AAHKS

AMERICAN ASSOCIATION OF HIP AND KNEE SURGEONS

FINAL SCIENTIFIC PROGRAM

Saturday—March 16, 2019

Venetian/Sands Expo

Room 2101

Las Vegas, Nevada

General Program Information

The Mission of The Hip Society

The **Mission** of The Hip Society is to advance the knowledge and treatment of hip disorders to improve the lives of our patients.

Meeting Objectives

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

CME Accreditation

This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of the American Academy of Orthopaedic Surgeons and The Hip Society. The American Academy of Orthopaedic Surgeons is accredited by the ACCME to provide continuing medical education for physicians. The American Academy of Orthopaedic Surgeons designates this live activity for a maximum of ***7.5 AMA PRA Category 1 Credits™***. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Evaluation

Your opinion matters! Please complete your evaluation online at: https://www.surveymonkey.com/r/HSWM2019 or use the QR code to access with your handheld smart device:

Photography

Please refrain from unauthorized photography and video recording of presentations. Your registration for, and attendance of, this session gives The Hip Society permission to capture images of session attendees and to use these images for internal and marketing purposes.

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Please join Zimmer Biomet for a non-CME Symposia
11:55 am – 1:00 pm

Lunch is provided to all participants by The Hip Society / AAHKS

Save the Date and Join Us in Orlando!

The AAOS 2019 Annual Meeting and Specialty Day

March 24-28, 2020

Acknowledgements

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2015-2016	Daniel J. Berry, MD
2016-2017	Harry E. Rubash, MD
2017-2018	Kevin L. Garvin, MD

Past Presidents of AAHKS

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Acknowledgements

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Congratulations: The 2019 Hip Society Lifetime Achievement Award Recipient

Session III (10:45 am – 10:50 am)

John J. Callaghan, MD
Iowa City, IA

Dr. Callaghan is the Lawrence and Marilyn Dorr Emeritus Chair and Emeritus Professor of Orthopaedic Surgery and Biomedical Engineering at the University of Iowa. He received a Bachelor of Science at the University of Notre Dame, and Doctor of Medicine at Loyola University. He completed his residency at the University of Iowa and a fellowship in Hip Surgery at the Hospital for Special Surgery. After serving in the Army for four years at Walter Reed Army Medical Center and two years on the faculty at Duke University, he has practiced the last 28 years at the University of Iowa.

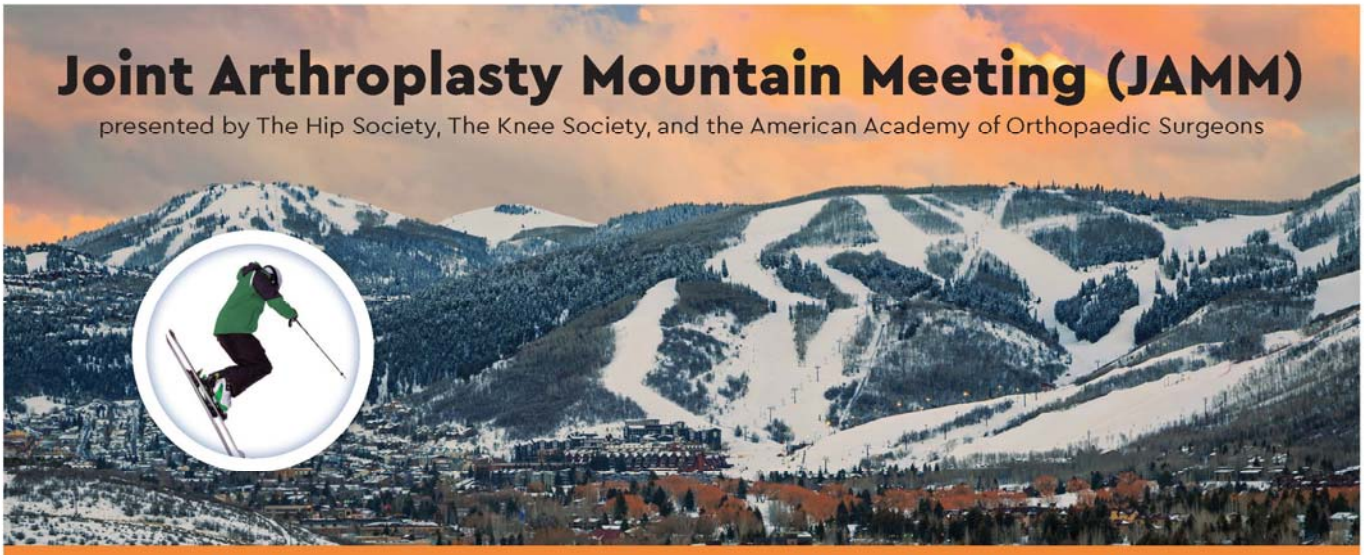
John has been involved in all aspects of Hip Surgery over his 34-year career including research, education and patient care. He has made major contributions to the field of hip surgery both in basic biomechanics research and clinical outcomes. Through funding, that included principle investigator funding, from the National Institutes of Health, The Veterans Administration, and the Orthopaedic Research and Education Foundation, he and his collaborators made fundamental contributions to the field of hip arthroplasty including the relationship of sliding distance to wear, impingement and dislocation mechanics, edge detection measurements of wear, acetabular preparation for cementless fixation and the contribution of third body particles to wear. The research has been recognized by multiple organizations through their society research awards including the Hip Society (6), the Orthopaedic Research Society (2 Harris Awards), the Orthopaedic Research and Education Foundation (2) and the American Bone and Joint Surgeons (Nicolas Andry Award).

On the clinical front, Dr. Callaghan has helped pioneer the reporting of long-term outcomes in all areas of hip arthroplasty: primary cemented and cementless fixation, and revision cemented and cementless fixation, including functional long-term evaluation in the younger patient. In addition, he has made major contributions in outcomes research using large administrative databases. As President of the American Academy of Orthopaedic Surgeons in 2010, he assured Academy resources were available to rejuvenate the American Joint Replacement Registry initiative. He has been involved in the development of a number of the successful second generation cementless and cemented hip implants.

Dr. Callaghan's contributions in moving and leading the field of hip surgery have been recognized by his peers electing him as President of the American Association of Hip and Knee Surgeons, The Hip Society, and the International Hip Society.

Joint Arthroplasty Mountain Meeting (JAMM)

presented by The Hip Society, The Knee Society, and the American Academy of Orthopaedic Surgeons



February 2 – 5, 2020 • Park City, UT

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Course Director

Elevate your approaches with access to expertise

Get equipped with current approaches and preferred techniques for complex primary and revision total knee and total hip arthroplasty. Experts from The Hip Society and The Knee Society offer strategies to improve your operative performance and patient outcomes. This high-touch course puts you at the table with leading hip and knee surgeons in small-group roundtable discussions, plus dynamic keynotes, symposia, and lively point-counterpoint debates on treatment decision-making.

Course Highlights:

- Low participant-to-faculty ratio in roundtable format offers direct access to expertise
- Panel discussions offer strategies, tips and pearls
- "Golden Hip" and "Golden Knee" Surgical Video Competition

AAOS
American Academy of Orthopaedic Surgeons

Register at hipsoc.org or call The Hip Society at 1-847-698-1638 or The Knee Society at 1-847-698-1632

AAHKS
AMERICAN ASSOCIATION OF HIP AND KNEE SURGEONS

AAOS
AMERICAN ACADEMY OF ORTHOPAEDIC SURGEONS

Fundamentals of Hip and Knee Arthroplasty for Orthopaedic Residents

April 12 – 14
Long Beach, CA
Erik N. Hansen, MD
Mark J. Spangehl, MD
Course Directors

April 26 – 28
Rosemont, IL
Brett R. Levine, MD
Michael J. Taunton, MD
Course Directors

Residents – Expand your surgical skills for hip and knee arthroplasty!

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

AAOS/AAHKS/KS/HS Resident Member/Resident/ Post-Residency Fellow	Early Registration *(received before 3/1/19)*	Standard Registration *(received on or after 3/1/19)*
	$150	**$250**

Register early and save $100!

To register, call AAOS Customer Service at 1-800-626-6726

Congratulations: The 2019 Hip Society Scientific Award Winners

Session III (10:15 am to 10:45 am)

The 2019 John Charnley Award

Increased PJI Risk Following Primary TKA and THA with Alternatives to Cefazolin: The Value of Allergy Testing for Antibiotic Prophylaxis

Presenter: **Cody C. Wyles, MD**

Co-Authors: Mario Hevesi MD, Douglas R. Osmon MD, Miguel A. Park MD, Elizabeth B. Habermann PhD, David G. Lewallen MD, Daniel J. Berry MD, Rafael J. Sierra MD

The 2019 Otto Aufranc Award

Cluster-Randomized Trial of Opiate-Sparing Analgesia after Discharge from Elective Hip Surgery

Presenter: **Majd Tarabichi MD**

Co-Authors: Andrew N. Fleischman MD, Gabriel Makar BS, Carol Foltz PhD, William J. Hozack MD, Matthew S. Austin MD, Antonia F. Chen MD, MBA

The 2019 Frank Stinchfield Award

An Approach Based Comparison of Periprosthetic Joint Infection Rates in Total Hip Arthroplasty: A Single Institution Experience

Presenter: **Vinay K. Aggarwal, MD**

Co-Authors: Spencer Weintraub BS, Julie Klock BS, Anna Stachel, MPH, Ran Schwarzkopf MD MSc, Richard Iorio, MD, Jonathan M. Vigdorchik MD, William J. Long, MD, FRCSC

The Hip Society's Traveling Fellowships

The Hip Society's Rothman-Ranawat Traveling Fellowship

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

Congratulations, 2019 Rothman-Ranawat Traveling Fellows!

Roshan P. Shah, MD, JD
New York, NY, USA

Ben J. Burston, MBChB (Honrs), DipMed Ed, FRCS (Tr&Orth)
Oswestry, United Kingdom

Udo Ego Anyaehie, MBBS, FWACS
Enugu, Nigeria

Mailyn A. Muskus Ealo, MD
Bogota, Colombia

Those interested in applying for the **2020 Rothman-Ranawat Traveling Fellowship**, please visit The Hip Society's website www.hipsoc.org, click on the **Education** tab.

The deadline to apply for the 2020 Fellowship is August 15, 2019.

The Hip Society-British Hip Society Traveling Fellowship

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

The 2019 Hip Society-British Hip Society Traveling Fellowship

Those interested in applying for the **2019 Fellowship**, please visit The Hip Society's website www.hipsoc.org, and click on the **Education** tab.

The deadline to apply is June 1, 2019.

In Memoriam:
Richard H. Rothman, MD, PhD
(1936 – 2018)

Richard H. Rothman, MD, PhD, founder of the Rothman Orthopaedic Institute in Philadelphia, died at the age of 81 on Oct. 21, 2018, after a battle with cancer.

A native of Cheltenham Township in Pennsylvania, Dr. Rothman obtained a B.A. in history along with his degree in medicine at the University of Pennsylvania. He received his PhD in anatomy at Thomas Jefferson University. Dr. Rothman performed more than 50,000 total hip and knee replacements during his career, according to the Rothman Orthopaedic Institute, and was the developer of the Stryker Accolade total hip replacement system.

Beyond orthopedics, Dr. Rothman served as vice chair of the board of trustees at Thomas Jefferson University, was a trustee of the University of Pennsylvania and the Brandywine River Museum of Art. He was also a senior advisor on the board of trustees for the Riverside Corporation and taught medical students at Jiao Tong University in Shanghai.

“Dick Rothman was a brilliant surgeon, innovator in hip surgery and creator of one of the great orthopedic institutions in the world. His talents were incredible and his enthusiastic spirit in everything he did made him a natural leader and ensures his extraordinary legacy.” **Thomas P. Sculco, MD**

The Hip Society is committed to continuing Dr. Rothman’s legacy through its prestigious annual Rothman-Ranawat Traveling Fellowship program.

2019 AAHKS Annual Meeting
Call for Submissions

ABSTRACTS AND SYMPOSIUM PROPOSALS DUE JUNE 1, 2019

Submit high-quality scientific and socioeconomic abstracts for consideration as podium or poster presentations. Abstracts are blind reviewed by the AAHKS Program Committee review team.

Submit Symposium proposals covering all aspects of arthroplasty and health policy. Proposals are reviewed by the AAHKS Program Committee.

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

Save the Date!

November 7-10, 2019
Hilton Anatole
Dallas, Texas, USA
Registration opens in May.

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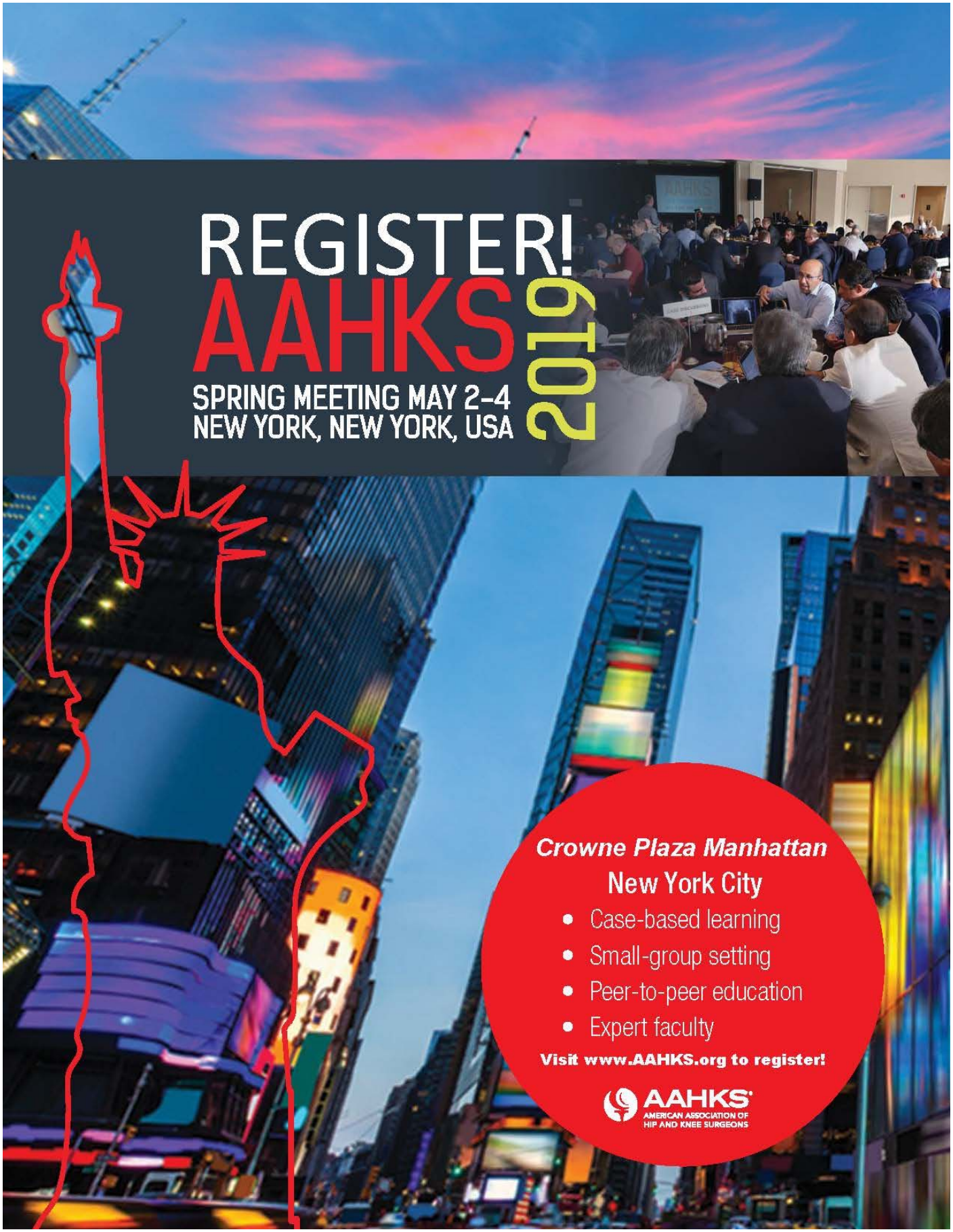

Notes:

7:55 am – 8:00 am	**WELCOME** *Douglas E. Padgett, MD (New York, NY) – President, The Hip Society*	
8:00 am – 8:30 am	**DEBATE I: Surgical Approaches: Does it Matter?** *Moderator: John J. Callaghan, MD (Iowa City, IA)*	
8:02 am – 8:12 am	Anterior Hip Approach *Wael K. Barsoum, MD (Weston, FL*	
8:13 am – 8:23 am	Posterior Hip Approach *Robert T. Trousdale, MD (Rochester, MN)*	
8:23 am – 8:30 am	**DISCUSSION**	
8:30 am – 9:10 am	**Session I: Decreasing Complications** *Moderator: William A. Jiranek, MD (Durham, NC)*	
8:30 am – 8:36 am	Scope of Problem David C. Ayers, MD (Worcester, MA)	27
8:37 am – 8:43 am	VTE Update Paul F. Lachiewicz, MD (Chapel Hill, NC)	29
8:44 am – 8:50 am	Implant Loosening Michael Tanzer, MD, FRCSC (Montreal, QC, Canada)	30
8:51 am – 8:57 am	Modifying Risk Factors *Richard Iorio, MD (Boston, MA)*	31
8:57 am – 9:10 am	**DISCUSSION**	
9:10 am – 10:00 am	**Session II: Hip Instability** *Moderator: William J. Maloney, III, MD (Redwood City, CA)*	
9:10 am – 9:16 am	Bearing: Role for “Standard” Head Sizes *Amar S. Ranawat, MD (New York, NY)*	31
9:17 am – 9:23 am	Soft Tissue Procedures *Stephen J. Incavo, MD (Houston, TX)*	34
9:24 am – 9:30 am	Bearing: Dual Mobility *Arlen D. Hanssen, MD (Rochester, MN)*	35
9:31 am – 9:37 am	Bearing: Constrained Options *Thomas P. Sculco, MD (New York, NY)*	36
9:38 am – 9:44 am	Acetabular Positioning *Robert L. Barrack, MD (St. Louis, MO)*	37
9:44 am – 10:00 am	**DISCUSSION**	
10:00 am – 10:15 am	**COFFEE / REFRESHMENT BREAK**	

7:55 am – 8:00 am	**WELCOME** *Robert L. Barrack, MD (St. Louis, MO), – President, The Knee Society*
8:00 am – 9:10 am	**Session I: Non-Operative Management of the Painful Knee: Biologics and Other Options. What Should You Be Doing?** *Moderator: Jay R. Lieberman, MD (Los Angeles, CA)*
8:00 am – 8:05 am	Introduction *Jay R. Lieberman, MD (Los Angeles, CA)*
8:06 am – 8:11 am	The Regulatory Environment: How Does It Influence Your Treatment Options? *Thomas P. Vail, MD (San Francisco, CA)*
8:12 am – 8:17 am	Oral Agents: It's A Good Start! *Henry D. Clarke, MD (Phoenix, AZ)*
8:18 am – 8:23 am	Corticosteroid Injections: Do They Really Work? *David F. Dalury, MD (Towson, MD)*
8:24 am – 8:29 am	Hyaluronic Acid: What's the Fuss? *William J. Maloney, III, MD (Redwood City, CA)*
8:30 am – 8:35 am	Platelet-Rich Plasma: What, Where, and When? *Scott A. Rodeo, MD (New York, NY)*
8:36 am – 8:41 am	Stem Cells: Hype or Reality? *Jason L. Dragoo, MD (Redwood City, CA)*
8:41 am – 9:10 am	**DISCUSSION**
9:10 am – 10:00 am	**Session II: Special Highlights** *Moderator: Thomas P. Vail, MD (San Francisco, CA)*
9:10 am – 9:20 am	**The John N. Insall Award** Fructosamine is a Better Glycemic Marker Compared to Glycated Hemoglobin (HbA1C) in Predicting Adverse Outcomes Following Total Knee Arthroplasty: A Prospective Multicenter Study *Noam Shohat, MD (Tel Aviv, Israel)*
9:21 am – 9:31 am	**The Chitranjan S. Ranawat Award** Elective Joint Replacement Outcomes Improve in Malnourished Patients with Nutritional Intervention: A Prospective Population Analysis Demonstrates a Modifiable Risk Factor *William C. Schroer, MD (St. Louis, MO)*
9:32 am – 9:42 am	**The Mark Coventry Award** A Multi-center Randomized Clinical Trial of Tranexamic Acid in Revision Total Knee Arthroplasty: Does the Dosing Regimen Matter? *Yale A. Fillingham, MD (Hanover, NH)*
9:43 am – 9:48 am	**The Insall Travelling Fellowship Update** *W. Norman Scott, MD, FACS (New York, NY)*

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10:15 am – 11:15 am	**Session III: Special Highlights** *Awards Moderator: Mathias P.G. Bostrom, MD (New York, NY)*
10:15 am – 10:25 am	**The John Charnley Award** Increased PJI Risk Following Primary TKA and THA with Alternatives to Cefazolin: The Value of Allergy Testing for Antibiotic Prophylaxis 40 *Cody C. Wyles, MD (Rochester, MN)*
10:25 am – 10:35 am	**The Otto Aufranc Award** Cluster-Randomized Trial of Opiate-Sparing Analgesia after Discharge from Elective Hip Surgery 41 *Majd Tarabichi, MD (Chicago, IL)*
10:35 am – 10:45 am	**The Frank Stinchfield Award** An Approach Based Comparison of Periprosthetic Joint Infection Rates in Total Hip Arthroplasty: A Single Institution Experience 42 *Vinay K. Aggarwal, MD (Palo Alto, CA)*
10:45 am – 10:50 am	**The Hip Society Lifetime Achievement Award** *Presented by Douglas E. Padgett, MD*
10:50 am – 10:55 am	**Recap of the 2018 Rothman-Ranawat Fellowship** **The Hip Society's Rothman-Ranawat Traveling Fellowship** *Benjamin M. Stronach, MD (Jackson, MS) & Elie S. Ghanem, MD (Birmingham, AL)*
10:55 am – 10:58 am	**Tribute to Richard H. Rothman, MD, PhD** *Douglas E. Padgett, MD (New York, NY)*
10:58 am – 11:00 am	**Introduction of the 2019 Rothman-Ranawat Fellows** Adolph V. Lombardi, Jr., MD (New Albany, OH)
11:00 am – 11:15 am	**Presidential Guest Speaker** *Jeremy L. Gilbert, Ph.D., FBSE* *Professor of Bioengineering* *Clemson University* *Professor of Orthopaedics* *Medical University of South Carolina (Charleston, SC)*

9:49 am – 9:54 am	**Highlights from The Knee Society's 2018 Members Meeting** *Ryan M. Nunley, MD (St. Louis, MO)*
9:55 am – 10:00 am	**Highlights from the ORS 2019 Annual Meeting** *Timothy M, Wright, PhD (New York, NY)*
10:00 am – 10:15 am	**COFFEE / REFRESHMENT BREAK**
10:15 am – 11:15am	**Session III: Patient Selection and Optimization** *Moderator: Bryan D. Springer, MD (Charlotte, NC)*
10:15 am – 10:21 am	Avoiding Dissatisfaction (Osteoarthritis Study Initiative) *William A. Jiranek, MD (Durham, NC)*
10:22 am – 10:28 am	Managing the Medical Co-Morbidities: Modifiable and Non-Modifiable *Matthew S. Austin, MD (Philadelphia, PA)*
10:29 am – 10:35 am	Managing the Non-Medical Co-Morbidities: Depression, Mental Illness, Coping and Resilience *James A. Browne, MD (Charlottesville, VA)*
10:36 am – 10:45 am	Mini-Debate I: Is Obesity a Hard Stop? *Affirm – David F. Dalury, MD (Towson, MD)* *Oppose – Nicholas J. Giori, MD (Palo Alto, CA)*
10:46 am – 10:55 am	Mini-Debate II: Is Smoking a Hard Stop? *Affirm – William B. Macaulay, MD (New York, NY)* *Oppose – Michael J. Dunbar, MD, PhD (Halifax, NS, Canada)*
10:56 am – 11:15 am	**DISCUSSION**

11:15 am – 11:55 am	**Debate II: Outpatient THRs** *Moderator: Joshua J. Jacobs, MD (Chicago, IL)*	
11:17 am – 11:27 am	Pros *Keith R. Berend, MD (New Albany, OH)*	
11:27 am – 11:38 am	Cons *Michael P. Bolognesi, MD (Durham, NC)*	
11:39 am – 11:45 am	Reality and Economics *Kevin J. Bozic, MD (Austin, TX)*	
11:45 am – 11:55 am	**Discussion**	
11:55 am – 1:00 pm	***Please join Zimmer Biomet for a non-CME Symposia.*** **Lunch** is provided to all participants by The Hip Society / AAHKS	
1:00 pm – 1:45 pm	**Session IV: Lessons Learned from Difficult Cases** *Moderator: Daniel J. Berry, MD (Rochester, MN)*	
1:00 pm – 1:06 pm	Case 1 *C. Anderson Engh, Jr., MD (Alexandria, VA)*	
1:07 pm – 1:13 pm	Case 2 *Ran Schwarzkopf, MD, MSc (New York, NY)*	
1:14 pm – 1:20 pm	Case 3 *James I. Huddleston, III, MD (Redwood City, CA)*	
1:21 pm – 1:27 pm	Case 4 *Jay R. Lieberman, MD (Los Angeles, CA)*	
1:27 pm – 1:45 pm	**DISCUSSION/ AUDIENCE VOTES**	
1:45 pm – 2:30 pm	**Session V: Young Adult Hip** Moderator: Rafael J. Sierra, MD (Rochester, MN)	
1:45 pm – 1:51 pm	Contemporary Treatment of Femoroacetabular Impingement John C. Clohisy, MD (St. Louis, MO)	44
1:52 pm – 1:58 pm	Osteotomy Michael B. Millis, MD (Boston, MA)	45
1:59 pm – 2:05 pm	Resurfacing Paul E. Beaulé, MD, FRCSC (Ottawa, ON, Canada)	48
2:06 pm – 2:11 pm	THA in Pediatric, Adolescent and Young Adult Oleg A Safir, MD, MEd, FRCSC (Toronto, ON, Canada)	49
2:11 pm – 2:30 pm	**DISCUSSION**	

11:15 am – 11:55 am	**Session IV: The Painful TKA Diagnostic Dilemmas: Case Presentations and Panel Discussion** *Moderator: Daniel J. Berry, MD (Rochester, MN)*
	Panelists: *Christopher L. Peters, MD* *Douglas D.R. Naudie, MD, FRCSC (London, ON, Canada)* *Jean Noel Argenson, MD (Marseille, France)* *Mark W. Pagnano, MD (Rochester, MN)* *Russel E. Windsor, MD (New York, NY)*
11:39 am – 11:45 am	Algorithm for the TKA with Occult Pain *Daniel J. Berry, MD (Rochester, MN)*
11:45 am – 11:55 am	**DISCUSSION**
11:55 am – 1:00 pm	***Please join Zimmer Biomet for a non-CME Symposia.*** **Lunch** is provided to all participants by The Knee Society / AAHKS
1:00 pm – 2:05 pm	**Session V: Current Debates in TKA** *Moderator: Thomas S. Thornhill, MD (Boston, MA)*
1:00 pm – 1:06 pm	Mini-Debate I: Robotic UKA Expensive and Unnecessary *David W. Murray, MD, FRCS (Oxford, United Kingdom)*
1:07 pm – 1:13 pm	It is the Future of UKA *Fares S. Haddad, MD (London, United Kingdom)*
1:14 pm – 1:21 pm	**DISCUSSION**
1:22 pm – 1:28 pm	Mini-Debate II: Antibiotic Cement in Primary TKA Routine Use Justified *Henry D. Clarke, MD (Phoenix, AZ)*
1:29 pm – 1:35 pm	It Should be used Sparingly *Arlen D. Hanssen, MD (Rochester, MN)*
1:36 pm – 1:43 pm	**DISCUSSION**
1:44 pm – 1:49 pm	Mini-Debate III: Metal Allergy in TKA An Occasional Cause of Symptoms and Failure *Joshua J. Jacobs, MD (Chicago, IL)*
1:50 pm – 1:55 pm	It Doesn't Even Exist *Mark W. Pagnano, MD (Rochester, MN)*
1:56 pm – 2:05 pm	**DISCUSSION**

H I P	Venetian / Sands 2101	
2:30 pm – 3:03 pm	**Session VI- A: Revision THR: Acetabular Issues** *Moderator: Wayne G. Paprosky, MD (Winfield, IL)*	
2:30 pm – 2:36 pm	Jumbo Cups *Scott M. Sporer, MD (Winfield, IL)*	50
2:37 pm – 2:42 pm	Wedges and Augments *Richard W. McCalden, MD (London, ON, Canada)*	52
2:43 pm – 2:49 pm	Custom Flanged Cups *Douglas A. Dennis, MD (Denver, CO)*	56
2:60 pm – 2:56 pm	Cup Cage *Allan E. Gross, MD, FRCSC, O. Ont. (Toronto, ON, Canada)*	57
2:57 pm – 3:03 pm	**DISCUSSION**	
3:04 pm – 3:40 am	**Session VI-B Revision THR: Femur** *Moderator: David G. Lewallen, MD (Rochester, MN)*	
3:04 pm – 3:10 pm	Fluted Tapered Stems *Don S. Garbuz, MD, MHSc, FRCSC (Vancouver, BC, Canada)*	59
3:11pm – 3:17 pm	Managing Bone Loss *Gwo-Chin Lee, MD (Philadelphia, PA)*	61
3:18pm – 3:24pm	Peri-Prosthetic Fractures *Emil H. Schemitsch, MD (London, ON, Canada)*	62
3:24pm – 3:40pm	**DISCUSSION**	
3:40 pm – 3:55 pm	**COFFEE / REFRESHMENT BREAK**	

COMBINED SESSIONS I & II
with The Hip Society and will be held in
VENETIAN/ SANDS 2201

2:05 pm – 3:04 pm	**Session VI: Revision Techniques** *Moderator: John J. Callaghan, MD (Iowa City, IA)*
2:05 pm – 2:10 pm	Fully Cemented Stems Technique: Rationale and Results *David G. Lewallen, MD (Rochester, MN)*
2:11 pm – 2:16 pm	Hybrid Fixation Technique and Results *Keith Berend, MD (New Albany, OH)*
2:17 pm – 2:22 pm	Femoral and Tibial Cones Technique and Results *R. Michael Meneghini, MD (Fishers, IN)*
2:23 pm – 2:28 pm	Indications and Technique for Distal Femoral Replacement *Ryan M. Nunley, MD (St. Louis, MO)*
2:29 pm – 2:34 pm	One Stage Indication and Technique *Denis Nam, MD, MSc (Chicago, IL)*
2:35 pm – 2:40 pm	Articulating Spacer Indications and Technique *Michael P. Bolognesi (Durham, NC)*
2:41 pm – 2:46 pm	Knee Arthrodesis: Current Indications and Techniques *Thomas K. Fehring, MD (Charlotte, NC)*
2:47 pm – 3:03 pm	**DISCUSSION, CASE PRESENTATIONS**
3:04 pm – 3:40 pm	**Session VII: Lessons Learned From the Legends** *Moderator: Thomas P. Sculco, MD (New York, NY)*
3:04 pm – 3:10 pm	Case 1 *Robert E. Booth, Jr., MD (Philadelphia, PA)*
3:11 pm – 3:17 pm	Case 2 *Adolph V. Lombardi, Jr., MD (New Albany, OH)*
3:18 pm – 3:24 pm	Case 3 *Kelly G. Vince, MD, FRCSC (Whangarei, New Zealand)*
3:25 pm – 3:31 pm	Case 4 *Michael A. Mont, MD (New York, NY)*
3:31 pm – 3:40 pm	**DISCUSSION**
3:40 pm – 3:55 pm	**COFFEE/REFRESHMENT BREAK**

C O M B I N E D S E S S I O N S

Venetian/ Sands 2201

3:55 pm – 4:40 pm	**COMBINED SESSION I: Pain Management** *Moderator: John B. Meding, MD (Mooresville, IN)*	
3:44 pm – 4:01 pm	How Big is the Problem? *Bryan D. Springer, MD (Charlotte, NC)*	64
4:02 pm – 4:08 pm	Pre-Intervention Management *Carlos J. Lavernia, MD (Coral Gables, FL)*	
4:09 pm – 4:15 pm	Opiate Sparing Analgesia *William J. Hozack, MD (Philadelphia, PA)*	
4:16 pm – 4:22 pm	Post-Operative Management *Craig J. Della Valle, MD (Chicago, IL)*	65
4:24 pm – 4:40 pm	**DISCUSSION**	
4:40 pm – 4:45 pm	**Highlights from the AAHKS 2018 Annual Meeting** *Craig J. Della Valle, MD (Chicago, IL) President of AAHKS*	
4:45 pm – 5:35 pm	**COMBINED SESSION II: Prosthetic Joint Infections Update** *Moderator: Kevin L. Garvin, MD (Omaha, NE)*	
4:45 pm – 5:01 pm	Prevention *Michael H. Huo, MD (Dallas, TX)*	
5:02 pm – 5:08 pm	Diagnosis *Steven J. MacDonald, MD, FRCSC (London, ON, Canada)*	
5:09 pm – 5:15 pm	Treatment *R. Michael Meneghini, MD (Fishers, IN)*	66
5:16 pm – 5:21 pm	Costs *Thomas K. Fehring, MD (Charlotte, NC)*	68
5:21 pm – 5:35 pm	**DISCUSSION**	
5:35 pm	**MEETING ADJOURNED**	

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Session I: Decreasing Complications

8:30 – 8:36 am

Scope of Problem

David C. Ayers, MD

THR is an extremely successful procedure for patients with advanced arthritis of the hip; as it provides outstanding pain relief and functional improvement. THR produces the highest QALY improvement of any surgical procedure

National Quality Forum: NQR #1550 TJR Complications Rates

- Measure evaluation: complication rate following primary TJR Dec 2009
- Measure estimates Hospital complication rates associated with Medicare TJR patients from DOS to 90d
- This led to public reporting of hospital complication and readmission rates as CMS Core Measurement

Methods: Evaluated 878,098 Medicare Fee for Service Beneficiaries From 2008-2010 at 3479 hospitals

- Results: Risk standardized complication rate 3.6%
- Range from 1.8% to 9.0%; a 4- fold difference in complication rates across US hospitals
- NQF Conclusion: “Variability is a signal of differences in quality of care received…”
- “these are elective procedures typically performed on healthy patients and complication rates are expected to be low….The variation observed is a signal that there are differences in the quality of care delivered across hospitals that result in variation in outcomes”
- Most common complications: Pneumonia 0.86%, Pulmonary Embolus 0.75%, PJI/wound infection 0.67

Readmission Rates

- Reported 30d readmission rates vary from 3.5% to 5.5%
- Incidence increases over time; 90d readmission rate of 7%

FORCE-TJR Readmission Rates; 8280 primary unilateral THR patients over 65 yo: merged with CMS claims data

Results: 4.7% patients over 65 30d readmission (validated with CMS claims data)

7.1% of all FORCE pts readmitted during 6m after THR; all charts reviewed and audited

Pre-op Medial Risk Factors for CMS patients with Readmission:

	NO Readmission	Readmission	p value
Charlson >2	19%	24%	0.02
Smoking (current)	3.5%	11%	0.03
CHF	9.3%	17.8%	0.06
Diabetes	24.6%	42.2%	0.009
Renal Failure	8.7%	22.2%	0.002
PVD	24.4%	48.9%	0.001

Reasons for 30d readmission; chart review to confirm diagnosis

55% of patients readmitted for Medial Reason

45% for Hip related reason: 16% cellulitis; 9% dislocation; 4% Prosthetic infection; 4% DVT/PE;

4% hematoma; 2% Periprosthetic fracture; 6% Other (including pain)

One Year Revision Rates:

- International registries report all cause THR revision rates based on registry dta where surgeons report revision and cause of revision
- Some countries linkages with national health records assist monitoring revision rates, etiology
- Historically US THR revision rates were based on CMS claims that cannot verify initial surgery date when THR occurs before the patient is 65 yo
- Claims cannot verify laterality of revision (vs laterality of initial THR) pre-ICD-10
- No revision data have been available for pts under 65; fastest growing sub-group of pts in US

Determined US 1- year revision rates for primary THR in patient 65 yo or older using FORCE-TJR data

- Reasons for revision documented based on clinical chart review
- 0ver 9000 primary unilateral THR between 2011 and 2014
- FORCE-TJR: Reason for revision Dislocation 36%; Fracture 20%; Infection 12%
  CPR 1yr 1.6%
- MARCQI: Reason for revision Fracture 27%, Dislocation 26%, Infection 19%
  CPR 1yr 1.5%

1. Bozic et al, Variation in hospital-level risk-standardized complication rates following elective primary total hip and knee arthroplasty. J Bone Joint Surg Am 2014; 96(8):640-7.
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3. Fry et al, Risk-Adjusted Hospital Outcomes in Medicare TJR Surgical Procedures. J Bone Joint Surg AM 2017; 99(1):10-18.
4. Paxton et al, Are There Modifiable Risk Factors for Hospital Readmission After THR in a US Healthcare System. CORR 2015; 473(11): 3446-55.
5. Ayers et al, One Year THR Revision Rates in the US: Incidence and Etiology in Patients 65 Years of Age and older. Proceeding of International Society of Arthroplasty Registries, June 2018.

8:37 – 8:43 am

VTE Update

Paul F. Lachiewicz, MD

Introduction: VTE prophylaxis after total hip arthroplasty (THA) requires a careful balance between the risks of a symptomatic event (DVT or PE) and bleeding requiring reoperation. There has been general agreement between the "guidelines" of the AAOS, AACP, and SCIP since 2012, and to my knowledge, there have been no new guidelines published. Risk stratification has been suggested, distinguishing between "standard risk" patients (who generally receive aspirin and/or some form of mechanical compression), and "increased risk" patients (who generally receive an anticoagulant). Many pharmacologic agents have been used for VTE prophylaxis after elective THA, but there is little data on the trends of anticoagulant use in the USA. Rivaroxaban was the first novel oral anticoagulant approved for THA patients, but its "real-world" efficacy is unknown.

Materials and Methods: Using the Truven Health MarketScan database, new anticoagulation prescriptions after elective THA from 2010 to 2015 were analyzed. The frequency of deep vein thrombosis (DVT), pulmonary embolism (PE), and adverse events, within 90 days, were then evaluated in 12,876 users of warfarin and 10,892 users of rivaroxaban in commercially insured (CI) patients, and 7,416 users of warfarin and 4,739 users of rivaroxaban in Medicare supplement (MS) patients. Data was analyzed for each anticoagulant by odds ratios using logistic regression models with stabilized inverse probability treatment weighting.

Results: The use of warfarin decreased from approximately 50% each in 2010, in both insurance cohorts, to 10% in CI patients and 30% in MS patients in 4th quarter 2015. The use of rivaroxaban increased from 0 to 33% in both cohorts from 2011 to 2015. In the multivariate analysis, in CI patients, females had lower odds of getting rivaroxaban, and patients in Western region had higher odds of getting rivaroxaban; in MS patients, increasing age had reduced odds of getting rivaroxiban, but Western region and surgery in 2015 had higher odds. With logistic regression analysis, both CI and MS patients given rivaroxaban had significantly lower odds ratio of both DVT and PE. There was no significant difference in rates of bleeding between warfarin and rivaroxaban, but warfarin, unexpectedly, had higher odds ratio of prosthetic joint infection in both CI and MS cohorts.

Conclusions: There has been an increase in VTE prophylaxis with rivaroxaban, and a decrease in both warfarin and LMWH use after elective THA over four years. Patient factors, insurance type, and comorbidities were associated with this change. In actual clinical efficacy, rivaroxaban had lower odds ratio of both DVT and PE than warfarin, and bleeding risks were similar. The association of warfarin with an increased odds ratio of PJI compared to rivaroxaban requires further study. The multicenter, randomized clinical PEPPER trial, organized by Vin Pelligrini, comparing prophylactic strategies is in progress, and will hopefully bring clarity to these issues.

8:44 – 8:50 am

Implant Loosening

Michael Tanzer, MD, FRCSC, FAAOS

Despite advances in implant design and surgical technique, The Australian Registry indicates that implant loosening remains the leading cause of revision, accounting for 25% of all revisions. Failure of a hip implant to osseointegrate to the adjacent host bone, results in the formation of fibrous tissue at the bone–implant interface and eventual loosening of the implant. This can be caused by low biocompatibility of implant, surface characteristics and the design of the implant, bone quality, surgical technique, and insufficient bone turnover.

To improve the rate and quality of osseointegration and survivability, manufacturers have focused on implant design, coatings and topographic changes of the implant surface. The features of the implant design and surgical technique have a crucial effect on primary stability of the implant and its ability to osseointegrate to the host bone. Osseointegration per se is not linked to any particular surface characteristics, because a great number of different surfaces achieve clinical osseointegration. However, the stronger or weaker bone responses may be related to the surface characteristics. Hydroxyapatite coatings continue to be used to enhance osseointegration, but its benefit as an adjuvant means of fixation has been variable. In addition, systemic medications have demonstrated a beneficial effect on preventing implant loosening.

Most recently, highly porous implant materials have gained widespread popularity due to its clinical success. The introduction of additive manufacturing to the design armamentarium has allowed for the introduction of bone-mimicking meta-biomaterials that offer an alternative porous surface to facilitate osseointegration. Strategies to enhance osseointegration of cementless implants continue to evolve and some of these modifications to hip implant surfaces will be reviewed.

8:51 – 8:57 am

Modifying Risk Factors

Richard Iorio, MD

Although some risk factors are non-modifiable, such as age and gender, it is important that healthcare organizations emphasize medical optimization of TJA candidates with modifiable risk factors (MRF) to prevent hospital readmissions and improve outcomes. MRFs that influence readmission include hospital length of stay (LOS), respiratory conditions, body mass index (BMI), diabetes, cardiovascular diseases, hepatic disease, chronic renal disease, venous thromboembolic (VTE) disease, tobacco use, substance abuse, psychiatric conditions, and fall risk. Various risk stratification instruments exist, such as the American Society of Anesthesiologist (ASA) score, however they include both non-MRFs and MRFs. Furthermore, they are unable to guide medical optimization protocols, and instead simply categorize patients at risk for perioperative complications. The Perioperative Orthopaedic Surgical Home (POSH) program, which includes a Readmission Risk Assessment Tool (RRAT), was developed to better stratify and optimize TJA candidates (see below). With the help of this program, the alignment of the hospital, patient, payer, and surgeon can concurrently be addressed and provide cost-effective, high quality care and improved patient outcomes.

Background: It is well recognized that unplanned readmissions following total joint arthroplasty (TJA) are more prevalent in patients with comorbidities. However, few investigators have delayed surgery and medically optimized patients prior to surgery. In its current form, the Perioperative Orthopaedic Surgical Home (POSH) is a surgeon-led screening and optimization initiative targeting eight common modifiable comorbidities.

Methods: A total of 4,188 patients who underwent TJA between January 2014 and December 2016 were retrospectively screened by the Readmission Risk Assessment tool (RRAT) score. From this cohort, 1,194 subjects a preoperative RRAT score ≥3 and were eligible for inclusion. Patients were then separated into two cohorts based upon whether they were medically optimized according to the POSH initiative (POSH; n= 216) or continued with surgery (non-POSH; n= 978) despite their high-risk for readmissions. Demographics and quality metrics were then compared between the two cohorts.

Results: Since the implementation of the POSH initiative, patients with RRAT scores ranging from 3 to 5 have experienced lower 30-day (1.6% vs. 5.3%; p=0.03) and 90-day (3.2% vs. 7.4%; p<0.05) readmission rates when compared to the non-POSH cohort. Only 15.3% of medically optimized patients enrolled in the POSH initiative were discharged to a post-acute care (PAC) facility, whereas, 23.4% of non-POSH patients were discharged to a PAC facility (p=0.01). There were no differences in LOS and infection rates between the two cohorts. Moreover, 90-day episode of care costs were 14.9% greater among non-POSH Medicare TJA recipients and 32.6% higher if a readmission occurred.

Conclusions: The identification and medical optimization of comorbidities prior to surgical intervention may enhance the value of care TJA candidates receive. A standardized multi-disciplinary approach to the medical optimization of high-risk TJA candidates may improve patient engagement and perioperative outcomes, while reducing cost associated with TJA. Historically, surgical risk stratification methods emphasized the appraisal of non-modifiable risk factors, which have incentivized ‘cherry picking’ and ‘lemon dropping’ behaviors. Only recently has medical optimization of high-risk TJA candidates demonstrated improved outcomes by reducing hospital readmissions when patients undergo TJA after optimization.

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- Kim, Kelvin; Anoushiravani, Afshin; Chen, Kevin; Li, Robert; Slover, James; Bosco, Joseph A.; and Iorio, Richard. Perioperative Orthopaedic Surgical Home (POSH): Optimizing TJA Patient Health and Preventing Readmission. Journal of Arthroplasty, Accepted for publication, January 2019.

Readmission Risk Assessment Tool (RRAT)

Patients undergoing TJA may be risk stratified for the risk of readmission using the above RRAT tool. Modifiable risk factor categories are listed in the left column with their respective risk factors in the three adjacent columns. Risk factors are graded based upon severity (columns 1, 2 and 3) and total score is summed. RRAT scores ≥3 should result in a hard stop until the patient is optimized. Stop hand indicates hard stop until modifiable risk factor is resolved.

*Patient has a history of coronary artery disease, cerebrovascular accident, peripheral vascular disease or venous thromboembolic disease, age ≥60 years and at least 21 cardiac risk factors; renal insufficiency (CrCl < 60ml/min); diabetes; COPD; hypertension; recent smoker (<30 days); cancer; heart failure

**Has VTED risk factors: cerebrovascular accident, COPD, BMI ≥40, coronary artery disease, peripheral vascular disease, thrombophilia (activated protein C resistance, elevated factor VIII and lipoprotein A)

Session II: Intraoperative and Early Postoperative Complications: Surgical Exposure and How to Manage (Video-Based)

9:10 – 9:16 am

Bearing: Role for "Standard" Head Sizes

Amar S. Ranawat, MD

Femoral head size in total hip arthroplasty has increased in recent years. Currently, head sizes measuring 32-36 mm are the most common. Despite the trend of using larger femoral head sizes, surgeons still have reservations in naming the optimal size. Current research suggests that increasing femoral head size comes with its own set of limitations and complications. For instance, larger femoral head sizes are associated with increased stability but also decreased THA survivorship thus complicating the decision of what head size should be used.

The optimal bearing size should combine the highest possible stability and best hip function with the lowest possible wear in an attempt to increase THA longevity. When determining femoral head size for total hip arthroplasty, four crucial factors should be taken into consideration: patient range of motion, dislocation rate, survivorship, and groin pain attributed to impingement. The optimal bearing size should allow the greatest hip function while also maintaining stability and durability in an effort to maximize THA longevity.

According to Zijlstra et al., research has indicated a reduced risk of revision for dislocation using 32 mm heads instead of 22-28 mm heads. Supporting the trend of increasing femoral head size, Tsikandylakis et al. showed an increased range of movement in the hip attributed to increased femoral head sizes up to 36-38 mm. Cinotti et al. had similar findings in regard to the association of larger head sizes and increased hip range of motion. They also found the 32 mm femoral head to perform very closely to the 36 mm and 38 mm femoral heads even in the presence of non-optimal cup positioning. The 32 mm head also rated lowest in terms of groin pain attributed to impingement or overstuffing of the anterior capsule. While larger femoral head sizes prevent impingement, head sizes larger than 32 mm overstuffed the capsule.

Lachiewicz et al. presented data against the use of larger femoral head sizes in regard to rate of THA wear. While no association between femoral head size and linear wear rate was found, 36-40 mm femoral heads had higher volumetric wear (median 26.1; 95% CI, 11.3–47.1) than did 26-mm heads (median 3.1; 95% CI, 0.7–12.3), 28-mm heads (median 12.3; 95% CI, 3.0–19.3), and 32-mm heads (median 12.9; 95% CI, 6.6–16.8; $p = 0.02$). The increased wear can be attributed to the thinner polys and increased frictional torque found in larger heads.

While no femoral head size dominates in every criterion, current evidence on associations between femoral head sizes and hip range of movement, dislocation, THA longevity, and groin pain due to iliopsoas impingement suggest the ideal measurement to be 32 mm.

9:17 – 9:23 am

Soft Tissue Procedures

Stephen J. Incavo, MD

I. Abductor Muscles

Hip abductor tendon tears are an under-recognized cause of chronic, often progressive, lateral hip pain, weakness, and limp. These tears are often degenerative in nature predominately in females, however, they can also be associated with acute trauma or following direct lateral surgical approach for THR. Positive clinical signs and symptoms are an indication for MRI scan. A proposed classification scheme can guide surgical treatment.

Type I – minor tears (no avulsion)	Type II – avulsion of gluteus medius from bone
A. Gluteus medius/minimus partial tears B. Gluteus minimus complete tears C. Longitudinal tear of gluteus medius	A. < 50% B. ≥ 50%

Multiple repair techniques and salvage procedures have been reported: however, re-tear remains a frequent complication following surgical repair. Because of disappointing results after traditional repair using bone tunnels or suture anchors in the greater trochanter, a new technique using a vertical bone trough in the mid-portion of the greater trochanter was developed. This produced significantly improved findings of lower reoperation rates, greater pain reduction, and ability to perform a single leg stance. Importantly, no cases of trochanter fracture occurred.

Surgical treatment for Type I chronic tears is open tenodesis of the 2 tendons to each other. Type II tears are treated with repair into a bone trough. This technique has also been used successfully when an abductor muscle avulsion is encountered during THR.

Importantly, the post-op recovery is gradual for Type II tears: Walker for 6 weeks followed by use of a cane for 6 weeks. At 12 weeks, gentle patient directed ab/adduction is allowed with formal strengthening at 16 weeks.

II. Psoas Muscle

Psoas tendonitis following THR due to anterior prominence of the acetabular component can be difficult to treat. If non-operative treatment fails, an injection into the tendon sheath can be confirmatory. If symptoms are severe enough to warrant surgery, a psoas tenotomy is recommended for < 8mm of acetabular prominence on a true lateral radiograph, and acetabular revision for ≥ 8 mm of shell prominence based on a recent report from the Mayo Clinic (JBJS 2017).

9:24 – 9:30 am

Bearing: Dual Mobility

Arlen D. Hanssen, MD

Dislocation remains one of the most common postoperative complications following primary and revision THA. Often the occurrence of dislocation is multifactorial but after primary THA is often due to malposition of the acetabular and/or femoral components or in high-risk patients such as advanced age, gender, congenital hip dysplasia, spinal deformity, morbid obesity, or underlying neurological disorders.

Revision THA is in itself a procedure with inherently higher risk of dislocation compared with primary THA and a number of additional high-risk revision diagnoses have been identified. These include isolated acetabular revision, reimplantation for infection, revision for instability, and abductor insufficiency.

In addition to ensuring proper component position, use of alternative bearing options such as large femoral heads (LFR), dual mobility (DM), and constrained liners have been used to both prevent and treat hip instability following revision THA. The literature clearly demonstrates a reduction in postoperative hip instability for a variety of high-risk patient cohorts including all cause revision, reimplantation THA as a second stage for infection, and revision for instability.

Dual mobility constructs confer superior stability in all cause revisions when compared with LFR constructs and economic analysis suggests that a strategy including the use of DM confers a reduction in overall health care costs as compared with LFR. Although constrained liner constructs confer stability, they are associated with less overall hip ROM, are prone to impingement and subsequent failure. DM has been successfully used in the treatment of failed constrained liners constructs. Continued research is necessary to define the proper indications of the bearing options for improved hip stability.

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9:31 – 9:37 am

Bearing: Constrained Options

Thomas P. Sculco, MD

Instability after total hip arthroplasty is the most common indication for revision arthroplasty and can be difficult to treat. There are options available including use of larger femoral heads, dual mobility sockets and constrained sockets. The purpose of this study is to evaluate the outcomes associated with the use of a constrained acetabular component as a treatment for instability after hip arthroplasty. We reviewed the clinical and radiographic outcomes of 149 arthroplasties, that had been performed with use of a single design of constrained acetabular component between 2007 and 2012 at a single institution. Patient demographics and case specific data were collected The Mann-Whitney U test was used to assess continuous variables. Categorical variables were examined using the Chi-square test and Fisher's exact test when appropriate. Survival probability was calculated using the Kaplan-Meier method.

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

This study correlates with results of other papers in the literature looking at outcome of constrained tripolar type sockets. The focal constraint socket with a metal ring type design have a much greater failure rate (9-29%) Constrained liners remain an excellent option for hip instability in early to midterm follow up. It is particularly useful in patients with severe abductor insufficiency, neurologic disease and spasticity and paralysis.

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9:38 – 9:44 am

Acetabular Positioning

Robert L. Barrack, MD

I. Clinical Relevance

A. Many total hips dislocate with components in “apparently” good position.

B. Dislocation rates are much higher among patients with spine deformities/spine fusions
   1. Longer fusions are higher risk than shorter fusions
   2. Fusion to the sacrum are the worst

C. Most historical studies have utilized traditional orthopedic radiologic technique
   1. Supine Position
      A. Non-weight bearing
      B. Not at risk position for instability
   2. Does not allow assessment of spine-pelvis motion

II. Functional Imaging

A. Introduced in past decade for spine – focus on sagittal balance

B. Involves imaging spine along with pelvis and lower extremities
   1. Sitting
   2. Standing

C. EOS (Paris, France)
   1. Simultaneous AP-lat imaging
   2. Lower radiation dose
   3. Less distortion

D. Alternative – Lateral plain x-ray

III. Normal Pelvic Rotation

A. Standing Position

   1. Pelvis flexes
   2. Head coverage increases –optimal for weight bearing
   3. Effective combined anteversion (ante-inclination) decreases
   4. Sacral slope increases
   5. Pelvic outlet view

B. Sitting – position

   1. Pelvis extends
   2. Head coverage decreases
   3. Ante-inclination increases – optimal for stability – avoiding anterior impingement
   4. Sacral slope decreases
   5. Pelvic inlet view

IV. Pathological patterns – Surgical adjustment

A. “Stuck standing”

1. Pelvis fails to extend (remains flexed) with sitting
2. Ante-inclination stays too low
3. Prone to anterior impingement, posterior dislocation
4. Surgical options
    a. Increase inclination and anteversion (50°, 30°)
    b. Increase femoral (combined) anteversion
    c. Remove sources of anterior impingement
        i. Anterior trochanter
        ii. AIIS

B. “Stuck sitting”
1. Pelvis fails to flex (remains extended) when standing
2. Ante-inclination too high
3. Prone to anterior dislocation
4. Surgical options
    a. Decrease ante-inclination (35°, 10°)
    b. Decrease femoral (combined anteversion)
    c. Remove sources posterior impingement
        i. Posterior trochanter
        ii. Sacrum

V. Role of spine surgery

A. Controversial

B. Spine surgery first to restore sagittal balance?
1. Only when clinically indicated
2. *Potential* to prevent a previously stable THA from being rendered unstable

C. *Apparently* contradicted by reports of lower dislocation rate when THA *precedes* spine surgery

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Session III: Special Highlights

10:15 – 10:25 am

The John Charnley Award

Increased PJI Risk Following Primary TKA and THA with Alternatives to Cefazolin: The Value of Allergy Testing for Antibiotic Prophylaxis

Cody C. Wyles, MD

Abstract

Aims: The aims of this study were to characterize antibiotic choices for perioperative TKA and THA prophylaxis, assess antibiotic allergy testing efficacy, and determine rates of periprosthetic joint infection (PJI) based on perioperative antibiotic regimen.

Patients and Methods: We evaluated all patients undergoing primary TKA or THA at a single academic institution from January 2004-May 2017, yielding 29,695 patients with 3,411 patients (11.5%) undergoing preoperative allergy testing. A series of institutional databases were combined to identify allergy consultation outcomes, perioperative antibiotic regimen, and infection-free survivorship until final follow-up.

Results: Among allergy-tested patients, 3,310 patients (97.0%) were cleared to use cephalosporins. For the entire cohort, 28,174 patients (94.9%) received cefazolin and 1,521 patients (5.1%) received non-cefazolin antibiotics. Infection-free survivorship was significantly higher among patients receiving cefazolin compared to non-cefazolin antibiotics with 0.06% higher survival free of infection at 1 month, 0.56% at 2 months, 0.61% at 1 year, and 1.19% at 10 years ($p<0.001$). Overall, the risk of PJI was 33% lower in patients treated with cefazolin after adjusting for ASA Classification and BMI ($p<0.001$). The number needed to treat with cefazolin to prevent 1 PJI was 164 patients at 1-year and 84 patients at 10-years. Therefore, potentially 6,098 PJIs could be prevented by 1-year and 11,905 by 10-years in a cohort of 1,000,000 primaryTKA and THA patients.

Conclusions: PJI rates are significantly higher when non-cefazolin antibiotics are used for perioperative TKA and THA prophylaxis, highlighting the positive impact of preoperative antibiotic allergy testing to increase cefazolin usage. Given the low rate of true penicillin allergy positivity and readily modifiable risk factor that antibiotic choice provides, we recommend perioperative testing and clearance for all patients presenting with penicillin and cephalosporin allergies.

10:25 – 10:35 am

The Otto Aufranc Award

Cluster-Randomized Trial of Opiate-Sparing Analgesia after Discharge from Elective Hip Surgery

Majd Tarabichi, MD

Aims: To assess the efficacy of multimodal analgesia with a minimal opiate supply compared with traditional opiate regimens after discharge from elective hip surgery.

Methods: Prospective, three-arm, parallel-group, cluster-randomized, crossover trial conducted at four surgical sites from June 2017-January 2018, consisting of a pre-screen evaluation, 30-day daily assessments, and final evaluations after 30- and 90-days. Eligible participants were greater than 18 years old, undergoing primary, unilateral hip replacement during the study period. Chronic opiate users and patients with contraindications to protocol medications were excluded. Patients (n=235) undergoing hip replacement were randomized in clusters to receive one of three pain regimens at hospital discharge: traditional large opiate supply (Group B-60 tablets), or a traditional opiate regimen without multimodal, analgesia (Group C-60 tablets). Clusters were determined by surgeon, with each cluster alternating between interventions in 4-week intervals. The multimodal regimen comprised scheduled-dose acetaminophen and gabapentin for four weeks and meloxicam for two weeks postoperatively.

Results: Daily pain was significantly lower in both multimodal groups, Group A (Coeff-0.81, p=0.003) and Group B (Coeff-0.61, p=0.021). While daily utilization and duration of opiate use was lower for both Group A (Coeff-0.77, p<0.001) and Group B (Coeff-0.30, p=0.04) compared with Group C, opiate use was also lower for Group A than Group B (Coeff-0.46, p=0.002). There were significantly fewer opiate-related symptoms in Group A compared to Group C (p=0.005), but Group B and C didn't differ (p=0.13). Additionally, both multimodal regimens improved satisfaction and sleep, and there was no difference in hip function or adverse events.

Conclusion: A multimodal analgesic regimen with minimal opiates improved pain control while significantly decreasing opiate utilization and opiate-related adverse effects. It is now time to renounce the unfounded reliance on traditional opiate analgesia after elective surgery.

Trial Registration: clinicaltrials.gov, NCT03358888

10:35 – 10:45 am

The Frank Stinchfield Award

An Approach Based Comparison of Periprosthetic Joint Infection Rates in Total Hip Arthroplasty: A Single Institution Experience

Vinay K. Aggarwal, MD

Introduction: There has been a renewed interest in the surgical approach used for total hip arthroplasty (THA). Risk factors for periprosthetic joint infection (PJI) have been well studied over the past decade, yet PJI remains one of the most devastating complications following THA. At our center, multiple surgical approaches are used for THA. We studied the impact of direct anterior (DA) versus non-direct anterior (NA) surgical approaches on PJI and examined the impact of new perioperative protocols on PJI rates following all surgical approaches at a single institution.

Methods: 6086 consecutive patients undergoing primary THA at a single institution from 2013- 2016 were retrospectively evaluated. Data obtained from electronic patient medical records included age, sex, body mass index (BMI), medical comorbidities, surgical approach, and presence of deep PJI. Deep PJI was defined according to National Healthcare Safety Network's (NHSN) criteria for joint space infection following prosthetic hip replacement. Infection rates were calculated yearly for the DA and NA approach groups. Covariates were assessed and used in multivariate analysis to calculate adjusted odds ratios for risk of development of PJI with DA compared to NA approaches. In order to determine the effect of adopting a set of infection prevention protocols on PJI, we calculated odds ratios for PJI comparing patients undergoing THA for two distinct time periods: 2013-2014 and 2015-2016. These periods corresponded to before and after we implemented a set of perioperative infection protocols.

Results: There were 1985 patients in the DA group and 4101 patients 23 in the NA group. The overall rate of PJI at our institution during the study period was 0.82% (50/6086) and decreased from 0.96% (12/1245) in 2013 to 0.53% (10/1870) in 2016. There were 24 deep PJI's in the DA group (1.22%) and 26 deep PJI's in the NA group (0.63%) (p=0.0231). After multivariate analysis, the DA approach was 2.2 times more likely to result in PJI than the NA approach (95% CI OR 1.1-3.9, p=0.0062) for the overall study period. When stratified by time, patients undergoing THA utilizing any approach prior to adopting the infection prevention protocols (2013-2014), were 1.8 times more likely to have PJI compared to patients undergoing THA after the adoption of the protocols, however this result did not reach significance (95% CI OR 0.901-3.653, p=0.0953).

Conclusions: We found higher rate of PJI in DA versus NA approaches. However, adoption of infection prevention protocols mitigated these PJI rates, such that they were diminished in both approach groups for the period following the use of the protocols. Institutional learning curves and adaptation of interventions aimed at PJI prevention positively contributed to the decreased rate of PJI observed for all approaches over time.

Session IV: Lessons Learned from Difficult Cases

1:00 – 1:45 pm

Four surgeons will present difficult hip cases from which important lessons were learned, and the moderator will use the cases to explore how the difficult problems illustrated by each case might be avoided, and when that is not possible, how each might most effectively be treated. The audience will be engaged in the discussion and vote will be held for the most “challenging” hip case presented.
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Session V: Young Adult Hip

1:45 – 1:51 pm

Contemporary Treatment of Femoroacetabular Impingement

John C. Clohisy, M.D.

The understanding and treatment of femoroacetabular impingement (FAI) has evolved dramatically over the past fifteen years. The concept of FAI is now well-accepted and is considered one of the most common causes of pre-arthritic hip pain and dysfunction in young patients. Collective evidence indicates that FAI structural abnormalities are associated with a heightened risk for the development of hip pain, intra-articular disease (articular cartilage and labrum) and progressive secondary osteoarthritis. Translational investigations show that the impingement zone is a major source of catabolic and pro-inflammatory factors initiating the intra-articular degenerative cascade. Both arthroscopic and open surgical treatment focusing on deformity correction, normalization of hip biomechanics and repair of intra-articular damage has been associated with favourable clinical outcomes (improved pain and function) in the majority of patients. Recent investigations also indicate disease modification with improved articular cartilage health after the surgical treatment of FAI.

Despite remarkable advances in the diagnosis and treatment of FAI, there is a major need for improved evidence to guide future diagnostic and treatment algorithms. Patient-specific factors impacting disease presentation and treatment outcomes need to be clarified. Disease-specific characteristics including the stage of joint degeneration, and the details of the FAI pathomorphology are critical to optimizing patient selection for surgery, surgical planning and the clinical outcomes of surgical treatments. Modifiable surgical factors including approach, treatment of intra-articular abnormalities, and accuracy of deformity correction are aspects of FAI treatment that require additional consideration. Contemporary treatment encompasses an armamentarium of procedures including arthroscopy, surgical hip dislocation, periacetabular osteotomy and proximal femoral osteotomy. Each procedure has distinct advantages, disadvantages and indications for treating symptomatic FAI. Current controversies will be discussed and focus on defining the predictors of clinical outcomes, the role/indications for open procedures, optimal treatment of the borderline dysplastic hip (with FAI features), optimal strategies for residual childhood deformities (Perthes and SCFE) and treatment impact on natural history. Given the progress to date and ongoing efforts, the management of FAI disorders should continue to improve relative to providing predictable pain relief, improved function and disease modification over time.

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1:52 – 1:58 pm

Osteotomy

Michael B. Millis, MD

I. Structural/mechanical etiology for most osteoarthritis of the hip
  A. Regional variations in specific etiology
  B. Dysplasia is most common single etiology in much of the world
    1. Japan: 80+% (Takatori 2001)
    2. Europe, North America 40+% (Aronson 1986)
  C. DDH>Idiopathic Cam FAI>Perthes>SCFE as etiologies of OA
    1. In North America (Clohisy 2011)

II. Understanding the pathomechanics in the at-risk hip is essential for successful hip preservation
  A. Conceptual: Instability, femoracetabular impingement(FAI), and combinations of Instability and FAI seem responsible for progressive damage in most hips which develop OA
  B. Practical:
    1. Accurate analysis of the young adult patient with hip disease
      a) Interview to assess symptoms, needs, expectations
      b) Physical exam
      c) Imaging
      d) Synthesis of information; treatment selection
      e) Shared decision-making??

III. Indications for hip preservation surgery
  A. Correctable mechanical factor(s) predisposing to dysfunction/OA
  B. More upside than downside
    1. Duration of improved function in the preserved hip
    2. "Match the expected lifetime of the operation to the expected lifetime of the patient." - Heinz Wagner

IV. Indications for realignment osteotomy for hip preservation
  A. Deformity or malalignment correctable by osteotomy

V. Published outcomes
  A. Dysplasia
    1. PAO
      a) 30 years Lerch (Ganz-Bern),
      b) 1/3 still doing well
      c) 18-20 yrs Wells/Matheney/Millis (Boston 50+% 0-min symptoms;~25% symptoms but still have native hip; ~25% THR or high pain
      d) Wells/Clohisy (St Louis)
      e) Troelsen/Soballe (Aarhus)

    2. RAO
      a) Takatori, others

      Negative predictive factors for hip preservation success:
      Patient-related: Older age; high preop pain, poor preop motion, cartilage damage, psychosocial stressors
      Surgery-related: imprecise correction: postop residual or iatrogenic instability or impingement

      b) FAI

      Longterm results not yet available

      c) SCFE

      Iowa results the classic
      Progressive decline in function over time for all treatment groups
      Uncorrected FAI and FAI-related damage likely the cause of OA
      Contemporary treatment have only short-term outcomes available

d) Perthes
Intraarticular surgery offers new hope for improved results
e) AVN
ITO's
Asia: Transtrochanteric rotational osteotomy

VI. Pearls to pick up: Tips for success in hip osteotomy surgery

A. Precise mechanically-based analysis

1. 3D and dynamic assessment will become routine

B. Precision treatment the ideal

1. Combinations of realignment, +/-intraarticular surgery, +/-adjuvant cartilage work

C. Clear treatment program worked out preop

1. Multimodal support
a) PT
b) Peer and other psychosocial support as needed

D. Close follow-up

1. Short-term

2. Long-term

VII. Pitfalls to avoid in hip osteotomy surgery

A. Expectations, needs>>>expected outcomes

B. Unclear/uncorrectable pathomechanics

C. Imperfect match between patient and treatment team

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1:59 – 2:05 pm

Resurfacing

Paul E. Beaulé, MD, FRCSC

The optimal patient for hip resurfacing arthroplasty (HRA) is a young active man with osteoarthritis, typically younger than 60 years of age (1, 2). . Although HRA in females remains highly controversial (2-4), positive outcomes comparable to that of males have been observed by the first author (P.B.) in females 40 to 50 years of age with femoral implant size larger than 48 mm. Studies of the National Joint Registry for England and Wales and the Australian Orthopaedic Association National Joint Replacement Registry support these observations (5, 6). Patients should be counseled that frequent impact activity can increase the risk of femoral failure (7, 8). One study by Le Duff and colleagues found that impact activity was associated with up to a fourfold increase in the revision rate at mean 10-year follow-up (8). Currently, two metal-on-metal hip resurfacing systems are commonly used worldwide: Birmingham Hip Resurfacing (BHR; Smith & Nephew), which uses hybrid fixation, and the Conserve Plus (MicroPort), which has hybrid and noncemented fixation options.

The authors of a 2015 study reported a high rate of implant survival with revision as the end point at 5-yr follow-up in patients treated with the Conserve Plus (mean age, 48.3 years). At mean 6.6-year follow-up, 30 hips (5.4%) required conversion to THA, with loosening of the acetabular implant (1.8%) and fracture or loosening of the femoral neck (0.9%) as the leading causes of failure. Five-year survival with a revision endpoint was 94.5% (95% CI: 93.5% to 95.5%). Implants with an abduction angle >50° were at significantly greater risk of radiolucency. The incidence of adverse tissue reaction was 0.7% (9). The best clinical survivorship was observed in patients with femoral implant sizes greater than 48 mm consistent with data from the Australian Orthopaedic Association National Joint Replacement Registry (5).

A more recent analysis looked at patients less than 45 years of age with minimum 5 years of followup in 260 hips (221 pts) (168 males/53 females, mean age 40.1 years). At a mean follow-up of 6.5 years, there were 20 revisions from hip resurfacing to total hip replacement in 19 patients with two cases of infection and 18 cases of failure for non-infectious reasons. For non-infectious causes, survivorship was 95% and 94% at 5 and 10 years, respectively. When comparing females and males, 5-year survivorships were 90.2% and 96.0%, respectively. Similarly, the 10-year survivorships for females and males were 88.5% and 95.4%, respectively. High cup abduction angle and female sex were risk factors for failure.

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2:06 – 2:11 pm

THA in pediatric, adolescent and young adult

Adam M. Katchky, Ryan N. Katchky, Martin F. Gargan, Simon P. Kelley, Oleg A. Safir

Introduction
Numerous musculoskeletal and systemic conditions may affect the hips of paediatric patients. While the large majority of patients go on to achieve positive outcomes, a small number will progress to end stage arthropathy with significant functional impairment. Management options have been significantly limited for this population. An adolescent hip arthroplasty program was developed with the aim to improve symptoms and quality of life for patients with pain and disability refractory to joint preserving management strategies.

Methods
All patients were assessed jointly by a paediatric hip surgeon and an adult hip arthroplasty surgeon pre-operatively, with all procedures conducted at a dedicated tertiary care paediatric centre under general anesthesia. All procedures were completed through a direct lateral (trans-gluteal) approach, using uncemented components (Zimmer Biomet®, Warsaw, IN) and a ceramic on highly cross-linked polyethylene bearing. Data was collected prospectively after approval from the Institutional Review Board. All patients completed clinical examination and functional scores pre-operatively and at six months post-operatively.

Results
Twenty-eight patients (29 hips) have undergone adolescent THA through this program. The most common diagnoses were avascular necrosis (n=18), idiopathic chondrolysis (n=2), chondrolysis secondary to slipped capital femoral epiphysis (n=2), and juvenile idiopathic arthritis (n=2). Numerous additional diagnoses accounted for 1 case each. Mean age at surgery was 16.0 years (11.8-18.7; SD=2.1). OHS improved from 24.8 (7-43; 10.9) pre-op to 39.3 (15-46; 7.6) at six months ($p = p<0.00001$). WOMAC improved from 49.4 (4-88; 23.1) to 10.4 (1-53; 12.1) ($p<0.00001$), while ASKp improved from 77.6 (32.7-99.2; 20.0) to 90.6 (48.3-100; 12.0) ($p=0.009$). There were 2 early complications: 1 intra-operative acetabular fracture (managed with primary components) and 1 post-operative pulmonary embolus (medical management).

Conclusion
Adolescent patients with end-stage hip arthropathy who underwent THA demonstrated significant early improvements in symptoms and function. THA may be a viable management option in severely impaired adolescent patients with end stage hip arthropathy, in whom no joint preserving options remain. Longer term follow up is required to assess the longevity of THA in this population.

Abbreviations
THA - Total hip arthroplasty
OHS - Oxford Hip Score
WOMAC - Western Ontario and McMaster Universities Osteoarthritis Index
ASKp - Activity Scale for Kids - performance version

Session VI-A: Revision THR: Acetabular Issues

2:30 – 2:36 pm

Jumbo Cups

Scott M. Sporer, MD

Objectives:
1) Predict acetabular bone loss and develop a surgeon comfort "threshold" for acetabular revision

2) Demonstrate surgical techniques for "jumbo acetabular cups" to address acetabular defects with cavitary bone loss.

Introduction: Acetabular revision for instability, infection, polyethylene wear and aseptic loosening remain common despite improved prosthetic component designs. Periarticular bone loss observed at the time of a revision can compromise component fixation and result in early loosening. Several options, including both nonbiologic and biologic fixation, are available to treat bone loss. A successful surgical reconstruction utilizing cementless acetabular components requires intimate contact between the prosthesis and host bone along with immediate mechanical stability. Nonbiologic options necessitate immediate as well as long-term mechanical stability by distributing the physiologic stress of the acetabulum to the surrounding intact acetabular bone. Biologic methods of acetabular reconstruction are advised except in cases of severe bone loss or radiation since all nonbiologic revisions will eventually fail. The amount of bone loss undoubtedly influences the ability to obtain initial fixation. The location of remaining supportive bone however has a more important role in providing durable fixation than does the quantity of bone loss.

Defect Classification
Acetabular defect classifications can be used to predict intraoperative bone loss and to help guide reconstructive options. The classification of the American Academy of Orthopaedic Surgeons classifies bone loss as contained, segmental, combined contained and segmental, pelvic discontinuity or ankylosis. The classification of Paprosky utilizes four radiographic criteria from an AP pelvic radiograph: 1) Superior migration of the hip center 2) ischial osteolysis 3) teardrop osteolysis and 4) position of the implant relative to Kohler's line. (Figure #1). Superior migration represents bone loss of the acetabular dome involving the anterior and posterior columns. Ischial osteolysis indicates bone loss from the posterior column including the posterior wall while teardrop osteolysis and migration beyond Kohler's line represent medial bone loss. Proximal migration of the acetabular component beyond 3 centimeters from the native hip center or severe ischial lysis correlates with difficulty obtaining initial stability with a hemispherical component alone. These defects will require additional structural support from either a bulk allograft, metallic augmentation, acetabular cage or a custom implant in order to obtain stable initial fixation.

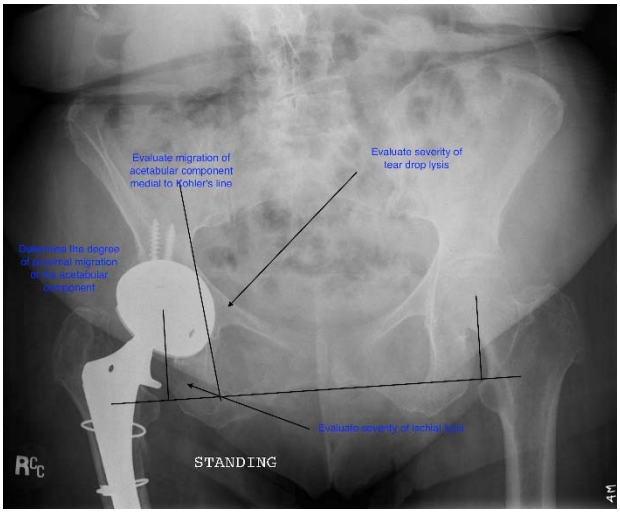

Figure #1: Criteria for Paprosky acetabular defect classification

Hemispherical/Elliptical component
An acetabular component with a hemispherical or elliptical design can be used in patients when the hip center of rotation has not migrated more than 3 centimeters proximally (Paprosky Type I, IIA, IIB, IIC). Following acetabular component removal, the remaining host bone is exposed, and a thorough debridement of all granulation tissue is performed. A pelvic discontinuity can be identified by observing motion between the superior and inferior hemipelvis while stressing the ischium with a Cobb elevator. Assuming a discontinuity is not present, the level of the true acetabulum can be determined by placing a retractor in the obturator foramen. Sequentially larger hemispherical can be used to size the acetabulum until the anterior and posterior columns are engaged. Trial acetabular components can be used to assess the stability of the socket along with the degree of bone uncoverage. Most acetabular defects will have 5-20% of the acetabular component uncovered posteriorly-superiorly if the trial is placed in 40 degrees of vertical inclination and 15 degrees of anteversion. It is important to avoid the temptation to place the component in a vertical position to improve coverage as this may lead to a higher risk of dislocation and early polyethylene wear. Cavitary bone defects can be packed with either local autograft or allograft using a reamer on reverse 2 mm smaller than the last reaming. A 2-millimeter press fit is used in most patients to obtain initial fixation. Supplemental fixation with multiple screws is advised in all revisions to minimize micromotion and promote bone ingrowth. Screws should be placed not only posterior-superiorly into the dome of the acetabulum but should also be placed inferiorly into the ischium.

Tips and Pearls for Acetabular Revision:

- Ream until anterior and posterior column engaged to allow intrinsic trial stability
- Ream slightly superior to improve coverage
- Avoid “Chasing” superior dome – O.K. to leave superior portion of acetabular component uncovered
- Reverse Ream with reamer 1-2 mm undersized to pack cavitary defects
- Use Cup with multiple Holes
- Place several screw in various locations. Attempt to obtain ischial fixation.

2:37 – 2:42 pm

Wedges and Augments

Richard W. McCalden, MD

Introduction:
Revision of the acetabular component in a failed total hip replacement can range from relatively straightforward to complex. The treatment options are dependent to a large extent on the quality of the bone and the bone defects present. Over the past 15 years, newer materials and designs have been developed to deal with complex acetabular revision cases. In particular, so called "porous metals" in the form of hemispherical shells and various metal augments, have been developed to enhance biological fixation in the face of acetabular bone defects often encountered with revision surgery.

Indications for the use of Porous Metals & Metal Augments in Acetabular Reconstruction:
For revision THR, the indications for the use of porous metal technology are fairly intuitive, namely, those situations where bone quantity and/or quality are compromised, making conventional porous coatings less likely to succeed. Therefore, virtually all revision acetabular surgery warrants the use of enhanced porous metal technology. However, the treatment options for acetabular reconstruction are really dependent to a large extent on the bone defects present. Therefore, it is important to have a useful bone defect classification to help guide the treatment plan. The bone defect classification of Paprosky and associates[1] is the most commonly used to define acetabular bone defects and guide treatment. At our centre, we have found the classification system developed by Gross (validated by Saleh et al[2]) to be very useful. These classification systems have many common characteristics, and both provide a practical guide to the use of specific implants and reconstruction techniques, along with outlining the role for metal augments and/or bone graft in revision acetabular reconstruction.

In the Paprosky classification, there are three basic types of defects (Type I, II and III) which are further defined based on the degree of medial or superior migration, the presence or absence of ischial or teardrop lysis, and whether Kohler's line is intact or disrupted. The major distinction is between Type II (distorted but supportive rim) compared to Type III (non-supportive rim). Most Type II defects can be dealt with using a hemi-spherical porous shell alone (ie no metal augments) while Type III defects require a porous shell that often must be combined with an augment (or cage), as the rim is not supportive. The classification is found below.

Table 2
Classification of Acetabular Deficiencies in Total Hip Arthroplasty According to the System of Paprosky and Associates[2]

Type	Classification
I	Undistorted rim, walls, and columns intact
II	Distorted intact rim, supportive rim
IIA	Medial and/or superior migration < 3 cm, +/– lysis of lateral teardrop and ischium
IIB	Superior migration < 3cm above obturator directly, superior or superior lateral, noncontained, supportive defect
IIC	Köhler's line violated, increased lysis in teardrop, anterior and medial wall damage, < 3 cm superior migration, mild ischial lysis
III	Nonsupportive rim
IIIA	> 3 cm vertical migration above superior obturator, Köhler's line intact but often expanded medially
IIIB	> 3 cm vertical migration above superior obturator, severe ischial lysis > 15 mm below obturator, disruption of Köhler's line

In the Gross classification, there are five basic types of bone defects: (1) No substantial bone lost. (2) Contained loss of bone with intact columns and rim. (3) Uncontained loss of bone stock involving less than 50 percent of the acetabulum. (4) Uncontained loss of bone stock involving greater than 50 percent of the acetabulum. (5) Pelvic discontinuity with uncontained loss of bone. A more detailed summary of this classification is found in below.

TABLE I Scale for Assessment of Bone Loss in the Acetabulum

Type I	*No notable loss of bone stock.* Amount of bone loss is less than that which would require a revision component. There has been no migration of the primary component into the ilium, and both columns are largely intact.
Type II	*Contained loss of bone stock.* There is cavitary or volumetric enlargement of the acetabulum. If the cup does extend beyond the ilioischial line (protrusio), the defect can still be considered type II provided that the columns are intact.
Type III	*Uncontained (segmental) loss of bone stock involving <50% of the acetabulum, primarily affecting either the anterior or the posterior column.* Bone loss is considered uncontained if it is not amenable to treatment with morselized bone graft. The sum of all segments of bone loss in either the anterior or the posterior column allows ≥50% cup coverage by host bone (as assessed preoperatively with templates).
Type IV	*Uncontained (segmental) loss of bone stock >50% of the acetabulum affecting both the anterior and the posterior column.* Type IV is identical to type III except that the sum of the segmental bone loss in the columns exceeds 50%. There is no pelvic discontinuity.
Type V	*Acetabular defect with contained loss of bone stock in association with pelvic discontinuity.* Any pelvic discontinuity is considered a type-V defect regardless of the amount of bone loss.

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In the context of these two bone defect classifications, the use of porous metal hemispherical shells and the need for metal augments is outlined as follows:

- Paprosky & Gross Type I & II defects (cavitary defects with intact/supportive rim) – ideal for a porous metal hemispherical “jumbo cup” supplemented with screw fixation
- Gross Type III defects (segmental loss of bone < 50%) – ideal for porous metal hemispherical “jumbo cup” providing initial stability/support can be obtained with shell alone, then supplemented with multiple screw fixation (dome and lower hemisphere ie. ischium and/or pubis)
- Paprosky Type IIIA & IIIB, Gross Type IV defects (non-supportive rim, segmental loss of bone >50%) – with a significant defect in the rim, the use of a porous metal jumbo cup is often combined with a porous metal augment and /or cage. Hemispherical cup alone may not have initial stability – requires augment (or cage) to stabilize cup by converting defect from segmental (un-supportive rim) to a cavitary defect.
- Paprosky IIIB, Gross Type V defects (pelvic discontinuity) – requires use of porous metal jumbo cup combined with cage +/- metal augments +/- distraction technique +/- plating of posterior column

The use of porous metal, with its inherent scratch-fit and improved ingrowth potential, has pushed the boundaries of the traditional cementless porous-coated cup where historically it was felt that a minimum of 50% host bone contact was required for success. It is clear that the use of porous metal technology has led to clinical success in the face of less than 50% host bone contact, providing initial stability can be achieved. In fact, unless the segmental defect is large, wherein the initial stability of a hemispherical cup cannot be achieved, metal augments are required infrequently with the use of porous metal shells.

Key points for the use of porous metal acetabular shells & augments:

- Adequate exposure is paramount
- Carefully determine remaining host bone
- Confirm the integrity of the posterior column
- Judicious reaming to preserve as much bone as possible (in particular, the integrity of the anterior and posterior columns is paramount)
- Line-to-line or under-ream by 1-2 millimeters depending of the quality of the bone and the rigidity and surface roughness of the implant (Trabecular Metal revision shells are designed to be inserted line-to-line as the peripheral portion of the shell is flared). It is best to under-ream and then ream up slowly if the implant cannot be seated.
- use a trial shell to ensure inherent stability of cup at the rim and also to visualize where the bone defects exist at the rim or behind the cup. If trial shell is unsupported (ie unstable) then consider metal augment to provide stability
- Metal augments can be used anywhere around the rim (usually superiorly) to reconstruct dome/rim defects, supero-posteriorly to reconstruct posterior wall defects, or medially (in rare circumstances) to provide medial support for the shell
- Augment placement should provide stability to the shell

- peripheral metal augments are usually inserted prior to the definitive acetabular shell by placing trial shell in place (preferred technique)
- alternatively, peripheral metal augments can be added after insertion of definitive acetabular shell to provide additional support
- it is imperative to unitize the shell and augments by means of screw(s) through both components (where possible) and through the use of PMMA (ideally applied at the time of insertion of components)
- large medial defects can be filled with metal augments (combined with morsellized graft) used as "footings" to provide support for acetabular shell

Outcomes of Porous Metal combined with Metal Augments for Acetabular Reconstruction

There are a large number of papers examining the early and mid-term results of the use of TM revision shells to deal with a host of acetabular defects. Specifically, several papers have examined the combination of a porous shell and either augments or cages to deal with complex defects [11,12,13,19,21,22-24]. Overall, the results have been very excellent with the use of this technology.

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Revision THR with Porous Metals

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2:43 – 2:49 pm

Custom Flanged Cups

Douglas A. Dennis, MD

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

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

Advantages of CTAC use include obtaining rigid fixation on remaining host bone (ilium, ischium, and pubis). Shear fixation stresses are limited as the “non-flange” portion of the CTAC rests against the remaining iliac shelf. Lastly, by using fracture fixation principles, CTACs can be designed with locking screws to enhance the rigidity of fixation. Its custom design allows precise restoration of the native hip center, improving hip biomechanics, as well as assuring accurate replication of the desired cup position (inclination and anteversion). Its custom design enhances the precision of fit. Biomechanically, the device is much stronger than traditional non-custom cages. CTACs allow use of modular polyethylene liners (neutral, extended lip, or constrained) that enhances the surgeon’s ability to achieve hip stability intraoperatively. Lastly, from the preoperative CT scan and subsequent 3D model, substantial additional information is provided to the surgeon preoperatively to assist in planning including the size and shape of the bone defect, the presence and magnitude of a pelvic discontinuity, and even the predicted screw length to enhance thread engagement and avoidance of error in choosing a screw that’s too long that can injure intrapelvic structures.

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

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2:50 – 2:56 pm

Cup Cage

Allan E. Gross, MD, FRCSC, O. Ont.

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

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

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

Then, the slot for the ischial flange of the cage is created. The starting point is located in the inside surface of the acetabular rim, at 7 o'clock in the right and 5 o'clock in the left hip. The direction is dictated by the exposed lateral surface of the ischium and is confirmed by drilling a hole and using a depth gauge to make sure that for a distance of 3 cm the flange will be surrounded by bone. The slot is initiated using a special osteotome but completed by the real flange of the cage to avoid inadvertent perforation of the ischium by the sharp osteotome and endangering the sciatic nerve.

A helpful practice is to template with a trial cage and to adjust the superior and inferior flanges of the real cage before insertion. Usually the upper flanges need to be bent downward to the ilium and the lower ones upward to align with the ischium. The last action before inserting the cage is to prepare the lateral ilium for the upper flange. Abductor muscles should be gently elevated from an appropriate length of the ilium. This should be performed carefully to avoid damage to the superior gluteal neurovascular bundle and resultant lurch. Cage insertion starts with inserting the inferior flange all the way into the slot. Then the cage is impacted into the cup so that the upper flanges lie flat on the ilium, slightly towards posterior. The fixation depends on the distal flange and the screws through the superior flanges to the ilium. A minimum of three bicortical 6.5mm screws should be used to fix the flanges to the ilium but before that, it is recommended to insert a couple of screws in the dome of the cage through the cup and ilium. The latter screws will push the cage further into the concavity of the cup and minimize the gap between the two. Also by following a perpendicular direction relative to the flange screws, they provide a much stronger construction. From a biomechanical point of view, inserting one screw into the ischium just medial to the inferior flange is helpful to provide some compression force at the discontinuity site.

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

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

The 5-year Kaplan-Meier survival rate with revision for any cause representing failure was 93% (95% confidence interval [CI], 83.1-97.4), and the 10-year survival rate was 85% (95% CI, 67.2-93.8). The Merle d'Aubigné-Postel score improved significantly from a mean of 6 preoperatively to 13 postoperatively ($p < 0.001$). Four cup-cage constructs had non-progressive radiological migration of the ischial flange and they remain stable.
The cup-cage construct is a reliable option to treat chronic pelvic discontinuity and severe acetabular bone defects if stable fixation cannot be obtained through the use of a high-porosity metal cup with or without augments.

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3:04 – 3:10 pm

Fluted Tapered Stems

Don S. Garbuz, MD, MHSc, FRCSC

The goals of revision total hip on the femoral side are to achieve long term stable fixation, improve quality of life and minimize complications such as intraoperative fracture or dislocation. Ideally these stems will preserve or restore bone stock. Modular titanium stems were first introduced in North America around 2000. They gained popularity as an option for treating Paprosky 3B and 4 defects. Modular stems offer off the shelf customization. They allow the surgeon to get fixation distally first and then make adjustments to leg length and offset separately.

Several studies at our institution have compared the modular titanium stems with monoblock cobalt chromium stems. The main outcomes of interest were quality of life. We also looked at complications such as intraoperative fracture and postoperative dislocation. We also compared these 2 stems with respect to restoration or preservation of bone stock. In 2 studies we showed that modular titanium stems gave superior functional outcomes as well as decreased complications compared to a match cohort of monoblock cobalt chromium stems.

As mentioned one of the initial reasons for introduction of these stems was to address larger femoral defects where failure rates with monoblock cobalt chromium stems were unacceptly high. We followed a group of 65 patients at 5-10 years post revision with a modular fluted titanium stem. Excellent fixation was obtained with no cases of aseptic loosening. However, there were 5 cases of fracture of the modular junction.

Due to concerns of fracture of the modular junction at our institution we began using monoblock tapered stem in 2011 and now have switched to almost 100% monoblock fluted titanium stems. We recently reviewed our first 100 cases of femoral revision with monoblock stem. Excellent fixation was achieved with no cases of aseptic loosening. Quality of life outcomes were similar to our previous reported series on modular tapered titanium stems.

Both monoblock and modular fluted titanium stems can give excellent fixation and excellent functional outcomes. This leaves a choice for the surgeon. For the low volume revision surgeon modular tapered stems are probably the right choice.

Higher volume surgeons or surgeons very comfortable with performing femoral revision may want to consider monoblock stems. If one is making the switch it would be easiest to start with a simple case. Such a case would be one that can be done endofemoral approach. In this was the greater trochanter is available as the key landmark for reaming. After the surgeon is comfortable with this system more complex cases can easily be handled with the monoblock stem.

In summary both modular and monoblock titanium stems are excellent options for femoral revision. As one becomes more familiar with the monoblock stem it can easily become your workhorse for femoral revision. At our institution we introduced a monoblock titanium stem in 2011. It started out at 50% of cases amd now it is virtually used in almost 100% of revision cases

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3:11 – 3:17 pm

Managing Bone Loss

Gwo-Chin Lee, MD

Fortunately, improvements in materials and design have decreased the prevalence of catastrophic failures following total hip arthroplasty (THA). However, while the severity of bone loss seen during revision THA has been lessened, successful reconstruction of the femoral side still requires understanding and application of sound principles to achieve initial axial and rotational stability of the revision femoral component. The purpose of this lecture is to review the various techniques to manage femoral bone loss encountered during revision THA.

Bone loss during revision THA can occur as a result of osteolysis and component loosening or during component extraction. Minimizing bone loss during component removal can simplify subsequent reconstruction. Familiarity with the various techniques and tools necessary to disrupt the bone-prosthesis or cement-prosthesis interface is critical to the revision surgeon's armamentarium. In many ways, an early and planned osteotomy of the femur is the conservative approach to exposing and removing a well fixed femoral component during revision THA.

Several classifications for femoral bone loss have been proposed over the years. The one that is most widely used is the Paprosky classification because of its ability not only to describe the bone loss but also to prescribe the appropriate management. Choice of the type of revision femoral component depends on the degree of bone loss, the presence of stress risers that require bypass, and the integrity of the femoral isthmus. In general, revision femoral components should be longer than the primary THA components to allow for anchoring into virgin host bone. Primary THA stems should be reserved for cases of early loosening and subsidence with good residual metaphyseal bone stock. Even in these cases, the use of a dual tapered, ream and broach system may provide improved axial and rotational stability compared to primary wedge tapered stem designs.

Distal fixation can be generally accomplished using 2 types of femoral component designs: fully porous coated cylindrical components or fluted, tapered stems. Fully porous coated femoral components require at least a 4cm of intact femoral isthmus while fluted tapered stems can achieve stable fixation with 2 cm of isthmic fit. A cable distal to the osteotomy prior to femoral preparation can minimize the risk of periprosthetic fractures. It is also recommended that an intraoperative radiograph be obtained to confirm alignment and fit of the eventual revision femoral component. In cases when bone stock is inadequate, techniques such as impaction grafting, intussusception of an allograft prosthetic composite, and mega-prosthesis proximal femoral replacement have been described.

In summary, management of femoral bone loss in revision THA requires understanding of prosthesis design and application of sound reconstructive principles. A systematic approach to evaluation and reconstruction of bone loss can minimize intraoperative decision making, improve efficiency and reliability of prosthesis fixation.

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3:18 – 3:24 pm

Peri-Prosthetic Fractures

Emil H. Schemitsch, MD

Burden of Illness
Increasing prevalence of periprosthetic fractures
•Incidence (post THA) between 0.1-18% (JAAOS 2009)
•Growing elder population
•High mortality rate (post THA) at 1 yr: 11% vs hip fracture (16%) vs primary arthroplasty (2.9%)
–Bhattacharyya et al: JBJS(A) 2007
•High complication rate (up to 48%) and high re-op rate (up to 52% in Vancouver C fractures)
–Zurmond et al: Injury 2010

Failure Mechanisms (Failed internal fixation of periprosthetic fractures)
•Poor mechanics are a common problem
•Mechanisms
–Implant failure
–Fracture fixation failure

Why did failure occur?
•Stem in varus?
•No stem revision?
•Single lateral plate?
•Too many cables and not enough screws?

Vancouver Classification

A. Pertrochanteric
B. Periprosthetic tip
C. Distal femur

Goals of Revision THA
•Durable construct
•Restoration of bone stock
•Stable joint
•Good functional outcome

Pre-op planning
Key Questions
•Why did the implant fail?
•Is there varus remodeling?
•Exposure?
•Implant/cement removal techniques?
•Management of Bone Loss?
•Implant Selection?
•Do I need supplementary fixation?

Extended Trochanteric Osteotomy (ETO)
•Poor bone quality
•Varus remodelling of proximal femur
•Residual cement

Implant options
•Cementless Revisions
–Extensively porous coated
–Modular: **Modular fluted titanium stem preferred**
•Proximal Femoral Replacement

Revision: Keys to success
•Revise to a long stem implant (2 cortical diameters past the fracture): Modular vs non-modular?
•Key is distal stability: Modular fluted titanium stem preferred
•Perform ETO as necessary
•Additional extramedullary fixation is helpful particularly if non-modular stem used
•Avoid ending stem and strut /plate fixation at the same level

Moore et al. Tapered Fluted Titanium Stems in the Management of Vancouver B2 and B3 Periprosthetic Femoral Fractures. Clin Orthop 2014; 472:590-8.

•46 Vancouver B fractures (30 B2, 16 B3) available for review at a mean of 54 months
•Treated with modular tapered titanium stems.
•Two stems were revised / One nonunion
•Maintenance or improved bone stock in 89%
•Subsidence occurred in 24%
•Satisfaction score was 91 of 100

Conclusions
•Revision THA is an important option but continues to present a challenge in managing Vancouver B fractures
–Particularly in the face of marked bone loss
•Modular stems
–Newer alternative for femoral reconstruction
–Allow for fixation with marked bone loss
–My stem of choice for revision THA

3:55 – 4:01 pm

How Big is the Problem?

Bryan D. Springer, MD

Total joint arthroplasty of the hip and knee are two of the most successful surgeries in all of medicine. Long-term data suggests significant improvement in pain, function and quality of life with an overall low morbidity and mortality. The utilization of total hip and knee arthroplasty continues to rise. Yet there remains a certain sector of the population with debilitating arthritis who chose to avoid having surgery for fear of complications. One of the most common reasons for avoiding surgery is fear of pain from the surgery itself and during the recovery period.

In the early 2000's a concerted effort was made by organizations such as The Joint Commission so that the assessment of and the treatment of pain was more visible. Thus pain became "the 5th vital sign". Coupled with aggressive marketing of the pharmaceutical industry on the safety and non-addictive nature of opioids, they become the dominant pain management strategy for over a decade. Nowhere has this been more evident that in the United States where we represent approximately 20% of the world's population but account for over 80% of opioids prescriptions written. Orthopaedic Surgery is no exception to this. Our specialty is the second leading prescriber of opioids in the United States.

This aggressive utilization of opioid medication to treat both arthritis and postoperative pain has no doubt helped to fuel the opioids epidemic in the United States. From 1999-2006, greater than 200,000 people have died in the US from overdoses related to prescription opioids. The preoperative and postoperative utilization of opioids medications is associated with a high risk of dependency, addiction, diversion and death. In total hip and knee arthroplasty, the preoperative use of opioids is associated with higher dissatisfaction and a higher rate of complications and revision surgery compared to opioids naïve patients.

Fortunately as a response to this epidemic, orthopaedic surgeons and in particular arthroplasty surgeons have been leading the way in developing multi-modal pain management strategies to reduce the dependency on opioids medication both before and after total joint arthroplasty. These strategies rely on the reduction or elimination of preoperative opioids use as well as the utilization of non-narcotic medications and other modalities (nerve blocks and periarticular injections) to reduce the dependency on narcotic pain medications.

4:16 – 4:22 pm

Post-Operative Management

Craig J. Della Valle, MD

As hospital length of stay following adult reconstructive procedures has decreased, controlling pain in the perioperative period has become more challenging. Further, with an emphasis on reducing narcotic consumption, we have become more sophisticated in our methodologies relying on a combination of medications used together.

The basics of the post-operative regimen we use include:

- A long-acting **anti-inflammatory** medication. Our preference is Meloxicam as it is:
  - A once daily medication that is available as a generic
  - Well tolerated by most patients
- We tell patients that **Acetaminophen** should be their first line pain medication
  - Inexpensive, over the counter medication
  - Well tolerated and familiar to patients
- **Tramadol** is in general used as our second line for pain control
  - Available as a generic
  - Lower side effect profile than traditional narcotics
- **Oxycodone IR** is given (30 tablets) to use as a “last resort” for pain control
  - Our preference is to uncouple the use of acetaminophen and the narcotic pain medication to optimize the analgesic properties of acetaminophen while decreasing the need for opioids.
  - In a recent RCT performed at our center comparing an Rx for 30 vs. 90 tablets we found that patients who received 30 tablets had equivalent pain scores and satisfaction yet far fewer tablets left over (which are ripe for potential abuse). They also consumed less narcotics, although they did require slightly more frequent refills. We did find however, that most patients can be safely discharged with an Rx of only 30 tablets.
- A nerve stabilizing agent such as **Neurontin** is also utilized
  - Its biggest benefit may be a lower risk of chronic neurogenic pain, particularly after knee procedures
  - We prefer Neurotin over other agents such as Lyrica as it is available as a generic and hence easier for patients to obtain.

It is important to keep in mind that complicated regimens can be confusing for patients. We have found that frequent phone calls to the patients to review how they are doing with pain control soon after discharge is helpful. At this time, we review our suggestions for medication usage and seek to identify unwanted side effects or barriers to appropriate medication use.

Finally, it is important to ensure that patients know how to safely dispose of left over narcotic pain medications as these can lead to narcotic abuse.

5:09 – 5:15 pm

Treatment of Hip and Knee Periprosthetic Infection

R. Michael Meneghini, MD

Once diagnosed, chronic PJI has been traditionally been treated with a two-stage resection and reimplantion, while acute PJI is typically treated by the majority of surgeons with a debridement and component retention, particularly in cemented TKA. When cementless fixation is used in TKA, and more commonly in THA, a two-stage resection and reimplantation may be advocated in the acute PJI setting due to the relative ease in removing the implants before ingrowth. More recently, some have been advocating for a one-stage resection and reimplantation of the final implants during the same anesthetic in acute hip PJI.1-6 Based on the existing literature, one-stage exchange success rates range from 70-94.5%, while two-stage resection success rates range from 85-100%.2,7-12 An intriguing technique of two-stage component retention in hip and knee PJI involves initial I&D with insertion of high-dose antibiotic beads and exchange of modular parts, with a repeat debridement and removal of beads and insertion of final implants 5-7 days later with long-term IV antibiotics and has mid-term success rate of 90%.13 Patients with a history of prior procedure, prior debridements, and prior open surgery have a higher risk of treatment failure with respect to PJI 14. Additionally, other research has shown that patients who fail initial two-stage treatment for PJI have a reduced rate of cure with subsequent surgeries, and the risk for reinfection is high at 42% 15. Thus, in order to achieve the optimal functional outcome, it is essential to treat PJI successfully at first presentation and reduce the risk of subsequent intervention.

Increasingly more surgeons have adopted the use of a one-stage exchange for THA PJI patients with minimal co-morbidities infected with known organisms of relatively low-virulence and sufficient bone quality 1-5,16. Zeller et al. created a decision tree to aid in the choice between debridement, one-stage exchange, and two-stage exchange. One-stage exchange was selected for patients with ASA < 3, symptom duration longer than 2 weeks, in the setting of a stable prosthesis that was implanted > 1 month prior. Additional criteria required that there be no severe bone loss and a preoperatively isolated organism. Patients found to have a fungal infection or a difficult-to-treat organism were not eligible for one-stage treatment 16.

A significant challenge when interpreting the existing literature on the success of one and two-stage treatment options for hip PJI is the lack of standardized treatment protocols within the studies, creating numerous confounds that make data analysis and interpretation of outcome superiority between the two approaches extremely difficult. Recently, authors from Mayo Clinic published one of the longest term and scientifically rigorous reports on outcomes after two-stage exchange after hip PJI.10 They authors state the main limitation of the study was the lack of standardization in the two-stage exchange protocol.10

The authors recently reviewed a consecutive series of patients with PJI after THA, including chronically infected hosts, treated with a contemporary, evidence-based standardized two-stage resection and reimplantation THA protocol with respect to reinfection rates and outcomes. 55 consecutive two-stage resection and reimplantation THAs for PJI between 2011 and 2017 were retrospectively reviewed. Patients were categorized with McPherson's Staging System and infection defined by MSIS criteria. Contemporary standardized protocols were strictly adhered to including implant resection, meticulous debridement, high-dose antibiotic spacer, 6-week intravenous antibiotics, two-week drug holiday, and laboratory assessment of infection eradication prior to reimplantation. Extended antibiotics after reimplantation were not routinely used. Successful treatment was defined as reimplantation with component retention at minimum two-year follow-up. After exclusions for confounds, 48 of 52 patients had obtained minimum two-year follow-up (mean 57.2 months). 41.6% were chronically infected poor hosts (Stage III-B/C). Three patients required repeat debridement and/or spacer exchange prior to final reimplantation. Treatment success rate was 95.8% at two-year follow-up and both failures occurred in the late chronic PJI group (stage III). Our success rate with the two-stage procedure equals or exceeds single-stage treatment, in an unselected cohort of chronically infected poor hosts. More rigorous scientific studies are warranted prior to indiscriminate adoption of the single-stage treatment approach for PJI in THA and the two-stage approach should remain the gold standard in the treatment of chronic PJI.

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5:16 – 5:21 pm

Costs

Thomas K. Fehring, MD

Periprosthetic joint infection remains one of the most devastating complications following joint replacement today. If one looks at the scope of periprosthetic infection this problem has increased exponentially over the years just as the frequency of total hip and total knee procedures has increased. It has been projected that in 2020 49,000 prosthetic joint infections would require treatment in the US alone with a projected cost of $1.6 billion (1). Hospital charges for infected hip arthroplasties are 1.7 times greater than that of uninfected arthroplasties (1). The mean cost to treat an infected hip was $6,000 greater than treating infected total knees (2). Prosthetic joint infections have significantly longer hospitalizations, more readmissions, more clinic visits, and four times the mean annual cost (3). If one looks at the direct and indirect cost to society of prosthetic joint infection one notes that when you take lost wages into consideration and reinfection rates are added to the direct hospital cost tremendous cost are incurred. A 65-year-old with a prosthetic joint infection costs $389K to society, while a 55 year old with prosthetic joint infection costs $474K (4).

Unfortunately, the current reimbursement models for the treatment of infection are typically not reimbursed fairly placing the burden of care on the physician and the hospital (5).

Little progress has been made in reducing the incidence of prosthetic joint infection with prevalence hovering at 1-2%. Optimizing the patient preoperatively is one improvement strategy. One-stage treatment for prosthetic joint infection is another attractive strategy to decrease hospital costs in contrast to a two-stage procedure. Unfortunately, studies comparing one-stage and two-stage procedures are lacking. In a systematic review of the literature comparing one-stage or two-stage procedures 1,128 studies were reviewed; the overall quality of the studies were poor and the authors recommended a high quality randomized study be performed (6). Because of the projected cost of treating periprosthetic infection health economics mandates an investigation concerning one-stage procedures.

To that end a prospective, randomized, multicenter study excluding only fungal organisms and immunosuppressed patients has been initiated at 15 sites in the US. The protocol for these procedures includes re-prepping and re-draping between stages. All hosts are classified according to MSIS criteria. The data set necessary to have adequate power to determine which is superior is 309 patients. 135 patients have been enrolled to date. The protocol for the one-stage procedures is time intensive requiring a double instrument set up, re-prepping, and re-draping between stages requiring significant transition time between stages. Intraoperative service time for these procedures is significant. However, if the results of one-stage vs two-stage are similar significant economic savings will be realized. A salient question exists - If the results of one-stage vs. two-stage are similar will surgeons be discouraged from performing one-stage procedures that have patient and societal benefit because reimbursement is inadequate?

We studied the reimbursement and intraoperative service time for one-stage procedures compared to primary surgery. 51 one-stage procedures were compared to 250 primary total hips and 250 primary total knees at the OrthoCarolina Hip and Knee Center. Coding was performed via AAOS guidelines. We found that reimbursement per hour for primary total hip was $1,589.00 while reimbursement per hour for a one-stage infected hip procedure was $545.00 - lost revenue of $1,044/per hour. Likewise a primary total knee was reimbursed at $1,461.00/hour where a one-stage total knee procedure was reimbursed at $601.00/hour- lost revenue in this case was $860.00/hour. We concluded that one-stage procedures are reimbursed at approximately 1/3 the hourly rate of a primary arthroplasty. This fact may discourage surgeons from selecting this treatment alternative if studies currently ongoing confirm efficacy of one-stage treatment. Payers should be encouraged to reimburse physicians commensurate with intraoperative service time. If the results of one-stage are shown to be positive adoption will decrease morbidity and save the healthcare system financially. Therefore fair reimbursement is critical.

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

Credit Hours
The American Academy of Orthopaedic Surgeons designates this live activity for a maximum of 7.5 ***AMA PRA Category 1 Credits***™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

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

Upon completion of this program, participants should be able to:
• Update clinical skills and basic knowledge through research findings and biomechanical studies.
• Discuss the various surgical and non-surgical treatments and management of conditions related to the hip joint.
• Determine indications and complications in total hip arthroplasty.
• Critique presentations of surgical techniques and demonstrations of treatment options.
• Evaluate the efficacy of new treatment options through evidence-based data.

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

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Financial Disclosure
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