMI, glucose, host immunity, smoking, nutrition), appropriate choice, and timing of delivery of preoperative antibiotics, the use of alcohol based antiseptic skin solutions and a clean OR environment with minimal traffic have all been shown to decrease infection rates and should be incorporated into a surgeons SSI reduction strategy.

- WHO *Strong Recommendations* for SSI prevention:
  - Decolonization of known nasal carriers of Staph Aureus
  - Hair removal (clippers)
  - Precise timing of antibiotic prophylaxis
  - Surgical hand preparation
  - Perioperative oxygenation
  - Prophylactic antibiotics should not be prolonged
- WHO *Conditional Recommendation* on the use of irrigations solutions: Low evidence: conditional recommendation for irrigations with solutions, but may be a simple, inexpensive
- There is a lack of consensus on whether wound irrigation with solutions containing antiseptic agents should be performed. The addition of antibiotics to solutions should be avoided.
- There is a risk of cytotoxic effects on fibroblasts, keratinocytes, and other cell lines, previously reported acute kidney injury associated with Povidone Iodine solutions, optimal concentration needs to be defined.
- Previous studies showing benefit include combination of hip and knee patients, with small sample sizes, additional use of skin painting with betadine and 1 L saline irrigation, and inconsistent definition s of PJI with 3 months followup.
- Recent systematic review and metanalysis of 7 papers did not demonstrate a reduction in SSI between those patients receiving PI solution vs not. The authors did not find a difference even when looking at subgroups for type of infection, the type of arthroplasty, the time for diagnosis of infection, and primary or aseptic revision arthroplasty.

SESSION XII: TREATMENT OF INFECTION

Debridement, Antibiotics, and Implant Retention in 2021: Indications and Technical Points

Simon W. Young, MD

SUMMARY:

- Prosthetic joint infection (PJI) is the main cause of failure in modern TKA
- A key decision in treatment is whether to procede with Debridement, Antibiotics, and Implant Retention (DAIR), or proceed with a (one or two stage) Revision procedure
- Pre-requisites for DAIR include a previously well-functioning knee that is not loose, unstable, or requires revision for another reason such as malalignment
- Traditionally the treatment decision in well fixed, stable TKA is based on classification of PJI in to Post-operative, Acute haematogenous, or Chronic. The assumption has been that Post operative and Acute Haematogenous PJI can be treated with DAIR.
- This classification requires assessing how long bacteria have been present in the joint, which is not always straightforward, and typically relies on an assessment of duration of symptoms
- Recent studies have challenged this notion, as Acute Haematogenous PJIs that occur later have a significantly lower success rate with DAIR than post-operative PJI
- Studies looking at risk factors for failure of DAIR are typically retrospective, and include a large number of post-operative infections (which are likely to be treated with DAIR). A better focus should be on later 'Acute Haematogenous' and 'Chronic' PJI, as this is where surgical decision making is more difficult
- An alternative classification based on age of implant (<1 year vs >1 year) simplifies this question, with DAIR success rates higher in implants <1 year old
- Risk factures for failure of DAIR include presence of a sinus tract, longer symptom duration, host systemic compromise/combordities, and infecting bacteria (worse outcomes with Staph Aureus)

Technical Points

- Technique is critical to the success of DAIR, with a thorough debridement and synovectomy essential
- Arthroscopic washout should be viewed as temporizing only, and reserved for acutely unwell patients who would not tolerate a formal DAIR or revision procedure
- Higher DAIR success rates are seen with concurrent exchange of modular parts, and involvement of an arthroplasty surgeon, reflecting the importance of thorough debridement
- Thorough irrigation of involved tissues with copious volumes of fluid is performed following debridement. While there is little evidence for an 'acceptable' volume of fluid, most studies report a range of 3 to 9L

Continued...

- Irrigation is performed with sterile saline and may be supplemented with with antibiotic or antiseptic solution; aqueous chlorhexidine, octenidine, polyhexadine, dilute betadine, and hydrogen peroxide-based solutions have been described
- A 'Double DAIR' techniques has been described, with an initial debridement and placement of beads composed of polymethylmethacrylate (PMMA) impregnated with antibiotics, followed by a second DAIR procedure with removal of beads 5-7 days later. High success rates have been reported with this protocol.
- Calcium sulfate beads may be an alternative to traditional cement beads. Despite increased cost, the proposed advantage is as bioabsorbable antibiotic delivery system removing the need for additional surgery. Current reports are unclear as to whether they provide a benefit in DAIR.

How I Do a One-Stage: Principles and Technical Tips

Thorsten Gehrke MD

SUMMARY:

The two-staged exchange for periprosthetic joint infection (PJI) has become the "gold standard" world wide. Based on the first implementation of mixing antibiotics into bone cement by Prof. Buchholz in the 70`s, the ENDO-Klinik followed a distinct one staged exchange for PJI in over 85 % of all our infected cases until today. Looking carefully at current literature and guidelines for the PJI treatment, there is no clear evidence, that a two- staged procedure has a clearly higher success rate than a one-staged approach. Although postulated in relevant articles, most recommendations, e.g. duration of antibiotics, static vs. mobile spacer, interval of spacer retention, cemented vs. uncemented implant fixation, are based on level IV to III evidence studies or expert opinions, rather than on prospective randomized or comparative data.

Potentially a cemented one-stage exchange offers certain advantages, as mainly based on need for only one operative procedure, reduced antibiotics & hospitalization time and reduced relative overall costs. In order to fulfill a one-staged approach with the above described potential success, there are obligatory pre-, peri- and postoperative details, which need to be meticulously respected. The absolute mandatory infrastructural requirement is based on the clear evidence of the bacteria in combination with a distinct patient specific plan , by an experienced microbiologist, for the following topic antibiotics in the bone cement with combined systemic antibiotics.

Mandatory preoperative diagnostic test is based on the joint aspiration with an exact identification of the bacteria. The presence of a positive bacterial culture and respective antibiogramm is essential, to specifiy the antibiotics loaded to the bone cement, which allows a high topic antibiotic elution directly at the surgical side. A specific treatment plan is generated by an microbiologist. Contraindications for a one staged exchange include:

failure of > 2 previous one-staged procedures, infect spreading to the nerve-vessel bundle, unclear preoperative bacteria specification, unavailability of appropriate antibiotics, high antibiotic resistance

The surgical success relies not only on the complete removal of all preexisting hardware material (including cement and restrictors), furthermore an aggressive and complete debridement of any infected soft tissues and bone material is needed. Mixing antibiotics to the cement needs to fulfill the following criteria's:

Appropriate antibiogramm, adequate elusion characteristics, bactericidal (exception clindamycin), powder form (never use liquid AB), maximum addition of 10 %/PMMA powder. Current principles of modern cementing techniques should be applied.

Continued...

Postoperative systemic antibiotic administration is usually followed for only 10-14 days (exception: streptococci). We recommend an early and aggressive mobilisation within the first 8 days postoperatively, due to the cemented fixation an immediate mobilisation under full weight bearing becomes possible in most cases.

Persistence or recurrence of infection remains the most relevant complication in the one staged technique. As failures rates with a two staged exchange have been described between 9 % and 20 % in non-resistant bacteria, the ENDO-Klinik data shows comparative results after 8-10 years of follow up, which were confirmed independently also by some other international reports and study groups.

In summary a cemented one-stage exchange offers various advantages. Mainly the need for only one operation, shorter hospitalization, reduced systemic antibiotics, lower overall cost and relative high patient satisfaction. However a well defined preoperative planning regime including an experienced microbiologist are absolutely mandatory.

Suggested Literature

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How I Do a Two-Stage THA: Spacer Choice, Technical Tips

Thomas K. Fehring, MD

One Stage Vs. Two Stage: Which Is Best?

- One Stage data encouraging but difficult to interpret due to limited numbers, organism exclusion & comorbid patient exclusion
- Two Stage is the gold standard in U.S. but the reinfection rate is closer to 80% than the 90% often quoted

Optimizing Exposure

- Essential part of Success in Revision TKA
- Ability to remove implants without risk to bone stock or integrity of the patellar tendon is of paramount importance

Optimizing Exposure

- Not the time for minimally invasive surgery
- Extend incision
  - Proximally and distally

Skin Incisions

- Must understand the vascular anatomy of the anterior knee
- Blood supply goes from medial to lateral
- MUST use most lateral incision
- Raise a Sub Fascial Flap

Skin Incisions

- Measuring a 6-8 cm bridge is dangerous
- Will jeopardize blood supply between incisions

Debridement Keys to Success

- Meticulous/Aggressive
- All 4 Anatomic Areas must be Debrided
- Suprapatellar Pouch
- Medial Gutter
- Lateral Gutter
- Posterior Capsule

Continued...

Debridement Keys

- Biofilm is present not only on the metal parts but also on the soft tissue
- Aggressive cancer like soft tissue debridement is mandatory

Debridement Keys

- Debridement must include the Posterior Capsule
- Debride until an experienced knee surgeon wouldn't recognize it as an infection case

Keys to Safe Component Extraction

- Safe
- Expedient
- Bone Preserving
- Respectful of the extensor mechanism and tibial tubercle
- Polyethylene Insert

Order of Extraction

- Femur
- Tibia
- Patella

Femoral Component Removal

- Footed Osteotome
- Allows access to posterior condyles

Femoral Component

- Disrupt cement-prosthesis interface
- TPS saw allows precise disruption

Femoral Component Removal

- Release the interface until
- Gentle taps exhibit movement

Continued...

Tibial Component Removal

- 3 Step Process
  - Medial Tibia
  - Posterior Tibia
  - Anterolateral Tibia

Patella Extraction

- Poly Patella
  - Cut under the dome through the poly pegs
  - High speed Burr to remove cement plugs
- Metal Backed
  - Use a wheel to dissociate metal pegs
  - Pencil tip Burr to remove pegs

Canal Reaming

Hand reaming to debride but retain some cancellous bone for fixation at second stage

Double Set up Technique

- One Set Up For Extraction/Bone Preparation and Trial Instrumentation As In Primary Surgery
- Second set up for spacer preparation and insertion tools
  - Threaded Steinman pins
  - Drill
  - Femoral and Tibial Impactors

Two Stage Technique

- Clean side is set up and covered
- Dirty side wheeled out of room during room cleaning

3 – Step Irrigation Protocol
Extraction Side

- Pulse Lavage 3 L of NS
- 100 cc's of 3% H2O2 and 100 cc's of sterile water = 2 min soak
- Pulse Lavage 3 L of NS
- 1 L of dilute, sterile betadine
- (22.5 mL/L NS) = 3 min soak
- 3 L of NS

Continued...

Two Stage Technique

- After extraction and irrigation the wound is whip stitched
- Sterile towel placed over wound
- Io band over top of towel
- Dirty drapes are taken down and dirty instruments rolled out

Two Stage Technique

- Room is cleaned followed by re-prepping and draping
- New instrumentation is uncovered

What Goes On The Dirty Side?

- All extraction tools
- All bone prep instruments
- Trial implants
- Irrigation tools

What Goes On The Clean Side?

- Final Impactors
- Final component Assembly tools

Re-Implantation Irrigation Protocol

- PRIOR TO SPACERS PARTS BEING IMPLANTED ON CLEAN SIDE
- Pulse Lavage with 1L of NS
- 100 cc's of 3% H2O2 and 100 cc's of sterile water = 2 min soak
- Pulse Lavage with 1 L of NS
- 1 L of dilute, sterile betadine (22.5 mL/L NS) = 3 min soak
- Pulse Lavage with 1 L of NS

After Re-Implantation

- 1 Gram of vancomycin powder throughout wound

Two Stage Treatment Post Resection and Debridement

- Choices:
  - Resection without Spacer
  - Static Spacer
  - Articulating Spacer

Continued...

Spacer Block Technique in Revision of Infected TKA

- Local AB delivery system
- Improved soft tissue healing
- Prevention of soft tissue contracture
- Improved patient comfort between stages

Static Spacer in TKA

- Used in severe bone loss
- Should be a fusion spacer not a hockey puck
- Use crossed rush rods, ex fix rods or a tibial nail

Articulating Spacer Block

- Temporary molded antibiotic loaded PMMA implant
- Allows ROM between stages

Three Options

1) Premade off the shelf cement on cement
   - Expensive
   - Difficult to customize antibiotic dosing
2) Molded intraoperative cement on cement spacer
   - Allows customized antibiotic dosing
   - Crepitation during ROM
3) Conventional metal femur and all poly tibia both loosely cemented with IM antibiotic dowels
   - Allows customized antibiotic dosing
   - Improved ROM over molds

Articulating Spacer - Are Dowels Necessary?

- OrthoCarolina Study
- AAHKS 2021
- 60 Diaphyseal cultures taken from infected total knees
- 32% Culture positive

Continued...

Antibiotic Cement Ingredients

- Cement
  - 1 pack dowels
  - 1 pack femoral component
  - 1 pack tibia poly
  - Antibiotics: 2 vanco/2.4 tobra per pack
  - 1 threaded steiman cut in half

Antibiotic Protocol after Two Stage Treatment

- Six Weeks IV Antibiotics
  - Aspiration 2 weeks later
- Six Months PO Antibiotics
  - After Re-Implantation

How I Do a Two-Stage THA: Spacer Choice, Technical Tips

Carsten Perka, MD

SUMMARY:

Due to high rates of spacer-related complications in two-stage exchange total hip arthroplasty (THA), patients with advanced bone defects and abductor deficiency may benefit from a non-spacer two-stage revision. This lecture deals with the pros and cons of hip spacers and reports on the clinical course of a contemporary two-stage exchange THA without spacer insertion.

141 infected THA undergoing a planned two-stage exchange without spacer placement were reviewed. The mean duration from resection arthroplasty to reimplantation was 9 weeks (2-29). Clinical outcomes included interim revision, reinfection and aseptic revision rates. Restoration of leg-length was assessed radiographically. Modified Harris hip scores (mHHS) were calculated. Mean follow-up was 5 years (3-7).

34 patients (24%) had treatment failure according to the modified Delphi consensus criteria, including 13 reinfections, 16 interim re-debridements for persistent infection, 2 antibiotic suppressive therapies and 3 PJI-related deaths. Aseptic re-revision after reimplantation was necessary in 14 patients (10%). Dislocation accounted for most aseptic complications, with 20 dislocations occurring in 15 patients (11%). Leg-length was restored to preoperative measures. Mean mHHS significantly improved from 35 points to 67 points.

While in patients with sufficient bone stock, the use of hip spacers is still the method of choice, a non-spacer two-stage THA represents a viable option for managing patients with bone or soft-tissue loss. Spacer-related complications can be prevented without compromising infection eradication rates. Comparable functional results and adequate leg-length restoration are feasible when keeping interim periods short.

SESSION XIII: REVISION THA

Implant Removal: My Tips for Well Fixed Cup and Stem Extraction

Carsten Perka, MD

SUMMARY:

Implant removal may be necessary in a variety of different indications such as infection, instability, periprosthetic fractures, or implant failure. In these cases either partial or complete implant removal becomes inevitable. For the successful removal of implants, accurate preparation is key. Knowledge of the implants and their anchorage as well as availability of the necessary removal instruments are part of any preparation, as is knowledge of previous operations and any complications that may have occurred. Another crucial part of the planning is the choice of the right approach and familiarity with possibly necessary extensions in case of complications. A wide range of special instruments can be helpful in various situations. During cup removal, the relevant anatomy must be respected to prevent complications. The knowledge of "safe zones" is helpful to successfully use the various bone-saving removal instruments in this process. During stem removal, consideration must be given to different stem designs, lengths and anchorages in order to ensure successful explantation. The limits of endo- and transfemoral approach must be clear in order to achieve explantation without complications.

SESSION XIV: ACETABULAR REVISION

Large Diameter Hemispherical Cup With Screws: The Workhorse; Technical Tips for Success

Don S. Garbuz, MD, MHSc

SUMMARY:

95% of acetabular revisions can be done with hemispherical shells. Preoperative evaluation should include AP pelvis, Judet views and true lateral of the hip. CT scan is not absolutely essential but can be helpful if need to order equipment in.

The steps for success of hemispherical shell revision include: wide exposure, cup removal, reaming, cup insertion and cup fixation . Each of these steps are critical to success, and each will be discussed in this talk. Technique will vary depending on the amount of bone loss left once cup and foreign material are removed.

Once exposed reaming is critical. In bigger defects often reamers are used as sizers and many times reverse reaming can be used in order to preserve remaining bone.

In most cases highly porous multi-hole shells will be used in these revisions. Cup insertion should avoid strong impaction as this can lead to fractures in previously weakened bone. Always use multiple screws and try for ischial screw. Divergent screws give the most biomechanically strong construct.

Contraindications for hemispherical shells include: pelvic dissociation, large uncontained defects and failure to get adequate screw fixation. Examples of large uncontained defects that can and can't be handled with only a hemispherical shell will be discussed

Porous Metal Augments: Best Indications, Technical Tips

David G. Lewallen MD

SUMMARY:

Major bone loss involving the acetabulum can be seen during revision THA due to component loosening, migration or osteolysis and can also occur as a sequela of infected THA. Uncemented porous ingrowth components can be used for reconstruction of the vast majority of revision cases, where smaller segmental or cavitary bone defects are typically present. But when stable structural support on host bone is lacking, highly porous metal acetabular augments have been described as an alternative to large structural allograft, avoiding the potential for later graft resorption and the resulting loss of mechanical support that can follow. The fundamental concept behind these acetabular augments is the provision of critical additional fixation, structural support and increased contact area against host bone over the weeks following surgery while the desired ingrowth into porous implant surfaces is occurring.

Technique: Three separate patterns of augment placement have been utilized in our practice since the development of these implants two decades ago:

Type 1 - augment screwed to the superolateral acetabular rim in a **"flying buttress"** configuration for treatment of a segmental rim defect

Type 2 – augment placed superiorly against host in a **"double-bubble configuration"** and then fixed (with cement) to the acetabular component adjacent to the cup to fill a mainly elliptical cavitary defect, and

Type 3 – augment (s) placed medial to the cup like **"footing"** to fill a protrusio type cavitary or combined cavitary segmental defect of the superomedial or medial wall, and allow peripheral cup placement against the still intact acetabular rim.

In all cases the acetabular component and augment interface is unitized with cement, with care to prevent any cement extrusion between any implant and the bone. When possible in all type 1 and many type 2 defects, we now prefer to place the acetabular component first and fix it provisionally with 2 or more screws, and then place the augments second as this is technically quicker and easier. Type 3 cases with medial defects always require placement any augments first, before cup insertion. Supplemental cancellous bone graft is used routinely, but the need for structural bone is avoided. Despite their use typically in more major bone defect cases, these implants have proven to provide durable fixation over the first decade postop in several series (1-5).

Continued...

Summary: Highly porous metal acetabular augments are an infrequently needed, but extremely valuable, versatile and reliable adjunctive fixation method for use with uncemented acetabular components during complex revision THA associated with major bone deficiency. Smaller (often female) patients are more likely to require this approach as reaming away defects to allow insertion of a jumbo cup is more difficult in small patients with a smaller AP dimension to the acetabular columns and less local bone for implant support. Durability and apparent radiographic incorporation has been very good over the first decade despite the complex reconstructions originally required. This technique can allow the avoidance of structural bone grafting for even many massive bone defect problems, but additional followup is needed to see how durable these encouraging results are over the longer term, especially in cases of associated pelvic discontinuity where other adjunctive measures such as acetabular distraction and/or use of a cup cage construct "over the top" may be beneficial.

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Custom Triflange Cup: Why and How?

Mathias P.G. Bostrom, MD

SUMMARY:

WHY Use Triflange Cups?

Indications:

- Massive Acetabular Bone Loss:
  - Paprosky 3A/3B
- Pelvic Discontinuity
  - AAOS IV

Success:
Dependent on host bone to ensure adequate stability and fixation of components

Alternative Options:

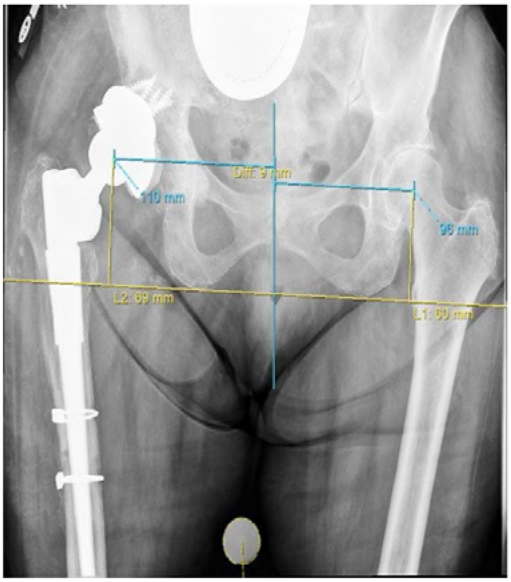
- Large hemispherical cups with augments
- Acetabular bone grafting and cemented cups
- Oblong components
- Reconstruction rings or cages
- Acetabular distraction techniques

Custom Triflange Components

Bridging of boney defects to obtain fixation to remaining bone:

- **Ilium**
- **Ischium**
- **Pubis**

Optimal geometry and orientation to provide intimate fit against the host bone and bridge existing bone defects to facilitate initial fixation



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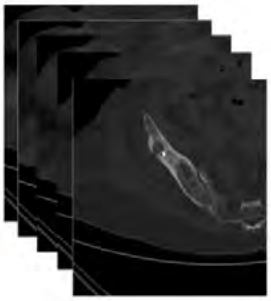
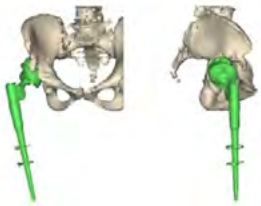
How?

Design Protocol

- Thin-cut (1 mm) CT scan of pelvis
- 3-D reconstruction of the images
- Computer generated model of the bone stock

- Prothesis designed





HSS Protocol

- Bone graft
- Hydroxyapatite coated to promote osseointegration
- With a combination of locking and non locking screws

Pros/Cons

Advantages:

- Flanges allow biological ongrowth
- Improved conformity with host bone
- Greater construct rigidity and resistance to fatigue failure

Disadvantages:

- Need for advanced imaging
- Manufacturing time
- Expense
- Inability to modify intraoperatively
- **High Complication Rate**

SESSION XV: FEMORAL REVISION

Fluted Tapered Stems: Modular and Non-Modular: Making Them Work

Steven J. MacDonald, MD

SUMMARY:

- In 2021, Fluted Tapered Stems, whether modular or non-modular, are the workhorse in Rev THA
- They are available from multiple manufacturers but have overlapping design similarities:
- 1) composed of titanium
- 2) have a conical tapered design to provide axial stability
- 3) have longitudinal flutes to provide rotational stability
- 4) have a surface finish to encourage bone ongrowth
- Based on the Wagner stem design
- Initially introduced into the North American market as modular stems to help the surgeon to address leg length, offset, version and proximal/distal bone mismatch issues
- Preoperative planning is critical and includes the planning for stem diameter, stem length, restoring native leg length and offset, incorporating the need for an extended trochanteric osteotomy
- Fastidious attention to distal reaming and creating a reproducible reamer depth is critical to achieving a tapered press-fit
- Achieving a reproducible press-fit is similar whether performing a modular or non-modular fluted tapered stem and the steps in achieving a reproducible press-fit will be discussed in detail

SESSION XVI: REVISION TKA TECHNIQUES

Exposure Challenges in Revision TKA: What To Do Before Reverting to Extensile Exposure; How to Do Quadriceps Snip; How to Do Tibial Tubercle Osteotomy

Giles R. Scuderi, MD

Adequate exposure is one of the most common difficulties encountered in revision knee arthroplasty. Several approaches have been utilized as the time of surgery to address the problems of exposure, especially in situations of stiffness and limited motion. In many cases, adequate exposure can be achieved with an extended medial parapatellar arthrotomy, synovectomy and re-establishment of the medial and lateral femoral gutters. A quadriceps snip can be performed to improve exposure, but in some cases with limited motion, a more extensile approach is necessary when the above sequential steps do not provide adequate exposure. In these situations a tibial tubercle osteotomy may be needed.

The tibial tubercle osteotomy is an alternative technique that releases the extensor mechanism distally with elevation of the tibial tubercle, which is hinged laterally. With adequate and secure repair at the conclusion of the procedure, the post-operative rehabilitation program can proceed without restriction.

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Implant Removal in TKA; My Favorite Technical Tips

Arun B. Mullaji, MD

SUMMARY:

Implant removal can be challenging unless a systematic approach is adopted. In this presentation, I will give 7 key tips to ensure explantation is safe & speedy, is done without more bone loss, without soft-tissue or NV complications, and can be accomplished usually via a standard approach.

1. Remove ***all*** implants ***only*** if necessary for satisfactory reconstruction. It is vital to assess patient's co-morbidities, activity level, bone quality, in addition to xray/CT/navigational analysis of implant size, position, integrity & fixation, in order to ascertain the risks vs benefits (added time, bone loss, possibility of fractures). While it is generally recommended to perform a complete revision of all components, most index patellae, some tibial and few femoral implants may be retained after judicious assessment of above factors.
2. ***Plan*** for instruments, tools, special techniques that may be deployed. These include standard tools: thin flexible osteotomes, punch, oscillating saw. Occasionally disassembly tools may be needed as some inserts & trays may require removal of unique pins, clips, screws. Revision instruments that are useful are universal extraction clamps, special punches, cement splitter, pointed osteotome, reverse curette, and slaphammer. Special tools may be required for cementless instrument – high speed diamond-edge wheels and burrs, and fixation devices if TTO or femoral windows are made.
3. ***Minimize releases*** during exposure, preserving tendon & ligament attachments. Useful manoevers are elevating the medial edge of patellar tendon, pinning its tibial tuberosity insertion, excising the fat pad and scar behind the patellar tendon, lateral release, clearing medial and lateral gutters, and externally rotating the tibia to subluxate the tibia anteriorly.
4. Remove the modular insert first to gain space. Disengage a locking screw/pin/clip if any. Most can be levered out with an osteotome anteriorly, some need to be slid out sideways, and very rarely need to be removed piecemeal after sectioning with a saw.
5. Clear entire circumference of implant, then identify & initiate disruption of correct interface. In a cemented design, identify the ***cement-implant*** interface, in a cementless design, identify the ***bone-implant*** interface. Initiate the interface disruption with a thin osteotome.
6. Ensure entire interface disrupted systematically prior to disimpaction, using an oscillating saw, thin osteotomes, and stacked osteotomes. Cementless tibial components may need to have the stem cut off from the tray with a diamond wheel, which can also be used for amputating the pegs of cementless patellae.
7. Disimpact along axis of implant ensuring a clear exit path.

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Implant Removal in TKA; My Favorite Technical Tips

Jean-Noël Argenson, MD

SUMMARY:

When considering revision Total Knee Arthroplasty (TKA) it is important to clearly identify the reason for failure directly related to a knee intrinsic mode of failure[1]. It is also important to consider if the revision is performed for a septic or an aseptic mode of failure which implies laboratory evaluations. The clinical and radiological preoperative planning should evaluate the state of: the skin, the extensor mechanism, the bone loss, and the ligaments. The revision TKA itself will include several steps such surgical approach, exposure of the prosthesis, implant removal, tibial and femoral reconstruction more or less associated to patella revision, stability assessment and choice of final implant constraint.

We suggest a stepwise algorithm for implant removal starting by exposing circumferentially all the periphery of the femoral component[2]. This is obtained, once the approach into the joint is achieved, by freeing the suprapatellar pouch first and then by freeing the anterior femur using a curved large rugine. The next step will be the removal of the modular tibial polyethylene insert using a thin and narrow osteotome in order to gain more access to the joint. The next step will be to access the cement-prosthesis femoral interface to be disrupted preferentially with a small oscillating saw, then using a medium width straight osteotome for the medial and lateral periphery of the component while a curved osteotome can be useful for accessing the area around the notch and the posterior condyles. The use of an ultrasound cement removal system may have the potential to provide high frequency vibrations in order to clean more easily the molten cement from the interface. Once the implant is freed from the cement bed, a stepped impactor placed flush on the anterior flange or a femoral component clamp with a slap-hammer attachment can be used to remove the implant, always axially and avoiding flexion or extension forces[3].

Once the exposure of the tibial component has been achieved by the release of adhesions between the anterior tibia and the patellar tendon proximal to the Anterior Tibial Tubercle (ATT), the tibial component removal can then be proceed in a similar fashion. After using the oscillating saw from the center to the periphery, stacking osteotomes at the fixation interfaces are helpful to disengage the component starting with a broad osteotome upon which a second thin blade osteotome is positioned in order to avoid applying forces on the soft relying bone. Ultrasound cement removal system can also be used at this step to clear the interface in a smooth fashion. A slap hammer or stepped impactor can then be used to remove the tibial tray. As it is the case for the femur, well-bonded cement may be left in place if a cemented implant is to be used in the revision procedure, to lower the risk of additional bone loss from the femoral condyles or the tibial plateau.

Continued...

Special situations include the removal of cementless implants with well-bonded central or peripheral posts and implants with well fixed extension stems. The transaction of the post at the base of the undersurface tibial plate may be necessary using a high speed burr or a large power saw in case of tantalum or titanium material, before the plate can be removed. In case of well fixed cemented extension stems the use of trephines may be needed to extract such stems both on the femoral and tibial side. More rarely a distal anterior femoral window or an extended ATT osteotomy can be necessary to access a well fixed stem and the cement in periphery[4]. Reconstruction in our experience for such cases will be achieved by a combination of metaphysal cones, cemented stems and cerclage wires[5].

In conclusion implant removal in revision TKA will require a solid preoperative plan, multiple instruments and a sufficient dose of patience. The most important things to be protected during the course of revision TKA are: the skin during the approach, the extensor mechanism during the exposure and the bone during implant removal.

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SESSION XVII: REVISION TKA

Biologic Metaphyseal Fixation with Cones: How To, Technique Tips

David G. Lewallen, MD

SUMMARY:

Biologic fixation using highly porous metal cones has proven to provide durable mechanical support for revision knee components on both the femoral and tibia sides of the joint (Kamath, et al, JBJS 97 (3):216-223, 2015) and Potter, et al, JBJS 98-A(15):1286-1291, 2016) The adjunctive fixation provided by cones can help prevent loosening and provide important mechanical support to resist axial or bending stresses and rotational loads, especially when large condylar defects are present in the distal femur. Larger cones have recently been supplemented in several systems with smaller central cones designed primarily to add fixation even when axial mechanical support is adequate. The combination of both cement and cementless fixation of an individual component can be synergistic: initial cementing of the under surfaces of the implant and up to the diaphyseal area of the stem reliably controls initial implant interface motion and allows bone to grow into the porous portion. Once bone ingrowth occurs longer term loads on the cement bone interface is decreased providing potential protection against late loosening.

Technical steps of importance include:

1) Maximize support of the trial femoral or tibial component on host bone
2) Minimize host bone removal to optimize fit and support
3) Fill smaller residual bone defects with bone graft, standard block augments, or in some cases small central cones to improve fixation
4) Consider **larger cones to reestablish metaphyseal mechanical support** in the face of **impaired bone quantity** due to segmental or condylar defects where size or location precludes stable axial or rotational support of the component and threatens durability of fixation over the short term
5) Consider **smaller central cones for improved long-term fixation** and durability, especially in the presence of **impaired bone quality**.
6) Cement stems at least up to the metaphyseal-diaphyseal junction if long press fit stems are used or cement the entire length of an intermediate length stem
7) Consider impaction grafting of the diaphysis beyond the cone for severe endosteal bone damage from prior failed long stems to further enhance fixation (Bedard, et al, *BJJ* 102 No. 6 supplement A:116-122, 2020)

Biologic Metaphyseal Fixation with Sleeves: How To, Technique Tips

Carsten Perka, MD

SUMMARY:

Revision total knee arthroplasty (TKA) often challenges surgeons due to severe bone loss. Proper fixation of the revision implant - and by that good long-term survival -depends on the amount of bone that is left for fixation. According to the landmark paper of Morgan-Jones et al., fixation of revision TKA should be achieved at least in 2 of 3 zones (joint surface, metaphysis, diaphysis) for long-term survival. Therefore, larger defects – especially Anderson Orthopedic Research Institute (AORI) type II b and III- usually requires additional fixation in the metaphysis to reduce stress shielding and improve rotational stability, compared to diaphyseal fixation alone. Metaphyseal fixation can be achieved using sleeves. Those are usually made of titanium and offer a macrostructured surface for long-term biological fixation by osseointegration. To improve the latter freshening of the sclerotic bone is mandatory. Furthermore, for good primary fixation sleeves require an optimal press fit. Thus, optimal positioning of the sleeve might be challenging if the shape of the defect does not approximate the axis of the diaphysis. This might result in a stem-corticalis conflict as the sleeve can push the implant in a certain position. Careful preparation is necessary. This can – at least in AORI type I and II defects - be avoided by using sleeves without stem which showed good short-term follow-up and is suggested to decrease the risk for “end-of-stem-pain”. A limitation of sleeves is that they are usually implant specific and it is advocated that they should not be combined with alternating TKA- systems.

Extensor Mechanism Reconstruction with Marlex Mesh

Matthew P. Abdel, MD

SUMMARY:

Complications involving the knee extensor mechanism occur in 1% to 12% of patients following total knee arthroplasty (TKA), and have negative effects on patient outcomes[1,2]. While multiple reconstruction options have been described, the results in patients with a prior TKA are inferior to those in patients without a TKA1. However, optimistic results have been reported by Browne and Hanssen with the use of a synthetic mesh (knitted monofilament polypropylene)[3], and recently reinforced in a larger series by Abdel et al[4]. In this technique, a synthetic graft is created by folding a 10 × 14 inch sheet of mesh and securing it with nonabsorbable sutures. A burr is then used to create a trough in the anterior aspect of the tibia to accept the mesh graft. The graft is inserted into the trough and secured with cement. After the cement cures, a transfixion screw with a washer is placed. A portal is subsequently created in the lateral soft tissues to allow delivery of the graft from deep to superficial. The patella and quadriceps tendon are mobilized, and the graft is secured with sutures to the lateral retinaculum, vastus lateralis, and quadriceps tendon. The vastus medialis is then mobilized in a pants-over-vest manner over the mesh graft, and secured with sutures. Finally, the distal arthrotomy is closed tightly to completely cover the mesh with host tissue. Recent innovations include placing 5 cm of the mesh in the intramedullary canal, revising the components to a rotating hinge TKA, and completing a patellectomy to optimize pull and closure of the reconstruction. In the original series, Browne and Hanssen noted that 9 of 13 patients achieved an extensor lag of <10° with preserved knee flexion and significant improvements in the mean Knee Society scores for pain and function.[3] In the most updated series[4], 65 of 77 mesh reconstructions were in place at a mean of 4 years. Of the 12 patients who were re-revised, 5 were due to patellar tendon ruptures, 5 for quadriceps tendon disruptions, and 2 for symptomatic lengthening of the mesh. There were 4 additional patients who had mesh failures, but they did not undergo revision mesh reconstructions. The mean improvement in extensor lag was 26°, with a mean extensor lag of 9° at most recent follow-up ($p<0.001$).

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DEBATE: Stems in Revision TKA

Uncemented Diaphyseal Engaging Stems are Easiest and Best

Steven J. MacDonald, MD

TAKE HOME KEY POINTS:

- There is a role for both cemented and cementless stems in Rev TKA
- Cementless diaphyseal engaging stems are indicated for the majority of Rev TKA cases for the following compelling reasons:
- 1) current generations Rev TKA's are based on intramedullary instrumentation and cementless canal filling stems are a seamless adjunct to this system
- 2) cementless diaphyseal engaging stems provide the surgeon with a reproducible alignment. Cemented stems have a significant potential for malalignment
- 3) in the event that extraction is required for infection, a not rare outcome in Rev TKA, cementless stems provide a much more reproducible technique with significantly less intraoperative time and potential host bone stock loss. Extraction of cemented stems can be very technically challenging.
- 4) cementless stems are much more time efficient and decrease the need for intraoperative radiographs, compared to cemented stems
- The vast majority of Rev TKA cases can be handled well with joint line cement, cementless metaphyseal fixation in the form of sleeves or cones, and cementless press-fit stems
- Cemented stems are only indicated when dealing with very large diaphyseal canals when a press-fit stem can not be achieved (rare with current stem offerings) or a tumor-type implant with no metaphyseal or joint line fixation
- The most recent literature systematic review indicates a significantly higher failure rate for cemented stems in Rev TKA and the authors recommend using cementless stems wherever possible

Cemented Stems Are More Reliable

James A. Browne, MD

TAKE HOME KEY POINTS:

The use of stems in revision total knee arthroplasty is not controversial. Stems can supplement component fixation, bypass bone defects, offload deficient bone, and reduce interface stresses. Loosing remains a major cause of failure in revision total knee arthroplasty, and achieving fixation in compromised bone is necessary for a durable outcome.

When comparing cemented to uncemented stems, the literature provides no clear cut winner when it comes to survivorship. There appears to be a trend in revision total knee arthroplasty over the last decade towards the use of shorter cemented stems in combination with metaphyseal cones or sleeves. Cemented stems offer several benefits:

Continued...

1. Achieve reliable and immediate fixation
2. Decouple alignment from the diaphysis (avoids malalignment and makes it possible to “cheat” shorter stems into more desirable positions)
3. Improve efficiency and simplicity while reducing cost
4. Vastly reduce end of stem pain
5. Allow for local antibiotic delivery

There are typically three arguments given for the use of uncemented stems:

1. Cement is hard to remove. The use of shorter stems has mitigated this problem.
2. Longer uncemented stems can help with alignment. Engagement of the diaphysis often becomes a negative of uncemented stems where there is some deformity. It is often desirable to not be a slave to the diaphysis to properly alignment components. If the surgeon desires to use the diaphysis to guide alignment then bone cuts can be made using cutting guides that are positioned via intramedullary rods.
3. Cement does not work well in previously revised bone. Little cancellous bone may remain for cement interdigitation. This legitimate concern is mitigated by the technique of diaphyseal impaction bone grafting and metaphyseal cones.

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Total Joint Orthopaedics: Unpaid consultant
Zimmer: IP royalties

William A. Jiranek, MD, FAAOS, FACS (Morrisville, NC)
Submitted on: 07/18/2021
American Association of Hip and Knee Surgeons: Board or committee member
Biomech Holdings LLC: Stock or stock Options
DePuy, A Johnson & Johnson Company: IP royalties
Hip Society: Board or committee member

Carlos J. Lavernia, MD, FAAOS
Submitted on: 10/29/2021
closex MAB: Board or committee member
Johnson & Johnson: Stock or stock Options
Journal of Arthroplasty: Editorial or governing board
MAKO SURGICAL/STRYKER: IP royalties
Stryker: Paid consultant; Stock or stock Options
Symmetry Medical (Telcomet): Stock or stock Options
Wright Medical Technology, Inc.: Stock or stock Options
Zimmer: Stock or stock Options

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David G. Lewallen, MD, FAAOS (Rochester, MN)
Submitted on: 06/02/2021
Acuitive Technologies: Stock or stock Options
Corin U.S.A.: Research support
Ketai Medical Devices: Stock or stock Options
Orthopaedic Research and Education Foundation: Board or committee member
Zimmer Biomet: IP royalties; Paid consultant

Jay R. Lieberman, MD, FAAOS (Los Angeles, CA)
Submitted on: 09/16/2021
AAOS: Board or committee member
BD Surgiphor: Stock or stock Options
DePuy, A Johnson & Johnson Company: IP royalties; Paid consultant
Hip Innovation Technology: Stock or stock Options
Hip Society: Board or committee member
Musculoskeletal Transplant Foundation: Board or committee member
Saunders/Mosby-Elsevier: Publishing royalties, financial or material support
Western Orthopaedic Association: Board or committee member

Adolph V. Lombardi Jr, MD, FAAOS* (New Albany, OH)
Submitted on: 10/06/2021
Central Ohio Orthopaedic Management Company: Board or committee member
Clinical Orthopaedics and Related Research: Editorial or governing board
Current Concepts in Joint Replacement: Board or committee member
Elute, Inc.: Stock or stock Options
Hip Society: Board or committee member
Innomed: IP royalties
Joint Development Corporation: Stock or stock Options
Journal of Arthroplasty: Editorial or governing board
Journal of Bone and Joint Surgery - American: Editorial or governing board
Journal of Orthopaedics and Traumatology: Editorial or governing board
Journal of the American Academy of Orthopaedic Surgeons: Editorial or governing board
Knee: Editorial or governing board
Operation Walk USA: Board or committee member
Parvizi Surgical Innovation: Stock or stock Options
Prescribe Fit: Stock or stock Options
SPR Therapeutics, LLC: Stock or stock Options
Surgical Technology International: Editorial or governing board
VuMedi: Stock or stock Options
Zimmer Biomet: IP royalties; Paid consultant; Research support

Steven J. MacDonald, MD* (Canada)
Submitted on: 10/22/2021
Canadian Orthopaedic Association: Board or committee member
CurvaFix: Stock or stock Options
DePuy, A Johnson & Johnson Company: IP royalties; Paid consultant; Research support
Hip Innovations Technology: Stock or stock Options
International Hip Society: Board or committee member
JointVue: Stock or stock Options
PSI: Stock or stock Options
Smith & Nephew: Research support
Stryker: Research support
Zimmer: Research support

William J. Maloney, MD, FAAOS* (Redwood City, CA)
Submitted on: 08/24/2021
AAOS: Board or committee member
Flexion Therapeutics, Inc: Stock or stock Options
Flexion Therapeutics, Inc.: Paid consultant
Knee Society: Board or committee member
Stryker: IP royalties; Paid consultant
TJO: Stock or stock Options
Western Orthopedic Association: Board or committee member
Zimmer: IP royalties

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Submitted on: 10/01/2021
American Association of Hip and Knee Surgeons: Board or committee member
DJ Orthopaedics: IP royalties; Paid consultant
Emovi: Stock or stock Options
Hip Society: Board or committee member
International Congress for Joint Reconstruction: Board or committee member
Journal of Arthroplasty: Editorial or governing board
KCI: Paid consultant
Kinamed: Paid consultant
Knee Society: Board or committee member
Orthopedics Today: Editorial or governing board
Osteoremedies: IP royalties; Paid consultant

Michael A. Mont, MD, FAAOS* (Baltimore, MD)
Submitted on: 11/04/2021
American Association of Hip and Knee Surgeons: Board or committee member
Centrexion: Paid consultant
CERAS Health: Stock or stock Options
CyMedica Orthopedics: Research support
Hip Society: Board or committee member
Johnson & Johnson: Paid consultant; Research support
Journal of Arthroplasty: Editorial or governing board
Journal of Knee Surgery: Editorial or governing board
Knee Society: Board or committee member
Kolon TissueGene: Paid consultant
Medicus Works LLC: Publishing royalties, financial or material support
MirrorAR: Stock or stock Options
National Institutes of Health (NIAMS & NICHD): Research support
Next Science: Paid consultant
Organogenesis: Research support
Orthopedics: Editorial or governing board
Pacira: Paid consultant
Patient-Centered Outcomes Research Institute (PCORI): Research support
Peerwell: Stock or stock Options
Pfizer: Paid consultant
RegenLab: Research support
Smith & Nephew: Paid consultant
Stryker: IP royalties; Paid consultant; Research support
Surgical Techniques International: Editorial or governing board
Up-to Date: Publishing royalties, financial or material support
USMI: Stock or stock Options
Wolters Kluwer Health - Lippincott Williams & Wilkins: Publishing royalties, financial or material support

Arun Mullaji, MD, FRCS (India)
Submitted on: 11/15/2021
Asia Pacific Arthroplasty Society: Board or committee member
DePuy, A Johnson & Johnson Company: IP royalties; Paid consultant; Research support
Indian Joint Registry: Board or committee member
Indian Society of Hip and Knee Surgeons: Board or committee member
Knee Surgery and Related Research: Editorial or governing board
Springer: Publishing royalties, financial or material support
Zimmer: Research support

Stephen B. Murphy, MD, FAAOS (Boston, MA)
Submitted on: 07/20/2020
International Society for Technology in Arthroplasty: Board or committee member
International Society of Computer Assisted Orthopedic Surgery: Board or committee member
MicroPort Orthopedics Inc.: IP royalties
Surgical Planning Associates, Inc.: Stock or stock Options

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Charles L. Nelson, MD, FAAOS (Philadelphia, PA)
Submitted on: 08/06/2021
American Board of Orthopaedic Surgery, Inc.: Board or committee member
American Orthopaedic Association: Board or committee member
Journal of Hip Surgery: Editorial or governing board
Zimmer: Paid consultant

Douglas E. Padgett, MD, FAAOS* (New York, NY)
Submitted on: 10/05/2021
Actabond: Stock or stock Options
DJ Orthopaedics: IP royalties; Paid consultant; Paid presenter or speaker
Evolve Orthopaedics: Stock or stock Options
Hospital For Special Surgery: Board or committee member
Journal of Arthroplasty: Editorial or governing board
navbit: Stock or stock Options
Orthophor: Stock or stock Options
Parvizi Surgical Innovations: Stock or stock Options
Tangen: Stock or stock Options

Mark W. Pagnano, MD, FAAOS (Rochester, MN)
Submitted on: 05/31/2021
DePuy, A Johnson & Johnson Company: IP royalties
Hip Society: Board or committee member
Knee Society: Board or committee member
Stryker: IP royalties
Wolters Kluwer Health - Lippincott Williams & Wilkins: Publishing royalties, financial or material support

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Submitted on: 04/14/2021
CeramTec: Paid consultant
ConvaTec: Paid consultant
Innomed: IP royalties
Intellijoint: Paid consultant; Stock or stock Options
Journal of Arthroplasty: Editorial or governing board
MicroPort: Paid consultant
Next Science: Paid consultant
Wolters Kluwer Health - Lippincott Williams & Wilkins: Publishing royalties, financial or material support
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Alphaeon: Stock or stock Options
Becton Dickenson: Publishing royalties, financial or material support
Ceribell: Stock or stock Options
Corentec: IP royalties; Paid consultant; Stock or stock Options
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Ethicon: Paid consultant
Fidia Pharm: Paid consultant
Heraeus: Paid consultant
Hip Innovation Technology: Stock or stock Options
Intellijoint: Stock or stock Options
Jaypee Publishers: Publishing royalties, financial or material support
Joint Purification Systems: Stock or stock Options
Jointstem: Paid consultant
KCI / 3M (Acelity): Paid consultant
MDValuate: Stock or stock Options
MicroGenDx: Paid consultant; Stock or stock Options
Molecular Surface Technologies: Stock or stock Options
Nanooxygenic: Stock or stock Options
Parvizi Surgical Innovations and Subsidiaries: Stock or stock Options
Peptilogics: Paid consultant
PRN-Veterinary: Stock or stock Options
SLACK Incorporated: Publishing royalties, financial or material support
Sonata: Stock or stock Options
Tenor: Paid consultant
Wolters Kluwer Health - Lippincott Williams & Wilkins: Publishing royalties, financial or material support
Zimmer Biomet: Paid consultant

Carsten Perka, MD (Germany)
Submitted on: 11/11/2021
AORecon: Board or committee member
DePuy, A Johnson & Johnson Company: IP royalties; Paid consultant; Paid presenter or speaker
German Orthopaedic and Trauma Society, Northern German Orthopaedic and Trauma Society, Arbeitsgemeinschaft Endoprothetik (German Endoprosthetic Society): Board or committee member
Hip Society: Board or committee member
Journal of Bone and Joint Surgery - British: Editorial or governing board
Link Orthopaedics: Paid consultant; Paid presenter or speaker
Smith & Nephew: IP royalties; Paid consultant; Paid presenter or speaker
Springer: Editorial or governing board
Thieme: Editorial or governing board
Zimmer: IP royalties; Paid consultant; Paid presenter or speaker

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American Association of Hip and Knee Surgeons: Board or committee member
Biomet: Paid consultant; Paid presenter or speaker; Research support
CoNextions Medical: Stock or stock Options
Journal of Arthroplasty: Editorial or governing board
Journal of Hip Preservation: Editorial or governing board
Knee Society: Board or committee member
Muve Health: Stock or stock Options

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Smith & Nephew: Research support
Stryker: IP royalties; Paid consultant; Paid presenter or speaker; Research support

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Submitted on: 05/29/2021
3M: Paid presenter or speaker
Acelity: Paid consultant
Biomet: IP royalties; Paid consultant; Paid presenter or speaker
Convatec: Paid presenter or speaker
Force Therapeutics: Stock or stock Options
Journal of Knee Surgery: Editorial or governing board
Medtronic: Paid consultant
Operation Walk USA: Board or committee member
Pacira: Paid consultant
ROM Tech: Stock or stock Options
SpringerElsevierThiemeWorld Scientific: Publishing royalties, financial or material support
Zimmer: IP royalties; Paid consultant; Paid presenter or speaker

Thomas P. Sculco, MD, FAAOS (New York, NY)
Submitted on: 10/24/2021
American Journal of Orthopedics: Editorial or governing board
Exactech, Inc: IP royalties
J. Robert Gladden Society: Board or committee member
Lima Orthopedic: Unpaid consultant
Orthopaedic Research and Education Foundation: Board or committee member

Andrew John Shimmin, MD (Australia)
Submitted on: 06/02/2021
Corin UK: Research support; Stock or stock Options
corin ukmatortho: IP royalties
corin ukmatortho uk: Paid consultant
knee 360: Unpaid consultant
matortho UK: Research support
Smith & Nephew: Paid consultant

Rafael Jose Sierra, MD, FAAOS (Rochester, MN)
Submitted on: 05/23/2021
American Association of Hip and Knee Surgeons: Board or committee member
Anchor study group: Board or committee member
Biomet: Paid consultant; Paid presenter or speaker
Cytori: Research support
DePuy, A Johnson & Johnson Company: Research support
Journal of Arthroplasty: Editorial or governing board
Knee Society: Board or committee member
Link Orthopaedics: IP royalties; Paid consultant
Midamerica orthopedic society: Board or committee member
Muller Foundation: Board or committee member
Orthalign: IP royalties
Orthoalign: Paid consultant; Stock or stock Options
Springer: Publishing royalties, financial or material support
Stryker, Biomet: Research support
Think: Paid consultant
Zimmer: IP royalties; Research support

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American Joint Replacement Registy: Board or committee member
DJO Surgical: IP royalties; Paid consultant
Hip Society: Board or committee member
Osteoremedies: IP royalties; Paid consultant
SLACK Incorporated: Publishing royalties, financial or material support
Stryker: Research support
Zimmer: IP royalties; Research support

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Bryan Donald Springer, MD, FAAOS* (Charlotte, NC)
Submitted on: 10/22/2021
AJRR: Board or committee member
American Association of Hip and Knee Surgeons: Board or committee member
Arthroplasty Today: Editorial or governing board
Convatec: Paid consultant
ICJR: Board or committee member
Journal bone and joint infection: Editorial or governing board
Journal of Arthroplasty: Editorial or governing board
Osteoremedies: IP royalties; Paid consultant
Stryker: IP royalties; Paid consultant

Robert T. Trousdale, MD, FAAOS
Submitted on: 06/01/2021
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

Jan M.K .Victor Sr., MD, PhD (Belgium)
Submitted on: 05/31/2021
BVOT: Board or committee member
Corin: Paid presenter or speaker
European Federation of National Associations of Orthopedics and TraumatologyBelgische vereniging voor orthopedie en traumatologie: Board or committee member
Knee Society: Board or committee member
MoveUP: Research support
Moximed: Research support
Smith & Nephew: IP royalties; Paid presenter or speaker

Simon Young, MD, FRACS
Submitted on: 04/26/2021
American Association of Hip and Knee Surgeons: Board or committee member
Arthrex, Inc: Paid presenter or speaker
Smith & Nephew: Paid presenter or speaker
Stryker: Paid consultant; Paid presenter or speaker; Research support
Surgical Solutions: Stock or stock Options
Vidacare: Research support

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(This individual reported nothing to disclose); Submitted on: 06/08/2021

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(This individual reported nothing to disclose); Submitted on: 10/02/2021

Jola Tricroce (Schaumburg, IL)
(This individual reported nothing to disclose); Submitted on: 09/21/2021

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