



SAVE THE DATE

2020 SPRING MEETING

April 30 - May 2, 2020

Radisson Blu Aqua Hotel | Chicago, USA

- Case-based learning
- Peer-to-peer education
- Small-group setting
- Expert faculty



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EDUCATIONAL ACTIVITY SCOPE

The **2019** AAHKS Annual Meeting is designed to provide practicing orthopaedic surgeons with research based, state-of-the-art information on diagnosis, surgical and non-surgical treatment options and overall management of hip and knee conditions. This educational activity includes the review of the most current scientific research study findings, faculty and participant discussions and interactive symposia. It covers multiple clinical topics such as primary and revision total hip arthroplasty, primary and revision total knee arthroplasty, non-arthroplasty, infection, complications other than infection as well as health policy. It is aimed at improving overall surgeon competence related to the care of patients with arthritis and degenerative disease.

OBJECTIVES

Upon completion of this educational activity, participants will be able to:

- Synthesize the most current research study findings in hip and knee condition management
- Evaluate various surgical and non-surgical treatment options (e.g., primary total joint arthroplasty, revision total joint arthroplasty, non-arthroplasty) in hip and knee condition management
- Assess the efficacy of new treatment options through evidence-based data
- Interpret relevant healthcare policy



ACCREDITATION AND CME CREDIT

The American Association of Hip and Knee Surgeons (AAHKS) is accredited by the Accreditation Council for Continuing Medical

Education (ACCME) to provide continuing medical education for physicians.

The American Association of Hip and Knee Surgeons (AAHKS) designates this live activity for a maximum of 18 AMA PRA Category 1 Credits $^{\text{TM}}$. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

CLAIM CME CREDITS

AAHKS will send an **email** with a meeting evaluation upon conclusion of the Annual Meeting. At the end of the evaluation, there will be a link to claim CME credit. It is the meeting attendee's responsibility to claim credits based on the hour-for-hour participation actually spent in the educational activity.

DISCLAIMER

The material presented at this Annual Meeting has been made available by AAHKS for educational purposes only. This material is not intended to represent the only, nor necessarily the best methods or procedures appropriate for the medical situations discussed; but rather, is intended to present an approach, view, statement or opinion of the faculty, which may be helpful to others who face similar situations. AAHKS disclaims any and all liability for injury or other damages resulting to any individual attending a course and for all claims, which may arise out of the use of the techniques, demonstrated there in by such individuals, whether these claims shall be asserted by a physician or any other person.

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By attending the Annual Meeting, participants acknowledge and agree that AAHKS and/or its agents may record the Program and related events, use audio and video recordings, photographs and presentation materials such as slides and abstracts for AAHKS's purposes, including but not limited to other educational products, news, advertising and promotional purposes, without compensation.

FDA STATEMENT

Some pharmaceuticals and/or medical devices demonstrated at the Annual Meeting have not been cleared by the US 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 clearance status of each pharmaceuticals and/or medical device he or she wishes to use in clinical practice. The AAHKS policy provides that "off label" status of the device or pharmaceutical is also specifically disclosed (i.e. that the FDA has not approved labeling the device for the described purpose). Any device or pharmaceutical is being used "off label" if the described use is not set forth on the product's approved label.

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AAHKS wishes to thank
DePuy Synthes
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For their generous educational grants that make the Annual Meeting possible.

Education

DISCLOSURE

Each participant in the Annual Meeting has been asked to disclose if he or she has received something of value from a commercial company or institution, which relates directly or indirectly to the subject of their presentation. These are the disclosure categories:

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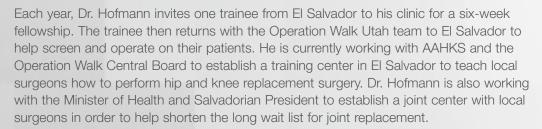
An indication of the participant's disclosure appears after his or her name as well as the commercial company or institution that provided the support. AAHKS does not view the existence of these disclosed interests or commitments as necessarily implying bias or decreasing the value of the author's participation in the course. Disclosures can be found in the back of this program and at www.AAHKS.org/Meeting.



Dr. Hofmann to Receive the 2019 AAHKS Humanitarian Award

Presenting the 2019 AAHKS Humanitarian Award to Aaron A. Hofmann, MD

Aaron A. Hofmann, MD has been selected as the 2019 American Association of Hip and Knee Surgeons (AAHKS) Humanitarian Award recipient. Dr. Hofmann, who is a 1991 charter member of AAHKS, founded Operation Walk Utah 15 years ago after traveling on an Operation Walk mission with Lawrence D. Dorr, MD to Guatemala. The focus of Operation Walk Utah is the Hospital Nacional Santa Tecla in El Salvador where more than 800 patients are on a waiting list for hip and knee replacement surgeries. Dr. Hofmann travels with his team twice a year and sees 55-70 patients on each trip.



Erin Hofmann told the story of how her father not only has performed more than 1,000 surgeries for Salvadorians in need, but how he also stepped in when the program lost its storage room due to the hospital's need for the space. "My dad traveled to San Salvador for 36 hours on a weekend in between his own surgeries and clinics. He showed up with one other OpWalk volunteer, building materials and a local workforce...to move equipment, pour concrete and stack cinder blocks. The storage shed they built solidifies the commitment to return to El Salvador for many years to come."

According to Dr. Dorr, "Aaron's work has sparked other Operation Walk chapters in at least eight states. No other Operation Walk Surgeon has invested so much personal money or demonstrated such entrepreneurial enthusiasm for improving his team's delivery of care to people who would otherwise remain disabled throughout their lives."

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

Nominations for the 2020 AAHKS Humanitarian Award are now being accepted through April 15, 2020 at www.AAHKS.org/Humanitarian.



No Difference in Survivorship or Functional Outcome Between Surgeon Preference for Computer Assisted Navigation vs. Conventional Instrumentation in 19,221 Total Knee Arthroplasties at 12 years

Notos

Timothy Roberts, MBChB, Simon W. Young, MBChB, FRACS, MD

Introduction: This study compares the revision rates and functional outcomes of total knee arthroplasty (TKA) implanted using computer-assisted surgery (CAS) with conventional instrumentation from a large national database at up to 12 years follow-up. Recognizing that selection bias may arise from the preferential use of CAS in difficult or complex cases, the implant survival data and postoperative functional scores were analyzed with reference to whether the surgeon routinely implanted TKA using CAS or conventional instrumentation.

Methods: Revision rates and functional data in terms of Oxford Knee Questionnaire (OKQ) scores at six months, five years and ten years were obtained for 19,221 TKAs implanted between 2006 and 2018 from the New Zealand Joint Registry (NZJR). This data was analyzed comparing two patient cohorts: 1) those treated by high volume surgeons who implanted using CAS for >90% of TKAs ("routine CAS"); and 2) those treated by high volume surgeons using CAS for <10% of TKAs ("routine conventional").

Results: After 12 years, the revision rate per 100 component years was 0.437 for the "routine CAS" surgeons compared to 0.440 for the "routine conventional" surgeons (p=0.734). For patients under the age of 65, the revision rate per 100 component years was equivalent for "routine CAS" surgeons compared to "routine conventional" surgeons (0.585 vs. 0.508, p=0.524). The OKQ scores were similar at six months (38.88 vs. 38.52, p=0.172), five years (42.26 vs. 41.77, p=0.206) and ten years (41.59 vs. 41.74, p=0.893) when comparing the two cohorts. Surgeons who performed more than 50 TKAs using CAS took 13 minutes longer on average than those using conventional instrumentation (89 minutes vs. 76 minutes, p<0.001).

Conclusions: We found no difference in implant survival between CAS and conventional instrumentation systems, even when controlling for potential surgeon bias of using CAS in only difficult cases.

Functional Gain and Pain Improvement After Primary Total Knee Replacement Are Influenced by Patient Characteristics and Not Implant Manufacturer

Notes

Adam W. Green, MD, Kyle Alpaugh, MD, Hua Zheng, PhD, Wenyun Yang, MS, Patricia D. Franklin, MD, MPH, **David C. Ayers, MD**

Introduction: Implant selection is largely based on institutional factors, surgeon training, and preference. International registries compare relative revision rates by implant but do not assess functional outcomes. We sought to quantify and compare functional outcomes by implant manufacturer. We compared pre-post primary total knee replacement (TKR) pain improvement and functional gain at 12 months in a contemporary multi-site patient cohort to determine if patient-reported gains differ among implant manufacturers.

Methods: 9,818 patients (mean age=65.8 years, 65% females) received implants by Stryker, Zimmer Biomet, Smith & Nephew or DePuy. Preoperative demographics including medical (modified Charlson), musculoskeletal, and emotional (SF; MCS) comorbidity data were collected and merged with pre- and post-TKR pain and function (KOOS pain and ADL) scores from each patient. Descriptive statistics, kernel density curves, and multivariable linear models, adjusted for variation within site, were performed. Statistical significance was set at p<0.05.

Results: Manufacturer A, B, C and D implants were used in 5,658, 2,202, 1,283, and 675 patients respectively. The majority reported excellent pain relief and functional gains across implants. Across implant manufacturers, pre-post improvements in KOOS knee pain scores were comparable (A=35.6, B=35.8, C=35.9, D=34.3). Similar improvements were seen in KOOS ADL scores across all implants (A=30.9, B=30.5, C=30.2, D=28.3). In multivariable models adjusting for patient covariates, implant manufacturer was not significantly associated with postoperative pain or function. However, patient factors (older age, non-white race, smoker, low back pain, pain in non-operative hips/knees, low MCS) are associated with significantly (p<0.05) poorer gains in pain and function.

Conclusions: Multiple different implants are used for primary TKR. No differences in postoperative pain improvement or functional gain at 12 months were seen between implant manufacturers. However, patient factors continue to significantly influence gains in postoperative pain and function.

The Cumulative Effect of Depression and Substance Abuse on Postoperative Complications After Primary Total Knee Arthroplasty

Luke J. Garbarino, MD, **Peter A. Gold, MD**, Hiba Anis, MD, Nipun Sodhi, MD, Jonathan R. Danoff, MD, Sreevathsa Boraiah, MD, Vijay J. Rasquinha, MD, Michael A. Mont, MD

Notes

Introduction: Substance abuse, alcohol abuse and depression have individually been shown to negatively affect total knee arthroplasty (TKA) outcomes. However, their cumulative effect on postoperative complications has not been well elucidated. Therefore, this study aimed to determine the impact of depression, substance abuse and alcohol abuse on postoperative complications following TKA.

Methods: TKA patients were prospectively followed at 15 hospitals in a large health system between 2017 and 2019. Patients with depression, substance abuse and alcohol abuse were identified using diagnosis codes. Variables collected were patient demographics, medical comorbidities, prosthetic joint infections (PJI), urinary tract infections, cellulitis, periprosthetic fractures, instabilities, implant failures, osteolyses and thromboemboli. Univariate analysis and multivariate analyses were performed to identify the combinations of mental health disorders associated with complications.

Results: 11,403 TKA patients were identified: 1,536 with a history of depression, 591 with a history of substance abuse and 91 with a history of alcohol abuse. Univariate analysis showed that depression was associated with implant failures (p<0.001) and alcohol abuse with PJIs (p<0.001) and deep vein thromboses (p=0.003). Substance abuse was associated with PJI (p<0.001), wound complications (p=0.022) and implant loosening (p=0.007). Multivariate analyses found that alcohol abuse (OR: 19.419, p<0.001), substance disorder (OR: 3.693, p=0.010), and depression plus substance (OR: 13.639, p<0.001) were associated with PJIs. Additionally, depression plus alcohol (OR: 26.616, p=0.000) and depression plus substance abuse (OR:4.401, p=0.021) were associated with cellulitis.

Conclusions: Patients with depression, substance abuse or alcohol abuse were found to be at greater risk of postoperative complication. In combination, the cumulative effect of depression and abuse was found to be far more likely to be associated with both PJI and cellulitis than if found in isolation. The results of this study can help identify those patients who are at greater risk for postoperative complications in order to enable improved preoperative optimization and patient education.

Preoperative Behavioral Pain Management Strategies in Total Joint Arthroplasty: A Prospective Randomized Controlled Trial Comparing Mindfulness, Hypnosis and Cognitive-Behavioral Psychoeducation

Adam Hanley, PhD, Eric Garland, PhD, **Jeremy M. Gililland, MD**, Christopher E. Pelt, MD, Lucas A. Anderson, MD, Christopher L. Peters, MD, Jill A. Erickson, PA-C

Notos

Introduction: To better support patients' recovery after total joint arthroplasty (TJA), we introduced evidence-based, preoperative behavioral pain management strategies to our existing multi-modal pain management protocol. This study examined the effect of three different adjunctive interventions (mindfulness meditation, hypnotic suggestion, cognitive-behavioral psychoeducation) on preoperative pain and anxiety as well as physical function in early recovery following primary TJA.

Methods: This was a three-arm, prospective randomized controlled trial conducted in a university-based orthopaedic practice. Patients (N=288: knee=185, hip=103) attending a preoperative education class were randomized to one of three 15-minute interventions: mindfulness (n=108), hypnosis (n=90), or psychoeducation (n=90). A brief survey measured pain-at-rest, desire for pain medication, and anxiety immediately before and 15 minutes after the preoperative intervention. Additionally, preoperative and 6-week postoperative PROMIS Physical Function (PF) scores were compared.

Results: Linear mixed modeling, adjusted for age, BMI, and comorbidities, revealed that mindfulness and hypnosis significantly reduced preoperative pain intensity by 24% and 26% respectively (p<0.001), pain unpleasantness by 29% and 33% (p<0.001), and anxiety by 43% and 29% (p<0.001). Preoperative mindfulness training significantly increased PROMIS PF scores from patients' preoperative to 6-week postoperative visit (+5.62, p<0.001, MCID 3.34) relative to hypnosis and psychoeducation, which showed no significant change from preoperative to 6 weeks.

Conclusions: Findings from this study suggest that a single, 15-minute mindfulness or hypnosis intervention immediately reduced preoperative pain intensity, pain unpleasantness, and anxiety in patients preparing for TJA. Historically, we have found no significant improvement in PROMIS PF scores 6 weeks after TJA; whereas, with preoperative mindfulness training, we found clinically and statistically significant improvements in self-reported physical function at 6-weeks postoperatively. These findings suggest that brief, preoperative mindfulness training may be an effective adjunct that can be easily disseminated in clinical settings, provide immediate preoperative pain and anxiety relief, and may improve postoperative physical function.

The Effect of the IPACK Block on Pain Following Primary TKA: A Double Blinded, Prospective, Randomized Trial

Jillian Vitter, MD, **George F. Chimento, MD**, Kim Bland, MD, Bobby Nossaman, MD, Leslie Thomas, MD, Matthew Patterson, MD

Notes

Introduction: Regional anesthesia is utilized to minimize postoperative pain following total knee arthroplasty (TKA). The purpose of this this study was to determine if preoperative infiltration of local anesthetic between the popliteal artery and posterior capsule of knee (IPACK) controlled posterior knee pain following TKA.

Methods: IRB approval was obtained and a power analysis was performed. Patients were randomized into one of two treatment arms: 1) continuous adductor canal block (ACB) with IPACK block (IPACK Group), or 2) continuous ACB with sham subcutaneous saline injection (No IPACK Group). Only the anesthesiologist performing the block was aware of randomization status. Following surgery, a blinded medical assessor recorded opioid consumption, pain scores, and gait distance.

Results: There were 35 people in the IPACK group and 34 in the NO IPACK group. There was no difference demographically between the groups. In the Post Anesthesia Care Unit (PACU), the average (P=0.0122) and worst (P=0.0168) pain scores at rest were statistically (but not clinically) significant, with lower scores in the IPACK group. There was no difference in the pain scores during physical therapy (P=0.2080). There was no difference in opioid consumption in the PACU (P=0.7928), or at 24 hours (P=0.7456). There was no difference in pain scores on POD 1 in the morning (a.m.) (P=0.4597) or evening (p.m.) (P=0.6273), nor was there any difference in walking distance (P=0.5197). There was also no difference in length of stay in the PACU (P=0.9426) or hospital (P=0.2141).

Conclusions: The IPACK group had lower pain scores at rest in the PACU, but this was not clinically significant. The routine use of the IPACK Block is not supported by the results of this study. There may be use of the IPACK block as a rescue block in patients who have contraindications to a standard multimodal treatment regimen or in patients with chronic pain or opioid dependence.

Intraoperative Surgeon Administered Adductor Canal Blockade Is Not Inferior to Anesthesiologist Administered Adductor Canal Blockade: A Prospective Randomized Trial

Motos

Max R. Greenky, MD, Mikayla E. McGrath, BS, Eric Levicoff, MD, Robert Good, MD, **Asim Makhdom, MD, MSc, FRCSC**, Jess H. Lonner, MD

Introduction: Controlling pain after total knee arthroplasty (TKA) remains a challenge. A single shot adductor canal block (ACB) decreases postoperative pain. A specialty-trained anesthesiologist imposes cost and skill barriers. Cadaveric studies and magnetic resonance imaging data show that access to the adductor canal is possible from within the joint; thus, the potential for intraoperative, surgeon administered ACB through a standard surgical approach is feasible. The purpose of this study is to compare the efficacy of surgeon administered intraoperative ACB to anesthesiologist administered ACB.

Methods: Patients undergoing primary TKA were prospectively randomized to receive either an anesthesiologist administered (Group 1) or surgeon administered (Group 2) ACB using 15ml of ropivacaine 0.5%. Outcomes were pain visual analogue scale (VAS), range of motion, opioid consumption, and patient satisfaction scores.

Results: 51 patients were enrolled (Group 1=28, Group 2=23) and followed for a minimum of 6 weeks. There was no difference in active flexion at postoperative day (POD) 0, or 6 weeks (p=0.86, 0.074 and 0.59). There was no difference in active extension at POD 0, 1, or 6 weeks (p=0.38, 0.07 and p=0.3). Opioid equivalents were equal on POD 0,1, and 2 (p=0.86, 0.68, 0.47). Patients in Group 1 had significantly less pain on POD 0 (p=0.014), but there was no difference in pain VAS score on POD 1 or 2 (p=0.4, p=0.95). There was no difference in patient satisfaction with pain control on POD 0, 1, or 2 (p=0.6, p=0.7, p=0.9).

Conclusions: Surgeon administered ACB is not inferior to anesthesiologist administered ACB with respect to range of motion, patient satisfaction, or opioid consumption, although pain on POD 0 may be greater. Surgeon administered ACB is an effective alternative to anesthesiologist administered ACB.

Quicker and More Predictable Return of Motor Function and Ambulation After Mepivacaine vs. Bupivacaine Spinal: A Double-Blind RCT in Primary TKA and THA

Notes

Cody C. Wyles, MD, Mark W. Pagnano, MD, Robert T. Trousdale, MD, Rafael J. Sierra, MD, Michael J. Taunton, MD, Kevin I. Perry, MD, Hugh Smith, MD, PhD, Christopher Duncan, MD, Matthew P. Abdel, MD

Introduction: Spinal anesthesia provides several benefits for patients undergoing total knee arthroplasty (TKA) and total hip arthroplasty (THA), but historically comes at the cost of slower return of lower extremity motor function. In this prospective, double-blind, randomized clinical trial, we sought to determine if a mepivacaine spinal would allow substantially quicker and more predictable return of motor function as compared to traditional low-dose bupivacaine spinal anesthesia during primary TKA and THA.

Methods: This trial was conducted at a single academic institution. Prior to trial initiation, strong internal pilot data determined that 154 patients were required to achieve 80% power. Patients were randomized in a 1:1 fashion with advanced computerized stratification based on procedure, sex, age group, and BMI. Following surgery, motor function was assessed in the non-operative lower extremity according to the Bromage scale and discontinued once Bromage 0 was achieved (spontaneous movement at hip/knee/ankle).

Results: Mean time to return of lower extremity motor function was 29 minutes quicker and less variable in patients receiving mepivacaine: 184 minutes (95% Cl=168-199 minutes), compared to low-dose bupivacaine: 213 minutes (95% Cl=184-241 minutes). Mean time to successful participation in physical therapy including ambulation was 20 minutes quicker and less variable in patients receiving mepivacaine: 399 minutes (95% Cl=375-423 minutes), compared to low-dose bupivacaine: 419 minutes (95% Cl=388-451 minutes). The proportion of patients experiencing postoperative orthostatic hypotension or transient neurologic symptoms in those receiving mepivacaine compared to low-dose bupivacaine was 18% vs. 11% and 0% vs. 0%, respectively (non-significant).

Conclusions: For patients undergoing primary TKA and THA, spinal anesthesia with mepivacaine allowed quicker and less variable return of lower extremity motor function compared to low-dose bupivacaine, without a concomitant increase in complications potentially associated with spinal anesthetics. This is particularly of value in an era of short-stay and outpatient surgery.

The Use of Tourniquet Does Not Negatively Influence Outcomes in Total Knee Arthroplasty: A Randomized Controlled Trial

Jorge Padilla, MD, Jonathan Gabor, BS, Alex Tang, BS, Erik A. Schnaser, MD, Morteza Meftah, MD, Ran Schwarzkopf, MD

Notes

Introduction: Intraoperative tourniquet use in total knee arthroplasty (TKA) is a common practice which may improve visualization of the surgical field and reduce blood loss. However, the safety and efficacy associated with tourniquet use continues to be the subject of debate among orthopaedic surgeons. The primary purpose of this study is to evaluate the effects of tourniquet use on pain, opioid consumption and patient-reported outcomes (PROs) following TKA.

Methods: This is a multicenter randomized controlled trial among patients undergoing TKA. Patients were randomized preoperatively to undergo TKA with or without the use of an intraoperative tourniquet. Frequency distributions, means, and standard deviations were used to describe baseline patient demographics (age, gender, race, BMI, ASA score, smoking status), length of stay (LOS), surgical factors, 90-day readmissions, visual analogue scale (VAS) pain scores, PROs (VR-12 MCS and PCS, KOOS, JR.), physical therapy score (Boston University AM-PAC Basic Mobility Inpatient Short Form), and opioid consumption in morphine milligram equivalents (MME). T-tests were used to test for significant differences between continuous variables and 2 for categorical variables. A p-value threshold of <0.05 was considered statistically significant.

Results: In total, 70 patients were included in this study, with 37 patients undergoing TKA without tourniquet and 33 patients with tourniquet. No statistically significant differences were found in surgical time (124.3 vs. 121.5 minutes; p=0.80), LOS (2.4 vs. 2.4 days; p=0.98), pain scores (2.0 vs. 2.2; p=0.76), inpatient opioid consumption (32.2 vs. 36.6 MMEs; p=0.65), outpatient opioid consumption (28.1 vs. 25.4 MMEs; p=0.81), KOOS, JR. scores (63.5 vs. 53.9; p=0.17), AM-PAC (21.1 vs. 21.1; p=0.97), VR-12 PCS scores (38.5 vs. 44.0; p=0.39), and VR-12 MCS (52.3 vs. 47.6; p=0.55) scores between the tourniquet-less and tourniquet cohorts, respectively. There were no readmissions in either cohort during the 90-day episode of care.

Conclusions: Utilization of a tourniquet during TKA does not negatively impact postoperative pain scores or opioid consumption. Furthermore, use of a tourniquet does not appear to affect patient satisfaction or outcomes.

Symposium I

Multimodal Anesthesia and Analgesia in Total Joint Arthroplasty: Where Do We Stand in 2019? A Collaborative Clinical Practice Guideline

Moderator: William G. Hamilton, MD

Faculty: Yale A. Fillingham, MD, Denis Nam, MD, MSc, James A. Browne, MD

Effective pain control after total joint arthroplasty (TJA) has been shown to improve outcomes including faster recovery, lower complication rates, reduced costs of care, and improved patient satisfaction. There are many anesthetic and analgesic options to control pain after TJA. Historically, opioids were a cornerstone of controlling pain after TJA. However, opioids have significant side effects and risks, including addiction, which has led to the opioid epidemic the United States is fighting today. Multimodal analgesic regimens in TJA have garnered significant interest because they limit the use of opioids perioperatively. Yet, today there is no consensus regarding the optimal anesthesia and anesthetic regimen for TJA that maximizes effective postoperative pain control and minimizes the risks associated with prescribing opioids. This symposium will present and discuss the initial findings of the Anesthesia & Analgesia in Total Joint Arthroplasty Clinical Practice Guidelines, which is a collaboration between the American Association of Hip and Knee Surgeons, American Academy of Orthopaedic Surgeons, American Society of Regional Anesthesia and Pain Medicine, the Hip Society, and the Knee Society. This will be the first of a two-part series presenting the findings on oral medications including opioids, nonsteroidal anti-inflammatories, acetaminophen, and gabapentinoids. We will discuss the current evidence for each of the medications and address current controversies, such as oral vs. intravenous acetaminophen, how to manage preoperative opioid users, and whether gabapentinoids should be used for both hip and knee arthroplasty.

Learning Objectives:

- 1. To discuss the current controversies and the current evidence on acetaminophen, nonsteroidal anti-inflammatories, and gabapentinoids for the treatment of pain during and after THA and TKA.
- **2.** To understand the current opioid epidemic, the role of the arthroplasty surgeon, and how to minimize opioid use after THA and TKA.
- 3. To discuss the challenges associated with patients taking opioids prior to THA or TKA and the best evidence-based methods for treating these patients and their pain both prior to and after surgery.

Outline:

Introduction

William G. Hamilton, MD

Opioids in Arthroplasty: The Many Challenges Facing Arthroplasty Surgeons in 2019

Denis Nam, MD, MSc

Acetaminophen: Is There a Difference Between Oral and IV?

William G. Hamilton, MD

Gabapentinoids: How Effective Are They and Which Medication Should We Use?

James A. Browne, MD

NSAIDs: How Much, How Long, and What About Ketorolac?

Yale A. Fillingham, MD

Discussion

All Faculty

Notes			

Symposium II

Simplifying the Hip-Spine Relationship for Total Hip Arthroplasty

Moderator: Jonathan M. Vigdorchik, MD

Faculty: Michael P. Bolognesi, MD, Lawrence D. Dorr, MD, Douglas A. Dennis, MD

This symposium will provide the latest information on why the hip-spine relationship is important to consider in total hip arthroplasty and how it influences the functional acetabular component position as well as THA outcomes. Most importantly, audience members will leave with an understanding of the hip-spine relationship and a simple, easy way to incorporate it into their practice.

Learning Objectives:

- **1.** To understand the terminology to use when speaking about the hip-spine relationship
- 2. To understand how to perform the work-up and execute the plan
- **3.** To understand when to utilize advanced technology or alternative bearing surfaces

Outline:

Introduction

Jonathan M. Vigdorchik, MD

Fact or Fiction – What Do I Actually Believe?

Michael P. Bolognesi, MD

Simple Introduction to the Hip-Spine for the TJA Surgeon

Lawrence D. Dorr, MD

Specific Case Examples that Highlight the Main Issues

Jonathan M. Vigdorchik, MD

Why Not Dual Mobility for All?

Douglas A. Dennis, MD

Discussion

Jonathan M. Vigdorchik, MD

Pain Control After Total Hip Arthroplasty: A Randomized Trial Determining Efficacy of Fascia Iliaca Compartment Blocks in the Immediate Postoperative Period

Notes

Kamil Bober, MD, Allen A. Kadado, MD, Wayne T. North, MD, Michael A. Charters, MD

Introduction: The purpose of this randomized trial was to identify whether fascia iliaca compartment blockade (FICB) reduces postoperative pain and narcotic consumption and improves early functional outcomes in primary THA performed through the mini-posterior approach.

Methods: Patients were recruited from September 2017 to May 2019. Eligible patients received a primary THA using the posterior approach with epidural anesthesia. Postoperatively, patients were randomized to receive a FICB or a placebo block. Pain scores and narcotic consumption were recorded after surgery. Functional outcomes including distance walked during therapy, timed-up-and-go testing, and quadriceps strength were recorded. The patients completed PROMIS pain and physical function surveys at 4 weeks postoperatively.

Results: During the study period, 120 patients were recruited. There was no difference in the average pain scores at any time interval between the placebo and block groups during the first 24 hours (p=0.21-0.99). There was no difference between the pre-block and post-block pain scores in the block group (4.42 vs. 3.83, p=0.97). There was no difference in the cumulative morphine equivalents consumed between the two groups during any time interval postoperatively (p=0.06-0.25). Functional testing showed no difference between the two groups regarding distance walked during the first therapy session (65.6 vs. 76.8 ft. p=0.33) and timed-up-and-go testing (63.7 vs. 64.7 sec, p=0.95). There was an increased incidence of quadriceps weakness in the block group (22% vs. 0%, p=0.004) requiring the use of a knee immobilizer and alterations in therapy protocols.

Conclusions: This trial shows that FICB does not improve functional performance and does not decrease pain or narcotic usage after mini-posterior THA. However, it does increase the risk of quadriceps weakness, placing patients at an increased risk of falling and requiring changes in therapy protocols. Based on these results we do not recommend FICB after THA performed through the posterior approach.

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Topical Tranexamic Acid Increases Early Postoperative Pain After Total Hip Arthroplasty $^{\Diamond}$

Notes

Jeffrey Wurtz, BS, L. D. Wurtz, MD, Mary Ziemba-Davis, BA, Evan R. Deckard, BA, **R. Michael Meneghini, MD**

Introduction: Tranexamic acid (TXA) decreases blood loss and therefore may minimize painful postoperative hematomas after total hip arthroplasty (THA). This study evaluated early postoperative pain and blood loss in THA patients with and without the use of topical TXA..

Methods: A consecutive series of 174 THAs performed without TXA were compared to a consecutive series of 156 THAs performed with topical TXA. Procedures were performed by a single surgeon using identical perioperative medical and pain control protocols. Inpatient pain scores (VAS 0 to 10), opioid consumption (morphine equivalents, Meq), time to first opioid, and drop in hemoglobin (Hgb) were evaluated. Univariate analysis of topical TXA and 20 potential covariates of pain and blood loss were performed, followed by logistic and linear regression with p≤0.250.

Results: In multivariate analysis, THAs with TXA were independently associated with less hemoglobin loss than THAs without TXA (2.98 g/dL vs. 3.39 g/dL; p=0.001). Topical TXA use was associated with greater pain (3.41 vs. 1.71, p=0.001) and increased opioid consumption (44.2 vs. 24.2 Meqs, p<0.001) during the first 24 hours, and decreased time to first opioid (182 vs. 422 minutes, p=0.008). 33% of patients receiving TXA compared to 9% without TXA reported moderate-severe pain (p=0.021). Preoperative narcotic use (p=0.055 to 0.008) and fentanyl rather than morphine spinals (p=0.034 to 0.008) also independently increased postoperative pain.

Conclusions: Findings continue to support TXA in minimizing blood loss in THA; however, increased early postoperative pain with topical TXA was an unexpected discovery. This finding is reinforced by TXA affecting GABA and glycine receptors in the spinal dorsal horn, and TXA causing periarticular cell death in vivo at clinical concentrations. We currently avoid topical TXA use clinically, particularly in the outpatient early discharge setting, and are exploring whether similar findings are observed with intravenous TXA.

♦ The FDA has not approved tranexamic acid for use in orthopaedics.

Risk of Dislocation by Surgical Approach Following Modern Primary Total Hip Arthroplasty

Cody C. Wyles, MD, Adam Hart, MD, Mario Hevesi, MD, Kevin I. Perry, MD, Matthew P. Abdel, MD, Mark W. Pagnano, MD, **Michael J. Taunton, MD**

Introduction: There is renewed interest in dislocation after surgical approach with popularization of the direct anterior approach. The purported advantage of both the lateral and direct anterior approaches is decreased risk of dislocation. The purpose of this study was to assess the risk of dislocation by approach following modern primary total hip arthroplasty (THA).

Methods: All primary THAs at a single academic institution from 2010 to 2017 were analyzed through our institutional total joint registry. There were 7,023 THAs including 3,754 posterior, 1,732 lateral, and 1,537 direct anterior. Risk of dislocation was assessed against the competing risks of revision surgery, death, patient factors and surgical approach. All-cause revision was assessed as a secondary outcome. Mean age was 63 years, 51% were female, and mean body mass index (BMI) was 30 kg/m2. Median follow-up was 2 years.

Results: The cumulative incidence of dislocation at 1-year and 5-years by approach was as follows: posterior (2.1%; 3.0%), lateral (0.7%; 0.7%), direct anterior (0.4%; 0.4%) (p<0.001). Compared to the posterior cohort, the adjusted risk of dislocation was decreased for the lateral (hazard ratio [HR]=0.28, p<0.001) and direct anterior cohorts (HR=0.18, p<0.001). The cumulative incidence of revision for instability at 1-year and 5-years by approach was as follows: posterior (0.8%; 1.0%), lateral (0.6%; 0.6%), direct anterior (0%; 0%) (p=0.09). The adjusted risk of all-cause revision surgery was increased among the lateral cohort compared to posterior (HR=1.75, p=0.003) and direct anterior (HR=2.44, p=0.002) and among patients with diagnoses other than osteoarthritis (HR=2.89, p<0.001). Among patients who dislocated, 69 (83%) had anteversion >25°.

Conclusions: This study documents the risk of dislocation by surgical approach among a large contemporary cohort undergoing primary THA. The risk of dislocation was higher following the posterior approach; whereas, all-cause revision surgery was found to be higher following the lateral approach.

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The Majority of Total Hip Arthroplasty Patients with a Stiff Spine Do Not Have an Instrumented Fusion

Jonathan M. Vigdorchik, MD, **Douglas A. Dennis, MD**, Leonard R. Walter, FRACS, Jim Pierrepont, PhD, Andrew J. Shimmin, MD, FRCS (Ortho)

Introduction: Total hip arthroplasty (THA) patients with limited lumbar flexion have increased rates of dislocation. An instrumented spinal fusion is a well-recognized cause that's risk increases with increasing number of levels fused. However, many patients without an instrumented fusion also exhibit abnormal spinopelvic mobility. The purpose of this study was to understand the proportion of THA patients without an instrumented fusion that have limited lumbar flexion and behave as if they are mechanically fused.

Methods: A retrospective analysis was performed on a large database of 6,340 patients undergoing primary THA. All patients had preoperative spinopelvic measurements. Lumbar lordosis was measured on standing and flexed-seated lateral radiographs, with the resulting difference defined as a patient's lumbar flexion (LF). Any instrumented fusion of the lumbar spine was observed on the lateral standing radiograph and recorded. Limited lumbar flexion (the definition of a stiff spine) was classified by LF <20°. The percentage of patients with an instrumented fusion and limited lumbar flexion was then determined.

Results: Of the 6,340 patients, 207 (3%) had an instrumented fusion. Of these 207 patients, only 67 (32%) had a lumbar flexion <20 degrees. Of the combined 6,340 patients, 355 (6%) had limited lumbar flexion. Of these 355 patients, only 67 (19%) had an instrumented fusion.

Conclusions: The vast majority (81%) of THA patients with a stiff spine do not have an instrumented fusion. We recommend preoperative spinopelvic assessment of all patients undergoing THA, as only a minority of those with limited lumbar flexion have an instrumented fusion and may otherwise be overlooked. Lumbar degenerative disc disease is common in THA patients, limits the available lumbar flexion in the same way an instrumented fusion might and potentially increases the risk of dislocation in this subset of patients.

The Effect of Preoperative Anemia on Complications Following Total Hip Arthroplasty

Matthew J. Grosso, MD, Venkat Boddapati, MD, Herbert J. Cooper, MD, Jeffrey A. Geller, MD, Roshan P. Shah, MD, Alexander L. Neuwirth, MD

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Introduction: Complications following total hip arthroplasty (THA) can lead to increased costs and patient dissatisfaction. Current literature suggests that preoperative hematocrit levels may play an important role in determining risk for complications following THA. The purpose of this study was to determine the role of preoperative anemia status on 30-day complications following total hip arthroplasty.

Methods: Using the National Surgical Quality Improvement Program registry from 2006-2016, we identified all patients who underwent primary THA. Patients were placed into 3 cohorts based on preoperative hematocrit levels (Normal >36% [N=166,538], Mild Anemia 27%-36% [N=13,214], Severe Anemia <27% [N=541]). Differences in 30-day postoperative medical complications and readmission rates were compared using bivariate and multivariate analyses.

Results: Multivariate logistic regression analysis identified mild anemia compared to normal hematocrit as a significant risk factor for total complications (OR 1.46, p<0.001), mortality (OR 2.06, p<0.001), renal complications (OR 2.59, p<0.001), respiratory complications (OR 1.89, p<0.001), sepsis (OR 2.01, p<0.001), wound infection (OR 1.36, p<0.001), and urinary tract infection (OR 1.44, p<0.001). Severe anemia was also a risk factor with a higher odds ratio for total complications (OR 1.99, p<0.001). Both mild and severe anemia were significant risk factors for increased rates of perioperative blood transfusion (mild: OR 4.04, severe: OR 5.58), non-home discharge (OR 1.74, OR 1.64), and unplanned hospital readmissions (OR 1.42, OR 1.66).

Conclusions: Preoperative anemia is a significant risk for perioperative complications following primary THA. Even mild anemia can lead to significantly increased risks of mortality, medical complications, and unplanned hospital readmissions in THA. This study further supports the need for screening and preoperative intervention for patients in this at-risk group.

www.AAHKS.org/Meeting 2⁴

Does Femoral Morphology Predict the Risk of Periprosthetic Fracture After Cementless Total Hip Arthroplasty?

Cindy R. Nahhas, BS, Kevin C. Bigart, MD, Gregory P. Ruzich, BA, Chris Culvern, MS, Michael B. Salzano, BS, Craig J. Della Valle, MD, **Denis Nam, MD, MSc**

Introduction: Periprosthetic femur fracture remains a leading mode of early failure following cementless total hip arthroplasty (THA). The purpose of this study was to determine if a specific femoral morphology is associated with an increased risk of periprosthetic fracture after cementless THA.

Methods: An institutional arthroplasty registry was used to identify 35 primary, cementless THAs revised for acute, postoperative periprosthetic fracture ("fracture" cohort). Patients were matched 1:2 to 70 THAs without fracture ("control" cohort) for age, BMI, gender, and stem design. Preoperative radiographic measurements performed on AP pelvis and femur radiographs included the neck-shaft angle, endosteal width at four locations and external cortical diameter at two locations. Measurements were used to calculate the morphological cortical index (MCI), canal flare index (CFI), canal calcar ratio (CCR), and canal bone ratio (CBR). Postoperative measurements included canal fill, stem alignment, and distal stem cortical contact. Statistical analyses included clustered regressions, Fisher's Exact, and Student's T test.

Results: Greater endosteal width in fracture vs. control patients at 10cm distal to the lesser trochanter (15.28 vs. 14.37, p=0.1) resulted in differences in the CFI (3.05 vs 3.28, p=0.03), CCR (0.50 vs. 0.47, p=0.03), and CBR (0.46 vs. 0.43, p=0.03) between the two groups. These measurements indicate decreased meta-diaphyseal taper in fracture patients. Femoral neck angle was more varus in fracture patients (131.4 vs. 134.6 degrees, p=0.04). There were no differences in the stem canal fill (0.84 vs. 0.86 at mid-third, p=0.1; 0.85 vs. 0.88 at distal third, p=0.09), stem varus or valgus position (p=0.08), or distal stem-cortex contact (p=0.6) between cohorts.

Conclusions: Patients sustaining an acute, periprosthetic fracture with cementless femoral fixation after THA had thinner distal cortices and a decreased meta-diaphyseal taper. Surgeons should be aware of the potential risk of periprosthetic fracture in patients with this specific morphology when performing a cementless THA.

Does Femoral Component Cementation Affect Costs or Clinical Outcomes After Hip Arthroplasty in Medicare Patients?

Jason Oh, MD, William Yang, BA, Tara Moore, MS, Kristina Dushaj, MA, Herbert J. Cooper, MD, **Matthew S. Hepinstall, MD**

Notes

Introduction: Although cementless femoral fixation in total hip arthroplasty (THA) is known to contribute to higher complication and reoperation rates when compared to cemented fixation, utilization of cementless femoral fixation continues to rise. New data is available from the Centers for Medicare and Medicaid Services (CMS) regarding total costs of care per surgical episode. Using this data, we investigated whether femoral cementation affects: (1) 90-day costs; (2) readmission rates; (3) re-operation rates; (4) length of stay (LOS); and (5) discharge disposition for Medicare patients undergoing THA.

Methods: We performed a multicenter retrospective cohort study of 1,671 primary THA cases in Medicare patients. CMS data was used to evaluate lump costs including the surgical admission and early postoperative period. Costs were correlated with clinical outcomes from electronic medical record review. Multiple regression analyses were performed to assess differences in costs and outcomes.

Results: Controlling for cohort differences, cemented patients were significantly more likely to be discharged home compared to cementless patients. Cemented patients also demonstrated trends toward lower costs, lower readmission rates, and shorter LOS compared to cementless patients. All reoperations within the early postoperative period occurred in patients managed with cementless femoral fixation.

Conclusions: In a large Medicare population, cemented femoral fixation outperformed cementless fixation with respect to discharge disposition and also trended toward superiority with regards to LOS, readmission, cost of care, and reoperation. Cemented femoral fixation remains relevant and useful despite the rising popularity of cementless fixation. Orthopaedic surgeons in training should become competent with femoral cementation technique.

Symposium III

Total Knee Arthroplasty Removal from the Medicare Inpatient-Only (IPO) List: Implications for Surgeons, Patients, and Hospitals

Moderator: Richard Iorio, MD

Faculty: Derek A. Haas, MBA, C. Lowry Barnes, MD, Charles M. Davis, MD, PhD

This symposium will examine the impact of the Centers for Medicare and Medicaid Services (CMS) removing total knee arthroplasty (TKA) from inpatient-only status for Medicare patients in January 2018. We will cover the following topics:

- The trend in adoption of outpatient TKAs for Medicare patients since January 2018, and how that varies across hospitals
- When Medicare TKA patients are more or less likely to be coded as a hospital outpatient case
- The impact of outpatient TKAs on patient re-retreatment rates
- The revenue implications of coding TKAs as inpatient vs. outpatient based on your hospital
- The impact on potential incentives in value-based payment models, e.g. CJR and BPCI
- The implications for patients staying more than 2 midnights, those staying 1 midnight, and those being discharged the same day
- Where we will be next year, in three years, and how to prepare successfully

We will draw on both our own experiences and a recent analysis we conducted of 100% of the Medicare FFS TKAs across the country.

Learning Objectives:

- **1.** To understand the current state of adoption for outpatient TKAs across the country.
- 2. To become more attuned to the financial implications of TKA patients having different lengths of stay in the hospital and how their cases are coded.
- **3.** To get ready for increased adoption of outpatient TKAs.
- **4.** To be thoughtful about what payment models will enable you to be most successful based on your level of adoption of outpatient TKAs.

Outline:

Introduction

Richard Iorio, MD

Analyzing the Adoption of Outpatient Total Knee Arthroplasty (TKA) Since 2018

C. Lowry Barnes, MD

The Patient Impact Broken Down by Length of Stay and Population Segment

Richard Iorio, MD

The Financial Implications for Surgeons and Hospitals and How This Is Influencing Current Practice

Derek A. Haas, MBA

The Quality and Financial Impact at My Hospital Charles M. Davis, MD, PhD

Discussion

Richard Iorio, MD

Notes			

Removal of Total Knee Arthroplasty from the Inpatient Only List Adversely Affects Bundled Payment Programs

Notes

Michael Yayac, MD, David A. Janiec, MBA, Matthew S. Austin, MD, P. Maxwell Courtney, MD

Introduction: Beginning in January 2018, the Centers for Medicare and Medicaid Services (CMS) removed total knee arthroplasty (TKA) from its inpatient only (IPO) list. Many hospitals inappropriately began to schedule all TKA procedures as an outpatient, excluding them from CMS bundled payment programs. The purpose of this study was to determine the impact of the removal of TKA from the IPO list on our institution's Bundled Payments for Care Improvement (BPCI) Initiative.

Methods: We queried our institutional database to identify all Medicare patients who underwent primary TKA from 2017-18 performed by one of 37 surgeons across 20 hospitals. Hospital status was recorded and crosschecked with CMS claims data. Demographics, comorbidities, and short-term outcomes were compared between patients classified as outpatient or inpatient TKA. Episode-of-care BPCI costs were then compared from 2017 to 2018 and the cost to the program was calculated based upon the CMS target price.

Results: Of the 2,135 primary TKA patients in 2018, 908 (43%) were classified as an outpatient. Of the outpatient cases, 147 (18%) had a length of stay beyond two-midnights, potentially qualifying for inpatient status. Inpatients had a longer length of stay (1.9 vs. 1.4 days, p<0.001) and higher rates of discharge to rehabilitation (17% vs. 3%, p<0.001), but no difference in medical comorbidities, complications, or readmissions (all p>0.05). Ninety-day episode-of-care claims cost increased when comparing the BPCI patients from 2017 to 2018, (\$19,222 vs. \$19,417, p=0.002). The removal of TKA from the IPO list resulted in a projected loss of at least \$2,896,520 in unrealized savings for our institution's BPCI program.

Conclusions: By excluding all outpatient TKA from bundled payment programs, the increased costs of BPCI may disincentivize providers from participating. CMS should provide clarity as to documentation for outpatient status and address the negative implications on alternative payment models.

The Clinical and Financial Consequences of the Centers for Medicare and Medicaid Services' Two-Midnight Rule in Total Joint Arthroplasty

Notes

Adam J. Schwartz, MD, MBA, Kevin J. Bozic, MD, MBA, Henry D. Clarke, MD, Adam A. Sassoon, MD, MS, Matthew R. Neville, MS, David A. Etzioni, MD

Introduction: To lessen the financial burden of total joint arthroplasty (TJA) and encourage shorter hospital stays, the Centers for Medicare and Medicaid Services (CMS) recently removed total knee arthroplasty (TKA) from the inpatient-only (IPO) list. This policy change now requires providers and institutions to apply the two-midnight rule (TMR) to short-stay (one-midnight) inpatient hospitalizations (SSIH).

Methods: The National Inpatient Sample (NIS) from 2012 through 2016 was used to analyze trends in length of stay (LOS) following elective TJA. Inflation-adjusted hospital costs for Medicare TJA's performed in 2016 were determined for five LOS groups (LOS=0, 1, 2, 3, >3). Utilizing publicly available policy documentation, published median Medicare payments, and NIS hospital costs, we analyzed the application of the TMR to SSIH's and compared the results to the previous policy environment. Specifically, we modelled three scenarios for all 2016 Medicare SSIH's: (1) all patients kept an extra midnight to satisfy the two-midnight rule, (2) all patients discharged as an outpatient, and (3) all patients discharged as an inpatient.

Results: The overall percentage of Medicare SSIH's increased significantly from 2.7% in 2012 to 17.8% in 2016 (p<0.0001). Scenario 1 resulted in no change in out-of-pocket (OOP) costs to patients, no change in CMS payments, and hospital losses of \$117.0 million. Scenario 2 resulted in no change in patient OOP costs, reduction in payments from CMS of \$181.8 million, and hospital losses of \$357.3 million. Scenario 3 resulted in no change in patient OOP costs, no change in CMS payments, and an estimated \$1.71 billion of SSIH charges at risk to hospitals for audit.

Conclusions: The results of this analysis reveal the conflict between LOS trends following TJA and the imposition of the TMR. In the absence of a change in current policy, it is imperative that CMS provide stakeholders with unambiguous criteria for short-stay inpatient hospitalizations.

Surgeon Reimbursement Unchanged as Hospital Charges and Reimbursements Increase for Total Hip Arthroplasty

Notes

Brian C. Werner, MD, Nicole E. During, MD, Dennis Q. Chen, MD, James A. Browne, MD

Introduction: As total hip arthroplasty (THA) incidence in the United States increases, healthcare entities look to reform policy to decrease costs while improving efficiency and quality of care. The relationship between surgeon and hospital charges and payments for THA has not been well examined. The goal of this study is to report trends and variation in hospital charges and payments compared to surgeon charges and payments for THA in a Medicare population.

Methods: The 5% Medicare sample was used to capture hospital and surgeon charges and payments for THA from 2005-2014. The charge multiplier (CM; ratio of hospital to surgeon charges) and the payment multiplier (PM; ratio of hospital to surgeon payments) were calculated. Year to year variation and regional trends in patient demographics, Charlson Comorbidity Index (CCI), length of stay (LOS), CM and PM were evaluated. Statistical significance of trends was evaluated using student's t-tests. Correlations between the financial multipliers and LOS were evaluated using a Pearson correlation coefficient (r).

Results: 56,228 patients were included. Hospital charges were significantly higher than surgeon charges throughout the study period and increased substantially (CM increased 8.7 to 11.5, p<0.0001). Hospital payments relative to surgeon payments followed a similar trend (PM increased 11.0 to 15.2, p<0.0001). Similar trends were noted in all four regions of the US. LOS decreased significantly throughout the study from 4.14 to 2.99 days (p<0.0001), while CCI remained stable. As LOS decreased, the ratio of hospital to surgeon charges and payments paradoxically increased.

Conclusions: Hospital charges and payments relative to surgeon charges and payments have significantly increased for THA despite stable patient complexity, measured by CCI and decreasing LOS. As health care shifts toward value-based care with shared responsibility for outcomes and cost, more closely aligned incentives between hospitals and providers is needed.

Hospital Total Joint Arthroplasty Case-Mix Burden and Patient Flows in the Era of Payment Reform: Impact on Resource Utilization Among New York State Hospitals

Notes

Sara N. Kiani, BA, Samuel Z. Maron, MA, Nicole Zubizarreta, MPH, Aakash Keswani, BA, Leesa Galatz, MD, Madhu Mazumdar, PhD, Jashvant Poeran, MD, PhD, Calin S. Moucha, MD

Introduction: Alternative payment models have been increasingly adopted in orthopedic surgery; mainly bundled payments in total joint arthroplasty (TJA). Concerns persist regarding unintended consequences, such as the selection of healthier TJA candidates. We aimed to study potential selection in terms of: 1) trends in patient comorbidity burden; and 2) the association with costs.

Methods: This retrospective cohort study used 2011 and 2016 New York SPARCS data, including all hip and knee arthroplasties (n=36,365). The main effect of interest was patient comorbidity burden estimated by the Charlson-Deyo Index. The main outcomes were cost and non-home discharge. Hospitals were categorized into those with either an increased, stable (with 5% buffer), or decreased percentage of patients with comorbidities (Charlson-Deyo>0) between 2011-2016. Mixed-effects models measured the association between Charlson-Deyo Index and outcomes by hospital comorbidity categorization. Odds ratios and 95% confidence intervals are reported.

Results: Overall, 46 (n=8,810), 39 (n=16,300) and 67 (n=11.255) hospitals were categorized into the increased. stable and decreased comorbidity burden categories, respectively. Hospitals with decreased patient comorbidity were generally those with a lower annual TJA volume (median: 481) compared to those with increased (median: 558) or stable patient comorbidity (median: 726, p<0.0001). Adjusting for relevant covariates, we found that increased patient comorbidity was associated with increased costs (maximum 22% CI 19%-25%, p<0.0001). However, this effect was moderated in hospitals with increased comorbidity burden. Similarly, increased patient comorbidity was associated with increased odds (maximum OR 3.06 Cl 2.59-3.61, p<0.0001) of institutional post-acute care discharge. This effect was weakest in hospitals with increased patient comorbidity.

Conclusions: The majority of hospitals studied saw a decrease in TJA patient comorbidity burden, which may be suggestive of patient selection. Our findings also suggest that a redistribution of comorbid patients to select hospitals could be beneficial, as these hospitals may be better equipped to care for them.

Are We Treating Similar Patients? Hospital Volume and the Difference in Patient Populations for Total Knee Arthroplasty

Notes

Hiba Anis, MD, Nicholas Arnold, MD, Deepak Ramanathan, MD, Michael A. Mont, MD, Brendan M. Patterson, MD, MBA, **Robert M. Molloy, MD**, Carlos A. Higuera, MD

Introduction: Early findings of superior total knee arthroplasty (TKA) outcomes at high-volume centers have led to distinct referral patterns based on patient factors and hospital volume. We compared characteristics of primary TKA patients at high-volume hospitals to those at lower volume hospitals.

Methods: A retrospective review of 12,541 primary TKAs from an institutional database from 2014-2017 was conducted. Patients were stratified into risk groups based on age (>65 years), body mass index (BMI; >40), and Charlson Comorbidity Index (CCI; ≥4). Patients with ≥2 of these characteristics were high-risk. Sixteen hospitals were classified as low-, intermediate-, or high-volume according to average number of TKAs per year at each hospital (<250, 250-499, and >500, respectively). Thresholds were guided by percentiles and recent literature. Patient gender, race, age, BMI, CCI, and risk group were compared between hospital volume tiers. These relationships were evaluated with multivariate logistic regression models adjusted for study covariates.

Results: There was a greater percentage of high-risk patients at high-volume hospitals, compared to those at intermediate- or low-volume hospitals (p<0.001). Multivariate analysis showed that patients with a BMI >40 were more likely to be treated at high-volume centers compared to intermediate- (OR 1.4; p<0.001) and low-volume centers (OR 1.4; p<0.001). Patients with CCI scores ≥4 were more likely to be treated at high-volume hospitals compared to intermediate- (OR 1.5; p<0.001) or low- (OR 1.2; p=0.002) volume centers. Overall, patients with BMI >40 were 38% more likely to undergo TKA at high-volume hospitals (OR 1.4; p<0.001) and patients with CCI scores ≥4 were 38% more likely to undergo TKA at high-volume hospitals (OR 1.4; p<0.001) compared to both low- and intermediate-volume hospitals combined.

Conclusions: Analyzing disparities in patient populations is crucial to accurately interpret outcome comparisons between hospitals as they have substantial impact on reporting quality metrics. This study found hospitals performing >500 TKAs per year treated patients with higher BMIs and greater comorbidity burdens.

Reviews of Orthopedic Surgeons on Physician Rating Websites: Analysis of 11,535 Reviews

Notes

Jessica Yu, BS, Linsen T. Samuel, MD, MBA, Sercan Yalcin, MD, Assem A. Sultan, MD, Atul F. Kamath, MD

Introduction: Physician rating websites have become an increasingly popular method for patients to give feedback and obtain information about physicians and their past performances. Each physician rating website uses different criteria to evaluate physicians, with the option for patients to provide written reviews. Our goal was to identify factors that patients value when seeing an orthopedic surgeon.

Methods: The study design was observation. We analyzed 9 major physician rating websites (RateMDs. com, HealthGrades.com, Vitals.com, WebMD.com, Yelp.com, CareDash.com, Wellness.com, ZocDoc. com, YellowPages.com) to evaluate the online ratings of orthopedic surgeons and examine the variables that influence these ratings. Numeric ratings were standardized on a scale from 0 to 100 with higher values indicating more positive ratings. For websites with sub-components to each review, relationships between high ratings and individual components were analyzed.

Results: Online reviews of orthopedic surgeons in state analysis were evaluated in April 2019, accumulating a total of 11,535 reviews. The average overall rating of orthopedic surgeons was positive at 83.6 on our scale. The majority of physicians amassed 20 reviews or fewer on each website. Higher ratings of orthopedic surgeons were correlated with staff friendliness (p=0.010), punctuality (p=0.009), and knowledge/expertise (p=0.031). Analysis of written reviews showed that resolutions of original patient complaint were associated with a high-scoring review.

Conclusions: The online trend of orthopedic surgeons is positive overall with particular weight placed on timeliness and staff friendliness. Since submission of a physician review is purely voluntary, this data is affected by participation bias. The average number of reviews per physician is remarkably small, so the validity of these ratings as they correlate to actual physician performance should be questioned. In all, this study has tremendous impact for orthopedic surgeons because understanding the reasoning behind positive and negative reviews may help improve patient satisfaction.

Body Mass Index Is a Better Predictor of Periprosthetic Joint Infection Risk than Local Measures of Adipose Tissue Following Total Knee Arthroplasty

Simon W. Young, MBChB, FRACS, MD, Julia Shearer, MBBS, Lewis Agius, MD, FRCS (Ortho), Neil Burke, MD, FRCS (Ortho), Richard Rahardja

Notes

Introduction: Both body mass index (BMI) and local measures of adiposity at the surgical site have been identified as potential risk factors for periprosthetic joint infection (PJI) following total knee arthroplasty (TKA). We aimed to evaluate previously used measures of assessing knee adiposity and to determine what measure is best for predicting both surgical duration and PJI following TKA.

Methods: We performed a multicenter retrospective review of 4,745 patients who underwent a primary TKA over the period of January 2013 through December 2016 across three hospitals. Patient demographics, comorbidities, surgical duration and postoperative infection status within one-year were recorded. Preoperative weightbearing AP and lateral x-rays were analyzed for each patient to determine pre-patellar adipose thickness, bony width of the tibial plateau, and total soft tissue knee width. From this, the knee adipose index (KAI) was calculated from the ratio of bone to total knee width. Multivariate analysis was performed to assess risk factors for PJI.

Results: The PJI rate at one year was 0.7% (31/4, 745). There was a strong correlation between PJI risk and BMI >35 (OR 2.9, 95% CI 1.4-6.1). In contrast, neither KAI nor pre-patellar fat thickness showed a significant correlation with PJI risk (p>0.05). We observed substantial variability in local measures of adiposity (KAI and pre-patellar fat thickness) compared to BMI. Surgical duration was longer with higher BMI and higher measures of local adiposity (KAI and pre-patellar fat thickness).

Conclusions: Local adiposity at the knee varies greatly for any given BMI. BMI is superior to measures of local adiposity at the surgical site in predicting PJI following TKA. The systemic effects of obesity may be more important than local adipose tissue in PJI risk following TKA.

Fate of the Morbidly Obese Patient Who Is Denied Total Joint Arthroplasty

Joshua A. Shapiro, MD, Patrick R. Taylor, BA, Arvind Narayanan, MD, Christopher W. Olcott, MD, Daniel J. Del Gaizo, MD

Notes

Introduction: The purpose of this study was to investigate the outcomes of patients denied total hip arthroplasty (THA) or total knee arthroplasty (TKA) due to morbid obesity (BMI>40kg/m2).

Methods: We performed an observational study at our tertiary center with a minimum 2-year follow up. Patients denied arthroplasty were contacted and provided a self-administered survey including the Harris Hip Score (HHS) or Knee Society Score (KSS). Statistical analysis included an unpaired student t-test with significance set at p<0.05.

Results: 2,819 individuals were identified. 125 (4.4%) were denied THA or TKA due to morbid obesity. 24 of those (19.2%) met requisite weight and underwent arthroplasty at our institution. The remaining 101 were contacted: 31 (30.7%) agreed to participate including 7 (22.6%) with hip and 24 (77.4%) with knee arthritis. The average age at denial was 59.1 vs. 62.6 years at survey. Of those denied THA (n=7), three (42.9%) sought second opinions and received an average of two additional denials. None achieved a BMI under 40kg/m2 or received THA. The average HHS (/100) at survey was 34.6±13.1. Of those denied TKA (n=24), thirteen (54.2%) sought second opinions and received an average of 0.75 additional denials. Five (38.5%) subsequently received TKA at an outside institution, with an average BMI of 49.2±6.3 kg/m2 compared to 47.8±5.3 kg/m2 at our denial (p=0.71). One (20.0%) developed prosthetic joint infection. One (4.2%) achieved requisite BMI (39.6kg/m2) but did not undergo arthroplasty. There was no difference in KSS Pain (/50) or Function (/100) between those denied TKA (8.8±11.5; 34.1±22.5) and those who subsequently underwent TKA elsewhere (13.0±19.9; 28.0±43.1) (p=0.55; 0.68).

Conclusions: At a minimum 2-year follow up, 80.0% never achieved a BMI under 40kg/m2. Those who sought another opinion were often denied again due to obesity. In the small subset of patients that ultimately underwent arthroplasty by another surgeon, outcomes were poor and similar to non-arthroplasty.

Primary Total Knee Arthroplasty Performed Using High-Viscosity Cement Is Associated with Higher Odds of Revision for Aseptic Loosening

Notes

Leonard T. Buller, MD, Vindhya Rao, BA, Yu-Fen Chiu, MS, Denis Nam, MD, MSc, Alexander A. McLawhorn, MD, MBA

Introduction: Aseptic loosening (AL) is the most common reason for revision total knee arthroplasty (TKA). An association between high viscosity cement (HVC) and AL has been suggested by small, uncontrolled, caseseries. This study sought to determine whether HVC use during primary TKA is independently associated with the development of AL requiring revision. Our null hypothesis was no difference in revision for AL rates between cement type groups.

Methods: We retrospectively analyzed a prospectively collected database to identify all primary TKAs from January 2007 through December 2016. Patients with less than two years follow-up were excluded. Cement type used during the primary procedure was divided into two groups (HVC: Simplex HV, Palacos, Cobalt; and low viscosity cement (LVC): Simplex). Data on potential confounders including age, body mass index (BMI), preoperative diagnosis, antibiotics in the cement, and implant type were collected. Outcomes including no revision, revision for a reason other than AL and revision for AL were collected. Multivariable logistic regression analysis was used to determine whether HVC is independently associated with revision for AL.

Results: 10,016 patients were included. Revision for AL was significantly higher in the HVC cohort (91/4791; 1.9%) vs. the LVC cohort (48/5224; 0.92%) (p<0.001). After controlling for potential confounders, logistic regression demonstrated HVC to be independently associated with higher odds of revision for AL (OR: 2.17, 95% CI: 1.46-3.21, p<0.001). Younger age was associated with higher odds of revision for AL (OR: 0.96, 95% CI: 0.94-0.98, p<0.001). Preoperative diagnosis, BMI and antibiotics in cement were not associated with AL, although implant manufacturer and type dynamically influenced rates of revision for AL in the HVC cohort.

Conclusions: Though HVC is an attractive option for use in primary TKA, this adequately sized and appropriately controlled study demonstrates higher odds of revision for AL when using HVC with multiple different implant types.

Stiffness After Total Knee Arthroplasty: Is It a Result of Spinal Deformity?

Notes

Jonathan M. Vigdorchik, MD, Oren Feder, MD, Aaron Buckland, MD, David J. Mayman, MD, Kaitlin M. Carroll, BS, Peter K. Sculco, MD, William J. Long, MD, Seth A. Jerabek, MD

Introduction: There are no studies to date analyzing the effect of spinal malalignment on outcomes of total knee arthroplasty (TKA). Knee flexion is a well-described lower extremity compensatory mechanism for maintaining sagittal balance with increasing spinal deformity. The purpose of this study was to determine whether a subset of patients with poor range of motion (ROM) after TKA have unrecognized spinal deformity, predisposing them to knee flexion contractures and stiffness.

Methods: We retrospectively evaluated a consecutive series of patients who underwent manipulation under anesthesia (MUA) for poor ROM after TKA. Using standing full-length biplanar images, knee alignment and spinopelvic parameters were measured. Patients were stratified by pelvic incidence-lumbar lordosis (PI-LL) as a measure of spinal sagittal alignment with a mismatch >10 degrees defined as abnormal, and we calculated the incidence of sagittal spinal deformity.

Results: 138 patients were included for analysis. Average time to MUA was 10±5 weeks (range: 5-42). Average ROM before MUA was extension 2 degrees (range: -10-20) and flexion 82 (range: 35-125). All patients had a postoperative mechanical axis within ±3 degrees of neutral. 113 patients (82%) had a PI-LL mismatch of greater than 10 degrees (average 14 degrees). In the spinal deformity group, average post-manipulation range of motion was statistically improved for flexion but not extension. Average post-manipulation range of motion was statistically improved for flexion and extension in the non-spinal deformity group.

Conclusions: This is the first study to recognize that sagittal deformity is present in patients who underwent a MUA for stiffness after TKA. We suggest that knee flexion as a compensation for sagittal imbalance predisposes to flexion contractures and poor ROM after TKA. Patients who present with a clinical suspicion of spinal deformity should be worked up preoperatively and counseled about their risk of stiffness after TKA.

Identification of Clinical and Biological Risk Factors for Postoperative Stiffness After Total Knee Arthroplasty for Osteoarthritis

Notes

Meghan Kirksey, MD, PhD, George Birch, BS, Haoyan Zhong, MPA, Alexandra Sideris, PhD, Valeria Rotundo, BS, Peter K. Sculco, MD

Introduction: There is evidence that cytokines and adipokines play a role in the development of organ fibrosis, however the role of inflammation in the development of arthrofibrosis after total knee arthroplasty (TKA) has not been well explored. This study aims to identify differences in the perioperative clinical and cytokine profiles of patients who do and do not develop stiffness after TKA performed for osteoarthritis (OA).

Methods: 162 patients with end-stage OA scheduled for TKA were enrolled in this prospective cohort study. Perioperative plasma and synovial fluid cytokine levels were measured using the V-Plex Human Cytokine 30-Plex Panel (Mesoscale: Rockville, Maryland, USA). All cytokine concentration levels are log-transformed. Linear mixed model was used to estimate the difference of changes of each plasma cytokine from baseline to POD2 between stiffness and non-stiffness subjects, with autoregressive covariance structure, using time points as fixed effect and subjects as random effect.

Results: 19.8% (32/162) of patients met criteria for postoperative stiffness at 6 weeks following TKA for OA. Lower preoperative ROM and presence of neuropathic pain were associated with increased risk of postoperative stiffness. Postoperative plasma levels of 9/31 cytokines studied were significantly different between stiff and non-stiff patients (p<0.05) including Interferon Gamma Induced Protein 10 (IP10) and Interleukins 5, 7, and 12p70.

Conclusions: Nearly 20% of patients in this cohort developed early postoperative knee stiffness, which was associated with limited preoperative ROM, neuropathic pain, and acute postoperative differences in levels of nine cytokines. These results support the theory that the biologic response to surgery in the first two days postoperatively may influence long-term clinical outcomes. Future research directed towards early control of inflammatory cytokines may identify interventions to reduce post-TKA stiffness.

Manipulation Under Anesthesia After Total Knee Arthroplasty: Who Still Requires a Revision?

David P. Brigati, MD, James I. Huddleston, MD, David G. Lewallen, MD, Richard L. Illgen, MD, Heena Jaffri, MPH, Diane M. Ziegenhorn, PT, Dena S. Weitzman, OD, Kevin J. Bozic, MD, MBA

Notes

Introduction: Stiffness after total knee arthroplasty (TKA) is a multifactorial complication involving patient, implant, surgical technique and rehabilitation factors occasionally necessitating manipulation under anesthesia (MUA) or revision. Few modern databases contain sufficient longitudinal information on all of these factors. We characterized the MUA after primary TKA population and identified independent risk factors for early revision TKA after MUA from the American Joint Replacement Registry (AJRR).

Methods: We retrospectively reviewed primary TKAs for patients ≥65 years old in the AJRR from 01/01/2012-3/31/2019. We linked these to the Centers for Medicare and Medicaid Services database to identify MUA and revision TKA procedure codes. We compared groups with Chi-squared testing and identified independent risk factors for subsequent revision with multivariable logistic regression presented as odds ratios with 95% confidence intervals.

Results: Of 871,032 primary TKAs included, 5,491 (0.6%) underwent MUA after a median of 2.0±1.0 months. Revision surgery occurred in 350 (4.7%) of MUA patients after median of 7 months. The timing of MUA was not different between revision and no revision patients (p=0.26). Patients undergoing MUA were older than nonmanipulation patients (70 vs. 67 years old, p<0.01) with a higher incidence of tobacco use (4.8% vs. 1.5%, p<0.01). However, younger age was an independent risk factor for revision after MUA (0.97, 0.96-0.98, p<0.01). The utilization of cruciate retaining implants was significantly lower in both MUA patients (13% vs. 55%, p<0.01) and patients undergoing revision after MUA (24% vs. 50%, p<0.01). Cruciate retaining design was not independently associated with revision TKA after MUA (p=0.73).

Conclusions: The incidence of MUA after primary TKA is low at 0.6% in the Medicare population but 4.7% of MUA patients progress to early revision after a median 7 months. Younger age was associated with revision TKA after MUA.

Polymerase Chain Reaction Multiplex Provides Minimal Utility in Periprosthetic Joint Infection Diagnosis

Notes

Beau J. Kildow, MD, Sean P. Ryan, MD, Richard Danilkowicz, MD, Alexander L. Lazarides, MD, Michael P. Bolognesi, MD, Thorsten M. Seyler, MD, PhD, William A. Jiranek, MD

Introduction: Utilization of molecular sequencing modalities in periprosthetic joint infection (PJI) diagnosis and organism identification have gained popularity. Polymerase chain reaction (PCR) multiplex offers timely results of common organisms within 24 hours. The purpose of this study was to compare the diagnostic accuracy of PCR multiplex, culture, the Musculoskeletal Infection Society (MSIS) criteria, and the recently proposed criteria by Parvizi et al. in the diagnosis of PJI.

Methods: In this retrospective study, aspirate or tissue samples were collected in 93 revision and 77 primary arthroplasties for routine diagnostic workup for PJI and sent to the laboratory for PCR multiplex. Concordance along with statistical differences between diagnostic studies were calculated using Chi-squared test for categorical data.

Results: When comparing to the MSIS criteria, concordance was significantly lower for PCR at 65.9% compared to 87.6% for culture (p<0.001). There was no significant difference based on prior infection (p=0.706) or sample collection method (tissue swab or synovial fluid) (p=0.316). Of the 78 patients that met MSIS criteria, only 20 (25.6%) samples identified an organism.

Conclusions: In our series, PCR has little utility as a standalone test for PJI diagnosis with a sensitivity of only 25.6% when using MSIS criteria as the gold standard. PCR also appears to be significantly less accurate than culture in the diagnosis of PJI. Currently, laboratory tests used for either criteria for PJI diagnosis should be obtained along with the overall clinical picture to help guide decision making for PJI treatment.

Prospective, Multicenter, Adjudicator-Blinded Clinical Trial of the Alpha-Defensin Lateral Flow Test for Periprosthetic Infection

Carl A. Deirmengian, MD, Carlos A. Higuera, MD, Janet D. Conway, MD, John Madigan, MD, Sujith Kallur, MS, Robin Ratel, MD, Keith Kardos, PhD

Introduction: The purpose of this study was to evaluate the diagnostic performance of the alpha-defensin (AD) lateral-flow test for periprosthetic joint infection (PJI) for FDA submission, and secondarily to compare the AD lateral flow test to the AD laboratory-based test for PJI.

Methods: A prospective, multicenter, adjudicator-blinded clinical trial (NCT02868736) was designed as required by the FDA for consideration of a de novo diagnostic device. The trial design included 2 arms: 1) a prospective cohort of patients prior to anticipated revision hip or knee arthroplasty (N=305), and 2) a laboratory-derived fresh synovial fluid sample cohort of subjects meeting Musculoskeletal Infection Society (MSIS) criteria for PJI (N=65). The 2013 MSIS criteria were utilized as the gold standard for subject classification, with each subject independently adjudicated by a panel of three expert adult arthroplasty surgeons blinded to study results. Adjudication of the combined cohorts yielded 122 MSIS positive and 248 MSIS negative patients.

Results: The AD lateral flow test for PJI demonstrated a sensitivity of 94.3% (95% CI: 88.5-97.7%) and specificity of 94.8% (95% CI: 91.2-97.2%) in the combined cohorts. In the prospective cohort alone, the AD lateral flow test had a sensitivity of 89.7% (95% CI:78.8-96.1%) and specificity of 94.8% (95% CI:91.2-97.2%). The exclusion of 17 samples with a red blood cell count >1,000,000 cells/ul in this cohort yielded a sensitivity of 94.4% (95% CI:84.6-98.8%). There was no statistically significant impact of prior antibiotic treatment, other medication treatment, underlying systemic inflammatory diagnoses or culture positivity. The sensitivity and specificity of the AD lateral flow test (94.3 and 94.8%) in combined cohorts did not demonstrate a statistically significant difference from the AD laboratory-based test (92.7 and 97.6%; both p>0.05).

Conclusions: This study demonstrates that the AD lateral flow test for PJI has excellent performance in diagnosing PJI, similar to the laboratory-based test for AD. It is now the first FDA-authorized diagnostic test to aid in detecting PJI.

votes		

Diagnostic Utility of a Novel Point-of-Care Test of Calprotectin for Periprosthetic Joint Infection in Total Knee Arthroplasty Patients

Jared A. Warren, DO, Hiba Anis, MD, Alison K. Klika, MS, Xiaochun Zhang, MD, Nicolas S. Piuzzi, MD, Carlos A. Higuera, MD

Notes

Introduction: Several synovial fluid biomarkers for diagnosis of periprosthetic joint infection (PJI) are being investigated, however point-of-care (POC) tests are not widely available. Synovial calprotectin can effectively exclude PJI diagnosis and a novel lateral flow POC test for synovial calprotectin has shown potential to be an effective PJI diagnostic tool. Thus, the objective of this study was to test the sensitivity and specificity of a calprotectin POC test for PJI in total knee arthroplasty (TKA) patients, using the gold standard Musculoskeletal Infection Society (MSIS) 2013 PJI diagnosis criteria.

Methods: Synovial fluid samples were prospectively collected from 73 patients who underwent revision TKA (rTKA) at two academic institutions. Patients followed the hospital standard of care for their diagnostic workup. Data collection included demographic, clinical, and laboratory data following the MSIS 2013 PJI diagnosis criteria. Synovial fluid samples were analyzed by synovial calprotectin POC tests using manufacturer's instructions. Quantitative calprotectin read-outs were categorized into high risk (>50 mg/L), medium risk (14-50 mg/L) and low risk (<14 mg/L) for infection by the test reader system. Patients were categorized as septic or aseptic using MSIS 2013 PJI diagnosis criteria by two independent reviewers blinded to the calprotectin results. Test performance characteristics with sensitivities, specificities, and areas under the curve (AUC) were calculated for 2 thresholds for infection: 1) >50 mg/L, and 2) >14 mg/L.

Results: Following MSIS criteria, 26 rTKAs were MSIS positive and 47 rTKAs were MSIS negative. For threshold 1 (>50 mg/L), the POC performance showed a sensitivity, specificity, and AUC of 96.2%, 93.6%, and 0.949 respectively. For threshold 2 (>14 mg/L), there was a sensitivity, specificity, and AUC of 100.0%, 78.7%, and 0.894 respectively.

Conclusions: Calprotectin POC test has excellent diagnostic properties including high sensitivity and specificity for diagnosing PJI in rTKA.

Reinfection or Persistence of Periprosthetic Joint Infection? Next Generation Sequencing Reveals New Findings

Notes

Karan Goswami, MD, Javad Parvizi, MD, FRCS, Orthopedic Genomics Workgroup

Introduction: Surgical management of PJI remains challenging with patients failing treatment despite our best efforts. An important question is whether these later failures reflect reinfection or the persistence of infection. Proponents of reinfection believe hosts are vulnerable to developing infection and new organisms emerge. The alternative hypothesis is that later failure is a result of an organism that was present but had not been given the chance to become a pathogen or was under antibiotic pressure and then turned into a pathogen. This multicenter study explores the second theory. Utilizing next-generation sequencing (NGS), we hypothesize that failures are often the result of an organism present at the time of initial surgery.

Methods: This prospective study involving 15 institutions collected samples from 635 revision total hip (n=310) and knee (n=325) arthroplasties. Synovial fluid, tissue and swabs were obtained intraoperatively for NGS analysis. Patients were classified per 2018 Consensus definition of PJI. Treatment failure was defined as reoperation for infection that yielded positive cultures during minimum 1-year follow-up. Concordance of the infecting pathogen cultured at failure with NGS analysis at initial revision was determined.

Results: Among the total cohort, 203 revisions were considered infected and 432 were aseptic (based on ICM-criteria). Of the infected cases, 157 were NGS-positive and 46 NGS-negative. Twenty-nine ICM-positive patients (29/157; 18.5%) failed by reoperation with an organism confirmed on culture. In 23 of these (23/29; 79.3%), the organism at failure was present on NGS at initial revision. The remaining 6 cases detected discordant organisms between initial NGS and culture at failure. Of the 432 ICM-negative patients, NGS identified microbes in 48.1% (208/432) of "aseptic" revisions, and 17 of these failed. Thirteen of the 17 failures (76.5%) were due to an organism previously detected by NGS at initial revision.

Conclusions: Our collaborative findings suggest that most failures (~79.3%) by infection recurrence could be attributed to an organism previously detected by NGS at index revision surgery.

Antibiotic Susceptibility of Organisms Recovered in Culture from Patients with Acute Prosthetic Joint Infection Following Primary Total Knee Arthroplasty

Notes

Charles M. Lawrie, MD, Sally Jo, BA, Toby N. Barrack, BA, Robert L. Barrack, MD

Introduction: Periprosthetic infection (PJI) after primary total knee arthroplasty (TKA) affects 1-2% of cases. Local prophylactic antibiotics, including tobramycin or gentamicin mixed in polymethylmethacrylate bone cement and vancomycin powder, are used despite mixed evidence for efficacy. Here, we report the antibiotic susceptibility of organisms recovered in culture from acute PJI after primary TKA to gentamicin, tobramycin and vancomycin.

Methods: Using a retrospective database of all primary TKA performed at a single institution between January 1, 2014 and July 1, 2018, we identified 18 cases of acute PJI after primary TKA as defined by the Musculoskeletal Infection Society 2011 guidelines as less than 3 months from index surgery. Cultures were obtained intraoperatively at the time of revision. Organisms from positive cultures underwent MIC testing to gentamicin, tobramycin and vancomycin using a gradient diffusion method (ETEST). MIC breakpoints for susceptibility were based on Clinical and Laboratory Standards Institute definitions.

Results: 18 cases of PJI after TKA were identified, including 4 polymicrobial infections (22.2%). Average time to revision was 38 days (range: 6-84 days). 34.8% of bacterial isolates were resistant to gentamicin, 39.1% were resistant to tobramycin and 17.4% were resistant to vancomycin. Of the 8 bacterial isolates resistant to gentamicin, 7 (87.5%) were susceptible tobramycin. Of the 9 bacterial isolates resistant to tobramycin, (88.9%) were susceptible to vancomycin. One bacterial isolate, a fusobacterium nucleatum from a polymicrobial infection was resistant to gentamicin, tobramycin and vancomycin.

Conclusions: Over one-third of bacteria causing acute PJI after primary TKA were resistant to aminoglycosides premixed in commercially available bone cements. All but one of the bacteria resistant to gentamicin and tobramycin were susceptible to vancomycin. The addition of vancomycin to bone cement or as powder in the surgical field can expand antibiotic coverage to include most organisms responsible for acute PJI after TKA.

Cutibacterium acnes Colonization: Implications for Total Hip Arthroplasty

Notes

Jacob M. Elkins, MD, PhD, Douglas A. Dennis, MD, Lindsay T. Kleeman-Forsthuber, MD, Todd M. Miner, MD, Charlie C. Yang, MD, Jason M. Jennings, MD

Introduction: *Cutibacterium acnes (C. acnes)* is now recognized as a clinical entity in periprosthetic joint infections (PJI) of the shoulder and spine. However, the colonization rate of *C. acnes* in the adult hip is currently unknown. Therefore, the purpose of this study was to investigate the rate of *C. acnes* colonization from the skin of healthy subjects from various anatomic locations corresponding to direct anterior and lateral/posterolateral surgical approaches.

Methods: 90 patients scheduled for hip or knee surgery were recruited for cultured biopsies. Four 3-mm dermal punch biopsies were collected after administration of anesthesia, but prior to delivery of perioperative antibiotics. Pre-biopsy skin prep consisted of a standardized preoperative 2% chlorhexidine skin cleanse and an additional 70% isopropyl alcohol mechanical skin scrub immediately prior to biopsy collection. Two culture samples 10-cm apart were collected from a location approximating a standard direct anterior skin incision, and two samples 10-cm apart were collected from a location approximating a lateral skin incision (suitable for a posterior, direct-lateral or anterolateral surgical approach). Samples were cultured for two weeks.

Results: 22 of the 90 (24%) patients had a positive culture biopsy, 14 of which (16% of all patients) were positive for *C. acnes*. Ten (71%) of the culture positive biopsies for *C. acnes* were obtained from the anterior location with 50% of those obtained from the most proximal sample site.

Conclusions: Approximately 16% of the patients in the study demonstrated positive *C. acnes* colonization about the hip, the majority of which occurred from an anterior location. *C. acnes* should be considered in the diagnosis of PJI after THA. Given the high rate of skin colonization, particularly regarding the direct anterior approach to the hip, these results have stimulated consideration for different skin preparations for the THA patient.

Symposium IV

The Current State of Practice Patterns of AAHKS Members

Moderator: Jay R. Lieberman, MD

During this symposium, the moderator will survey AAHKS members at the 2019 Annual Meeting to learn about their practice patterns.

Learning Objectives:

- **1.** To learn the present practice of AAHKS members
- **2.** To note any changes in practice patterns compared to prior surveys

Notes			

The James A. Rand Young Investigator's Award

Traditional Intravenous Fluid vs. Oral Fluid Administration in Primary Total Knee Arthroplasty: A Randomized Trial

Jason M. Jennings, MD, Mauricio Mejia, MD, Michael A. Williams, MD, Roseann M. Johnson, BS, Charlie C. Yang, MD, Douglas A. Dennis, MD

Notes

Introduction: Optimal perioperative fluid management has not been established in patients undergoing orthopaedic surgical procedures. Our purpose was to investigate the effects of perioperative fluid management on patients experiencing total knee arthroplasty (TKA).

Methods: 130 patients who met inclusion criteria undergoing primary unilateral TKA were prospectively randomized into traditional (TFG) vs. oral (OFG) perioperative fluid management groups. The TFG had a predetermined (4L) amount of intravenous fluids (IVF) administered in the perioperative period. The OFG began drinking a minimum of three, 20-ounces servings of clear fluids daily for three days prior to surgery. This cohort also drank 10-ounces of clear fluids 4 hours prior to surgery. Perioperative IVF were discontinued when the patient began oral intake or when the total amount of IVF reached 500mL. Outcome measures included: bodyweight (BW) fluctuations, knee motion, leg girth, bioelectrical impendence, quadriceps activation, functional outcomes testing, KOOS JR, VR-12, laboratory values, vital signs, patient satisfaction, pain scores, and adverse events.

Results: The TFG had increased BW the evening of surgery $(7.0\pm4.3 \text{ vs. } 3.0\pm3.9, \text{p=0.000})$, postoperative day (POD) #1 (9.1 $\pm4.3 \text{ vs. } 4.7\pm3.9, \text{p=0.000})$, and POD#2 (6.2 $\pm5.0 \text{ vs. } 4.4\pm4.0, \text{p=0.032}$). Bioelectrical impedance showed less limb edema in the OFG (4.2 $\pm29.7 \text{ vs. } 17.8\pm30.3, \text{p=0.000})$ on POD#1. Urine specific gravity differences were seen preoperatively between groups (OFG: more hydrated, p=0.002). Systolic blood pressure decrease from baseline was greater in the OFG upon arrival to the floor (19.4 $\pm13.5 \text{ vs. } 10.6\pm12.8, \text{p=0.000}$), and 8 (23.4 $\pm13.3 \text{ vs. } 17.0\pm12.9, \text{p=0.006}$) and 16 (25.8 $\pm13.8 \text{ vs. } 25.8\pm13.8, \text{p=0.046}$) hours after floor arrival. The TFG had more UOP on POD#1 (3369mL ±1343 mL vs. 2435mL ±1151 mL).

Conclusions: Oral fluid intake with IVF restriction in the perioperative period after TKA may offer short-term benefits with swelling and BW fluctuations. The authors continue to limit perioperative IVFs and encourage patient initiated fluid intake.

The Lawrence D. Dorr Surgical Techniques and Technologies Award

Aseptic Reoperations Within One Year of Primary Total Hip Arthroplasty Markedly Increase the Risk of Later Periprosthetic Joint Infection

Ashton H. Goldman, MD, Douglas Osmon, MD, Arlen D. Hanssen, MD, Mark W. Pagnano, MD, Daniel J. Berry, MD, Matthew P. Abdel, MD

Notes

Introduction: Despite the success of primary total hip arthroplasty (THA), a subgroup of patients will require an aseptic reoperation within the first year of the index THA. The goal of this study was to evaluate the risk of periprosthetic joint infection (PJI) in patients undergoing an aseptic reoperation within one year of a primary THA.

Methods: A retrospective review utilizing our total joint registry identified 213 primary THAs requiring aseptic reoperation within the first year following index arthroplasty. Septic reoperations and closed procedures were excluded. A control group of 15,415 THAs not requiring reoperation within the first year was identified. Patients were divided into 2 groups based on time from the index THA: 1) less than 90 days (n=112 THAs; 40% instability, 34% fracture, 8% contained hematoma/seroma); 2) 90 days to 365 days (n=101 THAs; 37% instability, 29% fracture, 14% aseptic loosening). Mean age at THA was 64 years, with 61% female. Mean follow-up: 5 years.

Results: Patients undergoing an aseptic reoperation within the first 90 days had a PJI rate of 4.7% at 2 years, while patients undergoing an aseptic reoperation between 91 and 365 days had a PJI rate of 3.1% at 2 years. In comparison, the control group had a PJI rate of 0.2% at 2 years. Compared to patients without a reoperation within the first year, patients who underwent reoperation within 90 days had an elevated risk of PJI (HR 12; p<0.0001), as did patients who had a reoperation between 91 and 365 days (HR 14; p<0.0001).

Conclusions: Aseptic reoperations within the first year following primary THA lead to a 14-fold increased risk of subsequent PJI. The risk was similar regardless of whether the aseptic reoperation was very early (within 90 days) or later (91 to 365 days).

The AAHKS Clinical Research Award

No Evidence for Higher Patient-Reported Outcome Scores After Total Hip Arthroplasty with the Direct Anterior Approach at 1.5 Months Postoperatively and Through a 5-Year Follow-Up

Notes

Nicholas Sauder, BA, Veronique J. Vestergaard, MD, Saira Siddiqui, MPH, Vincent P. Galea, BA, Charles R. Bragdon, PhD, Henrik Malchau, MD, PhD, Karim A. Elsharkawy, MD, James I. Huddleston, MD, Roger H. Emerson, MD

Introduction: The direct anterior approach (DAA) to total hip arthroplasty (THA) may result in faster postoperative patient recovery, as assessed by patient reported outcome measures (PROMs). However, many studies do not collect postoperative PROMs until 3 months, and do not report achievement of a patient acceptable symptom state (PASS) or a minimal clinically important improvements (MCII). This study compared PROMs between THA patients treated with the DAA or posterolateral approach between 1.5 months and 5 years, using literature-defined PASS and MCII thresholds.

Methods: A propensity score match of 100 DAA patients to 100 posterolateral patients from a multicenter US collaboration (6 centers, 398 patients) was performed, based on age, sex, body mass index, and Charnley class. The Harris Hip Score (HHS), the Short-Form 36 (SF-36), and a numerical rating scale (NRS) for hip-related pain were collected preoperatively, postoperatively (median weeks: 5.4), and at 1-, 3-, and 5-year follow-up visits. The proportion of patients reaching the HHS PASS, Pain MCII, and Function MCII in the DAA and the posterolateral groups was compared using binary logistic regressions, controlling for confounders. Power analysis revealed that an HHS PASS achievement difference of 19% (power=80%; alpha=0.05) could be detected.

Results: The DAA patients were significantly less likely to reach the HHS PASS at the postoperative visit (p=0.002; Odds Ratio (OR)=0.382), but not at later visits. The DAA patients had no difference from the posterolateral patients in their tendency to reach the Pain MCII at the postoperative (p=0.419), or 1-year mark (p=0.099). The DAA patients were less likely to reach the Function MCII at the postoperative visit (p=0.001; OR=0.334), but not at the 1-year visit (p=0.452).

Conclusions: The results did not support faster THA recovery after DAA and instead showed limited evidence that the posterolateral approach may result in faster recovery due to greater hip function.

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Symposium V

The Psychology of Total Joint Arthroplasty: Can We Modify Outcomes?

Moderator: Bryan D. Springer, MD

Faculty: Padma Gulur, MD, Wayne M. Sotile, PhD

Total knee arthroplasty (TKA) is an extremely successful surgical intervention for end-stage arthritis of the knee. It is associated with significant improvements in pain, function and quality of life. Overall, is it associated with a low morbidity and mortality. The utilization of TKA is expected to increase exponentially over the next two decades.

Despite its success, data exist that suggest up to 20% of patients are dissatisfied with the outcome of their TKA. The exact etiology has not been fully elucidated. Dissatisfaction has been associated with unmet expectations, unnatural feeling of the artificial joint, failure to reproduce normal knee kinematics and surgical technical errors. As such, there has been an explosion of technological advances to try and improve the 20% of patients that are dissatisfied with their TKA, including computer navigation, robotics and patient specific alignment (i.e. kinematic alignment). However, the results of these technologies on improving patient satisfaction have been negligible.

Considerable research has accumulated indicating that medical and physical variables alone cannot fully account for symptoms of pain and dissatisfaction. Biopsychosocial models have been put forward suggesting that a complete understanding of outcomes will require consideration of physical, psychological and social factors. Research has supported the view that psychological factors play a significant role in the experience of pain, disability and dissatisfaction associated with arthritis and outcomes following total knee arthroplasty. In other domains of research, variables such as pain catastrophizing, painrelated fears of movement, and depression have been identified as risk factors for prolonged pain and disability. High levels of pain catastrophizing predict ongoing pain and more severe disability in individuals with musculoskeletal conditions...

Learning Objectives:

- **1.** Introduce the psychological aspects of surgery and recovery
- 2. Understand how resiliency can influence outcomes
- **3.** Can resiliency be taught and/or modified to help improve outcomes following total joint arthroplasty?

- **4.** Understand the ramifications of preoperative opioids use and its effect on outcomes
- **5.** Discuss a preoperative optimization program for those on preoperative narcotics

Outline:

Introduction

Bryan D. Springer, MD

The Psychology of Total Joint Arthroplasty

Bryan D. Springer, MD

Can Surgical Resilience Be Assessed and Shaped in Total Joint Arthroplasty

Wayne M. Sotile, PhD

The Opioid Tolerant Patient: Preoperative Optimization

Padma Gulur, MD

Discussion

All Faculty

Notes			

A Multi-Center Randomized Clinical Trial of Tranexamic Acid in Revision Total Hip Arthroplasty: Does the Dosing Regimen Matter?

Notos

Robert A. Sershon, MD, Yale A. Fillingham, MD, Matthew P. Abdel, MD, Arthur L. Malkani, MD, Ran Schwarzkopf, MD, Douglas E. Padgett, MD, Thomas P. Vail, MD, Cindy R. Nahhas, BS, Denis Nam, MD, MSc, Craig J. Della Valle, MD

Introduction: The purpose of this multicenter, randomized clinical trial was to determine the optimal dosing regimen of tranexamic acid (TXA) to minimize perioperative blood loss for revision total hip arthroplasty (THA).

Methods: Six centers prospectively randomized 170 revisions to one of four regimens: 1) 1g of intravenous (IV) TXA prior to incision, 2) a double dose regimen of 1g IV TXA prior to incision and 1g IV TXA during wound closure, 3) a combination of 1g IV TXA prior to incision and 1g intraoperative topical TXA, or 4) three doses of 1950mg oral TXA administered 2 hours preoperatively, 6 hours postoperatively, and on the morning of postoperative day one. Randomization was based upon revision subgroups to ensure equivalent group distribution, including femur only, acetabulum only, both component, explant/spacer, and second stage reimplantation. Patients undergoing an isolated modular exchange were excluded. An a priori power analysis (alpha=0.05; beta=0.80) determined 40 patients per group were required to identify a 1g/dL difference in postoperative hemoglobin reduction between groups. Per-protocol analysis involved an analysis of variance, Fisher's exact tests, and two one-sided t-tests for equivalence.

Results: Demographic and surgical variables were equivalent between groups. No significant differences were found between TXA regimens when evaluating reduction in hemoglobin (single IV=3.4 g/dL, double IV=3.5 g/dL, combined=3.5 g/dL, oral=3.5 g/dL; p=0.93), calculated blood loss (p=0.90), or transfusion rates (single IV=14%, double IV=18%, combined=16%, oral=18%; p=0.97). Equivalence testing revealed all possible pairings were statistically equivalent, assuming greater than a 1g/dL difference in hemoglobin reduction as clinically relevant.

Conclusions: All TXA regimens tested had equivalent blood-sparing properties in the setting of revision THA. Surgeons should consider the lowest effective dose and the most economical regimen.

♦ The FDA has not approved tranexamic acid for use in orthopaedics.

Is There a Benefit to Modularity for Femoral Revisions When Using a Splined, Tapered Titanium Stem?

Notes

Matthew R. Cohn, MD, Matthew W. Tetreault, MD, Jefferson Li, BA, Cindy R. Nahhas, BS, Kyle N. Kunze, BS, Joseph Michalski, MPH, Brett R. Levine, MD, MS, Denis Nam, MD, MSc

Introduction: Proposed benefits of modularity for femoral revisions in total hip arthroplasty (THA) include more precise biomechanical restoration, but this has not been proven with use of a splined, tapered design. This study's purpose was to compare radiographic outcomes of restoration of hip length and offset as well as complications with the use of modular vs. monoblock splined, tapered titanium stems in revision THA.

Methods: We retrospectively reviewed 145 femoral revisions performed over 18 years at one institution with minimum 2-year follow-up (mean, 5.12 years; range, 2 to 17.3 years). Patients receiving a modular (67) or monoblock (78) splined, tapered titanium stem for femoral revision were included.

Results: Patients in the modular cohort were older (67.2+13.0 years vs. 60.2+12.1 years; P<0.01) and had a greater percentage of Paprosky IIIB or IV defects (20.5% vs. 5.3%; P<0.01). There were no significant differences in rates of intraoperative fracture (9.0% vs. 3.8%; P=0.3), postoperative fracture (3.0% vs. 1.3%; P=0.5), aseptic loosening (4.5% vs. 6.4%; P=0.7), dislocation (11.9% vs. vs. 5.1%; P=0.23), or reoperation for any reason (22.3% vs. 17.9%; P=0.7) between the modular and monoblock cohorts, respectively. Leg length discrepancy differed between groups (0.89+12.1mm vs. -2.98+10.9mm; P=0.04), though there was no difference in rates of LLD >1cm (35.8% vs. 38.5%, P=0.74). There were no differences in component subsidence >5mm (3.13+5.6mm vs. 2.17+2.1mm; P=0.4) or hip offset (73.2+12.5mm vs. 75.9+9.3mm; P=0.15) between the modular and monoblock cohorts. Restoration of hip offset compared to the contralateral hip did not differ (-5.88+10.1mm vs. -5.07+12.2mm; P=0.67). Harris Hip Score was similar between groups (70.7+17.9 vs. 73.9+19.7; P=0.36) at minimum 2-year follow-up.

Conclusions: Modular and monoblock splined, tapered titanium stems demonstrated comparable subsidence, hip offset, and complication rates for femoral revisions. Future investigations including a greater number of patients are required to determine if modularity is beneficial for more complex femoral defect.

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Projections of Revision Hip and Knee Arthroplasty in the United States to 2030

Andrew M. Schwartz, MD, Kevin X. Farley, BS, Thomas L. Bradbury, MD, George N. Guild, MD

Notes

Introduction: As the incidence of primary total joint arthroplasty rises in the United States, it is important to investigate how this increase will impact rates of revision arthroplasty. There is an abundance of data on the current incidence of revision arthroplasty, but no recent projections of future incidence based on this most recent data. The purpose of this study was to project the current and future incidence of revision total hip arthroplasty (rTHA) and revision total knee arthroplasty (rTKA) to the year 2030. Anticipating surgical volume will aid surgeons in designing protocols to efficiently and effectively perform rTHA/rTKA.

Methods: The National Inpatient Sample (NIS) was queried from 2002 to 2016 for all rTHA/rTKA. Using previously validated measures, Poisson regression and linear regression, analysis was performed to project annual incidence of rTHA/rTKA to the year 2030.

Results: In 2016, there were 53,755 rTHA and 66,915 rTKA. From 2002 to 2016, the annual average percentage change was 2.02% for rTHA and 5.8% for rTKA. From 2016 to 2030, rTHA incidence is projected to increase by between 31%-44% (73,924-82,170 cases performed in 2030; linear and Poisson regression models, respectively). rTKA incidence is projected to increase by between 49%-91% (114,914-151,563 cases performed in 2030, linear and Poisson regression models, respectively).

Conclusions: The incidence of rTHA/rTKA is projected to increase substantially in the next decade. Given the known risk factor profiles and advanced costs associated with revision arthroplasty, our projections should encourage high-volume institutions to generate revision-specific protocols akin to the primary arthroplasty pathways that many hospitals are currently optimizing. Early anticipation and protocolization of a perpetually increasing demand for rTHA/rTKA could promote safe, high-throughput systems in a cost-effective manner that is commensurate with current healthcare trends towards value-based care.

Outcome of Re-Revision Surgery for Adverse Local Tissue Reaction in Metal-on-Polyethylene and Metal-on-Metal Total Hip Arthroplasty

Bryant E. Bonner, MD, Paul Arauz, PhD, Christian Klemt, PhD, Young-Min Kwon, MD, PhD

Notes

Introduction: Adverse local tissue reactions (ALTR), initially described in metal-on-metal (MoM) total hip arthroplasty (THA), have also become an important risk factor for failure in metal-on-polyethylene (MoP) THA due to modular taper corrosion. Numerous studies have described a significant rate of complications and poor outcomes following revision surgery for ALTR, often requiring additional revision surgery. This study aims to report early complication rates, outcomes and potential risk factors associated with rerevision.

Methods: A total of 252 THA patients who underwent revision for ALTR were reviewed. There were 40 patients (16%) who underwent a second revision: 26 MoP taper corrosion and 14 MoM. Patient characteristics, complication rates, metal ion levels, and revision implant information were analyzed. Binary logistic regression was used to test for any associations between need for rerevision surgery and multiple different parameters.

Results: The overall complication rate following initial revision for ALTR was 21%. 16% of these revision patients required a re-revision. The most common indication for rerevision was dislocation (45%). Femoral heads exchanged during the initial revision surgery varied between groups (p<0.001) with metal heads being more common in the re-revision groups (53%). The complication rate was 35% following a re-revision: dislocation (36%), infection (36%), fracture (14%), implant loosening (14%). The rate of patients requiring a third revision was 23% with the most common indications being dislocation (33%). The average time between re-revision surgery and a third revision was 14 months (range: 0-53).

Conclusions: The rate for re-revision surgery following initial revision for an ALTR is high at 16%, with those requiring re-revision having a higher proportion of metal heads and extensive intra-operative tissue necrosis. Within the re-revision group, there was a high rate of complications (35%) and third revision rate (23%). These findings provide clinically useful information in preoperative counseling of patients undergoing re-revision surgery for ALTR.

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www.AAHKS.org/Meeting 5⁴

Patients Following Revision Total Hip Arthroplasty with Modular Dual Mobility Components Are at Risk of Increased Serum Metal Ion Levels

Notes

Roberto Civinini, MD, Christian Carulli, MD, Andrea Cozzi Lepri, MD, Fabrizio Matassi, MD, Matteo Innocenti, MD, Marco Villano, MD, Massimo Innocenti, MD

Introduction: Modular dual-mobility (MDM) total hip arthroplasty (THA) is designed with a cobalt-chromium liner inserted into a titanium acetabular component. The purpose of this study was to investigate the potential risks for fretting corrosion at this junction by measuring serum metal ions after MDM acetabular revision.

Methods: Thirty-seven patients with well-functioning revision THAs participated in a cross-sectional study at mean 5.1 (2 to 10) years after surgery. All received a trabecular titanium MDM acetabular component. The serum levels of cobalt and chromium were measured using inductively coupled plasma mass spectrometry. Reference ranges were: cobalt (0.083-0.61 μg/L); chromium (0.051-0.29 μg/L). Harris Hip Score and University of California Los Angeles (UCLA) activity score were measured for all patients. Mean, 95% CI and range were calculated for the variables. A multivariate linear regression analysis was performed to assess any significant correlation between variables. A data transformation for non-normal variables was used according to Tukey's ladder of powers. The level of significance was set at 0.05.

Results: The mean values of chromium and cobalt were 2.08 µg/L (95% CI, 0.9-3.2; range 0.02-11.8) and 1.99 µg/L (95% CI, 0.81-3.17; range 0.07-16.05), respectively. Eleven patients (29.7%) had ions level above the normal range, with 6 (16.2%) above 7 µg/L and 5 (13.5%) between 2 and 7 µg/L. A significant correlation was found between an elevated serum metal ions level (chromium/cobalt) and UCLA score (p=0.016). No significant correlation was found between serum metal ions values and patient's age (p=0.375), BMI (p=0.525) or follow-up length (p=0.155).

Conclusions: This is the first study of metal ions after revision MDM arthroplasty and we must conclude that serum metal levels elevation can occur secondary to metal debris resulting from corrosion of the index MDM THA. This potential risk must be included in the decision-making process when dealing with revision arthroplasty in active patients.

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Serum Metal Ion Levels Following Total Hip Arthroplasty: A Comparison Between Monoblock and Modular Dual Mobility Components

Notes

Ivan De Martino, MD, Peter K. Sculco, MD, Allina A. Nocon, PhD, Nicolas Selemon, BS, Alioune Diane, BS, David J. Mayman, MD, Thomas P. Sculco, MD

Introduction: Modular dual mobility (DM) components were introduced to overcome the difficulties controlling orientation during component insertion and inability to confirm full implant seating limitations of monoblock-DM components. Due to the metal-on-metal interface on modular-DM implants (titanium cup and CoCr liner), fretting and corrosion releasing metal ions can be a concern. This study prospectively reviewed metal ions (cobalt, chromium, and titanium) on patients with monoblock-DM and modular-DM implants with a minimum 1-year follow-up.

Methods: All patients with monoblock-DM and modular-DM implants underwent evaluation of metal ions at their one-year follow-up appointment. Radiographic evaluation for acetabular polar gaps was performed. Elevated metal ions were determined using standard laboratory ranges. Differences were assessed using the Mann Whitney-U test and Fisher's exact test.

Results: Fifty consecutive patients (25 monoblock-DM and 25 modular-DM) were included in this study. All patients in the monoblock-DM group were primary THA and all in the modular-DM group were revision THA. Mean age and BMI were 73 and 26, respectively. Mean length of implantation was 1.2 years. We found no difference in metal ion elevations between groups at a minimum of one-year post implantation (cobalt, p=1.0; chromium, p=0.49; titanium p=1.0). Within the modular-DM and monoblock-DM cohorts, there were an equal number of patients with mildly elevated cobalt (n=6), as well as mildly elevated titanium (n=1). When reviewed as raw values, there was a difference in mean chromium levels between monoblock-DM and modular-DM cohorts (monoblock-DM=1.4 vs. modular-DM=1.2, p=0.03). Two monoblock-DM patients had a 1-mm polar gap. One modular-DM liner was malseated.

Conclusions: There were no differences in metal ion elevation minimum one-year post implantation between primary monoblock-DM and revision modular-DM cohorts. This is encouraging based on the titanium/cobalt chrome interface in the modular-DM implant.

Symposium VI

Tips and Tricks to Save You During Revision TKAs: Video-Based Demonstrations

Moderator: Matthew P. Abdel, MD

Faculty: Daniel J. Berry, MD, Craig J. Della Valle, MD, R. Michael Meneghini, MD

Notes

This symposium will provide the latest information on managing patients with failed TKAs that require complex exposures, metaphyseal fixation to manage bone loss and improve biologic fixation, intraoperative infection management, and extensor mechanism reconstructions.

Learning Objectives:

- 1. To understand how to safely expose complex revision TKAs with a variety of surgical techniques based upon video demonstrations
- 2. To understand the principles and surgical techniques behind utilizing metaphyseal sleeves, metaphyseal cones, and stems to manage bone loss during revision TKAs
- **3.** To understand the technical features related to antibiotic spacers and extensor mechanism reconstructions

Outline:

Introduction

Matthew P. Abdel, MD

Exposures and Component Removal: It Is an Art!

Craig J. Della Valle, MD

Cones, Sleeves, and Stems:

How to Manage Bone Loss and Optimize Fixation

Daniel J. Berry, MD

Articulating and Non-Articulating Spacers:

What Are the Options in 2019?

R. Michael Meneghini, MD

Extensor Mechanism Disruptions:

A Synthetic Mesh Reconstruction

Matthew P. Abdel, MD

Discussion

All Faculty

What Is the Impact of PAO Surgery on Patient Function and Activity Levels?

Jeff R. Petrie, MD, Tonya An, MD, Perry L. Schoenecker, MD, Ira Zaltz, MD, The ANCHOR Group, Michael B. Millis, MD, Paul E. Beaule, MD, FRCSC, Daniel J. Sucato, MD, Robert T. Trousdale, MD, John C. Clohisy, MD

Notes

Introduction: The Bernese periacetabular osteotomy (PAO) is becoming a widely utilized procedure. Patients are younger, highly active, and may desire return to sport activity. Counseling and managing expectations in these patients is challenging as there is limited information regarding activity level after PAO. The purpose of this study was to analyze physical activity levels after PAO in a large, prospective multicenter cohort.

Methods: Assessment of prospectively collected data from a multicenter group included 456 hips treated by PAO for hip dysplasia. After exclusions, 359 hips (80 male, 279 female) remained with a mean age of 25.9 years and mean BMI of 25. Demographics, radiographic measures, and clinical outcomes were evaluated preoperatively, at 1 year, and at minimum 2 years postoperatively (mean: 44.9 months). Activity level was assessed with the University of California Los Angeles (UCLA) activity score. Patients were stratified into low, moderate, and high activity groups based on preoperative function. Descriptive statistics and linear regressions were performed for the primary outcome of change in UCLA.

Results: UCLA scores were improved on average 0.6 points at final follow up (p=0.001). When stratified, the low activity and moderate activity groups had significant improvement in UCLA scores (p<0.0001 and p=0.007) while the high activity group saw a decrease in UCLA scores (p<0.0001). mHHS, HOOS Pain, and HOOS Sports and Recreation scores were significantly improved across all activity levels. Univariable linear regression analysis identified prior ipsilateral surgery, arthroscopy at time of PAO, and preoperative ACEA to be predictors of the change in UCLA score (p<0.05). With the multivariable model, the effect of prior ipsilateral surgery was maintained (p=0.002).

Conclusions: The data suggests that improvements in activity level and function can be expected following PAO surgery, with greater gains experienced by patients with lower preoperative level of activity.

Surgical Treatment of Femoroacetabular Impingement: A Minimum 10-Year Outcome and Risk Factors for Failure

Notes

Hamed Vahedi, MD, Javad Parvizi, MD, FRCS

Introduction: Femoroacetabular impingement (FAI) is one of the well-known causes of hip pain and dysfunction in active young adults. Surgical treatment has been widely popularized during past decades. However, most reported results are limited to short- and mid-term follow up. The long-term success rate and risk factors for failure are largely unknown. This study aims to report our long-term (minimum 10-year) clinical outcome and the risk factors for treatment failure of femoroacetabular osteoplasty (FAO) and labral repair.

Methods: Using our prospective hip preservation database, 164 patients (178 hips) who had undergone FAO between January 2005 and April 2009 were identified. Patient demographics, clinical history, duration of preoperative symptoms, radiographic parameters (pre and postoperative alpha angle, hip dysplasia and retroversion, Tönnis grade for osteoarthritis) and intraoperative findings (chondral lesion, labral tear, subchondral cyst, size of the cam lesion) were reviewed and compared between success and failure group. At minimum 10-year follow-up, clinical functional outcome (modified HHS and SF36 at 6 weeks, 6 months, one year and after 10 years) and failure rate (conversion to total hip arthroplasty [THA]) were collected.

Results: The mean age was 34.3±10.4 years and 65 (39.6%) patients were female. There was significant improvement post-FAO in mean mHHS (58.2±3.9-86.4±3.2) and SF36 (60.4±4-85±4.1). At the latest follow-up (range: 10-14 years; mean: 12.5), 12.3% (n=22) of hips underwent THA and mean time to THA was 7.4±3.8 years. Older age, longer preoperative symptomatic period, higher preoperative alpha angle, presence of hip dysplasia and full thickness acetabular chondral lesion were detected as risk factors for conversion to THA.

Conclusions: Patients with symptomatic FAI who undergo surgery experience pain relief and functional improvement that appears to endure over a decade in the majority. This study on a large cohort with long-term follow-up has also identified patients who are at higher risk of failure.

Hip Arthroscopy for Patients with Persistent Pain Following Periacetabular Osteotomy: No Significant Changes in Pre- and Postoperative Patient Reported Outcomes

Notes

Mario Hevesi, MD, Cody C. Wyles, MD, Wahid Abu-Amer, MD, The ANCHOR Group, John C. Clohisy, MD, Robert T. Trousdale, MD, Aaron J. Krych, MD, Rafael J. Sierra, MD

Introduction: Periacetabular osteotomy (PAO) remains the gold standard procedure for joint preservation in symptomatic developmental dysplasia of the hip. To date, the role for hip arthroscopy (HA) to address intra-articular pathology for patients with unsatisfactory outcomes following PAO remains controversial, with little data available to guide clinicians. The purpose of this study was to harness the Academic Network of Conservational Hip Outcomes Research (ANCHOR) database to provide guidance regarding outcomes for patients undergoing HA for persistent pain following PAO.

Methods: The ANCHOR database was reviewed for all PAOs performed 2008-2018 undergoing subsequent HA. Patient demographics, patient reported outcome scores, and total hip arthroplasty rates were determined to evaluate the utility of arthroscopy following PAO.

Results: 29 patients (5 males, 24 females, age: 23.4±8.4 years) undergoing 32 PAOs (21 right, 11 left) with subsequent arthroscopy at 7 high-volume centers were evaluated. Mean preoperative lateral center edge angle (LCEA) was 17.5±9.3° which was corrected to 32.0±4.7° at the time of PAO. Patients were followed for a mean of 3.9±2.0 years after PAO and underwent HA at a mean of 1.5±1.1 years, with 23 (72%) undergoing concurrent hardware removal. Following arthroscopy, no patient reported outcome measure demonstrated a statistically significant postoperative difference. HOOS changed from 56.5±18.5 preoperatively to 58.1±20.5 postoperatively (p=0.74), WOMAC changed from 73.7±18.5 to 69.7±20.7 (p=0.63), UCLA score from 6.6 ± 2.8 to 6.0 ± 2.7 (p=0.64), and HHS from 63.6±17.0 to 65.0±19.8 (p=0.91). At final follow-up, one hip (3%) had converted to THA at 4.1 years following PAO and 3.0 years following HA.

Conclusions: In the largest available cohort of its kind, patients undergoing HA following PAO demonstrated no statistically significant postoperative change in four different scores. Given these findings, patients and surgeons alike should expect a guarded prognosis for persistent pain following PAO undergoing evaluation for revision arthroscopic management.

Hemiarthroplasty vs. Total Hip Arthroplasty for Femoral Neck Fractures: 2010-2017 Trends in Complication Rates

Juan C. Suarez, MD, William Arguelles, PhD, Don Parris, PhD, Emir Veledar, PhD, Anshul Saxena, PhD, Priscilla Rivera, MPH

Notes

Introduction: Optimal treatment for femoral neck fractures (FNF) remains debated. Recent data supports improved functional outcomes following total hip arthroplasty (THA) compared to hemiarthroplasty (HA) in active patients. However, temporal trends in complication rates between these treatments lacks study.

Methods: The National Surgical Quality Improvement Program database was retrospectively queried to compare differences between HA and THA over time (2010-2012, 2013-2015, and 2016-2017) in blood transfusions, operation time, major complications, minor complications, and 30-day readmission among FNF patients aged ≥50 years. Regression analyses adjusted for age, sex, anesthesia type, smoking, body mass index, hypertension, bleeding disorder, steroid use, and American Society of Anesthesiologists classification.

Results: 16,636 patients were identified. THA was associated with higher transfusion rates in 2010-2012 (mean: 0.34 vs. 0.28, p=0.001) and 2013-2015 (mean: 0.21 vs. 0.19, p=0.002), but not in 2016-2017 (mean: 0.13 vs. 0.14, p=0.146). Operation time was significantly higher for THA across all periods (p's<0.001), but declined over time (e.g., mean difference: 25.51 minutes in 2010-2012 vs. 17.60 minutes in 2016-2017). In recent years, THA became associated with less major (2016-2017: 5.4% vs. 10.2%, p=0.02; 2013-2015: 5.3% vs. 10.3%, p<0.001) and minor (2016-2017: 6.2% vs. 9.8%, p=0.02; 2013-2015: 7.2% vs. 12.4%, p<0.001) complications compared to 2010-2012 where there was no difference (major: 7.2% vs. 10.6%, p=0.87; minor: 12.6% vs. 10.1%, p=0.89). No significant differences in 30-day readmission were noted across periods.

Conclusions: THA is associated with less major and minor complications compared to HA for the treatment of FNF, despite longer surgical time. THA trends in transfusions and operation time have improved over time. There were no differences in 30-day readmission rates within the study period.

Patient and Surgeon Satisfaction with and Utility of Routine Follow-Up at One Year After Primary Total Hip and Total Knee Arthroplasty

Charles M. Lawrie, MD, Toby N. Barrack, BA, Wahid Abu-Amer, MD, Muyibat A. Adelani, MD, John C. Clohisy, MD, **Ryan M. Nunley, MD**, Robert L. Barrack, MD

Introduction: Guidelines for the optimal timing and number of routine clinical visits for asymptomatic patients have been suggested, however, no consensus exists. The purpose of this prospective survey study was to determine the utility of the routine one-year follow-up visit after primary total hip arthroplasty (THA) or total knee arthroplasty (TKA).

Methods: We prospectively enrolled all patients >18 years old undergoing primary TKA, THA, UKA, or SRA with a primary diagnosis of osteoarthritis. Those that were pregnant, incarcerated, had a pre-existing functionally limiting neurological disorder, or undergoing revision TKA or THA were excluded. At one-year follow-up, patients were asked to complete a burden survey including satisfaction (5-point scales) and if the visit was worthwhile (yes/no). Surgeons also completed a burden survey at this time which asked if any intervention was done, if any problems were diagnosed/avoided, and if the visit was worthwhile.

Results: Between October 2017 and July 2018, 512 patients who underwent primary TJA or SRA agreed to participate in the study. The final cohort consisted of 195 patients (102 THAs, 94 TKAs, 5 UKAs, and 1 SRA) in which passive one-year follow-up was obtained. Mean age was 62.7 years (79 males, 40.5%) and 378 days mean follow-up. Patients reported a mean 4.71 rating with satisfaction of care provided by their surgeon and mean 4.64 when asked if the visit was worthwhile. When physicians were asked if any problems, issues diagnosed, or complications were avoided because of the visit, 23.03% said yes. When asked if the visit was worthwhile, 66.84% said yes. For visits during which no interventions were performed or ordered, 49.44% of physicians said the visit was worthwhile.

Conclusions: Patients generally thought their follow-up visit was worthwhile. In visits without intervention, over half of physicians thought the visit was not worthwhile. Surgeons may consider restricting their one-year postoperative visits to symptomatic patients.

Notes			

Can an Outpatient Risk Assessment Tool Predict Who Needs Postoperative Hemoglobin Monitoring?

Notes

Oliver B. Nikolaus, MD, Taylor Rowe, BA, Bryan D. Springer, MD, Thomas K. Fehring, MD, **John R. Martin, MD**

Introduction: There have been recent improvements in surgical technique and perioperative blood management after total joint arthroplasty (TJA) that have decreased rates of transfusion. However, as many surgeons transition to outpatient total joint replacement, obtaining routine postoperative labs may be more challenging. Therefore, the following study was performed to determine if a commonly utilized outpatient assessment tool could predict who is at risk for requiring postoperative hemoglobin screening.

Methods: We performed a retrospective study of consecutive unilateral primary total knee arthroplasties (TKA) and total hip arthroplasties (THA) performed at a single institution. Retrospectively collected data included: preoperative and postoperative hemoglobin levels, need for blood transfusion, length of hospital stay, and Outpatient Arthroplasty Risk Assessment (OARA) score.

Results: There were 1,392 patients screened; however, only 504 patients met inclusion criteria. Mean age at time of primary arthroplasty was 65.3 years. 216 (42.9%) were primary THAs and 288 (57.1%) were primary TKAs. Six patients required a blood transfusion postoperatively (1.19%). Transfusion after surgery was associated with lower preoperative hemoglobin (mean of 10.9 vs. 13.8, p=0.0001), lower postoperative day one hemoglobin (mean of 8.5 vs. 11.3, p=0.00005), longer length of stay (1 vs. 2 days, p=0.0004), higher OARA score (mean of 60.0 vs. 5.0, p=0.0011), and total hip arthroplasty (p=0.00595). All patients that received a transfusion had an OARA score >34. Blood transfusion was not associated with age, sex, BMI or ASA score.

Conclusions: Risk of blood transfusion after primary TJA is uncommon, with an incidence of 1.19%. Transfusion is associated with low preoperative hemoglobin and higher OARA scores. The OARA, not ASA, score reliably identified patients at risk for postoperative blood transfusion.

Symposium VII

Periprosthetic Infection: A Practical Case-Based Approach

Moderator: Fares S. Haddad, FRCS

Faculty: Thomas K. Fehring, MD, Michael H. Huo, MD, Thorsten M. Seyler, MD, PhD

This symposium will cover any focused, case-based and practical mechanisms used to deal with various infection presentations. In each scenario, the key diagnostics and surgical intervention (including the types of prep, lavage and antibiotics used) will be discussed, followed by appropriate postoperative follow-up and advice. In each case, the relevant literature will be covered. As a whole, the symposium will be a practical case-based summary for the active clinician on how to work with acute infection post-surgery, late hematogenous infection, relatively benign organism infection that may suit a single-stage, complex infection that will suit a two-stage and an infection in a complex anatomical scenario with big implants that may require a specialist center.

Learning Objectives:

- **1.** To understand the practicality of applying the possible current solutions for PJI
- 2. To know when and how to execute debridement and implant retention, single stage exchange, 2-stage exchange and multistage procedures

Outline:

Introduction

Fares S. Haddad, FRCS

Cementless Implant Within 4 Weeks of Surgery: What, When and How?

Fares S. Haddad, FRCS

Established Polymicrobial Infection in Poor Host with a Discharging Sinus: An Update on Two-Stage Revision Technique

Michael H. Huo, MD

Low-Grade Infection Two Years Post-Arthroplasty in a Good Host: Would You Consider Single-Stage Exchange?

Thomas K. Fehring, MD

The Well-Fixed, Well-Functioning Implant with Hematogenous Infection: What Now? The Role of DAIR

Thorsten M. Seyler, MD, PhD

Discussion

All Faculty

Opioid Use After Discharge Following Primary Unilateral Total Knee Arthroplasty: How Much Are We Overprescribing?

Robert P. Runner, MD, Andrew N. Luu, MD, Nader A. Nassif, MD, Zachary P. Thielen, MD, **Travis S. Scudday, MD**, Jay J. Patel, MD, Steven L. Barnett, MD, Robert S. Gorab, MD

Notes

Introduction: The opioid crisis in America has resulted in increased pressure on orthopaedic surgeons to reduce the amount of narcotics prescribed for postoperative pain management. This study sought to quantify postoperative opioid use after hospital discharge for primary unilateral total knee arthroplasty (TKA) patients.

Methods: A prospective cohort of primary unilateral TKA patients by one of five senior fellowship trained arthroplasty surgeons were enrolled at a single institution. Detailed pain journals tracked all prescription and over-the-counter pain medication, quantity, frequency, and visual analog scale (VAS) pain scores. Narcotic and narcotic-like pain medications were converted to morphine milligram equivalents (MME). Statistical analysis was performed using student t-tests with <0.05.

Results: Data from 89 subjects was analyzed; the average VAS pain score was 6.92 while taking narcotics. The average number of days taking narcotics was 16.81 days. The distribution of days taking narcotics was "right-shifted" with 52.8% of patients off narcotics after 2 weeks, and 74.2% off by 3 weeks postoperatively. The average MME prescribed was significantly greater than MME taken (866.6 vs. 428.2, p<0.0001). The average number of narcotic pills prescribed was significantly greater than narcotic pills taken (105.1 vs. 52.0, p<0.0001). The average excess narcotic pills prescribed per patient was 53.1 pills. 43 (48.3%) patients took fewer than 40 narcotic pills; 67 (75.3%) patients took fewer than 75 narcotic pills. 4 (3.4%) patients did not require any narcotics; 36 (40.5%) patients required a refill of narcotics. 8 (9.0%) patients went home the day of surgery.

Conclusions: Significantly more narcotics were prescribed than were taken in the postoperative period following TKA, with an average 53.1 excess narcotic pills per patient. Adjusting prescribing patterns to match patient narcotic usage could reduce the excess narcotic pills following TKA.

Education Increases Disposal of Unused Opioids After Total Joint Arthroplasty: A Cluster Randomized Trial

Notes

Cindy R. Nahhas, BS, **Charles P. Hannon, MD**, Chris Culvern, MS, Tad L. Gerlinger, MD, Denis Nam, MD, MSc, Craig J. Della Valle, MD

Introduction: The purpose of this study was to determine the impact of education on proper disposal rates of unused opioids.

Methods: Following IRB approval, 563 patients undergoing primary hip (183 patients) and knee (380 patients) arthroplasty were cluster randomized to receive no education (Group 1), educational pamphlets (Group 2), or educational pamphlets plus text messages (Group 3). Patients were cluster randomized by week to prevent sharing educational materials and blinded to participation in the study to avoid behavioral modifications. Patients were surveyed 6 weeks postoperatively to determine if they disposed of their unused opioid pills using an FDA recommended method. Assuming a 15% difference in opioid disposal rates as clinically relevant, a power analysis determined that 76 patients per group (228 total) with medication to dispose were required. An as-treated analysis was conducted with Fisher's Exact and ANOVA tests with alpha=0.05.

Results: 539 (95.7%) patients completed the survey. 342 patients (60.1%) indicated that they had unused opioid pills at 6 weeks postoperatively; 89 patients in Group 1, 128 in Group 2 and 125 in Group 3. Of these 342 patients 9.0%, 32.8%, and 38.4% properly disposed of their unused opioids in Groups 1, 2 and 3 respectively (p<0.001 for no education vs. either strategy with no difference between the two educational strategies). Unused opioid pills were kept by 82.0%, 64.1%, and 54.4% of patients in Groups 1, 2, and 3 (p<0.001 for no education vs. either educational strategy). There were no differences between groups including daily inpatient opioid use, refill requirements, and preoperative opioid use other than gender (41.5%, 55.0% and 37.4% male; p=0.001), suggesting appropriate randomization.

Conclusions: Education on proper opioid disposal more than triples the rate of proper opioid disposal compared to no education. Further innovation is warranted given the inadequate rates of disposal even with appropriate education.

Is Preoperative Tramadol a Safe Alternative to Opioids in Total Knee Arthroplasty?

David E. DeMik, MD, Christopher N. Carender, MD, Nicholas A. Bedard, MD, Alan G. Shamrock, MD, John J. Callaghan, MD

Notes

Introduction: Preoperative opioid use has been shown to lead to postoperative opioid use following total knee arthroplasty (TKA). Tramadol is recommended for symptomatic treatment of osteoarthritis; however, it acts on opioid receptors and may confer similar adverse effects. The purpose of this study was to assess postoperative opioid use with preoperative opioid and tramadol use.

Methods: Patients undergoing primary TKA between 2007 and 2016 were identified in the Humana administrative claims database using CPT code 27447. Patients were stratified by whether they filled a prescription for an opioid, tramadol, either, or neither within 3 months before TKA. Prescription claims for opioids and tramadol were tracked for 12 months postoperatively. Relative risk for each group was calculated.

Results: 107,973 patients undergoing TKA were identified. Preoperatively, 29,890 (27.7%) patients filled a prescription for only opioids, 8,049 (7.5%) for only tramadol, 44,403 (41.1%) for either tramadol or opioids, and 63,570 (58.9%) did not fill a prescription for either. At 12 months after TKA, an opioid prescription was filled by 6.0% of preoperative opioid free patients, 35.2% preoperative opioid users (RR: 5.83 [5.63-6.03]), 9.2% preoperative tramadol users (RR: 1.52 [1.40-1.63]), and 29.5% preoperative opioid or tramadol users (RR: 4.88 [4.72-5.05]). Opioid or tramadol prescriptions were filled by 7.7% of preoperative opioid free patients, 37.3% preoperative opioid users (RR: 4.84 [4.70-4.99]), 26.2% preoperative tramadol users (RR: 3.40 [3.26-3.57]), and 35.7% preoperative opioid or tramadol users (RR: 4.64 [4.50-4.78]) at 12 months after TKA.

Conclusions: Patients taking tramadol preoperatively were found to be at lower risk for prolonged postoperative opioid use following TKA. However, patients taking either tramadol or opioids preoperatively continued to fill prescriptions for these medications at a significantly higher rate than those who were not. Additional studies are needed to assess if preoperative tramadol use is associated with inferior clinical outcomes.

The Effects of Opioid Use on Thromboembolic Complications, Readmission Rates and 90-Day Episode of Care Costs

Notes

Nipun Sodhi, MD, Hiba Anis, MD, Rushabh M. Vakharia, MD, Joseph O. Ehiorobo, MD, Nicolas S. Piuzzi, MD, Carlos A. Higuera, MD, Martin M. Roche, MD, Michael A. Mont, MD

Introduction: There is a paucity in the literature evaluating whether patients with a history of opioid use disorder (OUD) are at a greater risk of developing thromboembolic complications following primary total hip arthroplasty (THA). Therefore, the purpose of this study was to investigate whether OUD patients are at greater odds than non-opioid use disorder (NUD) patients in developing: 1) thromboembolic complications; 2) readmission rates; and 3) costs of care.

Methods: International Classification of Disease (ICD-9) codes and Boolean command operators were used to identify all patients with a 90-day history of OUD prior to THA. Patients with a previous history of venous thromboembolism (VTE), deep vein thrombosis (DVT), pulmonary embolism (PE), and coagulation disorders were excluded. Patients were matched 1:4 to controls by age, gender, Elixhauser Comorbidity Index scores and high-risk medical comorbidities, yielding 33,161 total patients with (n=6,665) and without (n=26,596) OUD. Multivariate logistic regression analyses were performed to compare the risks of developing VTE (DVT and/or PE) 90-days following the index procedure, 90-day readmission rates, and total global 90-day episode of care costs.

Results: Patients with a history of OUD were found to be at greater risk for 90-day VTEs (2.72 vs. 1.13%; OR 2.45, 95% CI 1.90-3.17, p<0.001) compared to matched NUD patients. Specifically, OUD patients were at greater risk for both DVT (OR 2.55, 95% CI 1.93-3.38, p<0.001) and PE (0.84 vs. 0.25%; OR 3.33, 95% CI 1.99-5.57, p<0.001). Additionally, patients with OUD were at an increased risk for 90-day readmission (OR 1.27, 95% CI 1.17-1.38, p<0.001) compared to controls. Primary THA patients with OUD incurred a 15% higher cost of care (\$21,595.82 vs. \$18,807.14) compared to NUD patients.

Conclusions: These findings demonstrate that primary THA patients with a history of OUD are at greater risk for thromboembolic complications, readmissions and higher costs of care in the 90-day postoperative period.

Use of Tetrahydrocannabinol and Cannabidiol Products in the Perioperative Period Around Primary Unilateral Total Knee Arthroplasty and the Impact on Opioid Consumption

Motoc

Robert P. Runner, MD, Andrew N. Luu, MD, Nader A. Nassif, MD, Jay J. Patel, MD, Steven L. Barnett, MD, Robert S. Gorab, MD

Introduction: Given the opioid crisis in America, patients are trying alternative medications including tetrahydrocannabinol (THC) and other cannabidiol (CBD) containing products in the perioperative period, especially in states where the use of these products is legal. This study sought to analyze any association of CBD/THC products usage in the perioperative period with postoperative opioid use after hospital discharge for primary unilateral total knee arthroplasty (TKA) patients.

Methods: A prospective cohort of primary unilateral TKA patients by five fellowship trained arthroplasty surgeons were enrolled at a single institution. Patients who completed detailed pain journals were queried for THC/CBD product usage. Pain medications were converted to morphine milligram equivalents (MME). Statistical analysis was performed with <0.05.

Results: Data from 84 patients following primary unilateral total knee arthroplasty were analyzed. 22.6% of TKA patients used THC/CBD products in the perioperative period. There was a wide variety of usage patterns among those using THC/CBD products. In comparing patients who did not use any THC/CBD products to those who did, there was no significant difference in the length of narcotic use (17.31 vs. 17.26 days, p=0.9872), total MME taken (441.31 vs. 450.33, p=0.9316), or narcotic pills taken (52.03 vs. 58.61, p=0.5544). Average pain scores were similar between groups (3.79 vs. 3.40, p=0.3372). There was no significant difference in the percentage of patients requiring a refill of narcotics (40.00% vs. 42.11%, p=0.8694) or length of stay (1.45 vs. 1.37 days, p=0.7336).

Conclusions: Understanding that THC/CBD usage was not consistent for patients who used these products, 22.6% of primary unilateral TKA patients tried THC/CBD products in the perioperative period, but THC/CBD use was not associated with a major effect on narcotic requirements. Further studies on the effects of THC/CBD in the perioperative period are needed as these therapies become more widely available in the US.

Symposium VIII

Adverse Local Tissue Reactions in THA: Who, When and How to Revise

Moderator: Young-Min Kwon, MD, PhD

Faculty: Joshua J. Jacobs, MD, Michael J. Taunton, MD, Douglas E. Padgett, MD,

Adolph V. Lombardi, Jr., MD, FACS

A combined didactic and case presentation format will highlight treatment of total hip arthroplasty (THA) patients with adverse local tissue reactions (ALTR) due to modular taper corrosion and metal bearing surface wear, enhancing understanding and applying evidence-based practice to optimize patient evaluation, revision surgery indication, surgical techniques and outcomes.

Learning Objectives:

- 1. To recognize that there is a spectrum of clinical presentations of ALTR due to taper corrosion and metal bearing surface wear, reflecting a complex interplay of implant, surgical and patient factors
- 2. To understand the current state of knowledge on importance of various taper material combinations and taper design geometry on taper corrosion
- **3.** To recognize that systematic risk stratification approach based on currently available data is critical in optimizing evaluation and revision surgery indications
- **4.** To gain understanding of utility and limitations of specialized diagnostic tests including metal ion levels and cross-sectional imaging studies in the clinical decision-making process
- 5. To understand that optimizing revision surgery outcomes for ALTR involves careful preoperative planning, implant selection, and surgical techniques to overcome challenges associated with soft tissue necrosis

Outline:

Introduction

Young-Min Kwon, MD, PhD

What Surgeons Need to Know About ALTR in THA Joshua J. Jacobs, MD

How to Interpret Metal Ions in ALTR

Michael J. Taunton, MD

How Useful Is MARS MRI in Evaluating ALTR?

Douglas E. Padgett, MD

Adolph V. Lombardi, MD
Discussion All Faculty
Notes

What are the common pitfalls and pearls in

performing revision surgery for ALTR?

Does Intermittent Catheterization Compared to Indwelling Catheterization Decrease the Risk of Periprosthetic Joint Infection Following Total Knee Arthroplasty?

Luke Garbarino, MD, Peter A. Gold, MD, Hiba Anis, MD, Nipun Sodhi, MD, Jonathan R. Danoff, MD, Sreevathsa Boraiah, MD, Vijay J. Rasquinha, MD, Michael A. Mont, MD

Notes

Introduction: Catheterization for the treatment of urinary retention commonly occurs after total knee arthroplasty (TKA). Recent studies have questioned the use of the indwelling catheterization, especially in its potential role as a nidus for infection. We are still unsure of its downstream effects on periprosthetic joint infections (PJI). Therefore, this study aimed to compare the risks of postoperative PJI following intermittent vs. indwelling catheterization after TKA.

Methods: Between 2017 and 2019, 15 hospitals in a large health system prospectively followed patients undergoing TKA. Postoperative indwelling catheter only, intermittent straight catheter only, and both indwelling and intermittent straight catheterizations were recorded. Patient demographics, comorbidities, body mass indices (BMI), and PJIs were collected from time of surgery to time of data collection with mean 14-month follow-up. Univariate and multivariate analyses were performed with independent t-tests and multiple linear regression models to compare catheterization treatment types.

Results: 9,123 TKAs were performed, with urinary retention treated by indwelling catheter only (62%, n=734), intermittent straight catheter only (25%, n=299), or both indwelling and intermittent catheterizations (13%, n=160). Univariate analyses showed that PJIs occurred in 1.1% of no-catheter patients and 2.3% of patients treated with bladder catheterization (p=0.002). Using multivariate analyses, indwelling catheter use (OR: 2.647, p<0.001), diabetes (OR: 1.837, p=0.005), and peripheral vascular disease (OR: 2.372, p=0.046) were found to have a statistically significant increased risk for PJIs. The use of intermittent straight catheterization (OR: 1.249, p=0.668) or both indwelling and intermittent (OR: 1.171, p=0.828) did not increase the risk for PJIs.

Conclusions: Treatment with bladder catheterization is commonly needed for urinary retention after TKA. This study found that the use of an indwelling catheter only, but not intermittent catheterization, increased the risk for PJI. This is an important finding to guide treatment for urinary retention after TKA in order to decrease the risk of PJIs.

Dilute Povidone-Iodine Solution Prevents Intraoperative Contamination of Sterile Water Basins During Total Joint Arthroplasty

Mark R. Nazal, MPH, **J. Luke Galloway, BA**, Karanpreet K. Dhaliwal, MS, Steven K. Nishiyama, DO, John S. Shields, MD

Notes

Introduction: Periprosthetic joint infection (PJI) is a major complication of total joint arthroplasty (TJA). The intraoperative splash basin has been found to be a potential source of contamination. Although consensus recommendations against the use of the splash basin have been made, splash basin use continues to be taught and utilized in practice. This study aims to investigate the effect of dilute betadine addition to the sterile water contents (0.02% solution) of the splash basin on contamination rates. This intervention could preserve the functionality and preferential use of the splash basin.

Methods: Patients undergoing primary TJA were enrolled in a randomized controlled trial with assignment to either the intervention/betadine group, in which dilute betadine was added to the standard sterile water (SW) splash basin, or the control/standard SW group. For a total cohort of 104 patients, a 120mL aliquot sample of basin fluid was collected at incision ("pre-procedure") and closure ("post-procedure"). Samples were cultured and monitored for 48 hours for growth, with further testing as necessary to identify microbial speciation.

Results: Of the final 100 post-procedure samples, 0 (0.0%) were positive in the betadine group, while there were 23 (47.9%) positive samples in the SW group (p<0.001). Of the positive cultures in the SW group, the most common species grown were coagulase-negative *Staphylococcus*, *Corynebacterium*, and *Micrococcus*.

Conclusions: In conclusion, treating sterile water splash basins with dilute povidone-iodine (0.02% solution) eliminates intraoperative contamination of splash basins in TJA procedures. This intervention is simple, low cost, and readily implementable, making it a reasonable addition to TJA protocols.

A Randomized Clinical Trial of Articulating and Static Spacers in the Management of Chronic Periprosthetic Knee Infection

Cindy R. Nahhas, BS, Peter N. Chalmers, MD, Javad Parvizi, MD, FRCS, Scott M. Sporer, MD, MS, Keith R. Berend, MD, Gregory K. Deirmengian, MD, Antonia F. Chen, MD, MBA, Matthew S. Austin, MD, Michael J. Morris, MD, Craig J. Della Valle, MD

Motoc

Introduction: The purpose of this multi-center, randomized clinical trial was to compare static and articulating spacers in the treatment of periprosthetic joint infection (PJI) complicating total knee arthroplasty (TKA).

Methods: 68 patients undergoing resection arthroplasty as part of a two-stage exchange for PJI at three centers were randomized to receive either a static (32 patients) or articulating spacer (36 patients). 49 Patients (72.1%) were available for follow-up at a mean 3.5 years (range: 2.0 to 6.4 years); 6 patients died, 7 were lost to follow-up, 3 were screen failures, 2 withdrew after surgery and one patient cancelled prior to surgery. Power analysis determined that 28 patients per group (56 total) were necessary to detect a 13° difference in range of motion (ROM) between groups with 80% power and alpha=0.05.

Results: Patients in the static spacer group had significantly longer mean hospital length of stay (LOS: 6.1 vs. 5.1 days; p=0.032). At final follow-up, the mean arc ROM in the articulating spacer cohort was significantly higher at 113.0° compared to 100.2° in the static spacer cohort (p=0.001). The mean Knee Society Score (KSS) was significantly higher in the articulating spacer cohort (79.4 vs. 69.8 points; p=0.043). Patients in the static spacer cohort had a greater need for an extensile exposure at the time of reimplantation (16.7% vs. 3.8%), and higher rates of reoperation (33.3% vs. 12.0%) and reinfection (12.0% vs. 8.0%). However, the latter differences did not reach statistical significance with the sample size studied.

Conclusions: This randomized study demonstrated that the use of an articulating spacer, compared to a static spacer, during the first stage of a two-stage exchange provided higher ROM, shorter LOS, and higher KSS. When the soft tissue envelope allows, and if there is adequate bony support, an articulating spacer is associated with improved outcomes.

Paper #54

Isolated Tibial Insert Exchange in Aseptic Revision TKA: Reliable and Durable for Wear; Less So for Instability, Insert Fracture/Dissociation, or Stiffness

Notes

Matthew W. Tetreault, MD, Jeremy T. Hines, MD, Daniel J. Berry, MD, Mark W. Pagnano, MD, Robert T. Trousdale, MD, Matthew P. Abdel, MD

Introduction: Modularity in total knee arthroplasties (TKA) allows for isolated tibial insert exchange with retention of well-fixed and well-aligned components. Simplicity makes this appealing, but published results for non-infectious indications are mainly small series. This study determined outcomes of isolated tibial insert exchange during aseptic revision TKA in a large, consecutive cohort.

Methods: From 1985–2016, 270 isolated tibial insert exchanges (among 7,121 revision TKAs the same years) were performed at one institution for non-infectious indications, including polyethylene wear (39%), instability (55%), insert fracture/dissociation (5%), or stiffness (1%). Patients with component loosening, implant malposition, infection or extensor mechanism problems were excluded. Mean age was 65 years with 62% females. Mean follow-up was 6 years.

Results: At 10 years, Kaplan-Meier survivorship free of re-revision was 68%. For diagnosis of insert wear, revision-free survivorship at 5 and 10 years was 89% and 74%, respectively. Re-revisions were more frequent for index diagnoses other than wear (HR 1.9; p=0.01) with 5- and 10-year survival of 74% and 69% for instability and 49% and 37% for liner fracture/dissociation. After exchanges for wear, the most common reason for re-revision was aseptic loosening (33%). After all other index diagnoses, the most common reason for re-revision was recurrence of that diagnosis. Other factors associated with re-revision were younger age (HR 1.4 per 10 years; p<0.01) and prior revision (HR 1.9; p<0.01). Mean Knee Society Scores improved from 54 preoperatively to 72 at 5 years and 78 at 10 years.

Conclusions: After isolated tibial insert exchange, the risk and reasons for re-revision correlated with preoperative indication. Best results were for polyethylene wear with 5- and 10-year survival of 89% and 74%. For other diagnoses, failure rate was higher and failure mode was most commonly a recurrence of the original diagnosis. TKA failures often are multi-factorial, and we advise some caution with this simplistic strategy.

Paper #55

Administration of Tranexamic Acid Improves Long-Term Outcomes in Total Knee Arthroplasty $^{\Diamond}$

Nicholas P. Drain, BS, Valerie Gobao, BS, Dominique Bertolini, BS, **Kenneth L. Urish, MD**, PhD, Brian R. Hamlin, MD, Brian A. Klatt, MD, Clair N. Smith, MS, Malcolm Dombrowski, MD, Michael J. O'Malley, MD

Notes

Introduction: Allogenic blood transfusion in total knee arthroplasty (TKA) is associated with increased incidence of morbidity, including periprosthetic joint infection (PJI), revision surgery, and irrigation and debridement (I&D). Tranexamic acid (TXA) reduces the rate of blood transfusions, but there has been limited evidence demonstrating improved outcomes in TKA resulting from decreased transfusion related complications. The objective of this study was to determine if TXA improves long-term outcomes and minimizes adverse events.

Methods: A multicenter retrospective matched cohort study was completed comparing 4,905 patients receiving TXA after a TKA as compared to 22,174 patients that did not receive TXA. Inclusion criteria included patients receiving a TKA for degenerative arthritis. The primary outcome was a diagnosis of PJI within two years of the primary TKA. Secondary outcomes included revision surgery and I&D within two years of surgery. Adverse events included readmission within 90 days postoperative transfusion, or deep venous thrombosis (DVT) within 90 days of the primary TKA. Adjusted odds ratios were determined using multivariate analysis controlling for age, gender, thromboembolic chemoprophylaxis, and Charlson comorbidity index (CCMI).

Results: 27,079 cases of TKA met inclusion criteria. 18% (n=4,905) received TXA. Multivariate analysis demonstrated that TXA administration resulted in an approximate 50% decreased incidence of PJI within two years (OR 0.47; p<0.0001). TXA administration improved secondary outcomes, with a decreased incidence of revision surgery at two years (OR 0.29; p<0.0001) and I&D (OR 0.10; p<0.0001) as compared to patients that did not receive TXA. Patients who received TXA also had decreased incidences of 90-day hospital readmission (OR 0.85; p=0.0001) and DVT (OR 0.45; p=0.0003). Consistent with previous studies, a reduction in transfusion rates was observed (OR 0.13; p<0.0001).

Conclusions: Administration of TXA in TKA resulted in decreased rates of PJI, revision surgery, I&D, and 90-day readmission, demonstrating that its use improves long-term outcomes.

♦ The FDA has not approved tranexamic acid for use in orthopaedics.

Paper #56

Fixed-Bearing Medial Unicondylar Knee Arthroplasty - Slight Varus, Just Right!

Notes

Sean E. Slaven, MD, John P. Cody, MD, Robert A. Sershon, MD, Henry Ho, MS, Robert H. Hopper, Jr., PhD, Kevin B. Fricka, MD

Introduction: Mechanical axis alignment has been shown to influence the long-term outcome of fixed-bearing medial unicompartmental knee arthroplasty (UKA). However, a consensus on the optimal postoperative alignment target has not been established. This study compared the postoperative mechanical alignment of well-functioning UKAs against two groups of failed UKAs, including revisions for progression of lateral compartment arthritis ("progression") and revisions for aseptic loosening or subsidence ("loosening").

Methods: From our prospective institutional database of 3,539 medial fixed-bearing UKAs performed since 2000, we identified 37 UKAs revised for progression and 61 UKAs revised for loosening. Each of these revision cohorts was matched based on age at surgery, gender, body mass index, and postoperative range of motion with unrevised UKAs that had at least 10 years of follow-up and a Knee Society Score of 70 or greater ("success" groups). Postoperative alignment was quantified by the hip-knee-ankle (HKA) angle measured on long-leg alignment radiographs.

Results: The mean HKA at 4-month follow-up for the progression group was $0.3\pm3.6^{\circ}$ of valgus compared to $4.4\pm2.6^{\circ}$ of varus for the matched success group (p<0.001). For the loosening group, the mean HKA was $6.1\pm3.1^{\circ}$ of varus compared to $4.0\pm2.7^{\circ}$ of varus for the matched success group (p<0.001). The HKA angles were similar among both success groups (p=0.52). The loosening group was revised at a mean of 3.3 ± 2.9 years compared to 5.4 ± 4.0 years for the progression group (p=0.004).

Conclusions: Mechanical alignment in the coronal plane is an important factor in the setting of fixed-bearing, medial UKA. Patients with well-functioning UKAs at 10 years exhibited mild varus mechanical alignment of approximately 4°, whereas patients revised for progression of osteoarthritis averaged more valgus (mean 0.3° valgus) and those revised for loosening averaged more varus (mean: 6.1° varus). The optimal mechanical alignment for component survival is likely slight varus.

Matthew P. Abdel, MD

American Association of Hip and Knee Surgeons: Board or committee member International Congress for Joint Reconstruction: Board or committee member Journal of Bone and Joint Surgery - British: Editorial or governing board Minnesota Orthopaedic Society: Board or committee Stryker: Paid consultant

Jeffrey A. Ackerman, MD

This individual reported nothing to disclose.

Muyibat A. Adelani, MD

American Association of Hip and Knee Surgeons: Board or committee member

Edward M. Adler, MD

Abbott: Stock or stock Options Journal of Arthroplasty, Bulletin of the NYU Hospital for Joint Diseases: Editorial or governing board Procter & Gamble: Stock or

stock Options

Stryker: Paid consultant

Ajay Aggarwal, MD

American Association of Hip and Knee Surgeons: Board or committee member Journal of Arthroscopy and Joint Surgery: Editorial or governing board Mid America Orthopaedic Association: Board or committee member Stryker: Paid presenter or speaker; Research support

Oluwaseun Akinbo, MD

This individual reported nothing to disclose.

Derek F. Amanatullah, MD, PhD

AAOS: Board or committee member DePuv, A Johnson & Johnson Company: Paid consultant Exactech, Inc: IP royalties; Paid consultant OREF: Research support Osteosynthesis and Trauma

Care Foundation: Research support

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Research support

Michael P. Ast. MD

American Association of Hip and Knee Surgeons: Board or committee member Conformis: Paid consultant Eastern Orthopaedic Association: Board or committee member OrthAlign: Paid consultant; Stock or stock Options OrthAlign Inc: Paid presenter or speaker Osso VR: Stock or stock Options Smith & Nephew: Paid consultant; Paid presenter or speaker; Research support Stryker: Paid consultant Surgical Care Affiliates: Paid consultant

Matthew S. Austin. MD

AAOS: Board or committee member American Association of Hip and Knee Surgeons: Board or committee member Corin U.S.A.: Paid consultant Journal of the American Academy of Orthopaedic Surgeons: Editorial or governing board Link Orthopaedics: Paid

consultant

Zimmer: Research support

David C. Ayers, MD

AAOS: Board or committee member American Orthopaedic Association: Board or committee member Journal of Bone and Joint Surgery - American: Editorial or governing board Trevor R. Banka, MD

This individual reported nothing to disclose.

C. Lowry Barnes, MD

American Association of Hip and Knee Surgeons: Board or committee member ConforMIS: Research support Corin U.S.A.: Other financial or material support DJO: IP royalties HealthTrust: Paid consultant HipKnee Arkansas Foundation: Board or committee member Journal of Arthroplasty: Editorial or governing board JSOA: Editorial or governing board Mid-American Orthopaedic

Association: Board or committee member None: Unpaid consultant Responsive Risk Solutions: Paid consultant; Stock or stock Options

Southern Orthopaedic Association: Board or committee member Zimmer: IP royalties

Hanv S. Bedair, MD

Options Osteon Holdings: Stock or stock Options Smith & Nephew: Paid consultant Wolters Kluwer Health -Lippincott Williams & Wilkins: Publishing royalties, financial or material support Zimmer: Research support

DEF Medical: Stock or stock

Jaime L. Bellamy, DO

This individual reported nothing to disclose.

Don C. Beringer, MD, FAAOS

Clinical Orthopaedics and Related Research: Editorial or governing board

Daniel J. Berry, MD

Bodycad: Paid consultant; Stock or stock Options Current Concepts in Joint Replacement (Hip Society and Knee Society): Board or committee member DePuy, A Johnson & Johnson

Company: IP rovalties: Paid consultant: Research support Elsevier: Publishing rovalties. financial or material support International Hip Society: Board or committee member Journal of Bone and Joint Surgery - American: Editorial or governing board Mavo Clinic Board of Governors: Board or committee member Wolters Kluwer Health -Lippincott Williams & Wilkins: Publishing royalties, financial or material support

Hari P. Bezwada, MD

Corentec: Paid consultant Encore Medical: Paid consultant Flexion Therapeutics: Paid consultant Journal of Arthroplasty: Editorial or governing board Journal of the American Academy of Orthopaedic Surgeons: Editorial or governing board

Kamil Bober, MD

This individual reported nothing to disclose.

Russell J. Bodner, MD

This individual reported nothing to disclose.

Michael P. Bolognesi, MD

Acelity: Other financial or material support Amedica: Stock or stock Options; Unpaid consultant American Association of Hip and Knee Surgeons: Board or committee member AOA Omega: Other financial or material support Arthroplasty Today: Editorial or governing board Biomet: Research support DePuy, A Johnson & Johnson Company: Research support Eastern Orthopaedic Association: Board or committee member Exactech. Inc: Research support Journal of Arthroplasty: Editorial or governing board Journal of Surgical Orthopaedic Advances: Editorial or governing board KCI: Research support Smith & Nephew: Other financial or material support; Unpaid consultant TJO: IP royalties; Paid presenter or speaker; Stock or stock Options Zimmer: IP royalties; Paid presenter or speaker; Research

Kevin J. Bozic, MD, MBA

support

American Association of Hip and Knee Surgeons: Board or committee member American Joint Replacement Registry: Board or committee member Carrum Health: Stock or stock Options Centers for Medicare and Medicaid Services: Paid consultant Embold Health: Paid consultant Harvard Business School: Unpaid consultant

David P. Brigati, MD

This individual reported nothing to disclose.

Thomas E. Brown, MD

This individual reported nothing to disclose.

James A. Browne, MD

American Association of Hip and Knee Surgeons: Board or committee member American Joint Replacement Registry: Board or committee member DJ Orthopaedics: IP royalties; Paid consultant Heron Therapeutics: Paid consultant Journal of Arthroplasty: Editorial or governing board: Publishing royalties, financial or material support Journal of Bone and Joint Surgery - American: Publishing royalties, financial or material Norvartis: Paid consultant OsteoRemedies: Paid consultant Radlink: Stock or stock Options Saunders/Mosby-Elsevier: Publishing royalties, financial or material support Southern Orthopaedic Association: Board or committee member Virginia Orthopaedic Society:

Leonard T. Buller, MD

This individual reported nothing to disclose.

Board or committee member

Matthew W. Bullock, DO, PT

American Association of Hip and Knee Surgeons: Board or committee member Arthroplasty Today: Editorial or governing board

Frank A. Buttacavoli, MD

KCI: Paid consultant Zimmer: Paid consultant

Paul C. Buzhardt, MD

This individual reported nothing to disclose.

Antonia F. Chen, MD, MBA

3M: Paid consultant
AAOS: Board or committee
member
ACI: Paid consultant
AJRR: Board or committee
member
American Association of Hip

and Knee Surgeons: Board or

committee member American Medical Foundation: Paid consultant

Annals of Joint: Editorial or governing board

Avanos: Paid consultant; Research support

bOne: Paid consultant
Bone & Joint 360 Journal:
Editorial or governing board
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Related Research: Editorial or

governing board

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DePuy, A Johnson & Johnson
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Options

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or stock Options

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board

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Editorial or governing board Musculoskeletal Infection Society: Board or committee

member

Recro: Paid consultant SLACK Incorporated: Publishing royalties, financia

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Darwin D. Chen, MD

Conformis: Paid consultant DePuy, A Johnson & Johnson Company: Paid presenter or speaker Smith & Nephew: Paid consultant Dennis Q. Chen, MD

This individual reported nothing to disclose.

George F. Chimento, MD

AAOS: Board or committee member

DePuy, A Johnson & Johnson Company: Research support Journal of Arthroplasty: Editorial or governing board Louisiana Orthopaedic Association: Board or committee member Sight Medical: Stock or stock

Options

Stryker: Paid consultant Vizient: Unpaid consultant

Roberto Civinini, MD

Microport: Paid consultant Orthofix, Inc.: Paid consultant Smith & Nephew: Paid presenter or speaker

Matthew R. Cohn, MD

This individual reported nothing to disclose.

Herbert J. Cooper, MD

AAOS: Board or committee member DePuy, A Johnson & Johnson

Company: Paid consultant Journal of Arthroplasty: Editorial or governing board Journal of Bone and Joint Surgery - American: Editorial or governing board

KCI: Paid presenter or speaker; Research support

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consultant

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David A. Crawford, MD

Kinetic Concepts, Inc.:
Research support

Zimmer: Research support

Brian M. Culp. MD

American Association of Hip and Knee Surgeons: Board or committee member Intellijoint: Paid consultant Medacta: Paid consultant Surgical Care Associates: Paid presenter or speaker

Brian M. Curtin, MD, MS

American Association of Hip and Knee Surgeons: Board or committee member American Joint Replacement Registry Review Commission: Board or committee member Biomet: Paid consultant CareStream: Paid consultant Clinical Orthopaedics and Related Research: Editorial or governing board DePuy, A Johnson & Johnson Company: Paid presenter or speaker European Journal of Orthopaedic Surgery and Traumatology: Editorial or governing board International Congress for Joint Reconstruction: Board or committee member Johnson & Johnson: Paid consultant Journal of Arthroplasty: Editorial or governing board Orthopedics: Editorial or governing board Springer: Publishing royalties, financial or material support

David F. Dalury, MD

Stryker: Paid consultant

DePuy, A Johnson & Johnson Company: IP royalties; Paid consultant: Paid presenter or speaker: Research support Johnson & Johnson: Stock or stock Options Robony: Stock or stock Options

Chris J. Dangles, MD

This individual reported nothing to disclose.

Charles M. Davis, III, MD, PhD

AAOS: Board or committee member Journal of Arthroplasty: Editorial or governing board

Ivan De Martino, MD

Lima Corporate: Paid consultant

Carl A. Deirmengian, MD

Biomet: Paid consultant Biostar Ventures: Paid consultant: Stock or stock Options

Domain: Stock or stock

Options

Trice: Stock or stock Options Zimmer: Paid consultant: Paid presenter or speaker; Research support

Daniel J. Del Gaizo, MD

Biomup: Research support Conformis: Research support DePuy, A Johnson & Johnson Company: Paid consultant; Research support Journal of Arthroplasty: Editorial or governing board Orthalign: Paid consultant Pacira: Research support Pacira Pharmaceuticals: Paid consultant: Paid presenter or speaker Reflection Health: Research

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Craig J. Della Valle, MD

American Association of Hip and Knee Surgeons: Board or committee member Arthritis Foundation: Board or committee member DePuy, A Johnson & Johnson Company: Paid consultant Hip Society: Board or committee member Orthopedics Today: Editorial or governing board Orthophor and Surgiphor: Stock or stock Options Parvizi Surgical Innovations: Stock or stock Options SLACK Incorporated: Editorial or governing board; Publishing royalties, financial or material

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consultant; Research support

David E. DeMik, MD

This individual reported nothing to disclose.

Douglas A. Dennis, MD

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Wolters Kluwer Health -Lippincott Williams & Wilkins: Publishing royalties, financial or material support

Matthew J. Dietz. MD

AAOS: Board or committee member American Association of Hip and Knee Surgeons: Board or committee member Heraeus Medical: Paid consultant Synotrac/Graftworx: Stock or stock Options

Lawrence D. Dorr, MD

Biomet: IP royalties DJ Orthopaedics: IP royalties Joint Development, Inc.: Stock or stock Options Operation Walk: Board or committee member Total Joint Orthopedics: Unpaid consultant Zimmer: IP royalties

Jacob M. Drew. MD

DePuy, A Johnson & Johnson Company: Paid presenter or speaker Journal of Arthroplasty: Editorial or governing board KCI: Paid consultant

Stephen T. Duncan, MD

Bone Support: Paid consultant Heraeus: Paid consultant Journal of Arthroplasty: Editorial or governing board Journal of the American Academy of Orthopaedic Surgeons: Editorial or governing board Kentucky Orthopaedic Society: Board or committee member Morph: Unpaid consultant Smith & Nephew: Paid consultant; Research support Stryker: Research support Zimmer: Paid consultant; Research support

Robert Easton, MD

Encore Medical: IP rovalties: Paid consultant; Paid presenter or speaker

Jacob M. Elkins, MD, PhD

This individual reported nothing to disclose.

Karim A. Elsharkawy, MD

This individual reported nothing to disclose.

Orry Erez, MD

AAOS: Board or committee member Brooklyn Orthopedic Society: Board or committee member New York State Society of Orthopedic Surgeons: Board or committee member Premia Spine: Stock or stock Options

Aidin Eslam Pour, MD

This individual reported nothing to disclose.

Thomas K. Fehring, MD

DePuy, A Johnson & Johnson Company: IP royalties; Paid consultant; Paid presenter or speaker; Research support

Michael J. Feldstein. MD. MS

FT1: Stock or stock options muvr: Stock or stock options Pfizer: Stock or stock options

Yale A. Fillingham, MD

AAOS: Board or committee member

American Association of Hip and Knee Surgeons: Board or committee member Johnson & Johnson: Paid consultant

Medacta: Paid consultant

Stuart J. Fischer, MD

AAOS: Board or committee member AAOS Now: Editorial or governing board AAOS Ortholnfo: Editorial or governing board AAOS, NJOS, OSNJ, NJMLIPA: Board or committee member Jones and Bartlett Publishers Sudbury, MA: Publishing royalties, financial or material

Michael A. Flierl, MD

support

Stryker: Research support

Mark G. Freeman, MD

Conformis: Paid consultant HealthTrustPG: Paid consultant Irrimax Corporation: Stock or stock Options Smith & Nephew: Paid consultant; Paid presenter or speaker

Kevin B. Fricka, MD 2ndMD: Paid consultant

OrthAlign: Stock or stock OrthoCareRN: Other financial or material support Pulse: Stock or stock Options Smith & Nephew: Paid consultant; Paid presenter or speaker; Research support Zimmer: Paid consultant: Paid presenter or speaker Zimmer, INOVA Health Care Services: Research support

Mark I. Froimson, MD, MBA

American Association of Hip and Knee Surgeons: Board or

committee member American Journal of Orthopedics: Editorial or governing board

Arthritis Foundation: Board or committee member

Clarify Health, LLC: Stock or stock Options

Flexion: Paid consultant Indago: Stock or stock Options Johnson & Johnson: Paid

Journal of Arthroplasty: Editorial or governing board Journal of Bone and Joint

consultant

Surgery - American: Editorial or governing board

Orthalign: Stock or stock

OSSO VR: Stock or stock Options

Pacira: Other financial or material support; Stock or stock Options

Thrive Peer Support: Stock or stock Options

UOC: Paid consultant

J. Luke Galloway, BA

This individual reported nothing to disclose.

Luke Garbarino, MD

This individual reported nothing to disclose.

Jonathan P. Garino, MD, MBA

American Association of Hip and Knee Surgeons: Board or committee member Clinical Orthopaedics and Related Research: Editorial or governing board Journal of Arthroplasty: Editorial or governing board Knee: Editorial or governing board Pennsylvania orthopedic society: Board or committee member Shukla Medical: IP rovalties Smith & Nephew: IP royalties; Paid consultant: Research support Zimmer: Research support

Jeremy M. Gililland, MD

AAOS: Board or committee

American Association of Hip

and Knee Surgeons: Board or committee member

Biomet: Research support CoNextions: Stock or stock

Options

DJ Orthopaedics: Paid

consultant

Journal of Arthroplasty: Editorial or governing board Medacta: Paid consultant OrthoGrid: IP royalties; Paid consultant; Stock or stock Options

Smith & Nephew: Paid consultant

Stryker: Paid consultant; Research support

Zimmer: Research support

Devon D. Goetz, MD

Clinical Orthopaedics and Related Research: Editorial or governing board Journal of Bone and Joint Surgery - American: Editorial or governing board society for arthritic joint surgery: Board or committee member

Peter A. Gold. MD

This individual reported nothing to disclose.

Ashton H. Goldman, MD

This individual reported nothing to disclose.

Jeffrey M. Goldstein, MD

Altus Spine: Paid consultant Bulletin of the Hospital for Joint Diseases: Editorial or governing board

Globus Medical: Paid consultant

International Society for the Advancement of Spine Surgery: Board or committee member

Johnson & Johnson: Stock or

stock Options

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board

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stock Options

Zimmer: Paid consultant

Gregory J. Golladay, MD

American Association of Hip and Knee Surgeons: Board or committee member Arthroplasty Today: Editorial or governing board; Publishing royalties, financial or material

support Journal of Arthroplasty: Editorial or governing board KCI: Research support

Orthosensor: Paid consultant;

Research support

Orthosensor, Inc: IP royalties Orthosensor, Inc.: Paid presenter or speaker; Stock or stock Options

Virginia Orthopaedic Society: Board or committee member

Joseph S. Gondusky, MD

DePuy, A Johnson & Johnson Company: Paid consultant Zimmer: Paid consultant

Alexander C. Gordon, MD

OrthoSensor: Paid consultant; Research support; Stock or stock Options

Karan Goswami, MD

This individual reported nothing to disclose.

Christopher W. Grayson, MD

This individual reported nothing to disclose.

Max R. Greenky, MD

This individual reported nothing to disclose.

Matthew J. Grosso, MD

Convatec: Paid consultant

Padma Gulur, MD

American society of Anesthesiologists: Board or committee member

Derek A. Haas, MBA

This individual reported nothing to disclose.

Fares S. Haddad, FRCS

bostaa: Board or committee member corin: IP royalties Journal of Bone and Joint Surgery - British: Editorial or governing board matortho: IP royalties Orthopedics Today: Editorial or governing board Smith & Nephew: IP royalties; Paid consultant; Research support Stryker: IP royalties; Paid

consultant; Research support

Brian R. Hamlin, MD

AAOS: Board or committee member Bodycad: IP royalties; Paid consultant; Stock or stock Options Journal of Arthroplasty, Transfusion: Editorial or governing board Smith & Nephew: Paid consultant

William G. Hamilton, MD

Biomet: Research support DePuy, A Johnson & Johnson Company: IP royalties; Paid consultant: Paid presenter or speaker: Research support Inova Health Care Services: Research support Total Joint Orthopedics: IP royalties; Paid consultant

Charles P. Hannon, MD

ExplORer Surgical: Paid consultant

Matthew S. Hepinstall, MD

AAOS: Board or committee member

Corin U.S.A.: Paid consultant Cymedica: Research support Exactech, Inc: Paid consultant Flexion Therapeutics: Research support

KCI: Paid consultant Stryker: Paid consultant; Paid presenter or speaker; Research support

Shane R. Hess, DO

This individual reported nothing to disclose.

Mario Hevesi, MD

Moximed: Paid consultant

Carlos A. Higuera, MD

American Association of Hip and Knee Surgeons: Board or committee member American Journal of Orthopedics: Editorial or governing board CD Diagnostics: Research support

Cymedica: Research support Ferring Pharmaceuticals: Research support Journal of Arthroplasty: Editorial or governing board Journal of Hip Surgery: Editorial or governing board Journal of Knee Surgery: Editorial or governing board KCI: Paid consultant; Paid presenter or speaker; Research support

Mid-American Orthopaedic Association: Board or committee member Musculoskeletal Infection Society: Board or committee

member

OREF: Research support Orthofix, Inc.: Research support

Orthogenics: Research support PSI: Stock or stock Options Stryker: Research support Zimmer: Paid consultant; Research support

James I. Huddleston, MD

AAOS: Board or committee member

American Association of Hip and Knee Surgeons: Board or committee member American Knee Society: Research support Biomet: Paid consultant: Research support California Joint Replacement Registry: Paid consultant Corin U.S.A.: Paid consultant: Paid presenter or speaker; Research support Exactech, Inc: IP royalties; Paid consultant; Paid presenter or Hip Society: Board or

committee member

Journal of Arthroplasty:

Editorial or governing board Knee Society: Board or committee member Porosteon: Paid consultant; Stock or stock Options Robert Wood Johnson Foundation: Research support Wolters Kluwer Health -Lippincott Williams & Wilkins: Publishing royalties, financial or material support

Zimmer: Paid consultant: Paid presenter or speaker

Jason R. Hull, MD

American Association of Hip and Knee Surgeons: Board or committee member

Michael H. Huo, MD

American Association of Hip and Knee Surgeons: Board or committee member AO Foundation: Paid consultant B-One Orthopedics: Paid consultant DePuv. A Johnson & Johnson

Company: Paid consultant

Implantcast: Paid consultant

American Association of Hip

and Knee Surgeons: Board or

Richard Iorio, MD

committee member Bulletin of the Hospital for Joint Disease: Editorial or governing board Clinical Orthopaedics and Related Research: Editorial or governing board Covina: Stock or stock Options Force Therapeutics: Stock or stock Options Hip Society: Board or committee member JBJS Reviews: Editorial or governing board Johnson & Johnson: Paid consultant Journal of Arthroplasty: Editorial or governing board Journal of Bone and Joint Surgery - American: Editorial or governing board Journal of the American Academy of Orthopaedic Surgeons: Editorial or governing board Knee Society: Board or

committee member MedTel: Paid consultant: Stock or stock Options Medtronic: Paid consultant Muve Health: Paid consultant; Stock or stock Options Pacira: Paid consultant Recro Pharma: Paid consultant URX Mobile: Stock or stock

Options

Wellbe: Stock or stock Options Zimmer: Paid consultant

Joshua J. Jacobs, MD

American Board of Orthopaedic Surgery, Inc.: Board or committee member Hip Society: Board or committee member Hyalex: Stock or stock Options Journal of Bone and Joint Surgery - American: Editorial or governing board; Publishing royalties, financial or material support Medtronic Sofamor Danek: Research support

Nuvasive: Research support Orthopaedic Research and Education Foundation: Board or committee member

Zimmer: Research support

Rina Jain, MD, FRCSC

This individual reported nothing to disclose.

Derek R. Jenkins, MD

This individual reported nothing to disclose.

Jason M. Jennings, MD

DePuy, A Johnson & Johnson Company: Research support Total Joint Orthopedics: Paid consultant

Xenex: Paid presenter or speaker

Seth A. Jerabek, MD

Imagen Technologies: Stock or stock Options Stryker: IP royalties; Paid consultant: Paid presenter or speaker; Research support

David S. Jevsevar, MD, MBA

American Association of Hip and Knee Surgeons: Board or committee member Medacta: Paid consultant Medscape: Publishing royalties, financial or material support

Atul F. Kamath, MD

AAOS: Board or committee member American Association of Hip and Knee Surgeons: Board or committee member BMC Musculoskeletal Disorders: Editorial or governing board DePuy, A Johnson & Johnson Company: Paid consultant; Paid presenter or speaker; Research support Innomed: IP royalties Johnson & Johnson: Stock or stock Options Procter & Gamble: Stock or stock Options Zimmer: Paid consultant; Paid presenter or speaker; Research support; Stock or stock Options

Mark S. Karadsheh. MD

Orthobullets: Publishing royalties, financial or material support

James A. Keeney, MD

American Orthopaedic Association: Board or committee member DePuy, A Johnson & Johnson Company: Paid consultant Flexion Therapeutics: Paid consultant Journal of Hip Surgery: Editorial or governing board Mid-American Orthopaedic Association: Board or committee member Missouri State Orthopaedic Association: Board or committee member Orthopedics: Editorial or governing board

Stephen J. Kelly, MD

American Association of Hip and Knee Surgeons: Board or committee member

Beau J. Kildow, MD

This individual reported nothing to disclose.

Meghan Kirksey, MD, PhD

This individual reported nothing to disclose.

Brian A. Klatt, MD

AAOS: Board or committee member AAOSAAHKS Abstract Review Committee: Board or committee member American Association of Hip and Knee Surgeons: Board or committee member Clinical Orthopaedics and Related Research: Editorial or governing board Journal of Arthroplastv: Editorial or governing board Journal of the American Academy of Orthopaedic Surgeons: Editorial or governing board MSIS: Board or committee SLACK Incorporated: Publishing royalties, financial or material support

David J. Kolessar, MD

DePuy, A Johnson & Johnson Company: Research support

Erik W. Kroger, MD

This individual reported nothing to disclose.

Chad A. Krueger, MD

Journal of Bone and Joint Surgeons- Deputy Editor: Board or committee member

Young-Min Kwon, MD, PhD

Biomet: Research support Corentec: Research support DePuy, A Johnson & Johnson Company: Research support Smith & Nephew: Research support

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Claudette M. Lajam, MD

AAOS: Board or committee member Arthrex, Inc: Paid presenter or speaker

Clinical Orthopaedics and

Related Research: Editorial or governing board HJD Bulletin: Editorial or governing board Journal of Arthroplasty: Editorial or governing board NYSSOS: Board or committee member

Pfizer: Employee (spouse)

Jason E. Lang, MD

This individual reported nothing to disclose.

Maxwell K. Langfitt, MD

This individual reported nothing to disclose.

Charles M. Lawrie, MD

American Association of Hip and Knee Surgeons: Board or committee member Medtronic: Paid presenter or speaker MicroPort Orthopedics: Paid consultant Zimmer: Research support

Eric A. Levicoff, MD

This individual reported nothing to disclose.

Brett R. Levine, MD, MS

American Association of Hip and Knee Surgeons: Board or committee member Artelon: Research support Biomet: Research support CORD: Board or committee member

DJ Orthopaedics: Paid consultant

Exactech, Inc: Paid consultant Human kinetics: Editorial or governing board Link Orthopaedics: Paid consultant

Medacta: Paid consultant
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Zimmer: Research support

Jay R. Lieberman, MD

AAOS: Board or committee member DePuy, A Johnson & Johnson

Company: IP royalties; Paid consultant

Hip Innovation Technology: Stock or stock Options

Hip Society: Board or committee member Musculoskeletal Transplant Foundation: Board or committee member Recro, Inc: Other financial or material support Saunders/Mosby-Elsevier: Publishing royalties, financial or material support

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Adolph V. Lombardi, Jr., MD. FACS

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Jess H. Lonner, MD

American Association of Hip and Knee Surgeons: Board or committee member American Journal of Orthopedics: Editorial or governing board Biomet: IP royalties; Paid

presenter or speaker Force Therapeutics: Paid consultant; Research support; Stock or stock Options Muvr Labs: Paid consultant; Research support; Stock or stock Options Proteonova: Stock or stock Options Saunders/Mosby-Elsevier: Publishing royalties, financial or material support Smith & Nephew: IP rovalties: Paid consultant; Paid presenter or speaker; Research support Springer: Publishing royalties, financial or material support Wolters Kluwer Health -Lippincott Williams & Wilkins: Publishing royalties, financial or

Tad M. Mabry, MD

presenter or speaker

Zimmer Biomet: Paid

material support

Zimmer: IP royalties; Paid

This individual reported nothing to disclose.

consultant: Research support

William B. Macaulay, Jr., MD

American Association of Hip and Knee Surgeons: Board or committee member Clinical Orthopaedics and Related Research: Editorial or governing board Journal of Arthroplasty: Editorial or governing board ORamaVR: Unpaid consultant OrthAlign: Stock or stock Options

Theodore T. Manson, MD

AAOS: Board or committee member
American Association of Hip and Knee Surgeons: Board or committee member
Clinical Orthopaedics and Related Research: Editorial or governing board
DePuy, A Johnson & Johnson Company: Research support Globus Medical: Paid consultant
Journal of Arthroplasty:
Editorial or governing board

Journal of Orthopaedics and

Traumatology: Editorial or

governing board Stryker: Paid consultant Synthes: Research support

Joseph D. Maratt, MD

Alexion Pharmaceuticals:
Stock or stock Options
Biogen: Stock or stock Options
Dimension Therapeutics: Stock
or stock Options
Merck: Stock or stock Options
Sage Therapeutics: Stock or
stock Options
Sanofi-Aventis: Stock or stock
Options
Zimmer Biomet: Paid
consultant

John R. Martin, MD

This individual reported nothing to disclose.

J. Bohannon Mason, MD

American Association of Hip and Knee Surgeons: Board or committee member DePuy, A Johnson & Johnson Company: IP royalties; Other financial or material support; Paid consultant Journal of Arthroplasty: Publishing royalties, financial or material support

Vasilios Mathews, MD

DePuy, A Johnson & Johnson Company: Paid consultant; Research support

Benjamin A. McArthur, MD

DJ Orthopaedics: Paid consultant Journal of Arthroplasty: Editorial or governing board D. Clinton McNabb, MD, FAAOS Total Joint Orthopedics: Paid consultant

Simon C. Mears, MD, PhD

Delta Ortho LLC: Stock or stock Options Fragility Fracture Network: Board or committee member International Geriatric Fracture Society: Board or committee member Journal of the American Geriatrics Society: Editorial or governing board

SAGE: Editorial or governing

board

R. Michael Meneghini, MD

DJ Orthopaedics: IP royalties; Paid consultant; Research support

Emovi: Stock or stock Options International Congress for Joint Reconstruction: Board or committee member Journal of Arthroplasty: Editorial or governing board KCI: Paid consultant Kinamed: Paid consultant Kinee Society: Board or committee member MuveHealth: Stock or stock Options Olio Health: Stock or stock Options

Orthopedics Today: Editorial or governing board

Osteoremedies: IP royalties; Paid consultant

Robert M. Molloy, MD

American Association of Hip and Knee Surgeons: Board or committee member Stryker: Paid consultant; Paid presenter or speaker; Research support

Zimmer: Research support

Michael A. Mont. MD

AAOS: Board or committee member

American Association of Hip and Knee Surgeons: Board or committee member Cvmedica: Paid consultant DJ Orthopaedics: Paid consultant; Research support Flexion Therapeutics: Paid

consultant Johnson & Johnson: Paid

consultant: Research support Journal of Arthroplasty: Editorial or governing board Journal of Knee Surgery: Editorial or governing board Knee Society: Board or committee member Medicus Works LLC: Publishing royalties, financial or

material support Microport: IP royalties National Institutes of Health (NIAMS & NICHD): Research support

Ongoing Care Solutions: Paid consultant; Research support Orthopedics: Editorial or governing board

Orthosensor: Paid consultant: Research support Pacira: Paid consultant

Peerwell: Paid consultant: Stock or stock Options Performance Dynamics: Paid

consultant

Pfizer: Paid consultant Skye Biologics: Paid consultant Stryker: IP royalties; Paid consultant; Research support Surgical Techniques

International: Editorial or governing board

Tissue Gene: Paid consultant TissueGene: Research support Up-to Date: Publishing royalties, financial or material

support

USMI: Stock or stock Options Wolters Kluwer Health -Lippincott Williams & Wilkins: Publishing royalties, financial or material support

Vincent M. Moretti, MD

This individual reported nothing to disclose.

Michael J. Morris, MD

Joint Development Corporation: Stock or stock Ontions

KCI: Research support SPR Therapeutics: Research

SPR Therapeutics, LLC: Stock or stock Options

Total Joint Orthopedics: IP royalties; Paid consultant Zimmer Biomet: Paid consultant: Paid presenter or speaker; Research support

Wayne E. Moschetti, MD, MS

DePuy, A Johnson & Johnson Company: Paid consultant; Paid presenter or speaker; Research support Medacta: Other financial or material support New England Orthopaedic Society: Board or committee member

Omni Life Science: Other financial or material support

Joseph T. Moskal, MD. FACS

AAOS: Board or committee member

American Association of Hip and Knee Surgeons: Board or committee member

Corin U.S.A.: IP royalties; Paid consultant

DePuv. A Johnson & Johnson Company: IP royalties

Invuity: Stock or stock Options Stryker: Paid consultant; Paid presenter or speaker

Think Surgical: Stock or stock Options

United Orthopaedic Company: Paid consultant

Calin S. Moucha, MD

3M: Paid presenter or speaker Biocomposites: Paid presenter or speaker Smith & Nephew: Paid

Colin A. Mudrick, MD

consultant

DePuy, A Johnson & Johnson Company: Paid consultant

Thomas G. Mvers. MD

Journal of Arthroplasty:

Editorial or governing board

Cindy R. Nahhas, BS

This individual reported nothing to disclose.

Denis Nam, MD, MSc

KCI: Paid consultant; Research support

Stryker: Paid consultant Zimmer: Research support

Sumon Nandi, MD, FACS

AAOS: Board or committee member

American Association of Hip and Knee Surgeons: Board or committee member Journal of Arthroplasty: Editorial or governing board

Nader A. Nassif, MD

DePuy, A Johnson & Johnson Company: Paid presenter or speaker

Nathaniel J. Nelms, MD

AAOS: Board or committee member

Arthroplasty Today: Editorial or governing board Stryker: Research support

Charles L. Nelson, MD

American Orthopaedic Association: Board or committee member Exactech, Inc: Paid consultant Journal of Hip Surgery: Editorial or governing board Knee Society: Board or committee member Zimmer: Paid consultant

W. Trevor North, MD

PeerWell: Stock or stock Options

Ryan M. Nunley, MD

AAOS: Board or committee member American Association of Hip and Knee Surgeons, Board of Directors and Treasurer: Board or committee member

Biocomposites: Paid consultant

Biomet: Research support Cardinal Health: Paid consultant

DePuy, A Johnson & Johnson Company: Paid consultant;

Research support Halyard: Paid consultant Hip Society: Board or committee member Hyalex: Stock or stock Options Medical Compression System Inc: Paid consultant Medical Compression Systems, Inc.: Research support

Medtronic: Paid consultant Microport: IP royalties; Paid

consultant

Mid-America Orthopaedic Association, Program Committee Chair, 2018 Program Chair: Board or committee member Mirus: Paid consultant Missouri State Orthopaedic Association, Board Member and President: Board or committee member Smith & Nephew: Paid consultant: Research support Southern Orthopaedic Assoc. 2018 President: Board or committee member Stryker: Research support The Knee Society, Education Committee, 2018 Program

Douglas E. Padgett, MD

Chair: Board or committee

member

DJ Orthopaedics: IP royalties; Paid consultant; Paid presenter or speaker Journal of Arthroplasty: Editorial or governing board The Hip Society: Board or committee member

Hari K. Parvataneni, MD

AAOS: Board or committee American Association of Hip and Knee Surgeons: Board or committee member Arthroplasty Today: Editorial or

aovernina board Florida Orthopaedic Society:

Board or committee member

Javad Parvizi, MD, FRCS

3M: Paid consultant Alphaeon: Stock or stock

Options

Ceribell: Stock or stock

Options

Corentec: IP rovalties: Paid consultant: Stock or stock

Datatrace: Publishing royalties, financial or material support Eastern Orthopaedic Association: Board or committee member

Elsevier: Publishing royalties, financial or material support Ethicon: Paid consultant Heraeus: Paid consultant Hip Innovation Technology: Stock or stock Options Intellijoint: Stock or stock

Options

Jaypee Publishers: Publishing royalties, financial or material

support

Joint Purification Systems: Stock or stock Options Journal of Bone and Joint Surgery - American: Editorial or governing board

MDValuate: Stock or stock

Options

MicroGenDx: Stock or stock

Ontions

Muller Foundation: Board or committee member NCI: Paid consultant Parvizi Surgical Innovations: Stock or stock Options Physician Recommended Nutriceuticals: Stock or stock Options

PRN-Veterinary: Stock or stock

Options

SLACK Incorporated: Publishing royalties, financial or

material support Stryker: Paid consultant

Tenor: Paid consultant TissueGene: Paid consultant Wolters Kluwer Health -Lippincott Williams & Wilkins:

Publishing royalties, financial or material support

Zimmer: Paid consultant

Christopher E. Pelt. MD

AAOS: Board or committee member

Acelity, Inc.: Paid consultant;

Paid presenter or speaker American Association of Hip and Knee Surgeons: Board or committee member Joint Development, LLC: Stock or stock Options TJO (Total Joint Orthopedics): IP royalties; Paid consultant; Paid presenter or speaker Zimmer Biomet: Paid consultant; Paid presenter or speaker; Research support

Brett C. Perricelli, MD

AAHKS - Abstract Review Committee: Board or committee member Biomet: Paid consultant Journal of Arthroplasty: Editorial or governing board Pacira Pharmaceuticals Inc: Stock or stock Options Zimmer: Paid consultant Zimmer Biomet: Paid presenter or speaker

Kevin I. Perry. MD

This individual reported nothing to disclose.

Jeffrey R. Petrie, MD

DePuy, A Johnson & Johnson Company: Other financial or material support Medtronic: Paid consultant: Paid presenter or speaker

Kevin D. Plancher, MD, MPH

American Association of Hip and Knee Surgeons: Board or committee member American Orthopaedic Society for Sports Medicine: Board or committee member American Shoulder and Elbow Surgeons: Board or committee member Arthroscopy Association of North America: Board or committee member Arthroscopy: The Journal of Arthroscopic & Related

Surgery: Editorial or governing board Clinical Orthopaedics and Related Research: Editorial or governing board Eastern Orthopaedic Association: Board or

committee member

Medical Society of the State of New York: Board or committee member

NY County Medical Society: Board or committee member Operative Techniques in Sports Medicine: Editorial or governing

Orthopaedic Research and Education Foundation: Board or committee member Techniques in Orthopaedics: Editorial or governing board

Gregory G. Polkowski II, MD. MSc

American Association of Hip and Knee Surgeons: Board or committee member Bone Support: Paid consultant DJ Orthopaedics: IP royalties; Paid consultant

Mihail Radulescu, MD

This individual reported nothing to disclose.

Adam J. Rana. MD

Smith & Nephew: Paid consultant

Harold W. Rees, MD AAOS: Board or committee

member American Association of Hip and Knee Surgeons: Board or committee member Heliyon: Editorial or governing board Journal of Arthroplasty: Editorial or governing board Orthopedics: Editorial or governing board PLOS one: Editorial or governing board

Benjamin F. Ricciardi, MD

Arthroplasty Today: Editorial or governing board Clinical Orthopaedics and Related Research: Editorial or governing board

Andrew B. Richardson, MD Total Joint Orthopedics: Paid consultant

Timothy Roberts, MBChB

This individual reported nothing to disclose.

David Rodriguez, MD

This individual reported nothing to disclose.

Robert P. Runner, MD

This individual reported nothing to disclose.

Alexander P. Sah, MD

Convatec: Paid presenter or

speaker

Mallinckrodt: Paid presenter or

speaker

NextStep: IP royalties Pacira: Paid presenter or speaker

Zimmer: Research support

Adam A. Sassoon, MD, MS

American Association of Hip and Knee Surgeons: Board or committee member Biocomposites Inc.: Paid consultant Orthalign: Paid consultant Smith & Nephew: Paid consultant

Nicholas Sauder, BA

This individual reported nothing to disclose.

Arjun Saxena, MD

American Association of Hip and Knee Surgeons: Board or committee member American Board of Orthopaedic Surgery, Inc.: Board or committee member DePuy, A Johnson & Johnson Company: Paid presenter or speaker Eastern Orthopaedic Association: Board or committee member Halyard: Research support Journal of Arthroplasty: Editorial or governing board Journal of Bone and Joint Surgery - American: Editorial or governing board Journal of Surgical Orthopaedic Advances: Editorial or governing board Journal of the American Academy of Orthopaedic Surgeons: Editorial or governing board United Orthopaedics: Research support

H. Del Schutte. Jr.. MD. FAAOS

Exactech, Inc: Paid consultant Medtronic: Paid presenter or speaker

South Carolina Orthopedic Society: Board or committee

member

Adam J. Schwartz. MD

Arthroplasty Today: Editorial or governing board

Andrew M. Schwartz, MD

This individual reported nothing to disclose.

Benjamin J. Schwartz, MD

Journal of Arthroplasty: Editorial or governing board Medacta: Paid consultant

Ran Schwarzkopf, MD, MSc

AAOS: Board or committee member

American Association of Hip and Knee Surgeons: Board or committee member

Arthroplasty Today: Editorial or governing board

Gauss surgical: Stock or stock Options

Intelijoint: Paid consultant; Stock or stock Options Journal of Arthroplasty: Editorial or governing board Smith & Nephew: Paid consultant; Research support Travis S. Scudday, MD Exactech, Inc: Research support

Peter K. Sculco, MD

EOS Imaging: Paid consultant Intellijoint: Research support Lima Corporate: Paid consultant

Christopher E. Selgrath, DO

Hip Innovation Technology: Stock or stock Options

Robert A. Sershon, MD

2ndMD: Paid consultant

Thorsten M. Seyler, MD. PhD

Advances in Orthopedics: Editorial or governing board American Association of Hip and Knee Surgeons: Board or committee member

Biomet: Research support Heraeus: Paid consultant KCI: Research support MedBlue Incubator Inc: Research support

Reflexion Health Inc.: Research

Smith & Nephew: Paid

consultant

Total Joint Orthopedics, Inc: IP rovalties

Total Joint Orthopedics, Inc.: Paid consultant

Roshan P. Shah. MD

Link Orthopaedics: Paid consultant U.S. Food and Drug Administration: Board or committee member

Vivek M. Shah. MD

Biomet: Paid presenter or speaker

DePuy, A Johnson & Johnson Company: Paid presenter or speaker

Medtronic: Paid consultant

Cambize Shahrdar, Jr., MD

This individual reported nothing to disclose.

Joshua A. Shapiro, MD

Renal Physicians Association: Board or committee member

Rafael J. Sierra, MD

American Association of Hip and Knee Surgeons: Board or committee member Anchor study group: Board or committee member Biomet: Paid consultant; Paid presenter or speaker Cytori: Research support DePuy, A Johnson & Johnson Company: Research support Journal of Arthroplasty: Editorial or governing board Knee Society: Board or committee member Link Orthopaedics: IP royalties; Paid consultant Midamerica orthopedic society: Board or committee member Muller Foundation: Board or committee member Orthoalign: Paid consultant; Stock or stock Options

Springer: Publishing royalties,

financial or material support Stryker, Biomet: Research support

Zimmer: IP royalties; Research

support

Sean E. Slaven, MD

This individual reported nothing to disclose.

James D. Slover, MD

AJRR Hip Society Steering Comm Member: Board or committee member American Association of Hip and Knee Surgeons: Board or committee member Biomet: Research support Hip Society: Board or committee member Knee Society: Board or committee member Pacira: Paid presenter or speaker

PCORI Advisor Board Shared Decsion Making: Board or committee member Smith & Nephew: Research support

Nipun Sodhi, MD

This individual reported nothing to disclose.

Wayne M. Sotile, PhD

This individual reported nothing to disclose.

Mark J. Spangehl, MD

American Association of Hip and Knee Surgeons: Board or committee member Arthroplasty Today: Editorial or governing board BodyCad: Paid consultant DePuy, A Johnson & Johnson Company: Research support Journal of Arthroplasty: Editorial or governing board Sonoran Biosciences: Stock or stock Options Stryker: Research support Zimmer: Paid consultant

Jonathon M. Spanyer, MD

DePuy, A Johnson & Johnson Company: Paid presenter or speaker Medacta International: Paid consultant

Smith & Nephew: Paid

presenter or speaker

Scott M. Sporer, MD, MS

American Joint Replacement Registy: Board or committee

member

DJO Surgical: IP royalties; Paid

consultant

Hip Society: Board or committee member Knee Society: Board or committee member

Myoscience: Paid consultant; Stock or stock Options Osteoremedies: IP royalties;

Paid consultant SLACK Incorporated:

Publishing royalties, financial or

material support

Stryker: Research support Zimmer: IP royalties; Research

support

Bryan D. Springer, MD

AJRR: Board or committee member American Association of

Hip and Knee Surgeons: Board or committee member Arthroplasty Today: Editorial or

governing board

Ceramtec: Paid presenter or speaker

Convatec: Paid consultant ICJR: Board or committee member

Joint purifications systems.: Other financial or material

support Journal of Arthroplasty: Editorial or governing board Knee Society: Board or committee member osteoremedies: Paid consultant

Strvker: IP rovalties: Paid consultant

Jeffrey B. Stambough, MD

American Association of Hip and Knee Surgeons: Board or committee member

Garen D. Steele, MD

American Association of Hip and Knee Surgeons: Board or committee member OrthoCor: Paid consultant Zimmer: Paid consultant

Benjamin M. Stronach. MD. MS

AAOS: Board or committee member

American Association of Hip and Knee Surgeons: Board or committee member

DePuy, A Johnson & Johnson Company: Paid consultant; Research support

DJ Orthopaedics: Paid consultant

Joint Development LLC: Stock or stock Options KCI: Paid consultant

Medical Device Business Services, Inc.: Paid consultant Mississippi Orthopaedic Society: Board or committee

member

Sawbones/Pacific Research Laboratories: IP rovalties Smith & Nephew: Paid consultant

Tightline Development LLC: IP rovalties

Louis S. Stryker, MD

AAOS: Board or committee member American Association of Hip and Knee Surgeons: Board or committee member Journal of Arthroplasty: Editorial or governing board

Juan C. Suarez, MD

Arthoplasty Today: Editorial or governing board Corin U.S.A.: IP royalties DePuy, A Johnson & Johnson Company: Paid presenter or speaker

T. David Tarity, MD

This individual reported nothing to disclose.

Michael J. Taunton, MD

AAOS: Board or committee member American Association of Hip

and Knee Surgeons: Board or committee member DePuy, A Johnson & Johnson Company: Research support DJ Orthopaedics: IP royalties;

Editorial or governing board Mid America Orthopedic

Paid consultant Journal of Arthroplasty: Association: Board or committee member Strvker: Research support

Matthew W. Tetreault, MD

This individual reported nothing to disclose.

Krishna R. Tripuraneni, MD

Arthroplasty Today: Editorial or governing board DJO Surgical: Research support Graftworx: Stock or stock Options Journal of Arthroplasty: Editorial or governing board Orthopaedic Implant Company: Stock or stock Options

Creighton C. Tubb. MD

Zimmer: Research support

AAOS: Board or committee member American Association of Hip and Knee Surgeons: Board or committee member Journal of Arthroplasty: Editorial or governing board

Stryker: Other financial or material support

Kimberly K. Tucker, MD

This individual reported nothing to disclose.

Kenneth L. Urish, MD, PhD

AAOS: Board or committee member

ASTM: Board or committee member

BodyCad: Research support Smith & Nephew: Paid consultant

Hamed Vahedi, MD

This individual reported nothing to disclose.

Jonathan M. Vigdorchik, MD

Corin U.S.A.: Paid consultant Intellijoint Surgical: Paid consultant; Stock or stock Options Zimmer: Paid consultant

Frank R. Voss. MD

AAOS Coding, Coverage and Reimbursement Committee: Board or committee member American Association of Hip and Knee Surgeons: Board or committee member american medical association. CPT committee member: Board or committee member

Joseph P. Ward, MD

This individual reported nothing to disclose.

Lucian C. Warth, MD

American Association of Hip and Knee Surgeons: Board or committee member Link Orthopaedics: Paid consultant OsteoRemedies: Paid consultant

Stryker: Paid consultant

Jonathan E. Webb, MD

This individual reported nothing to disclose

Samuel S. Wellman, MD

American Association of Hip and Knee Surgeons: Board or committee member Biomet: Research support DePuy, A Johnson & Johnson Company: Research support Joint Development, LLC: Stock or stock Options Journal of Arthroplasty: Editorial or governing board Stryker: Paid consultant; Research support Total Joint Orthopaedics: Paid consultant Total Joint Orthopedics: IP

Sigita Wolfe, MA

royalties

This individual reported nothing to disclose.

Zimmer: Research support

Cody C. Wyles, MD

This individual reported nothing to disclose.

Adolph J. Yates Jr., MD, **FAOA**

AAOS: Board or committee member American Association of Hip and Knee Surgeons: Board or committee member American Society of Hematologists: Board or committee member Journal of Arthroplasty:

Editorial or governing board Journal of Bone and Joint Surgery - American: Editorial or governing board Orthoworld: Paid presenter or speaker Zimmer: Paid presenter or

Michael Yayac, MD

speaker

This individual reported nothing to disclose.

Simon W. Young, MBChB, FRACS. MD

American Association of Hip and Knee Surgeons: Board or committee member

Arthrex. Inc: Paid presenter or speaker

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

Surgical Solutions: Stock or

stock Options

Vidacare: Research support

Khalid M. Yousuf, MD

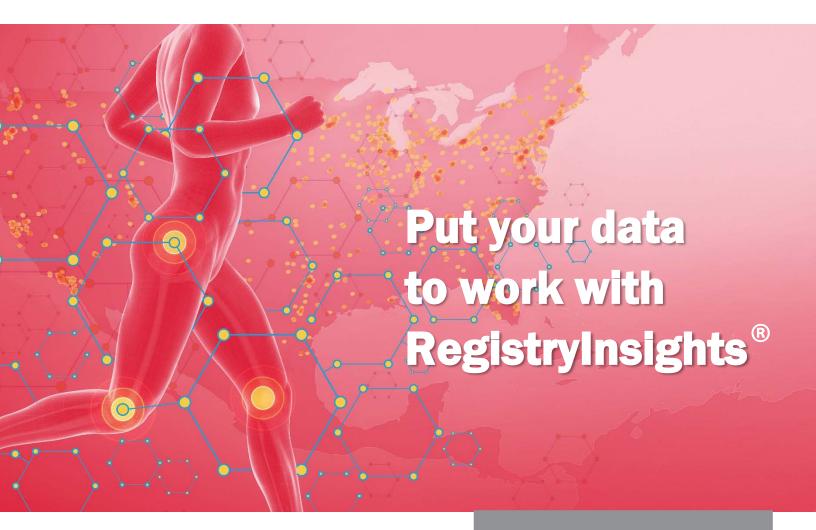
AAOS: Board or committee member American Association of Hip and Knee Surgeons: Board or committee member OrthAlign, LLC: Paid consultant

Mark W. Zawadsky, MD

American Association of Hip and Knee Surgeons: Board or committee member







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Future AAHKS Meetings

2020 AAHKS SPRING MEETING

April 30 - May 2 | CHICAGO

2020 AAHKS ANNUAL MEETING

November 5 - 8 | DALLAS



2021 AAHKS ANNUAL MEETING

November 11 - 14 | DALLAS

FUTURE AAHKS / THE HIP SOCIETY / THE KNEE SOCIETY SPECIALTY DAYS

March 28, 2020 | ORLANDO March 13, 2021 | SAN DIEGO



9400 W. Higgins Rd., Suite 230 Rosemont, IL 60018-4976 847-698-1200 www.AAHKS.org