FINAL PROGRAM

November 11-14, 2021 NOVEMBER 11-14, 2021 PEER REVIEWED. PEERLESS INSIGHTS.

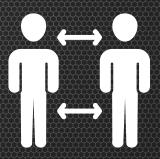




Wear a face mask



Wash hands often with soap and water



Stay at least 1 meter away from others

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AAHKS has developed a Health and Safety Plan for the duration of the meeting. Under the advisement of our health and safety partners, we have a set of protocols that cover:

- Meeting space considerations
- Health considerations
- Registration

- Table and seating set up
- Meal functions
- Staff guidelines
- Post-event follow up

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Education

EDUCATIONAL ACTIVITY SCOPE

The 2021 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 health care 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.

AAHKS designates this live activity for a maximum of 18 AMA PRA Category 1 Credits[™]. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

CLAIM CME CREDITS

Once the meeting concludes, AAHKS will send an **email** and an app notification with a link to the Annual Meeting evaluation. At the end of the evaluation, you will be redirected 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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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.

Educational Grants

AAHKS wishes to thank

DePuy Synthes DJO Global Heraeus Smith & Nephew Stryker Zimmer Biomet

for their generous educational grants and in-kind donations 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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- Medical/Orthopaedic publications editorial/governing board
- Board member/committee appointments for a society

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.



Presenting the 2021 Lawrence D. Dorr, MD, Humanitarian Award to John W. Barrington, MD



AAHKS is proud to present the 2021 Lawrence D. Dorr, MD, Humanitarian Award to John W. Barrington, MD. Dr. Barrington is a co-director of the Joint Replacement Center at Baylor Scott & White Frisco and a practicing orthopaedic surgeon with Plano Orthopedic & Sports Medicine Center in Plano, Texas. The award recognizes his leadership in medical mission trips to rural areas in Latin America, bringing access to orthopaedic care and supporting childhood education in underserved regions of the world.

"John has done hundreds of total hip arthroplasties in the Dominican Republic and helped build an elementary school in the neighborhood that has over 500 students. From teaching orthopaedic residents in the Dominican to teaching the first graders about going to medical school, he has unparalleled compassion to the humanitarian efforts there on the island," says Paul Charpentier, MD, who trained on medical missions with Dr. Barrington.

To expand upon the impact of these medical missions, Dr. Barrington founded MOVE (Ministry of Orthopaedic Volunteers and Education) Missions, a nonprofit that provides ongoing support to meet the medical and educational needs of underserved populations in the Dominican Republic. He trains both the American and Dominican medical students and residents to ensure enduring access to care once the mission is complete.

"John devotes his time, talent, and energy to improving the quality of life of people who are in dire need of medical and educational aid. He does all of this with a warm smile, a generous heart, and an unparalleled devotion," says former mission participant Colin T. Penrose, MD, Duke University School of Medicine Orthopaedic Surgery Department.

Dr. Barrington graduated from the University of California Davis Medical School in 2000 and completed his residency at the University of North Carolina and a joint fellowship at Harvard-Massachusetts General Hospital in 2006.

The 2021 Lawrence D. Dorr, MD, 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 2022 Lawrence D. Dorr, MD, Humanitarian Award are now being accepted through April 15, 2022 at **www.AAHKS.org/Humanitarian.**

Symposium I

Optimizing the Outpatient Hip and Knee Arthroplasty Pathway: From Practical Protocols to Optimal Outcomes

Moderator: Michael P. Ast, MD

Faculty: Craig J. Della Valle, MD, William A. Jiranek, MD, Raymond H. Kim, MD

This symposium will educate arthroplasty surgeons on the fundamentals of starting and growing an outpatient joints program. With the elimination of the inpatient only list and the payer pressure to decrease length of stay after joint replacement, all arthroplasty surgeons will at least need to be considering the essentials of this transition. The faculty will cover topics ranging from the data to support outpatient joint replacement, building safe and scalable protocols, making the transition to outpatient surgery at the hospital and the pertinent legal and business principles that surgeons should consider when making the transition to outpatient arthroplasty. This will allow the faculty to cover most of the important topics for the attendees regardless of their practice model or location.

Learning Objectives:

- **1.** To understand the data supporting outpatient hip and knee arthroplasty.
- 2. To understand strategic partnerships with your hospital and ASCs, including the business and legal issues related to ASCs that may impact implementation and execution.
- 3. To understand the critical teamwork and coordination anesthesia, medical and surgical teams to execute protocols that enable top level patient satisfaction and outcomes in outpatient TJA.

Outline:

Introduction

Michael P. Ast, MD

Data Supporting Outpatient TJA

Craig J. Della Valle, MD

Outpatient TJA at the Hospital: How and Why

William A. Jiranek, MD

Optimized Protocols Are Critical to Success: Anesthesia, Patient Selection and Surgical Considerations

Raymond H. Kim, MD

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Is a Same-Day Discharge Arthroplasty Program Necessary? A Propensity-Matched Cohort Study

Vivek Singh, MD, MPH, John Realyvasquez, MD, MPH, Trevor Simcox, MD, Claudette M. Lajam, MD, Ran Schwarzkopf, MD, MSc, **Roy I. Davidovitch, MD**

Notes

Introduction: Same-day discharge (SDD) total joint arthroplasty (TJA) programs often have stringent selection criteria. However, some patients who are deemed ineligible may nonetheless be SDD. This study compares outcomes between patients enrolled in our SDD TJA program who were successfully SDD to those who did not participate in the program but were also SDD.

Methods: We retrospectively reviewed all patients who were SDD following TJA from 2015-2020. Patients were stratified into two cohorts based on whether they were formally enrolled in our institution's SDD TJA program. Propensity-score matching was performed to limit the effect of confounding. Independent sample t-tests or Pearson's chi-squared tests were used to compare outcomes of interest between the matched groups.

Results: Of the 1,778 patients included, 1,384 (78%) completed the SDD TJA program and 394 (22%) were SDD but did not participate in the SDD TJA program. Cohorts were 1:1 propensity-score matched, representing a total of 550 patients for the matched comparison. Surgical time was significantly longer for patients who did not participate in the SDD TJA program compared to those who participated in the program (109.39 vs. 87.29 minutes; p<0.001). Discharge disposition (p=0.999), 90-day all-cause readmissions (p=0.999), 90-day all-cause revisions (p=0.563), as well as HOOS, JR and KOOS, JR scores at all time-points did not significantly differ between the two cohorts.

Conclusion: Our results suggest that enrollment in a formal SDD TJA program may not be a necessary precursor to achieving similar outcomes following TJA for patients that are SDD without formally enrolling in the program. Therefore, the presence of well-established, evidence-based protocols at an institution that has strong success and experience with value-based care, a formal program may no longer be needed. Future studies should aim to evaluate the utility of similar formal SDD programs as it pertains to patient outcomes.

Unicompartmental Arthroplasty: Efficacy and Safety of Same-Day Discharge in the Elderly Population

Matthew Sloan, MD, MS, Cameron Egan, MD, Neil P. Sheth, MD, Vivek M. Shah, MD

Introduction: Unicompartmental knee arthroplasty (UKA) has demonstrated efficacy and patient satisfaction, thus increasing in use over recent decades. We sought to determine whether older patients undergoing UKA were at increased risk of postoperative complications compared with younger patients, and if they were less likely to be discharged on the same day of surgery or within 24 hours.

Methods: The ACS-NSQIP database was queried from 2008-2018 and identified 12,259 patients undergoing UKA by CPT code (27446). Patients were grouped by Medicare-eligible status into under-65 and 65-and-older. Patient demographics, complications, and postoperative outcomes were compared by chi-square or Fisher's exact test for categorical variables, and Student's t-test for continuous variables. Multivariate logistic regression was used to compare patients by group and a sub-analysis by decade of age was performed to compare under-50 with older age decades.

Results: The older age group had a significantly higher percentage of same day discharge (SDD) following UKA (19.2 vs. 17.0%, OR 1.45, 95% CI 1.26-1.66, p<0.001). The older group exhibited a shorter operative time (84.5 vs. 90.1 min, p<0.001). The 30-day reoperation rate was lower among the older group (OR 0.39, 95% CI 0.23-0.66, p<0.001), as was any wound complication (OR 0.40, 95% CI 0.22-0.74, p=0.003). When assessing by age decade, the oldest age group (80-and-older), had a significantly lower rate of under-24-hour discharge (OR = 0.74, 95% CI 0.55-1.00, p=0.048), but otherwise did not differ from the index under-50 group.

Conclusion: This study demonstrates the safety of UKA in all age groups and confirms that older age is not a contraindication for UKA or SDD. In fact, the older age groups had lower rates of complication and higher rates of SDD and under-24-hour discharge, as well as shorter operative times than the younger groups.

Preoperative Patient Reported Outcome Reporting May Be Unreliable Among Multiple Settings

Notes

Daniel C. Sun, MD, Carl T. Talmo, MD, Joseph H. Dannenbaum, MD, Ruijia Niu, MPH

Introduction: Patient-reported outcome measures (PROMs) and their minimal clinically important differences (MCID) are becoming significant factors in judging value after total joint arthroplasty. Differences in patient reporting of identical PROMs between multiple preoperative settings have not been previously investigated.

Methods: The VAS, HOOS JR, and KOOS JR surveys were measured in 96 primary total knee arthroplasty (TKA) and 53 primary total hip arthroplasty (THA) patients. Patients were surveyed at the surgeon's office followed by the hospital preoperative screening area. Responses were compared utilizing paired t-test and Pearson correlation coefficients. Variations in scores were compared to MCIDs to determine the proportion of patients reporting differences greater than MCID between settings. Patient demographics were compared to PROM response changes using one-way ANOVA and Pearson chi-square test.

Results: Mean time between assessments was 82.27+72.06 days. THA and TKA patients reported a mean 0.62 higher VAS score in the surgeon's office compared to the hospital (p<0.01), and 29 (19.5%) of these patients' scores differed by a magnitude equal to or greater than MCID. Lower mean HOOS JR (-0.89+11.80 points) and KOOS JR (-1.24+10.34 points) scores were reported to the physician compared to the prescreening staff, although these differences did not reach statistical significance (HOOS JR, p=0.58; KOOS JR, p=0.24). Twelve (22.6%) THA patients reported higher HOOS JR scores of a magnitude equal to or greater than MCID between settings. Twenty (20.8%) TKA patients reported higher KOOS JR scores of a magnitude equal to or greater than MCID between settings. HOOS JR and KOOS JR surveys showed good correlation for 2 and 2 questions, respectively, with the remaining questions showing moderate correlation.

Conclusion: PROM scores may vary significantly between preoperative settings. Understanding this variability is an important consideration when including PROMs in value-based assessments and future health care policy.

The Impact of Surgeon Variability on Patient-Reported Outcomes in Total Hip Arthroplasty

Notes

SaTia T. Sinclair, DO, Alison K. Klika, MS, Robert M. Molloy, MD, Viktor E. Krebs, MD, Wael K. Barsoum, MD, Nicolas S. Piuzzi, MD, **Carlos A. Higuera, MD**

Introduction: In the setting of total hip arthroplasty (THA), studies have implicated patient-related factors as drivers of outcomes. While some studies have focused on surgeon/surgery-level factors (i.e., approach, volume, training), the impact of inter-surgeon variability is poorly understood. The purpose of this study was to assess: 1) effect of surgeon on 1-year patient-reported outcomes (PROMs) following THA; and 2) variability in 1-year PROMs among surgeons.

Methods: A prospective cohort of 3,695 patients who underwent THA for osteoarthritis between 2016 and 2018 was included. Baseline PROMs completion was 97.3%, and 78% of patients completed 1-year follow-up. Thirty-one surgeons from a large health care system were included. Likelihood ratio tests analyzed the relationship between surgeon and 1-year Hip Disability and Osteoarthritis Outcome Score (HOOS) pain subscale, HOOS-Physical Function Shortform (PS), HOOS for Joint Replacement (JR), University of California-Los Angeles (UCLA) activity score, Patient Acceptable Symptom State (PASS), length of stay (LOS), discharge disposition, and 90-day readmission. Proportional odds models were used to determine variable importance by Akaike Information Criterion (AIC) increase.

Results: 90.5% of patients reported positively to PASS at 1-year. There was a significant association between surgeon and 1-year HOOS pain, PS, JR, UCLA activity score, LOS, discharge disposition (p<0.001), and readmission (p=0.001). For HOOS pain, PS, and JR, the surgeon variable (AIC-increase: 39.5, 23.1, 21.8, respectively) was a better predictor of 1-year outcome than patient-level factors (e.g., age, sex, BMI, comorbidity index). Differences in the highest and lowest median probability of achieving any given score on the HOOS pain, PS, JR, and UCLA activity score were 16.1%, 16.8%, 19.8%, and 12.2%, respectively. Surgeon-level variability was not explained by approach (p=0.413).

Conclusion: Surgeon-level variability is measurable and appears to be a greater driver of 1-year PROMs than some patient-level characteristics. Incorporating surgeon variability into predictive modeling is important for accurate risk assessment.

Predictors of Success with Chronic Antibiotic Suppression for Prosthetic Joint Infections

Notes

Nicholas M. Brown, MD, Rebecca G. Burr, MD, Carlo Eikani, MD

Introduction: Management of recurrent prosthetic joint infection (PJI) after attempted surgical eradication remains a challenge. Chronic antibiotic suppression (CAS) is regarded as a reasonable treatment option for some patients with persistent infection or multiple co-morbidities. The purpose of this study is to compare cohorts who succeed and fail with CAS in order to guide management of future patients.

Methods: This retrospective cohort study assesses patients who were treated with CAS for PJI at a single institution between 2007 and 2020. Cases were identified from the Electronic Medical Record by search for relevant CPT code and key term followed by manual review. Patients were included if they had a culture-proven PJI and received antibiotics with intent for chronic suppression. Failure of suppression was defined as requiring reoperation after initiating CAS. A cox-proportional hazards multivariate regression model was used to identify factors predictive of success with suppression.

Results: We identified 48 PJIs (33 knees, 15 hips) managed with CAS. The median follow-up was 50 months (range 1.5-154.5). Controlling for BMI and gram status of the infecting organism, THA patients were less likely than TKA patients to require reoperation during the follow-up period (HR=0.18, 95% CI: 0.01–0.96; p=0.04). Controlling for all other variables, infections with a gram-positive organism were less likely than those with a gram-negative organism to require reoperation (HR=0.22, 95% CI: 0.05–0.88; p=0.03). It took 61.3 months for the probability of success to drop below 50% for knees. Conversely, probability never dropped below 90% for hips. It took 28.5 months for the probability to drop below 50% for gram-negative PJIs vs. 116.6 months to drop below 50% for gram-positive PJIs.

Conclusion: Chronic suppression is a reasonable strategy in patients who lack further surgical treatment options. Most hips and gram-positive infections were successfully treated with CAS in this cohort.

What Dose of Preoperative Opioids Affects Outcomes After Total Hip Arthroplasty?

E. Bailey Terhune, MD, Charles P. Hannon, MD, MBA, Robert A. Burnett, MD, Craig J. Della Valle, MD

Notes

Introduction: The purpose of this study was to identify the preoperative daily opioid dose associated with increased complications after total hip arthroplasty (THA).

Methods: Patients in the Humana claims database undergoing primary THA (2007-2018) with an opioid prescription within three months prior to surgery were stratified based on daily opioid dose: Tier 1) <5 milligram morphine equivalents (MME), Tier 2) 5-10 MME, Tier 3) 10-25 MME, Tier 4) 25-50 MME, Tier 5) >50 MME. Each tier was matched 1:1 to opioid naïve patients by age, comorbidities, gender, and smoking status. Emergency department (ED) visits were compared at 90-days. Surgical complications were compared at 2-years.

Results: 67,719 patients using preoperative opioids were identified and matched. 17.0% of patients using preoperative opioids visited the ED within 90 days of THA, compared to 13.3% of opioid naïve patients (p<0.001). 9.5% of patients using preoperative opioids were readmitted in the 90-day postoperative period, compared to 7.4% of opioid naïve patients (RR 1.30 [1.25-1.35] p<0.001). When stratified by tier, opioid users in all tiers had higher risk of ED visit and readmission compared to opioid naïve patients, and rates increased in a dose-dependent manner. Rates of superficial infection, periprosthetic joint infection (PJI), and dislocation were increased in patients taking preoperative opioids in Tiers 2 through 5 at all postoperative timepoints. Patients in Tier 3 through 5 had an increased risk of revision surgery.

Conclusion: Preoperative opioid use is associated with a dose-dependent increase in complications after THA. Less than one 5mg hydrocodone tablet daily leads to a significant increase in ED visits, while higher doses are associated with PJI, dislocation, periprosthetic fracture, and revision surgery. Continued efforts to educate physicians and patients regarding the harmful effects of opioids for the non-operative treatment of osteoarthritis are still needed.

Preoperative PROMIS-29 Fatigue Score Predicts Postoperative Opioid Use After Primary TKA and THA

Notes

Ethan C. Krell, MS, Yu-Fen Chiu, MS, Nicolas Sapountzis, BS, **Eytan M. Debbi, MD, PhD**, Amethia D. Joseph, MHA, Stephen Lyman, PhD, Lisa A. Mandl, MD, MPH, Alejandro Gonzalez Della Valle, MD

Introduction: Understanding preoperative patient social and psychological factors associated with opioid consumption after total knee (TKA) and hip arthroplasty (THA) may allow for individualized postoperative pain management. Pain catastrophizing, anxiety, and depression have long been associated with poor pain control and satisfaction after arthroplasty. Therefore, we endeavored to evaluate the effect of patients' preoperative demographics, as well as social, psychological, and innate pain sensitivity, on their postoperative opioid use after TKA and THA.

Methods: This single-institution prospective observational cohort study enrolled 243 opioid-naïve osteoarthritic patients who underwent elective primary TKA or THA. Preoperative demographics, PROMIS-29 (Physical Function/Anxiety/Depression/Fatigue/Sleep Disturbance/Social Activities/Pain Interference/Pain Intensity), Pain Catastrophizing Scale (PCS), and in-hospital measurements were recorded. A weekly survey was administered for three months postoperatively to determine morphine-milligramequivalent (MME) opioid consumption and time until opioid cessation. Multivariable regression models adjusting for age, sex, BMI, race, and mode of fixation were used to determine the association between refilled MMEs, total MMEs, opioid time till cessation, and PROMIS-29 domains.

Results: In the first 12 postoperative weeks, median MME consumption was 203 (IQR:78-461) for TKA and 35 (IQR:0-98) for THA patients. Median time to cessation was 3 (IQR:1-7) weeks for TKA and 1 (IQR:1-2) week for THA patients. Multivariable regression showed that, on average, each minimal possible increase in the preoperative PROMIS-29 Fatigue T-Score was associated with 12 additional total MMEs consumed during the first 12 postoperative weeks (p=0.015) and 18 hours later time to cessation (p=0.003). The other PROMIS-29 domains and the PCS were not significantly associated with narcotic use.

Conclusion: In this prospective cohort, only the fatigue domain of PROMIS-29 was significantly associated with postoperative MME consumption in opioid naïve arthroplasty patients. This novel finding suggests that evaluating preoperative patient fatigue is an overlooked but crucial patient-reported outcome, which should inform TKA and THA postoperative pain-management pathways.

Neocortex Formation in a Tapered Wedge Stem Is Not Indicative of Complications or Worse Outcomes

Patrick J. Kellam, MD, Dustin Randall, BS, Jeffrey J. Frandsen, MD, Brenna E. Blackburn, PhD, Christopher L. Peters, MD, **Christopher E. Pelt, MD**

Notes

Introduction: The formation of sclerotic bone, or neocortex, distally surrounding total hip arthroplasty (THA) stems may be seen around proximally porous-coated stems but can be confused with loosening. The goal of this study was to determine the prevalence of neocortex finding and whether it associated with worse outcomes after THA.

Methods: A retrospective review of two surgeons' experiences with a single tapered wedge stem was performed over 10 years, including 825 patients. Radiographs at 1-year as well as final follow-up were reviewed for evidence of sclerotic bone (neocortex) surrounding the stem in all 14 Gruen zones. Final attending radiology read of "lucency" was also recorded. Patients were grouped by presence of neocortex. PROMIS Physical Function scores and complications were compared using adjusted regression analysis.

Results: The neocortex group had 558 (68%) patients compared to 267 (32%) in the no neocortex group. The most common Gruen zones for evidence of neocortex were 10 (56%), 11 (52%), and 12 (52%). Six percent of patients had a finding of "lucency" on radiology read. No other zones had changes between follow-ups. There was no difference between groups in terms of dislocations (3.8% vs. 3.4%; p=0.78), infection (3.9% vs. 6.7%; p=0.08), and revision surgery (7.4% vs. 9.0%; p=0.41). There was a lower fracture rate in the neocortex group (0.5% vs. 4.1%; p=0.0005). PROMIS PF scores were significantly higher in the neocortex group (44.8 vs. 42.1; p<0.0001).

Conclusion: The presence of a distal neocortex is a common finding on follow-up radiographs after THA with this proximally porous-coated tapered wedge stem and does not indicate worse outcomes or increased revision rates or fracture risk. Those patients with this finding may in fact have better outcomes and decreased periprosthetic fracture risk.

Symposium II

The Popular Conversion Total Hip Arthroplasty: How to Attack These Tough Cases

Moderator: Matthew P. Abdel, MD

Faculty: Daniel J. Berry, MD, James A. Browne, MD, Douglas E. Padgett, MD

Notes

This symposium will provide the latest information on the technical tips and tricks related to conversion total hip arthroplasties for congenital and post-traumatic etiologies, including how to manage in situ hardware.

Learning Objectives:

- To comprehend the multiple ways in which the diverse array of in situ acetabular and femoral hardware can be managed when converting a patient to a total hip arthroplasty.
- 2. To understand the principles and surgical techniques behind utilizing modern implants (such as porous metals to address complex acetabular defects, and modular fluted tapered stems to address the majority of femoral defects) most successfully in conversion total hip arthroplasties.
- **3.** To comprehend the literature-based surgical results of patients with conversion total hip arthroplasties.

Outline:

Introduction

Matthew P. Abdel, MD

Acetabular Fractures: What Should I Do with These Screws and Plates?

Daniel J. Berry, MD

Prior SCFE, LCP, and Femoral Neck Pinning: What's My Workflow?

James A. Browne, MD

Intramedullary Nails and Fixed-Angle Plates: Tips and Tricks

Douglas E. Padgett, MD

Hemiarthroplasties and Resurfacings: Conversion THA Pearls

Matthew P. Abdel, MD

DiscussionAll Faculty

Lack of Demographic Information in THA/TKA Randomized Controlled Trial Publications

Notes

Katelynn M. Donnelly, MS, Hannah G. Theriot, BS, John P. Bourgeois, MPH, Andrew G. Chapple, PhD, Peter C. Krause, MD, Vinod Dasa, MD

Introduction: The impact of social determinants of health (SDOH) has been documented in orthopaedic literature. However, there is a lack of data on the inclusion of these variables in orthopaedic studies. Our aim was to investigate how many THA/TKA randomized controlled trials (RCTs) report SDOH variables such as race, ethnicity, insurance, income, and education within the manuscript.

Methods: A literature review was conducted on a PubMed search for RCTs published from 2017-2019 in 4 major orthopaedic journals which routinely publish on total joint arthroplasty: JBJS, JOA, CORR, and Osteoarthritis & Cartilage. The inclusion criteria, THA/TKA RCTs with a table 1 and patient demographics, resulted in 72 publications. Data collected included publication year, type of surgery, and the inclusion of race, ethnicity, insurance, income, and education in either the discussion, table 1, or multivariable regressions. Counts and percentages were used to summarize the variables. Additionally, Fisher's exact tests were used for comparisons on SDOH inclusion by journal name, publication year, and surgery type (THA vs. TKA).

Results: 5.6% of the manuscripts mentioned race, 4.2% included race within table 1, and 1.4% included ethnicity in table 1. Insurance, income, and education were not included in any of the 72 publications. Overall, only 5 studies discussed any one of the variables studied, and none included any SDOH variables in their multivariable regressions. There were no statistically significant differences on inclusion across journal year (p=0.78), journal name (p=1.00), or surgery type (p=0.555).

Conclusion: Our findings identify a significant shortcoming in the inclusion of SDOH variables in TKA/THA publications. Their exclusion may be indirectly perpetuating disparities if research that does not use representative patient samples is used in creating health policies and national standards.

New Patient Referral Patterns May Reflect Gender Biases

Notes

Timothy G. Visser, MD, MBA, Nicholas Bertha, MD, Nikkole Haines, MD

Introduction: Orthopaedic surgery is a male-dominated specialty with the lowest percentage of female residents and female faculty of all medical specialties (~14% of residents and 6.5% of attendings). Despite national increases in female residents and faculty in all specialties, orthopaedic surgery shows the slowest improvement in gender balance. This study investigates how patient demographics for male and female orthopaedic surgeons may differ based on referral biases and patient preferences.

Methods: A retrospective chart review was performed to analyze new patient demographics for male and female orthopaedic surgeons within adult hip and knee reconstruction (3 male, 1 female) and shoulder and elbow (2 male, 1 female) specialties at a single academic institution. During 2019, 2,642 adult patients (ages 18+) were identified as new. General call and automated new patient referrals were excluded. Patient insurance, sex, race, and age as well as sex of referring provider and referral type were recorded. Demographics were compared using chi-squared and t-test.

Results: Female surgeons had fewer referrals from male providers (45.3% vs. 50.3%, p=0.03) without differing referrals from female providers (30.6% vs. 29.9%, p=0.72). The female adult hip and knee surgeon also had less internal referrals compared to a male surgeon of similar experience and time at the institution (8.4% vs. 12.8%, p=0.03).

Conclusion: New patient demographics were different when comparing male and female orthopaedic surgeons at a single academic institution. The female adult hip and knee reconstruction surgeon received fewer referrals from male providers, no difference in female referrals, and received fewer internal referrals than a similar male colleague. This study is limited due its retrospective nature and its generalizability coming from a single academic institution. Nonetheless, there remains a need for additional female representation in orthopaedic surgery and new patient referral patterns may be a marker to assess and monitor gender-biases.

Discrepancies in Work-Family Dynamics Between Female and Male Orthopaedic Surgeons

Notes

Danielle Y. Ponzio, MD, **Courtney D. Bell, MD**, Alexandra I. Stavrakis, MD, Hope E. Skibicki, DO, Miranda Czymek, BS, Qudratullah Qadiri, BS, Alvin C. Ong, MD, Zachary D. Post, MD, Meghan Bishop, MD

Introduction: While orthopaedic surgery is one of the most rewarding fields in medicine, rigorous training, lifestyle, and professional obligations often conflict with family life. The objective of this study is to identify differences in workfamily balance between female and male orthopaedic surgeons in the U.S.

Methods: An anonymous survey was completed by 347 orthopaedic surgeons (153 female, 194 male) collecting data within the domains of demographics, work, family, and career and work-family balance satisfaction. Differences between males and females and risk factors for career dissatisfaction were identified.

Results: Female surgeons were younger than males (mean 41.1 vs. 50.1 years, p<0.001) and earlier in their careers (p<0.001). Opportunities for consulting (7.84% vs. 31.4%, p<0.001), course faculty (19.0% vs. 39.2%, p<0.001), and academic titles (30.7% vs. 47.4%, p=0.002) were significantly less common among females. There was a significant income disparity between women and men (on average \$300k-\$400k vs. \$400k-\$500k, p<0.001). Females were more likely never married (12.4% vs. 2.58%, p<0.001) or married at a later age (30.2 \pm 4.68, vs. 28.3 ± 3.89 p<0.001). Females were more likely to have no children (29.4% vs. 7.81%, p<0.001), require fertility treatment (32% vs. 11.9%, p<0.001), and have children after training (63.0% vs. 31.1%, p<0.001). Female surgeons reported increased responsibility in parenting (p<0.001) and household duties (p<0.001). Overall, 94.5% of surgeons were satisfied with their career, though female gender independently predicted dissatisfaction (p=0.044). Work-family balance satisfaction was 52.9% in females and 65.98% in males (p=0.008).

Conclusion: This study highlights deficiencies in work-family balance which appear to uniquely impact female surgeons. The discrepancy in work-family balance must be addressed to narrow the gender gap so as to allow women to achieve their personal and professional goals concurrently, as well as continue to attract, support, and retain women as successful orthopaedic surgeons.

Racial Differences in the Imaging Workup and Treatment of Knee and Hip Osteoarthritis

Notes

Mark Wu, MD, Ayden Case, Billy Kim, BS, Niall H. Cochrane, MD, Gabriela Nagy, PhD, Michael P. Bolognesi, MD, Thorsten M. Seyler, MD, PhD

Introduction: To advance current national efforts of improving equity in osteoarthritis (OA) management, it is important to first identify differences in care provided. There is limited evidence on sociodemographic differences in the preoperative workup and treatments of OA, particularly in non-African American minorities. We sought to identify differences in imaging modalities, administration of intraarticular injections, and arthroplasty between various racial/ethnic groups.

Methods: We retrospectively reviewed patients presenting to orthopaedic and/or non-orthopaedic clinics with a visit diagnosis of hip or knee osteoarthritis from 2013-2021 at a tertiary center. Variables included age, sex, race/ethnicity, insurance status, geographic location, and income. Univariate analyses compared differences between groups. Multivariate logistic regression analyses determined sociodemographic predictors of imaging workup and treatment.

Results: 141,203 patients with hip or knee OA were included. There were 88,018 (70.1%) Caucasian, 32,429 (25.8%) African American (AA), 2,453 (2.0%) Hispanic, 1,832 (1.5%) Asian, and 752 (0.6%) Native American patients. Multivariate analyses demonstrated that AA patients were less likely to undergo knee (OR: 0.81, p<0.001) and hip MRI (OR: 0.84, p=0.018). Asian patients (OR: 0.67, p=0.007) were less likely to undergo hip x-ray or receive a knee injection (OR: 0.83, p=0.009). AA (TKA: OR 0.57, p<0.001; THA: OR 0.66, p<0.001), Hispanic (TKA: OR 0.60, p<0.001; THA OR: 0.57, p=0.001), and Asian (TKA OR: 0.69, p=0.002; THA OR: 0.50, p=0.001) patients were all less likely to undergo TJA compared to Caucasians. Insurance status, income and sex also significantly influenced imaging modalities and treatments (p<0.05).

Conclusion: After controlling for sociodemographic factors, significant disparities existed in imaging, administration of injections, and/or arthroplasty for African American, Asian, and Hispanic patients. This suggests that unrecognized bias, other complex system issues, and/or patient-level factors contribute to racial/ethnic differences in care. These results provide a focus for future interventions aimed at improving the equity of OA interventions and raise the question of implementation of a standard checklist for patients presenting with arthritis to avoid differences in care.

Lower Rates of Ceramic Femoral Head Use in Non-White Patients: A National Registry Study

Alexander Upfill-Brown, MD, MSc, Noah Paisner, BS, Patrick C. Donnelly, MA, Ayushmita De, PhD, Adam A. Sassoon, MD, MS

Notes

Introduction: Racial disparities in total hip arthroplasty (THA) outcomes exist. Ceramic femoral heads have been shown to be superior to metal heads in terms of wear rates and corrosive changes and are used by most orthopaedic surgeons. Our goal was to investigate disparities in the use of ceramic heads in total hip arthroplasty with regard to race and ethnicity using the AAOS American Joint Replacement Registry (AJRR).

Methods: Adult THA procedures from 2012 to 2020 were queried from the AJRR and were assessed for ceramic femoral head utilization by race. A multilevel logistic regression model was applied to examine the association between race and ceramic femoral head usage. Models adjusted for other potential confounding demographic variables including age, gender, and body mass index.

Results: A total of 103,218 patients were included in analysis. Mean age was 70.1 years. The overall frequency of ceramic head use was 44.4%. In multivariate models, compared to white/non-Hispanic patients, Black (OR: 0.79 p<0.001), Hispanic (OR: 0.76 p=0.0365), Asian (OR: 0.74 p=0.045) and American Indian (OR: 0.52 p=0.0041) patients all had significantly lower rates of ceramic head use in THA. Younger patients were significantly more likely to receive ceramic heads, with the odds increasing 1.12 times (p<.0001) for each year decrease in patient age.

Conclusion: Black, Hispanic, American Indian and Asian patients have lower rates of ceramic head use in THA when compared to white patients. These differences exist despite the overwhelming popularity of ceramic femoral head use in modern arthroplasty and may contribute to a growing divide in THA outcomes between these groups. This difference may be driven by differential access to fellowship-trained arthroplasty surgeons or lower reimbursement driving the use of cheaper implants.

Symposium III

Caring for Diverse and High-Risk Patients: Surgeon, Health System, and Patient Integration

Moderator: Kimberly K. Tucker, MD

Faculty: Anna R. Cohen-Rosenblum, MD, Linda I. Suleiman, MD, Ugo Ihekweazu, MD,

James I. Huddleston III, MD

This symposium is designed to explore how differences in culture, race and health literacy can affect treatment, access, and outcome in total joint surgery. Issues discussed will be from three perspectives: patient, surgeon and health system. We will illustrate some strategies to integrate and improve these aspects. This will be an interactive symposium, where attendees will be able to submit questions anonymously.

Learning Objectives:

1. Navigation of Racial and Ethnic Differences

- **a.** Strategies to improve relationships and communication with diverse patient populations.
- **b.** How to recover if misunderstandings or poor communication occurs, given racial or cultural differences.
- **c.** Resources to help create or pivot strategy to address issues of diversity, equity and inclusion in your practice.

2. Health Literacy and High-Risk Patients

- **a.** Modification of expectations from patient and surgeon standpoint.
- **b.** How access to care affects this higher risk population.
 - i. Cost issues; transportation issues; access to therapy.
- **c.** Issues that occur given the care of an urban, at-risk population.
- d. Community engagement of this population
- **e.** Obstacles encountered when caring for underserved patients.

3. Policies and Systems Affecting this Diverse and High-Risk Population

- **a.** Limitations of health resources in a diverse and high-risk population.
- **b.** The infrastructure required to care for this population.
- **c.** The effect of systemic discrimination on outcome
- **d.** Assisting the patient in navigating our complex health care system.
- e. Economics and risk stratification.

Outline:

Introduction

Kimberly K. Tucker, MD

Treating Diverse Patient Populations: Navigating Racial/Ethnic Differences

Linda I. Suleiman, MD

The Impact of Health Literacy in the Care of Hip and Knee Arthroplasty Patients: Obstacles and Solutions Anna R. Cohen-Rosenblum, MD

High-Risk Patients in the Setting of Private Practice Ugo Ihekweazu, MD

The Economics of the High-Risk Patient James I. Huddleston III, MD

Discussion

All Faculty

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Can a Reduction in Revision Rates Make Robotic TKA Cost Neutral with Manual TKA in the Long Term?

Geoffrey S. Tompkins, MD, Katie Sypher, MBA, Michael Griffin, MBA, Paul J. Duwelius, MD

Notes

Introduction: Recently, our health system's cost/outcomes data showed that robotic TKA (RTKA) had greater per case cost than manual TKA (MTKA), with minimal differences in LOS and complications. RTKA advocates propose that improved short-term outcomes, as well as a long-term reduction in revisions, will justify the greater cost of RTKA. Given the higher cost for RTKA, without observed short-term advantages in our study, we sought to determine what long-term reduction in Revision TKA (RevTKA) would be required for RTKA to become cost neutral with MTKA.

Methods: Data from a propensity-matched study of 2,392 RTKA and 2,392 MTKA were used to calculate the costs of the acute stay, post-acute care, and readmissions to determine "episode cost." Using contemporary data, we also identified the mean total cost of (all cause) RevTKA in our health system. The episode cost difference of the RTKA and MTKA cohorts was divided by the mean cost of RevTKA to estimate the reduction in RevTKA required to make RTKA cost neutral with MTKA. The National Joint Registry (NJR) was consulted to identify the cumulative revision rate for the implant used in this study and to estimate the expected number of RevTKA for each cohort.

Results: Total episode cost for the RTKA cohort was \$5.7M greater than MTKA. Mean total cost per case for RevTKA was \$20,972. As such, 272 RevTKA would need to be prevented in the RTKA cohort to make it cost neutral with MTKA. The NJR estimates the revision rate for this implant to be 3.37% at 10-years (95% CI: 3.18-3.56%), thus only 81 revisions would be expected (95% CI: 76-85) per cohort.

Conclusion: Though any reduction in the RevTKA burden would be valuable and welcome, our data suggests it is not currently possible for RTKA to achieve cost parity with MTKA through decreased RevTKA.

Outcomes Are Better with a Medial-Stabilized vs. a Posterior-Stabilized Total Knee Implant

David F. Scott, MD, Celeste G. Gray, BS

Introduction: There is no consensus whether a posterior-stabilized (PS) total knee device is superior to a more congruent, cruciate-substituting, medial-stabilized device (MS). This study compared the clinical outcomes of two such devices. The primary hypothesis was that the clinical outcomes would be better in the MS group.

Methods: This prospective, randomized, single-center, Level 1 study compared the outcomes of 100 patients who received a PS device and 101 patients who received an MS device. All patients undergoing elective primary total knee arthroplasty were eligible for participation. Institutional Review Board approval and informed consent from participants were obtained. Clinical and radiographic assessments were performed preoperatively, 6 weeks, 6 months, and annually. Data were compared using T-test with a significance level of 0.05.

Results: All subjects reached the minimum follow-up period of 2 years. There were no statistically significant differences in demographic characteristics and preoperative scores; tourniquet time was 7.24% longer for the PS group (40.28 min vs. 37.56 min, p<0.0086). Alignment was not different between the groups (pre- or postoperatively). There were significant differences between groups for the 1 year and 2 years postoperative Knee Society scores, Forgotten Joint Score, and ROM; in every case where there was a statistically significant difference, the results were better in the MS group. For example, the FJS was 65.72 in the MS group at 2 years and 54.33 in the PS group (p=0.02). The maximum active flexion at 2 years was 129.75 in the MS group and 122.27 in the PS group (p=0.03).

Conclusion: The clinical outcomes of the MS group at 1 and 2 years were better statistically, and there was a statistically longer tourniquet time for the PS group. At the minimum 2-year follow-up, the results demonstrate superiority of the medially stabilized device in terms of multiple clinical outcomes.

Head-to-Head Comparison of Kinematic Alignment vs. Mechanical Alignment for TKA

Jonathan M. Vigdorchik, MD, Michael P. Ast, MD, Seth A. Jerabek, MD, Ameer M. Elbuluk, MD, Peter K. Sculco, MD

Notes

Introduction: Seeing as there are many alignment strategies for total knee arthroplasty (TKA), we need to determine differences between them in a rigorous, scientific way. Therefore, we sought to compare perioperative and postoperative functional outcomes in patients undergoing TKA for varus osteoarthritis (OA) with a mechanical alignment target vs. a kinematic alignment target, both executed with the same implant and same technological guidance.

Methods: We retrospectively reviewed a database of 936 TKAs and identified the final 100 patients that underwent unilateral TKA using mechanical alignment (MA) techniques. Those patients were 1:1 matched (age, sex, BMI, and varus OA) to the first 100 patients that underwent TKA using a kinematic alignment (KA) technique with the same implant and robotic technology. Perioperative anesthesia and pain and rehab protocols were the exact same. The primary outcome was the Forgotten Joint Score (FJS) postoperatively at 1- and 2-years. Secondary outcomes included perioperative and short-term VAS, functional outcomes, VR-12, and KOOS-JR. Power analysis revealed 94 patients to detect a significant difference in FJS.

Results: Mean VAS scores were higher in the MA group during the first 6 weeks (6 vs. 2, p=0.4), but statistically similar at 1-year. Six-week VR-12 mental and physical components were statistically similar (p=0.1). Patients did not differ in 6-week or 1-year knee range of motion (p>0.43). The KOOS-JR was significantly better in the KA group at 6-weeks, 1- and 2-years (p=0.09). The Forgotten Joint Score at 1- and 2-years postoperatively were significantly higher in the KA group (p<0.001).

Conclusion: Patients undergoing TKA with kinematic alignment experienced less pain in the first 6-weeks after surgery and had higher Forgotten Joint Scores at 1- and 2-years postoperatively. Alternative alignment and balancing strategies should be considered for TKA to increase patient satisfaction.

Motion During Cementing Significantly Decreases Tibial Implant Fixation Strength

Notes

J. Ryan Martin, MD, Peter Wronski, BS, Rachel Schilkowsky, MS, Alexander Orfanos, MD, Thomas K. Fehring, MD, J. Bohannon Mason, MD

Introduction: Aseptic tibial loosening following primary total knee persists despite technique and device-related advancements. The mechanisms for this mode of failure are not well understood. We hypothesized that knee movement while the cement was curing dispersed lipids at the implant cement interface and would result in decreased tibial fixation strength.

Methods: A cadaveric study was performed utilizing 32 torso-to-toe specimens (64 knees). Four contemporary total knee arthroplasty designs were evaluated. Each implant design was randomly assigned to a cadaveric specimen pair with side-to-side randomization. Specimen densitometry was recorded. Each tibial implant was cemented using standard technique. On one side, the tibial component was held without motion following impaction until complete cement polymerization. The contralateral knee tibial implant was taken through gentle range of motion and stability assessment seven minutes after cement mixing. Axial tibial pull-out strength and interface failure examination was performed on each specimen.

Results: The average pull-out strength for the no-motion cohort (5462N) exceeded the motion cohort (4473N) (p=0.001). The mean pull-out strength between implant designs in the no-motion cohort varied significantly [Implant A: 7230N; B: 5806N; C: 5325N; D: 3486N] (p=0.007). Similarly, the motion cohort inter-implant variance was significant [Implant A: 6146N; B: 5496N; C: 4054N; D: 2196N] (p \leq 0.001). Intra-implant pull-out strength was significantly different for designs A and D between cohorts. Tibial pull-out strength correlated with bone cement implant failure patterns.

Conclusion: Knee motion during cement polymerization is associated with significant decreases in tibial implant fixation strength. Reduction in implant pull-out strength was identified with each implant design with motion. Surgeons often elect to cement components simultaneously or check ligament balance, which may introduce motion during the curing process. Across all tested designs, we recommend limiting motion while cementing the tibial implant to improve fixation strength.

Is Cement Mantle Thickness a Primary Cause of Aseptic Tibial Loosening Following Primary Total Knee Arthroplasty?

J. Ryan Martin, MD, J. Bohannon Mason, MD, **Zachary Cox, BS**, Gregory G. Polkowski, MD, MSc, Stephen M. Engstrom, MD, Andrew A. Shinar, MD

Notes

Introduction: Aseptic tibial loosening following primary total knee replacement is one of the leading causes of long-term failure. Cement mantle thickness has been implicated as a source of aseptic tibial loosening. However, recent research has indicated the primary interface of implant failure occurs at the implant-cement interface. Therefore, the following study was designed to determine the cement mantle thickness in patients that develop aseptic tibial loosening, and to determine whether there is a difference in cement mantle thickness based on the interface of failure.

Methods: This retrospective cohort included 216 patients revised for aseptic tibial loosening. Patient demographics, operative data, and clinical outcomes were recorded. A preoperative radiographic assessment was performed to determine the interface of failure (implant-cement vs. cement-bone) as well as the thickness of the cement mantle using the Knee Society Radiographic Evaluation System zones. Cement mantle thickness was then compared between implant-cement and cement-bone failures.

Results: The average patient age was 65 years and average body mass index was 33.7 kg/m2. 203 patients demonstrated radiographic failure at the implant-cement interface and 13 patients demonstrated failure at the cement-bone interface. The average cement mantle thickness for all AP and lateral zones was significantly greater for patients that failed at the implant-cement interface vs. those that failed at the cement-bone interface (AP: 4.6 mm vs. 1.4 mm (p<0.001); lateral 4.6 mm vs. 1.9 mm (p<0.001).

Conclusion: The most common interface for implant failure in patients with aseptic tibial loosening was at the implant-cement interface. Patients that develop implant loosening at the cement-bone interface were noted to have a significantly decreased cement mantle compared to patients that failed at the implant-cement interface. Methods for decreasing tibial implant loosening should likely focus on improving the fixation at the implant-cement interface.

Effects of PCL Resection on Flexion-Extension Gap Balancing During Imageless Robotic-Assisted TKA

Notes

William K. Crockatt, MD, Kyle S. Nuland, MD, Michael B. Held, MD, MBA, Walkania M. Santos, BS, **Roshan P. Shah, MD**, Herbert J. Cooper, MD

Introduction: Gap balancing relies on bony resections and ligamentous releases to correct deformity and restore alignment. The posterior cruciate ligament (PCL) is a major stabilizing structure of the flexion space, yet evidence is inconclusive regarding change in gap laxity with its resection and whether this preferentially increases medial or lateral compartment laxity. This study aimed to accurately describe the effects of PCL resection using intraoperative robotic gap assessment.

Methods: Records were retrospectively reviewed for consecutive patients without exclusions who underwent primary robotic-assisted total knee arthroplasty (raTKA) utilizing a single system from July 2020 to March 2021. Patients were classified into two cohorts by preference for flexion gap balancing: cruciate-retaining (CR) or posterior-stabilized (PS) technique. Demographic information including age, sex, laterality, BMI, comorbidities, and ASA score were collected from the electronic medical record. Knee alignment and gap balancing measurements were collected by the robotic system after PCL resection in the PS cohort but before bone cuts were made.

Results: 98 robotic-assisted TKAs were included (59 CR, 39 PS) with no significant differences in demographic measures or preoperative alignment. Linear regression demonstrated a significant increase in medial compartment flexion laxity (3.4mm, p=0.000, 95% CI= [2.3 to 4.4mm]) and extension laxity (1.7mm, p=0.005, 95% CI [0.5 to 2.9mm]) in the PCL-resected/PS as compared to the PCL-retained/CR group. There were negligible changes in mean lateral flexion laxity (-0.02mm, p=.982, 95% CI= [-1.3 to 1.3mm]) and lateral extension laxity (-0.03mm, p=0.964, 95% CI= [-1.3 to 1.3mm]).

Conclusion: The success of modern robotic TKA depends on accurate pre-resection gap measurements. Robotic gap assessment data demonstrates PCL resection causes significant increases in medial flexion-extension laxity with negligible changes in lateral flexion-extension laxity. PCL resection should be performed prior to gap assessment during robotic PS TKA.

Hip Precautions Not Required After Posterior Total Hip Arthroplasty: A Prospective Randomized Study

Jared R.H. Foran, MD, Marlie R. Mounts, BS, Martin A. Aguilar, BS, Nimesh B. Patel, MD

Notes

Introduction: Hip precautions are traditionally employed after posterior total hip arthroplasty (THA). Some studies have questioned the necessity of hip precautions, but there are few prospective randomized controlled trials. The primary purpose was to investigate the necessity of hip precautions after posterior approach THA. We hypothesized that eliminating precautions in patients that achieved appropriate intraoperative stability would not increase the dislocation rate. Our secondary hypothesis was that HOOS Jr. scores would be superior in patients not receiving hip precautions.

Methods: This is a randomized controlled trial of 332 consecutive eligible patients undergoing primary THA. All patients had a minimum 12 week follow up. 51 patients were excluded. Exclusion criteria included lumbar fusion, scoliosis, abductor insufficiency, severe dysplasia, lack of consent, and lack of intraoperative stability (defined as combined 90° flexion and 45° internal rotation in 0° adduction). Power analysis confirmed sample size. Fisher's exact test was used to compare dislocation rates between the hip precaution (HP) control cohort and no hip precaution (NHP) study cohort. Mann-Whitney U test was used to compare differences in HOOS Jr. scores at 2, 6, and 12 weeks between cohorts.

Results: The dislocation rate was not increased in the NHP group (0/138: 0%) compared to the HP group (4/143: 2.79%) (p=0.001). All dislocations occurred in the HP group, two of which required revision. There were no differences in mean HOOS Jr. scores at 2, 6, or 12 weeks (p>0.05 at all time points).

Conclusion: Eliminating hip precautions in patients undergoing posterior approach THA that achieve 90°/45°/0° intraoperative stability does not increase the rate of dislocation. In fact, every dislocation occurred in patients receiving hip precautions. None occurred in those without precautions. Short term patient reported outcome measures are not affected by hip precautions. Surgeons may discontinue the use of hip precautions as the standard of care in patients achieving 90°/45°/0° stability.

Demographic Data Reliably Predicts Total Hip Arthroplasty Component Size

Motos

Michael Murphy, MD, Amir Boubekri, MD, James Myall, BA, Steven J. Ralles, MD, Nicholas M. Brown, MD

Introduction: Preoperative radiographic templating for total hip arthroplasty (THA) is commonly performed but studies have demonstrated low accuracy in predicting component size. Demographic data has been shown to be predictive of total knee arthroplasty implant sizes, although no study has assessed its relation to THA implants. The purpose of this study is to determine whether gender, height, weight, age, race, and ethnicity can accurately predict intraoperative THA component sizes.

Methods: A consecutive 1,270 index THAs were reviewed between January 1, 2013, and December 31, 2019. This included 12 unique femoral component designs, 6 acetabular component designs, 60 unique femur sizedesign combinations, and 23 unique acetabular sizedesign combinations. Implanted component sizes and patient demographic data was collected, including gender, height, weight, laterality, age, race, and ethnicity. A general linear model (GLM) was formulated to predict both femoral and acetabular implanted intraoperative component sizes from the demographic data.

Results: There was a significant linear correlation between gender, implant model, age, height, and weight for femur (R2=0.767; p<0.001) and acetabular sizes (R2=0.320; p<0.001). Calculated femur and acetabular component sizes averaged within 1.03 and 0.82 sizes of those implanted, respectively. Femur and acetabular sizes were predicted within 1 size 58.2% and 66.6% of the time, and within 2 sizes 88.0% and 95.2% of the time, respectively.

Conclusion: A general linear model was created based on patient specific demographics data to predict femur and acetabular THA component sizes. In a consecutive patient series, the GLM accurately and precisely predicted implanted component sizes. The model allows for simplified preoperative planning and potential cost-savings implementation. A free phone application was constructed for ease of implementation.

Can We Predict Fracture When Using a Short Cementless Femoral Stem in the Anterior Approach?

Notes

Niall P. McGoldrick, MD, FRCS (ORTHO), Michael Cochran, MD, Brook Biniam, BS, Ramandeep Bhullar, MD, Paul E. Beaule, MD, FRCSC, Paul R. Kim, MD, FRCSC, Wade T. Gofton, MD, FRCSC, **George A. Grammatopoulos, MD, FRCS (ORTHO)**

Introduction: Short cementless femoral stems are increasingly popular as they allow for minimal dissection for insertion. The use of such stems with the anterior approach (AA) in total hip arthroplasty (THA) has shown a considerable perioperative fracture risk. The primary aim of this study was to evaluate whether patient-specific femoral and pelvic morphology and surgical technique influence perioperative fracture risk. In doing so, we aimed to describe important anatomical thresholds alerting surgeons.

Methods: This is a single-center, multi-surgeon retrospective, consecutive, cohort study between 2014-2018. Of 1,145 primary THAs with a short, cementless stem inserted via the AA, 39 periprosthetic fractures (3.4%) were identified. These were matched for factors known to increase fracture risk (age, gender, BMI, side, Dorr classification, stem offset and indication for surgery) with 82 THAs that did not sustain a fracture. Radiographic analysis was performed using previously validated software to measure femoral (canal flare index [CFI], morphological cortical index [MCI], calcar-calcar ratio [CCR]) and pelvic (Ilium-ischial ratio [IIR], ilium overhang, and ASIS to greater trochanter distance) morphologies and surgical technique (% canal fill). Multivariate and Receiver-Operator Curve (ROC) analysis was performed to identify predictors of fracture.

Results: Femoral factors that differed included CFI $(3.7\pm0.6 \text{ vs. } 2.9\pm0.4, \text{ p}<0.001)$ and CCR $(0.5\pm0.1 \text{ vs. } 0.4\pm0.1, \text{ p}=0.006)$. The mean IIR was higher in fracture cases $(3.3\pm0.6 \text{ vs. } 3.0\pm0.5, \text{ p}<0.001)$. Canal fill % was reduced in fracture cases $(82.8\pm7.6 \text{ vs. } 86.7\pm6.8, \text{ p}=0.007)$. Multivariate analysis and ROC analyses revealed a threshold CFI of 3.17 was predictive of fracture (sensitivity: 84.6%, specificity: 75.6%). Fracture risk was 29 times higher when patients had combined CFI>3.17 and II ratio>3 (OR: 26.295%CI: 9.5-89.9, p<0.001).

Conclusion: Patient-specific anatomical parameters are important predictors of fracture risk. When considering the use of short stems via the AA, careful radiographic analysis would help identify those at risk to consider alternative stem options.

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Femoral Perforation During Anterior Approach Primary Total Hip Arthroplasty: Incidence and Outcomes

Notes

Matthew C. Kinney, MD, Henry Ho, MS, William G. Hamilton, MD

Introduction: Cortical perforation during femoral preparation is a recognized complication of total hip arthroplasty, but incidence and outcomes have not been described for the anterior approach. This study presents the incidence, risk factors, treatment algorithm and outcomes for intraoperative femoral perforation.

Introduction: An institutional database was queried to identify all primary anterior approach THA's performed by a single surgeon between 2009-2021. 3,973 THA's were identified, and a case series of 16 (16/3973; 0.4%) intraoperative femoral cortical perforations were encountered during broaching. Charts were reviewed to confirm operative management, collect demographic data, and capture postoperative complications. Preoperative radiographs were assessed for Dorr type, and canal-flare index (CFI) measurements, and postoperative radiographs were assessed for stem subsidence and loosening.

Results: The cohort consisted of 8 males and 8 females with an average age of 64.3 (range: 41-81) and BMI of 31.6 (21.3-44.4). In all 16 cases, the perforation was identified intraoperatively by direct visualization or fluoroscopy, the broach was redirected, and a standard primary cementless stem was implanted. 6 patients were limited to 50% weight-bearing after surgery, and 10 were allowed weight-bearing as tolerated protected with a walker/cane. At mean follow-up of 19.5 months, there were no revisions or reoperations, and no femoral complications identified, including stem subsidence, periprosthetic fracture, or loosening. Patient-related factors that may have increased perforation risk include BMI>40 (3/16 patients), pre-existing hardware resulting in sclerotic femoral bone (3/16), and a CFI≤3.0 (5/16).

Conclusion: Femoral perforation is a recognized intraoperative complication but may be higher with the anterior approach given challenges with femoral exposure and visualization. It can be managed with redirection of the broach, implantation of a primary stem, and protected postoperative weight-bearing. This complication appears more common when access to the femoral canal is impeded by body habitus or abnormal bony morphology.

Creation of a Total Hip Arthroplasty Patient-Specific Dislocation Risk Calculator

Cody C. Wyles, MD, Hilal Maradit-Kremers, MD, MSc, Dirk R. Larson, MS, Robert T. Trousdale, MD, Mark W. Pagnano, MD, Daniel J. Berry, MD, Michael J. Taunton, MD, Rafael J. Sierra, MD

Notes

Introduction: Many risk factors have been described for dislocation following total hip arthroplasty (THA), yet a patient-specific risk assessment tool remains elusive. The purpose of this study was to develop a high-dimensional, patient-specific risk-stratification nomogram that allows dynamic risk modification based on operative decisions.

Methods: 29,351 THA performed between 1998-2018 were evaluated including 21,978 primary and 7,373 revision cases. During mean 6-year follow-up, 1,522 THA sustained a dislocation. Patients were characterized on non-modifiable factors (demographics, THA indication, spinal disease, spine surgery, neurologic disease, connective tissue disease), and modifiable operative decisions (surgical approach, femoral head diameter, acetabular liner [standard/elevated/constrained/dual mobility]). Multivariable regression models and nomograms were developed with dislocation as a binary outcome at 1-year and 5-years postoperatively.

Results: Patient-specific dislocation risk was wide-ranging. from 2%-16% at 1-year to 3%-24% at 5-years in primary THA, and 7%-35% at 1-year to 10%-46% at 5-years in revision THA. In primary THA, direct anterior approach and lateral approach decreased risk compared to posterior approach (HR=0.27 and HR=0.58, respectively). In primary THA, when adjusting for approach, the combination of femoral heads ≥36mm and elevated liners yielded the largest decrease in risk (HR=0.28), followed by dual mobility constructs (HR=0.47). In revision THA, the adjusted risk of dislocation was most markedly decreased with dual mobility constructs (HR=0.34), followed by femoral heads ≥36mm and elevated liners (HR=0.60). In revision THA, adjusted risk of dislocation was decreased with acetabular revision, irrespective of whether other components were revised (HR=0.60).

Conclusion: This patient-specific dislocation risk calculator is strengthened by a robust multivariable model that accounts for comorbidities associated with instability and demonstrates wide-ranging patient-specific risk based on comorbid profile. The resultant nomograms can be used as a screening tool to identify high-risk THA patients and individualize operative decisions. Further refinement will include deep learning-assisted preoperative imaging and acetabular component position assessment.

Postoperative Instability and Cup Positioning in Robotic vs. Traditional Total Hip Arthroplasty

Notes

Jonathan H. Shaw, MD, Luke D. Wesemann, BS, Charles Jiang, BS, Tahsin M. Rahman, MD, Brian Darrith, MD, Jason J. Davis, MD

Introduction: Robotic-assisted total hip arthroplasty (R-THA) has become more prevalent over the last decade and its precision has yet to be conclusively translated into clinical benefits. The primary purpose of this study is to compare dislocation rates and related revisions between R-THA and manual total hip arthroplasty (M-THA). Secondarily, the study investigated acetabular cup position, available postoperative patient-reported outcome measures (PROMs), and 90-day postoperative complications.

Methods: A three-surgeon retrospective cohort study was conducted on 2,247 consecutive patients (1,724 M-THA, 523 R-THA) who received a primary THA between January 2014 and June 2020 at a single suburban academic hospital. Patient demographics, PROMs, postoperative ED visits, readmissions, and 90-day complications were collected via the Michigan Arthroplasty Registry Collaborative Quality Initiative. Individual chart review yielded dislocation rates with average follow-up of 4 years. Multivariate regression analysis was performed for primary and secondary outcomes. A representative sample of 386 radiographs including all dislocations were assessed for cup position.

Results: There were significantly lower rates of postoperative dislocation in R-THA (0.6%) vs. M-THA (2.5%; OR, 3.74; p<0.046). All robotic dislocators were successful with conservative treatment, whereas 46% of traditional dislocators were revised for recurrent instability. Cup anteversion (25.6° \pm 5.4° R-THA vs. 20.6° \pm 7.6° M-THA) was significantly greater and cup inclination (42.5° \pm 5.3° R-THA vs. 47.0° \pm 6.7° M-THA) was significantly lower in the R-THA group (p<0.05). No significant differences were noted in patient demographics, PROMs, or other complications (p>0.05).

Conclusion: R-THA resulted in less than one-fourth the dislocation rate of M-THA and no revision for instability. It was associated with no difference in PROMs or other early complications. The influence of R-THA on instability goes beyond cup positioning and deserves further study.

How Much Hip Motion Is Used in Real-Life Activities? Assessment of Hip Flexion by a Wearable Sensor

Notes

Alexander P. Sah, MD

Introduction: Hip range of motion precautions are often considered a requirement for patients after total hip replacement. Few studies have attempted to estimate hip motion during activities of daily living. These studies are limited by bulky equipment, outdated technology, or testing in a lab environment. The purpose of this study is to evaluate hip range of motion and gait during real-life activities in healthy individuals with a novel tracking wearable sensor.

Methods: Thirty subjects used a hip motion tracking device during a series of tested activities. Healthy volunteers were selected. The device accuracy has been validated by motion and gait lab analysis. Activities recorded in the real-world environment included walking, stair ascent/descent, squatting, sitting to standing, getting on/off toilet, getting in/out of car, tying shoes, and getting in/out of bed.

Results: Hip range of motion during walking averaged minimum to maximum hip flexion of 9.9° to 49.3°, respectively. During stair ascent, the average flexion arc widened from minimum 19.6° to maximum 67.8° flexion. Stair descent had the narrowest arc of 26.2° to 52.4° flexion. Squatting averaged 120.0° hip flexion, with transition of sitting to standing averaging 103.0°. Getting on and off the toilet averaged maximum 112.6°, while tying shoes averaged 126.1° maximum hip flexion. Getting into bed had average maximum of 95.6° and getting out 78.2°.

Conclusion: Hip precautions are often enforced after total hip arthroplasty without knowing normal arcs of motion during real-life activities. Understanding normal ranges of hip motion during activities of daily living in healthy individuals is useful for setting appropriate hip motion goals and for properly educating THA patients with accurate information. This technology can be useful in guiding postoperative precautions and also has applications for real-time monitoring of patient activity after hip replacement.

Symposium IV

The Current State of Practice Patterns of AAHKS Members

Moderator: Jay R. Lieberman, MD

	nposium will survey AAHKS members at the Annual to learn about their arthroplasty practice patterns.	Notes
Learnin	g Objectives:	
1.	To learn the present practice of AAHKS members.	
2.	To note any changes in practice patterns compared to prior surveys.	
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Randomized Controlled Trial of Incisional Negative Pressure Following High-Risk Direct Anterior THA

Herbert J. Cooper, MD, Walkania M. Santos, BS, Alexander L. Neuwirth, MD, Jeffrey A. Geller, MD, Jose A. Rodriguez, MD, Sebastian Rodriguez-Elizalde, MD, Roshan P. Shah, MD

Notes

Introduction: The direct anterior (DA) approach to total hip arthroplasty (THA) has been associated with higher rates of surgical site complications (SSCs) compared to other approaches, particularly among high-risk patients. Closed incision negative pressure therapy (ciNPT) is effective at reducing SSCs and surgical site infections (SSIs) in other orthopaedic populations. We asked whether ciNPT dressings could decrease risk of SSCs in high-risk patients undergoing DA THA.

Methods: This prospective, randomized controlled trial enrolled high-risk DA THA patients at three high-volume arthroplasty centers in the United States and Canada. Patients were offered enrollment if they had previously identified risk factors for SSC: BMI>30 kg/m2, diabetes, active smoking, or prior open surgery. Patients were randomized after closure to either a silver-impregnated hydrofiber (control) dressing or ciNPT dressing for 7 days. All 90-day SSCs were recorded, and photo-documentation was performed at 2- and 6-weeks. An a priori power analysis demonstrated 116 patients would be required to identify a 4.5x relative reduction in SSCs. Chi-square tests were used to evaluate probability of complications.

Results: 122 patients were enrolled and 120 completed data collection. SSCs occurred in 18.3% (11/60) of control patients compared to 8.3% (5/60) of those receiving ciNPT (X2=2.60, p=0.107). SSCs were either skin dehiscence to the subcutaneous level (13) or prolonged drainage (3). Seven control patients (11.7%) and two ciNPT patients (3.3%) met CDC criteria for superficial SSI (X2=3.00, p=0.083). Fifteen of sixteen SSCs resolved with local wound care, but one patient in the ciNPT group required early reoperation for acute PJI.

Conclusion: Among high-risk patients undergoing DA THA, we identified a non-significant trend toward lower rates of SSC and superficial SSI when ciNPT was used. The cost-effectiveness of this intervention in a high-risk primary DA THA population requires further study.

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COVID-19 Infection After Total Joint Arthroplasty Is Associated with Increased Complications

Enrico M. Forlenza, MD, John D. Higgins, MD, Robert A. Burnett, MD, Joseph Serino, MD, Craig J. Della Valle, MD

Notes

Introduction: The impact of a postoperative diagnosis of COVID-19 in patients undergoing total joint arthroplasty (TJA) remains unknown. The objective of this study was to characterize the effect of COVID-19 infection following TJA on perioperative complication rates.

Methods: The Mariner database was queried for patients undergoing total hip (THA) and total knee arthroplasty (TKA). TJA patients who were diagnosed with COVID-19 within 90 days postoperatively were matched in a 1:3 fashion based on age, gender and Charlson Comorbidity Index (CCI) with patients who were not diagnosed with COVID-19. Preoperative comorbidity profiles and complications within 3 months of surgery were compared. Statistical analysis included chi-squared tests and multivariate logistic regression with outcomes considered significant at p<0.05

Results: Of the 257 COVID positive patients, 144 (56.1%) underwent THA and 113 (43.9%) underwent TKA. On univariate analysis, COVID infection was associated with a higher incidence of DVT (5.8% vs. 1.2%; p<0.001), PE (5.8% vs. 1.0%; p<0.001), acute kidney injury (21.0% vs. 7.4%; p<0.001), cardiac arrest (3.5% vs. 0.3%; p<0.001), pneumonia (52.5% vs. 4.6%; p<0.001), UTI (17.9% vs. 10.7%; p=0.003) and all complications (47.1% vs. 24.4%; p<0.001). On multivariate analysis, COVID diagnosis was associated with an increased odds of DVT (OR: 5.21; 95% CI [2.29-12.56]), PE (OR: 5.87; 95% CI [2.52-14.75]), and all complications (OR: 2.80, 95% CI [2.08-3.77]). Incidence of DVT/PE was greater the closer the COVID diagnosis was to the surgical procedure chronologically (5.24 times at 1 month, 4.62 times at 2 months and 0.97 times at 3 months, p<0.001). A similar relationship was observed with all complications.

Conclusion: Patients diagnosed with COVID-19 within 3 months of TJA have a significantly greater incidence of postoperative complications. The risk of developing these complications is greater if the COVID-19 infection occurs closer in time to the surgical procedure.

Is There an Association Between Invasive Dental Procedures and PJI? A Case Cross Over Study

Notes

Bryan D. Springer, MD, Martin H. Thornhill, PhD, Peter S. Lockhart, Larry M. Baddour, MD

Introduction: Antibiotic prophylaxis (AP) before invasive dental procedures (IDPs) for patients with prosthetic joints has been widely recommended in the US to reduce the risk of late hematogenous periprosthetic joint infection (LPJI). This is despite lack of evidence of an association between IDPs and LPJI, or of the efficacy of AP in preventing LPJI. In the absence of an association between IDPs and LPJI, there is no rationale for using AP. Our objective, therefore, was to determine if there is a temporal association between IDPs and LPJI in a patient population where AP is not utilized.

Methods: This study was funded by an NIH/NIDCR grant. English National Health Service (NHS) hospital admissions and dental data were linked, and all patients admitted to hospital with LPJI from April 1, 2011, through March 31, 2017, for whom dental records were available, were examined. We performed a case-crossover analysis comparing the incidence of IDPs (including extractions, scaling and endodontic procedures) in the 3-months before LPJI admission (the case-period) with the incidence in the 12-months before (the control-period, months 4-15) using a longitudinal negative binomial regression model.

Results: 9,427 LPJI admissions (8,370 individuals) were recorded during the study period. 1,680 IDP occurred in the 3-month case-period prior to LPJI admission. This was significantly lower than the average (1,856 IDP/three months) over the preceding 12-month control-period (incidence rate ratio 0.92, 95% CI 0.97 to 0.96; p<0.05). Thus, there was no association between LPJI and IDP in the 3-months prior to LPJI hospital admission. Non-invasive dental procedure incidence was not significantly different between case and control time periods.

Conclusion: In the absence of any evidence of an increase in IDP before admission for LPJI, there is no rationale for continuing the practice of AP before dental procedures in patient with prosthetic joints.

Paradoxical Behavior of Plasma D-Dimer from Explantation to Reimplantation in a Two-Stage Revision

Notes

Tejbir S. Pannu, MD, Jesus M. Villa, MD, Aldo M. Riesgo, MD, Jorge Manrique Succar, MD, Carlos A. Higuera, MD

Introduction: The ability of plasma D-Dimer, an inflammatory marker, to determine the eventual outcome of reimplantation is still debatable. The variation of this marker from pre-explantation to pre-reimplantation remains unknown. Our objective was to evaluate a percentage improvement in D-Dimer, and its impact on the outcome of reimplantation. We hypothesized a decrease in D-Dimer at pre-reimplantation vs. pre-explantation.

Methods: A retrospective review was performed on a consecutive series of 95 two-stage revisions (cases) indicated for periprosthetic joint infection (PJI), Surgeries were performed by 3 surgeons at a single institution (2018-2020). The minimum follow-up was 1-year. The inclusion criteria comprised availability of D-Dimer results pre-explantation and pre-reimplantation. As a result, only 30 reimplantations were included. ESR and CRP were also collected. Success of reimplantation was defined by MSIS outcome-reporting tool: Tier-1 (infection control with no antibiotics), Tier-2 (infection control with suppressive antibiotics), Tier-3 (reoperation/spacer retention), and Tier-4 (death). Since data did not have normal distribution, non-parametric Mann-Whitney-U tests were conducted to compare ΔD -Dimer%. Receiver-operating-characteristic (ROC) curve analyses were conducted.

Results: The median time between explantation and reimplantation was 86 days (interquartile range [IQR]= 77.7-138.5 days). Overall, a paradoxical median percent increase (ΔD-Dimer% (INCREMENT)= 12.6%) in D-Dimer was found from pre-explantation to pre-reimplantation (IQR= -91%-32%). However, there was a percentage decrease in ESR (ΔESR% (DECREMENT)= -41.5%; IQR= -73%-2%) and CRP (ΔCRP% (DECREMENT)= -73%; IQR= -89%-60%). The percent changes in all markers were not significantly different between MSIS Tier 1/2 and 3/4 outcomes (ΔD-Dimer%; p=0.146; ΔESR%; p=0.946; ΔCRP%; p=0.463). With area under curve of 0.68, ΔD-Dimer% (INCREMENT) appeared to be performing best in diagnosing infection control, which was non-explanatory.

Conclusion: Our data from 30 two-stage revisions shows that D-Dimer paradoxically increases before reimplantation while other inflammatory markers (ESR/CRP) decrease, emphasizing that surgeons shall adopt caution using D-Dimer to make clinical decisions.

Higher Risk of AKI in Two-Stage vs. One-Stage Revision for Periprosthetic Joint Infection

Michael M. Valenzuela, BS, Susan M. Odum, PhD, Thomas K. Fehring, MD, Bryan D. Springer, MD, Jesse E. Otero, MD, PhD

Notes

Introduction: Standard treatment for periprosthetic joint infection (PJI) involves two-stage exchange arthroplasty, which utilizes placement of an antibiotic cement spacer (ACS). Conflicting evidence exists on the role of ACS in development of acute kidney injury (AKI) after first-stage surgery. We aimed to compare the incidence of AKI between the first stage of a planned two-stage exchange vs. one-stage exchange. We also evaluated risk factors that may influence the development of AKI in these patients.

Methods: This is a randomized clinical trial comparing one-stage vs. two-stage exchange treatments for PJI. 163 patients were randomized to receive either one- or two-stage exchange. The primary outcome variable was AKI, defined as a creatinine ≥ 1.5 times baseline or an increase of ≥ 0.3 mg/dL. Risk factors for AKI were evaluated using bivariate statistical tests and multivariable logistic regression.

Results: 127 patients were included for final analysis. 66 patients received two-stage exchange, and 61 patients received one-stage exchange. Patients who underwent the first-stage resection of a planned two-stage exchange were more likely to develop AKI when compared to the one-stage exchange group [15 (22.7%) vs. 4 (6.6%), p=0.011]. Length of stay was higher when patients experienced AKI [4 days (IQR 3-8) vs. 3 days (IQR 3-4), p=0.012]. On multivariable regression analysis, ACS placement [OR=7.48 (1.77-31.56)] and chronic kidney disease [OR=3.84 (1.22-12.08)] were independent risk factors for AKI. Macpherson host type and extremity grade, intraoperative anesthesia events, and postoperative ketorolac were not associated with development of AKI.

Conclusion: The two study groups received identical treatment, only differing by use of the ACS, suggesting ACS placement directly contributes to development of AKI. Our study provides evidence that use of antibiotic cement spacers for the treatment of PJI is independently associated with AKI. With regard to the risk of AKI, one-stage treatment for PJI may be a safer alternative.

Extended Oral Antibiotics Increase Bacterial Resistance in Patients Who Fail Two-Stage Exchange

Notes

Mick P. Kelly, MD, Jeremy M. Gililland, MD, Brenna E. Blackburn, PhD, Lucas A. Anderson, MD, Christopher E. Pelt, MD, Christopher L. Peters, MD, Laura K. Certain, MD

Introduction: Although recent studies have demonstrated a reduction in the rate of recurrent periprosthetic joint infection (PJI) with administration of prolonged oral antibiotics at the time of stage-two reimplantation, the potential for increasing bacterial resistance has not been studied and remains a concern.

Methods: We retrospectively reviewed all patients from 2014 to 2019 who underwent two-stage exchange for chronic PJI at a single institution. Patients were stratified based on those who had received at least two weeks of oral antibiotics at the time of stage-two reimplantation compared to those who did not receive oral antibiotics. The primary outcome was presence of an organism resistant to that oral antibiotic in any subsequent PJI. The secondary outcome was the overall rate of recurrent PJI in the two groups.

Results: Of the 211 patients who underwent two-stage exchange for PJI, 158 patients received prolonged oral antibiotics at time of stage two reimplantation. Baseline characteristics were similar between patients who received prolonged antibiotics compared to those who did not. Thirty-five patients had a recurrent PJI (17%). Of those patients who received prophylactic antibiotics, resistant organisms to that antibiotic were identified in 16 out of 24 (67%) patients compared to 0 out of 11 (0%) patients who did not receive antibiotics (p=0.0001). Recurrent PJI was diagnosed in 24 out of 158 (15%) patients who received oral antibiotics compared to 11 out of 53 (21%) patients who did not receive antibiotics (p=0.35).

Conclusion: Prolonged oral antibiotics following two-stage exchange increases drug resistance to that antibiotic in subsequent PJI. While we found a non-significant trend toward a slight reduction in the rate of recurrent PJI with the use of prolonged oral antibiotics, we recommend further research in the area to refine antimicrobial protocols as we consider risks and benefits of prolonged antibiotic treatment.

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The James A. Rand Young Investigator's Award

Questioning the "Nickel-Free" Total Knee Arthroplasty

Charles M. Lawrie, MD, MSc, Ryan M. Nunley, MD, Tyler Moon, MD, Toby N. Barrack, BA, Kimberly A. Bartosiak, MD, Rick W. Wright, MD, Robert L. Barrack, MD

Notes

Introduction: A study was undertaken to determine how much metal is present in the knee joint from performing a TKA with standard cobalt-chromium (Co-Cr) components as well as with "nickel-free, hypoallergenic" components.

Methods: Joint fluid was collected immediately prior to arthrotomy and from drainage fluid the following morning to determine the amount of metal debris generated when performing a TKA with stainless steel sawblades and saw captures. Pre- and post-procedure joint fluid was collected from 24 consecutive cases of cemented Co-Cr components (Group I) and compared to a cohort of 17 patients with known or suspected metal allergy who had an Oxinium femoral and a titanium alloy tibial component.

Results: Group I patients had statistically higher levels of nickel (Ni; 30%, p=0.033), cobalt (Co; 1200%, p<0.0001) and chromium (Cr. 218%, p<0.0001). The cutting blocks and sawblades do not contain cobalt, which was the metal ion in highest concentration; therefore, the cobalt must have come from impacting the components. Subsequently, the debris generation purely from the sawblades and cutting blocks could be discerned from Group II. whose components do not contain Co, Cr, or Ni. Group II patients had 9.5x significantly higher Cr (0.50 vs. 0.053, p<0.001) and 5.1x higher Ni (1.37 vs. 0.267, p<0.0001) post-TKA vs. pre-TKA while the cobalt level was not significantly different as expected with the absence of Cobalt in the components (0.12 vs. 0.07, p=0.60). The nickel levels generated in performing an Oxinium TKA was 3.3x higher than when performing a Co-Cr TKA (1.37 vs. 0.41 ppb, p<0.001).

Conclusion: The substantial degree of nickel generation resulting from performing a hypoallergenic "nickel-free" TKA calls into question the rationale of utilizing more expensive, lower nickel components on the basis of known or suspected nickel or chromium allergy.

AAHKS Surgical Techniques and Technologies Award

Patient Acceptable Symptom State After UKA: A Matched Pair Analysis in ACL Deficient & Intact Knees

Kevin D. Plancher, MD, MPH, Jasmine Brite, BS, Karen K. Briggs, MPH, Stephanie C. Petterson, PhD

Notes

Introduction: The Patient Acceptable Symptom State (PASS) is considered a level of well-being as measured by the patient. The aim of this study was to determine if the proportion of patients who achieved an acceptable level of function (PASS) after medial UKA was different based on the status of the ACL at the time of UKA.

Methods: Patients were included in the study who underwent UKA for isolated medial osteoarthritis. Exclusion criteria were ACL reconstruction within the past five years. The Knee injury Osteoarthritis Outcome Score function score (KOOS-ADL) was used as the primary outcome variable with a PASS of 87.5, as described for total knee arthroplasty (TKA). Patients completed all other KOOS subscales, Lysholm, WOMAC, and VR12. Failure was defined as conversion to TKA.

Results: Survivorship at 10 years was 97% in the ACL-deficient and ACL-intact groups. The median survival for the ACL-deficient group was 16.1 years [95% CI: 15.3-16.8] and 15.6 [95% CI: 14.8-16.361] (p=0.878) for the ACL-intact group. At an average of 9±3.5 years in the ACL-deficient group, 87% of patients reached PASS for KOOS ADL. In the ACL-intact group, at an average of 8.6±3 years follow-up, 85% reached PASS for KOOS ADL. There was no difference in the percentage of patients who reached PASS for all KOOS subscales and Lysholm between the ACL-deficient and ACL-intact groups.

Conclusion: PASS was achieved in 85% of all knees for KOOS ADL, similar to reports on TKA. Fixed-bearing medial non-robotically-assisted UKA resulted in 97% survival at 10 years in both the ACL-deficient knee and ACL-intact knee. The ACL-deficient cohort results were not significantly different from the ACL-intact knee for all measures of outcomes. Understanding PASS will allow better communication between surgeons and patients to improve of care for knees with single compartment arthritis.

AAHKS Clinical Research Award

Are Minimum 2-Year PROMs Necessary for Accurate Assessment of Patient Outcomes After Primary TKA?

Abhijit Seetharam, MD, Evan R. Deckard, BS, Mary Ziemba-Davis, BA, R. Michael Meneghini, MD

Notes

Introduction: The 2-year minimum follow-up after total knee arthroplasty (TKA) required by most academic journals is based on historical implant survivorship studies rather than patient-reported outcome measures (PROMs). Additionally, the COVID-19 pandemic placed an unprecedented burden on staff and halted asymptomatic clinic visits to minimize in-person exposure. The purpose of this study was to determine if clinically meaningful differences are observed in PROMs beyond the first year following TKA.

Methods: A retrospective review of prospectively collected PROMs for 1,093 primary TKAs at an academic center was performed. Changes in pain, function, activity level, and satisfaction were compared at four follow-up intervals—preoperatively, 4-months, 1-year, and minimum 2-years using repeated measures analysis.

Results: Response rates for preoperative, 4-month, 1-year, and minimum 2-year PROMs were 88.2%, 69.9%, 63.6%, and 55.7% respectively. Pain with Knee Society level walking and while climbing stairs, UCLA activity level, and KOOS Jr. scores improved from preoperative levels at 4-months, 1-year, and minimum 2-years. Patient satisfaction also improved over postoperative follow-up intervals (84.0%, 87.3%, 90.9%). While PROMs improved with statistical and clinical significance preoperatively to 4-months to 1-year (p≤0.082), improvements from 1-year to minimum 2-year follow-up were small and did not reach MCIDs for most PROMs demonstrating significant overlap of 95% confidence intervals.

Conclusion: While long-term follow-up after TKA remains important for implant survivorship and function, with the numbers available, 1-year PROMs were as clinically reliable and meaningful as 2-year PROMs. These findings question the necessity of in-person visits to collect PROMs beyond 1-year and suggest that 1-year outcomes are reliably predictive of longer-term outcomes for peer-reviewed publication.

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Symposium V

How Should Antibiotics Be Used in Primary and Revision Hip and Knee Replacement?

Moderator: Henry D. Clarke, MD

Faculty: Joshua S. Bingham, MD, Carlos A. Higuera, MD, Mark J. Spangehl, MD, Bryan D. Springer, MD

Perioperative prophylactic antibiotics have proven to be the single most effective measure for reducing surgical site infections after hip and knee replacement. Consequently, this practice has become widespread around the world. Although consensus exists around the broad principles in this field, controversies and unanswered questions also exist. This panel of experts, who have all contributed to our understanding of this area, will provide insight into several controversies and review the data driving recent changes. Most importantly, they will provide practical advice that will help the symposium participants optimize patient care, particularly in uncommon scenarios. Specific recommendations will address:

- Best practices for perioperative antibiotic use, including what antibiotic is best, when, for how long, and the best delivery route.
- Current recommendations in hip and knee replacement regarding the use of antibiotics in bone cement.
- Timing of prophylactic antibiotic administration prior to revision surgery: should preoperative antibiotics ever be held; if so, when?
- Emerging evidence to support extended postoperative prophylactic oral antibiotics in high-risk individuals and following surgery for periprosthetic joint infection.

Learning Objectives:

- 1. To understand best practices for prophylactic preoperative antibiotic administration in primary surgery.
- **2.** To be aware of current indications for use of antibiotics in cement in hip and knee replacement.
- **3.** To learn how to optimize prophylactic antibiotic use prior to revision joint replacement.
- **4.** To interpret emerging evidence for extended postoperative oral antibiotics in high-risk individuals.

Outline:

Introduction

Henry D. Clarke, MD

Current Recommendations for Utilizing Prophylactic Antibiotics in Primary and Revision Hip and Knee Arthroplasty: What, When & How?

Mark J. Spangehl, MD

When and How Should I Use Antibiotic Cement in Primary and Revision Joint Replacement?

Joshua S. Bingham, MD

Should I Use Antibiotic Irrigation Solutions and Antibiotic Powder in Primary and Revision Joint Replacement?

Bryan D. Springer, MD

Is There a Role for Extended Postoperative Oral Antibiotics in Primary TJA High-risk Individuals After Surgery for Periprosthetic Joint Infection?

Carlos A. Higuera, MD

Discussion

All Faculty

Notes			

The SLIM Study: Economic, Energy, and Waste Savings Through Lowering of Instrumentation Mass in THA

Notes

Andrew Adamczyk, MD, Paul R. Kim, MD, FRCSC, Wade T. Gofton, MD, FRCSC, Paul E. Beaule, MD, FRCSC, George Grammatopoulos, MD, FRCS (ORTHO)

Introduction: Nearly 700,000 total hip arthroplasties (THA) are annually performed in North America (NA), costing the health care system >\$15 billion. More than 5 million tons of waste is generated by the health care system annually in NA, with 30-70% generated from operating rooms. This study aims to assess the satisfaction of the current THA set-up amongst different stakeholders, to determine economic, energy and waste cost of the current set-up and apply lean methodology to improve efficiency, and lastly, to design and test "SLIM setup" based on lean principles and its ability to be safely implemented into practice.

Methods: A Needs Assessment Survey was circulated to OR nursing staff. Through feedback, surgeon input, and review of our standard instrumentation, the "SLIM setup" was designed, significantly reducing trays required. Eighty patients were randomized to either the standard or SLIM setup. OR time, blood loss, 90-day complication rate, cost per case, instrument weight (kg) per case, total waste (kg) per case, case set-up time, and number of extra trays required were compared between groups.

Results: The majority of nursing staff demonstrated dissatisfaction with the current THA setup and felt current processes lacked efficiency. The SLIM setup was associated with the following savings: Energy= -3.8 kWh/case; Waste= -1.5 kg/case; Cost= -\$498.60/case; Trays = -6 (758 kg/case). This change was deemed safe as OR time, blood loss and complication rates were not statistically different (p>0.05) between groups. Setup time was significantly shorter (p>0.05) in comparison to standard and extra instrumentation was opened in <5% of cases.

Conclusion: A more "minimalist approach" to THA can be safely implemented. The SLIM setup has been shown to be efficient and has been openly accepted by our allied staff. Such set-up can lead to 1500kg reduction in waste, 3800 kWh and \$498,600 in savings per 1,000 THAs performed.

The Cost-Effectiveness of Intraoperative Imaging in Total Hip Arthroplasty

Notes

Gregory Kirchner, MD, Nathan Smith, BS, Vincenzo Bonaddio, MD, Mark L. Dunleavy, MD, Lucas E. Nikkel, MD

Introduction: Acetabular component positioning may be improved with the utilization of intraoperative imaging. The purpose of this study was to determine if intraoperative imaging during total hip arthroplasty (THA) is economically justifiable.

Methods: A breakeven analysis was used as a model for cost-effectiveness, which incorporates cost of imaging, rate of revision surgery, and cost of revision surgery, and yields a final revision rate that needs to be achieved with use of intraoperative imaging in order for its use to be economically justified. Absolute risk reduction (ARR) is determined by the difference between the initial revision rate and final revision rate.

Results: At our institutional cost of \$46.00, intraoperative fluoroscopy would be cost-effective if it reduced the rate of revision (0.45%) by an ARR of 0.06%. Intraoperative flat-plate radiographs cost \$53.00 at our institution, which would be cost-effective at an ARR of 0.07%. Cost-effectiveness increases with lower costs for intraoperative imaging (\$15, ARR 0.02%), and decreases at higher costs (\$150, ARR 0.19%). Initial revision rate does not affect ARR, with revision rates from 0.10-1.00% yielding a consistent ARR of 0.06%. The cost of revision surgery affects cost-effectiveness, with a hypothetically low cost of \$10,000 resulting in an ARR of 0.46% that exceeds the initial revision rate of 0.45%, while a hypothetically high cost of \$90,000 reduces the ARR to 0.05%.

Conclusion: Intraoperative imaging would need to prevent only one revision among 1,665 THAs utilizing fluoroscopy or 1,430 THAs using flat plate radiographs in order for its use to be economically justified.

Home Health Care Is Associated with Increased ED Visits, Readmissions, and Costs Following TKA

Robert A. Burnett, MD, Christopher Mestyanek, BS, P. Maxwell Courtney, MD, Craig J. Della Valle, MD

Notes

Introduction: Some practices routinely provide patients with home health services, believing that they are beneficial to assist with care and monitoring in the early postoperative period following total knee arthroplasty (TKA). The purpose of this study is to determine whether patients receiving home health services postoperatively had lower rates of complications, emergency department (ED) visits, and readmissions as well as to determine if home health provided value by reducing total episode-of-care costs.

Methods: We retrospectively reviewed the Humana claims database to identify all primary TKA patients over 65 years old from 2010-2018. Patients who received home health services were matched using a propensity score algorithm to a set of similar patients that were discharged home without home health services. We compared complication rates, emergency room visits, readmissions, and 90-day episode-of-care claims costs between the groups. Multivariate regression analysis was performed to determine the independent effect of home health services on emergency department (ED) visits and hospital readmissions.

Results: Of the 185,444 TKA patients discharged home, 15,849 (8.5%) received home health services. Patients who received home health services had higher rates of ED visits at 2 weeks (3.3% vs. 2.8%, p=0.014) and 3 months (7.1% vs. 6.5%, p=0.038) as well as increased readmissions at 2 weeks (0.9% vs. 0.7%, p=0.028); complication rates were similar between groups (11.4% vs. 10.9%, p=0.159). Episode-of-care costs for home health patients were higher than those discharged under self-care (\$24,266 vs. \$22,539, p<0.001).

Conclusion: Home health services do not appear to provide value as they are associated with significantly increased costs and do not lower the rates of complications, ED visits or readmissions following TKA.

Frailty Is Associated with Increased Adverse Events and Costs After Primary Total Hip Arthroplasty

Notes

Michael K. Tram, BA, Alex S. Qian, BS, Jennifer T. Tram, BS, Casey M. O'Connor, MD, Matthew W. Tetreault, MD

Introduction: Frailty can predict adverse outcomes for multiple medical conditions and surgeries, but little is known about its relation to total hip arthroplasty (THA) outcomes. This study evaluates the association between Hospital Frailty Risk Score (HFRS) and postoperative events and costs after primary THA.

Methods: In this retrospective cohort study, we used the National Readmissions Database to identify patients discharged after primary THA for osteoarthritis, osteonecrosis, or hip fracture from January-November 2017. We calculated HFRS and used multivariate logistic regression to compare 30-day readmission rate and negative binomial regression to compare hospital course duration and total costs between frail and non-frail patients for each primary diagnosis. Thirty-day complication and reoperation rates were also compared.

Results: We identified 167,700 THAs for osteoarthritis, 5,353 for osteonecrosis, and 7,246 for hip fractures. Compared to non-frail patients, frail patients had increased 30-day readmission rates (5.3% vs. 2.5% for osteoarthritis, 7.1% vs. 3.3% for osteonecrosis, 8.4% vs. 4.3% for fracture; p<0.01 for all), longer hospital course (3.4 vs. 1.9 days for osteoarthritis, 4.1 vs. 2.1 days for osteonecrosis, 6.3 vs. 3.9 days for fracture; p<0.01 for all), and increased hospitalization costs (\$70,683 vs. \$61,653 for osteoarthritis, \$81,177 vs. \$64,091 for osteonecrosis, \$89,088 vs. \$77,195 for fracture; p<0.01 for all). Frail osteoarthritis patients had higher 30-day complication (4.4% vs. 1.9%; p<0.01) and reoperation rates (1.6% vs. 0.93%; p<0.01). Frail osteonecrosis patients had higher 30-day complication rates (5.3% vs. 2.6%; p<0.01). Frail hip fracture patients had higher 30-day complication (6.6% vs. 3.8%; p<0.01) and reoperation rates (2.9% vs. 1.8%; p < 0.01).

Conclusion: Frailty is associated with increased health care burden and postoperative events after primary THA. This is the first study to assess the correlation between HFRS and post-THA outcomes for different diagnoses. Further research can help to identify high-risk patients and mitigate complications and associated costs.

Disagreement in Readmission Rates After Total Hip and Knee Arthroplasty Across Datasets

Notes

Stephanie Zhao, MS, Alicia Sampson, BS, Jamil Kendall, MD, Ryland Kagan, MD

Introduction: In 2014, the Affordable Care Act (ACA) Hospital Readmissions Reduction Program (HRRP) began penalizing hospitals for excessive readmission rates 30-days following THA and TKA. Various datasets with non-standardized validation processes report readmission data, which may provide conflicting outcome values for the same patient populations.

Methods: We queried four separate datasets: the American Joint Replacement Registry (AJRR), Centers for Medicare and Medicaid Services (CMS) billing data, the Vizient data set and an advanced analytics integration (Cognos) report from our electronic medical record. We identified 2,763 patients who underwent primary TKA and THA at a single academic medical center from June 2016 to June 2019. We then matched 613 surgery encounters in all four databases. Our primary outcome metric was 30-day readmissions. Fleiss' Kappa was used to measure agreement among the different datasets.

Results: Of the 613 THA and TKA patients, there were 45 (7.3%) readmissions noted. Data collected from the CMS flagged 41 (6.7%) readmissions, Vizient flagged 11 (1.8%) readmissions, and the AJRR and Cognos report both flagged 6 (0.98%) readmissions each. None of the readmissions were identified by all four datasets. There was significant disagreement among datasets using Fleiss' Kappa (kappa= -0.1318, p=0.03).

Conclusion: There is disagreement in readmission rates in databases receiving the same patient data after THA and TKA. Care must be taken to establish standard validation processes and reporting methods when interpreting readmission rates from various datasets.

Outcomes Vary Significantly Using a Tiered Approach to Define Success After Total Knee Arthroplasty

Christopher N. Carender, MD, Natalie A. Glass, PhD, Ayushmita De, PhD, Kevin J. Bozic, MD, MBA, John J. Callaghan, MD, Nicholas A. Bedard, MD

Notes

Introduction: Patient reported outcome measures (PROMs) allow objective assessment of clinical outcomes following primary total knee arthroplasty (TKA); however, recent literature is focused on minimal clinically important differences (MCID). The purpose of this study was to use a tiered approach with progressively more stringent definitions of success to examine clinical outcomes of primary TKA at 1-year postoperatively.

Methods: The American Joint Replacement Registry (AJRR) was queried from 2012-2020 for primary TKA. Patients that completed the following PROMs preoperatively and 1-year postoperatively were included: Western Ontario and McMaster Universities Arthritis Index (WOMAC), Knee Injury and Osteoarthritis Outcome Score (KOOS), and KOOS for Joint Replacement (KOOS-JR). Changes in PROM scores from preoperative to 1-year postoperatively were measured. Rates of achievement of MCID by distribution-based and anchor-based criteria, rates of achievement of patient acceptable symptom state (PASS), and substantial clinical benefit (SCB) were calculated.

Results: 12,341 TKA were included. Mean improvement in PROM scores were – KOOS-JR: 29; WOMAC-Pain: 33; WOMAC-Function: 31 (p<0.0001 for all). Rates of distribution-based MCID achievement were – KOOS-JR: 88%; WOMAC-Pain: 87%; WOMAC-Function: 84%. Rates of anchor-based MCID achievement were – KOOS-JR: 79%; WOMAC-Pain: 61%; WOMAC-Function: 46%. Rates of PASS achievement were – KOOS-Pain: 55%; KOOS-Symptoms: 54%; KOOS-Quality of Life (QOL): 56%; KOOS-Activity of Daily Living (ADL): 63%; WOMAC-Pain: 79%; WOMAC-Function: 82%. Rates of SCB achievement were – KOOS-JR: 69%; KOOS-Pain: 78%; KOOS-Symptoms: 68%; KOOS-QOL: 79%; KOOS-ADL: 81%.

Conclusion: Clinical outcomes at 1 year following TKA vary significantly when analyzing with a tiered approach to define success. Score improvement above MCID did not imply achievement of PASS or SCB. A tiered approach to interpretation of PROMs offers a more comprehensive understanding of outcomes following TKA and should be utilized for future research and clinical assessment, rather than focusing only on the minimum score necessary to define clinical improvement.

Symposium VI

The Changing Economic Value and Leverage of Arthroplasty Surgeons

Moderator: Richard Iorio, MD

Faculty: C. Lowry Barnes, MD, Joseph A. Bosco III, MD, Derek A. Haas, MBA, Chad A. Krueger, MD

This symposium will examine the changing economic value and leverage of surgeons as arthroplasty cases continue to shift from being performed as hospital inpatient only, to hospital outpatient, to ambulatory surgery centers. Using 100% Medicare Part A and B claims data for the country, this symposium will present the following trends:

- Trend from 2017-2021 in which arthroplasty cases are being performed (inpatient, outpatient, ASCs; broken down by type of procedure [i.e., TKAs, hip fractures, etc.]).
- Trend over time in payment per case by care setting.
- Trend over time in total professional fees and facility fees generated by arthroplasty surgeons, and a projection of how this will likely trend prospectively based on the expected continued migration of site of surgery.
- Trend over time in revenue per arthroplasty surgeon and how it compares with that of other major surgeon types.
- Trend over time in arthroplasty revenue for hospitals and surgery centers.

Learning Objectives:

- 1. To understand the magnitude of the shift over time in where arthroplasties are being performed and the resulting economic impact on surgeons, hospitals, and surgery centers.
- **2.** To gain insight into how compensation for surgeons has and will continue to evolve based.
- 3. To learn strategies for increasing economic leverage (whether you are employed or private) and what factors may lead to reconsidering practice type.
- **4.** To learn how IPO, MIPS, APMS and the RUC reimbursement and coding changes are affecting orthopaedic practices.

Outline:

Introduction: We've Got a Problem Richard Iorio, MD

The National Trend in Arthroplasty Surgery Location and the Economic Impact on Surgeons, Hospitals, and Ambulatory Surgery Centers

Derek A. Haas. MBA

How The Shift in Arthroplasty Surgery Location Impacts the Economic Relationship of Hospital Employed Surgeons and Hospitals C. Lowry Barnes, MD

How The Shift in Arthroplasty Surgery Location Impacts the Economic Relationship of Private Surgeons, Hospitals and Ambulatory Surgery Centers Chad A. Krueger, MD

IPO, MIPS, APMS and the RUC Reimbursement and Coding Changes: What Do These Mean to You and Your Practice?

Joseph F. Bosco III, MD

Discussion

All Faculty

Notes			

Perioperative Use of Antifibrotic Medications Associated with Lower Rate of Manipulation After TKA

Notes

Ajay Premkumar, MD, MPH, Alex J. Anatone, MD, Alex Illescas, MPH, Stavros G. Memtsoudis, MD, PhD, Peter K. Sculco, MD, Michael B. Cross, MD, Alejandro Gonzalez Della Valle, MD

Introduction: Several commonly prescribed medications have known antifibrotic properties and have been shown to reduce postoperative scar formation in other clinical areas. It is unknown whether use of such medications perioperatively in patients undergoing TKA may improve rates of postoperative stiffness.

Methods: A large US employer-sponsored health care database was queried for patients who underwent elective primary TKA for primary osteoarthritis between 2015-2019. Patients were excluded if they had interrupted health care coverage within the 3 months before or after surgery. Demographic information and comorbidities were recorded along with whether patients were prescribed one of several medications with known antifibrotic properties during the three months before or after surgery. The four most frequently prescribed classes of antifibrotic medications included specific ACE-inhibitors, angiotensin II receptor blockers, COX-2 inhibitors, and HMG CoA reductase inhibitors. Univariable and multivariable regression was performed to identify associations between perioperative medication use and likelihood of undergoing MUA within three months of surgery.

Results: Complete data was available for 101,366 patients undergoing TKA, of which 4,536 underwent MUA (4.68%). Perioperative use of any antifibrotic medication was associated with a lower likelihood of undergoing MUA (p<0.001). When controlling for age, sex, comorbidities, opioid use, length of stay, and other variables, perioperative use of specific ACE inhibitors (OR 0.91, CI: 0.84-1, p=0.042), COX-2 inhibitors (OR 0.88, CI: 0.81-0.96, p=0.002), and angiotensin II receptor blockers, specifically losartan (OR 0.80, CI: 0.70-0.91, p=0.007), all remained significantly associated with lower rates of MUA.

Conclusion: This study, spanning over a hundred thousand primary TKA procedures over a recent five-year period, demonstrates an association between perioperative use of specific medications with antifibrotic properties and a decreased rate of MUA. These data will help inform future studies aimed to prospectively evaluate the potential of antifibrotic medications in preventing postoperative stiffness in high-risk patients undergoing knee arthroplasty.

110100		

Timing of Bariatric Procedures Prior to Total Knee Arthroplasty

Sahir S. Pervaiz, MD, Scott J. Douglas, MD, Oliver C. Sax, DO, MS, **Christopher G. Salib, MD**, Taj-Jamal Andrews, MD, Ronald E. Delanois, MD

Notes

Introduction: Postoperative malabsorption and malnourishment commonly occur following Roux-en-Y gastric bypass (GB) resulting in subsequent delay for potential total knee arthroplasty (TKA). Sleeve gastrectomy (SG) has become the mainstay for weight loss surgery among morbidly obese patients due to improved nutritional outcomes. Studies suggest delaying TKA after by GB by 1-year. However, improvements in operative technique may suggest normalized nutrition and BMI by 6-months. Thus, the purpose of this study is to compare revision and prosthetic infection (PJI) incidences among morbidly obese TKA recipients at 1-year and 6-months post GB and SG.

Methods: A national, all-payer database was queried to identify patients undergoing TKA from 2010-2020 (n=1,436,857). Patients with a prior GB (n=6,641) and SG (n=6,142) were identified. Patients were stratified into groups by timing of bariatric procedures prior to TKA using 6-month and 1-year intervals. We assessed revisions and PJIs and other complications at 90-days post TKA.

Results: Patients with SG and GB at 6-months had no difference in 90-day revision (p=0.736) and PJIs (p=0.805) incidence post-TKA. There were no differences in 90-day mechanical complications (p=0.982), and periprosthetic fracture (p=0.476) 6-months post SG and GB. At 1-year post GB and SG, there were no differences in 90-day revisions (p=0.999) and PJI (p=0.999) incidence post-TKA. There were no differences in 90-day mechanical complications (p=0.999) and periprosthetic fracture (p=0.309) post 1-year SG and GB.

Conclusion: There are no differences in 90-day outcomes for TKA after 6-months and 1-year from GB or SG, despite current practice dictating a delay for TKA by 1-year post GB and SG. Bariatric procedures should be recommended for the morbidly obese with severe osteoarthritis 6-months prior to TKA. These results should encourage surgeons to perform TKA among morbidly obese patients earlier without a compromise in risk.

Intraosseous Morphine Decreases Postoperative Pain and Pain Medication Use in TKA

Notes

Kwan J. Park, MD, Ava Brozovich, MPH, Austin Wininger, MD, Francesca Taraballi, PhD, Bradley S. Lambert, PhD, Thomas C. Sullivan, BS, Terry A. Clyburn, MD, Stephen J. Incavo, MD

Introduction: Intraosseous (IO) infusion of medication is a novel technique that has been shown to increase local tissue concentration of antibiotics. The clinical significance of IO morphine medication has not been previously studied. To decrease postoperative pain in TKA patients, we investigated adding morphine to the IO injection.

Methods: A randomized, double-blinded, controlled trial was performed on 48 consecutive patients undergoing TKA. The control group received an IO injection of antibiotics per institutional standard protocol for primary TKA. The experimental group received an IO injection of antibiotics with 10 mg of morphine in double-blinded manner. Pain, nausea, opioid use, and functional outcomes were assessed up to 14 days postoperatively. Morphine and IL-6 serum levels were obtained at pre-determined levels postoperatively in 20 patients.

Results: The experimental group had lower pain score that achieved statistical significance at one, two, three, and five hours postoperatively (p=0.0032, p=0.005, p=0.020, p=0.10, respectively). This trend continued for post-op day one, two, eight, and nine (40% reduction, p=0.001; 49% reduction, p=0.036; 38% reduction, p=0.025; 33% reduction, p=0.041). Opioid pain medication consumption (MME) for the experimental group recorded lower opioid consumption on day 1 (35% reduction, p=0.018). The experimental group had lower opioid consumption in the first 48 hours and 2 weeks post-surgery (p<0.05). KOOS Jr. results showed significant improvement at 2 weeks post-surgery (ES 0.6, p<0.05). Serum morphine levels in the experimental group were significantly less in the postoperative period (1.04 vs. 2.42, p=0.012). The experimental group had higher IL-6 levels for 10 hours postoperatively (13.15 vs. 7.51, p<0.001). There was no difference in nausea between groups.

Conclusion: IO morphine demonstrates superior postoperative pain relief immediately and up to 2 weeks with lower systemic serum morphine levels. IO morphine is a safe and effective method to decrease postoperative pain in TKA patients.

Comparison of Silver-Embedded Occlusive Dressings and Negative Pressure Wound Therapy After TJA

Notes

Katherine A. Lygrisse, MD, Greg M. Teo, MD, Vivek Singh, MD, MPH, Nishanth Muthusamy, BA, Ran Schwarzkopf, MD, MSc, **William J. Long, MD, FRCSC**

Introduction: Continuous wound drainage after total joint arthroplasty (TJA) can lead to the development of periprosthetic joint infection, and patients with high body mass index (BMI) are at higher risk of wound complications. The purpose of this prospective randomized controlled trial was to compare the use of silver-embedded dressings and negative pressure wound therapy (NPWT) in patients with BMI ≥35 m/kg2 undergoing TJA.

Methods: This randomized control trial looked at patients undergoing TJA between October 2017 and February 2020. An a priori power analysis was performed, and the study was fully powered with the sample size. Patients were randomized preoperatively to receive either a silverembedded occlusive dressing (control arm) or NPWT. Frequency distributions, means, and standard deviations were used to describe baseline patient demographics, surgical time, discharge disposition, postoperative complications, 90-day readmissions, and reoperations. T-test and chi-squared were used to test for significant differences between continuous and categorical variables, respectively.

Results: A total of 230 patients with average follow-up of 3 months were included in this study. Patients were divided evenly, with 115 patients in the control arm and 115 patients receiving NPWT. There were no statistically significant differences with regard to baseline demographics, surgical time, or discharge disposition between groups. Four (3.5%) patients in the control group had wound complications (3 cases of drainage, 1 nonhealing wound) and two patients in the NPWT group (1.7%; drainage) (p=0.68). There were zero 90-day readmissions in the control arm and two (1.8%) in the NPWT arm (p=0.50). There were three (2.6%) reoperations in the control arm (irrigation and debridement [I&D], I&D with liner exchange, and revision) and zero in the NPWT arm (p=0.25).

Conclusion: In our study patients with BMI \geq 35 m/kg2 undergoing TJA, there is no difference in wound complications, readmissions, or reoperations when treated with either NPWT or silver-embedded dressings.

Cemented Patellar Implant Malposition: A Non-Issue for the Painful TKA

Notes

Evan J. Peissig, MD, Thomas Hsing, MD, Ajay Aggarwal, MD, **Nathan J. Cherian, BS**, James A. Keeney, MD

Introduction: The identification of non-optimal patellar implant placement or patellar tilt might influence treatment considerations during revision total knee arthroplasty (TKA). We performed this study to determine whether patellar implant malposition or patellar tilt is associated with inferior patient reported outcome scores or patient satisfaction after primary TKA.

Methods: We identified 396 TKA patients (439 knees) from an institutional joint replacement registry that received cemented patellar resurfacing, were assessed with radiographs before and 6 weeks after surgery, and completed patient reported outcome measures (PROMs) before surgery and at a mean 505 days after surgery (range 365-799 days). We excluded TKAs performed without patellar resurfacing, coronal plane tibiofemoral malalignment >3 degrees, tibial slope <3 or >9 degrees (CR-TKA design), reverse tibial slope or >5 degrees (PS-TKA design), femoral component notching, or femoral component overhang. Preoperative demographic characteristics, expectations, CJR-defined outcome instruments, and UCLA activity score were compared between 60 TKAs performed without optimal patellar resurfacing technique (36 TKAs with patellar implant malposition and 24 TKAs with lateral patellar tilt), and 379 TKAs performed with optimal patellar implant placement.

Results: There were no differences in demographic features, preoperative radiographic disease severity, preoperative expectations, preoperative PROMs, tibiofemoral component alignment, postoperative PROMs, or patient reported satisfaction (p=0.48) between the two cohorts. KOOS- Jr improved similarly (p=0.62) among patients with optimal resurfacing (48.5 to 77.6 points) and with non-optimal resurfacing (47.7 to 76.6 points). The proportion of satisfied patients was similar in both optimal and non-optimal resurfacing groups (92.7% vs. 88.1%, p=0.29).

Conclusion: Patellar component malposition and patellar tilt identified on postoperative radiographs may prompt a treatment consideration during revision TKA surgery. However, the data obtained from this study do not suggest that these conditions contribute independently to postoperative pain, functional limitation, or patient dissatisfaction.

Symposium VII

Occupational Hazards to the Joint Replacement Surgeon

Moderator: Jonathan M. Vigdorchik, MD

Faculty: Claudette M. Lajam, MD, Jeremy M. Gililland, MD, Antonia F. Chen, MD, MBA

Notes

As the demand for joint replacement continues to increase year after year, we must focus on the longevity of the joint replacement surgeon. This symposium will help surgeons understand common injuries to joint replacement surgeons related to the repetitive nature of the procedures and now to prevent such injuries in their practices.

Learning Objectives:

- **1.** To understand radiation exposure to the orthopaedic surgeon, patient, and surgical team.
- **2.** To learn prevention strategies to minimize injuries over a career in joint replacement.
- **3.** To understand how technologies can help reduce injuries.

Outline:

Introduction

Jonathan M. Vigdorchik, MD

Radiation Exposure

Jeremy M. Gililland, MD

Noxious Exposures: Bovie Smoke, Cement, Noise

Claudette M. Lajam, MD

Repetitive Musculoskeletal Injuries

Antonia F. Chen, MD, MBA

How Can Technology Help Prevent Injury?

Jonathan M. Vigdorchik, MD

Discussion

All Faculty

Does Low Back Pain Improve Following Total Hip Arthroplasty?

Karim Shafi, MD, Jonathan M. Vigdorchik, MD, David A. Kolin, MS, Aaron Buckland, MD, Kaitlin M. Carroll, BS, **Seth A. Jerabek, MD**

Notes

Introduction: Patients indicated for total hip arthroplasty (THA) frequently present with both hip and low back pain (LBP). The purpose of this study was to compare patients whose back pain resolved following THA to those whose LBP did not resolve and to identify how to predict pain resolution using spinopelvic parameters.

Methods: A consecutive series of 500 patients who underwent THA for unilateral hip osteoarthritis was reviewed. All patients underwent biplanar standing and sitting EOS radiographs preoperatively. Patients with previous spine surgery or femoral neck fracture were excluded. The Oswestry Disability Index (ODI) scores was calculated preoperatively and at 1- and 2-years postoperatively. Spinopelvic parameters included pelvic incidence and change in sacral slope (SS) from standing to sitting with patients divided into 3 categories: <10, 10-25, >25-degree change.

Results: Of the 500 patients, 204 (41%) had documented LBP prior to THA. At one- and 2-year follow-up, resolution of back pain occurred in 168 (82.4%) and 187 (91.2%) patients respectively. The ODI for patients improved from 38.9±17.8 preoperatively to 17.0±10.6 at one year postoperatively (p<0.001). Pelvic incidence was not predictive of back pain resolution. When comparing spinopelvic parameters between the two groups, all patients whose back pain resolved had a sacral slope change from standing to sitting of >10 degrees while all patients whose back pain did not resolve had a change of <10 degrees.

Conclusion: This study demonstrates that symptomatic LBP resolved in 82% of patients after THA. The results of this study may be used to counsel patients regarding back pain and its resolution following total hip replacement and may help surgeons in the planning whether to address hip or spine pathology first.

Patients Who Do Not Receive Aspirin Due to Allergy Have an Increased Risk of Venous Thromboembolism

Notes

Graham S. Goh, MD, Elie Kozaily, MD, Timothy L. Tan, MD, Javad Parvizi, MD, FRCS

Introduction: Patient-reported allergies to aspirin or Nonsteroidal Anti-Inflammatory Drugs (NSAIDs) may preclude certain patients from receiving aspirin for venous thromboembolism (VTE) prophylaxis after total joint arthroplasty (TJA). This study aimed to (1) determine whether the use of non-aspirin agents due to a self-reported aspirin or NSAID allergy was associated with a higher incidence of VTE; and (2) determine the outcome of patients who reported an allergy and still received aspirin.

Methods: Prospectively collected data of 45,171 patients who underwent primary TJA between 2000 and 2019 at a single institution was reviewed. Patients who reported an allergy to aspirin (n=267) or NSAIDs (n=556) were identified (n=823) using electronic labels, administrative codes and comprehensive keyword searches. Using a validated VTE risk calculator, each patient was assigned a risk score based on 26 comorbidities. Ninety-day VTE, bleeding complications and allergic reactions were collected as endpoints. Multivariable logistic regression was performed to determine factors associated with VTE.

Results: The incidence of aspirin or NSAIDs allergy was 1.8%. Interestingly, 80 of 267 patients (30%) who reported an aspirin allergy still received aspirin. Compared to patients who received aspirin without a history of allergy (n=17,648), patients who received non-aspirin thromboprophylaxis due to aspirin or NSAID allergy (n=383) had a higher incidence of VTE (2.87% vs. 0.24%, p<0.001). Using multivariable regression, these patients had an 8-fold increase in VTE risk (adjusted OR: 7.94, 95%CI: 2.86–22.07, p<0.001). The incidence of true allergic reactions to aspirin among those with reported allergy was 1.8% (number-needed-to-harm, 55). None of the patients with reported aspirin allergy who received aspirin developed anaphylaxis or severe hypersensitivity reactions.

Conclusion: Patients with a self-reported allergy to aspirin or NSAIDs were at a significantly increased risk of VTE if they received non-aspirin thromboprophylaxis agents following TJA. Excluding a true allergy may be beneficial in these patients.

Improving Postoperative Acute Kidney Injury Rates Following Primary Total Joint Arthroplasty

Nathan R. Angerett, DO, Alexander Yevtukh, DO, Christopher Ferguson, DO, Michael E. Kahan, DO, Muzaffar Ali, DO, Richard H. Hallock, MD

Notes

Introduction: Perioperative hip and knee arthroplasty complications remain a significant clinical and financial burden. Our institution has shifted to developing protocols in an attempt to decrease these perioperative complications. This study focuses on acute kidney injury (AKI) rates status post primary total joint arthroplasty (TJA). Current literature demonstrates a 2%-15% incidence of AKI following TJA. To our knowledge there have been no published protocols that have effectively reduced AKI rates following TJA. The purpose of this study was to evaluate the effect that our institutionally developed perioperative renal protocol had on the postoperative AKI rates.

Methods: A retrospective cohort study was performed. Patient demographics, baseline creatinine, and postoperative creatinine values during the patient's hospitalization were collected and analyzed. The preintervention cohort data contained all patients at our institution that underwent a primary TJA from November 1, 2016, to January 1, 2018. The post-intervention cohort included all primary TJA patients from July 1, 2018, to February 2, 2020. The institution's renal protocol was under development and implementation during the several months between the two cohorts so that data was excluded. AKI was defined using the AKI Network (AKIN) classification system comparing baseline and postoperative creatinine values. A univariate analysis using the chisquared test was performed to determine the statistical significance of our results.

Results: Pre-intervention, 1,013 patients underwent a primary TJA with 67 patients developing an AKI postoperatively. Post-intervention, 2,169 patients underwent primary TJA with 90 developing an AKI (6.61% vs. 4.15%, p-value=0.0028, OR=0.61, 95% CI: 0.44-0.85).

Conclusion: To our knowledge, this is the first study in the literature that has found a statistically significant reduction in AKI rates following the implementation of a perioperative renal protocol. A reduction in AKI rates following TJA will result in improved outcomes and secondarily decrease the financial impact of postoperative complications seen following TJA.

Tranexamic Acid Decreases the Risk of Complications in TJA Patients with Preoperative Coagulopathy⁽⁾

Notes

Graham S. Goh, MD, Taylor D'Amore, MD, Jess H. Lonner, MD, Yale A. Fillingham, MD

Introduction: Preoperative coagulopathy is a surrogate for the risk of blood loss in surgical candidates and has been associated with increased perioperative morbidity. The anti-fibrinolytic effects of tranexamic acid (TXA) could negate the association between preoperative coagulopathy and adverse outcomes in patients undergoing total joint arthroplasty (TJA), although no studies have evaluated this relationship. This study aimed to compare the perioperative outcomes in coagulopathic patients undergoing TJA who did or did not receive TXA.

Methods: We identified 2,123 primary TJAs (975 knees, 1,148 hips) performed in patients with a preoperative coagulopathy between 2001 and 2019. Coagulopathy was defined as INR >1.2, platelet count <150,000/μL, or PTT >35 seconds. TXA was administered in 240 patients and not administered in 1,883 patients. Demographics, comorbidities, surgical details including operative time, blood loss, and thromboprophylaxis agent were recorded. Multivariable regression models were used to identify factors associated with 90-day complications, length of stay and discharge disposition.

Results: Patients who received TXA had a decreased risk of 90-day complications (OR 0.57, 95% CI 0.32–0.97, p=0.043), especially cardiovascular, gastrointestinal and genitourinary complications. Other variables protective against complications included male gender, knee joint, decreased Elixhauser comorbidity index and aspirin thromboprophylaxis. TXA use was also associated with shorter length of stay (beta 0.72, 95% CI 0.64–0.80, p<0.001) and decreased risk of non-home discharge (OR 0.52, 95% CI 0.30–0.90, p=0.020) following TJA. There was no difference in blood transfusions, wound complications or 90-day readmissions between the groups.

Conclusion: TXA use decreases perioperative complication risk and resource utilization in arthroplasty patients with a preoperative coagulopathy identified on preadmission testing. These findings support the broader adoption of TXA in patients undergoing TJA, particularly when the patient has a preoperative coagulopathy.

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

Geriatric Nutritional Risk Index Predicts Adverse Outcomes for Total Joint Arthroplasty

Notes

Christopher J. Fang, MD, Ghulam H. Saadat, MD, Bennet A. Butler, MD, Faran Bokhari, MD

Introduction: Malnutrition affects patient outcomes following total joint arthroplasty (TJA). Although hypoalbuminemia has been used as a surrogate, there is no unanimous method for screening and assessing malnutrition. This study aimed to determine if malnutrition, as defined by the Geriatric Nutritional Risk Index (GNRI), is independently correlated with short-term (<30 days) postoperative complications and prognosis in patients undergoing TJA.

Methods: The 2016-2019 American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) was queried for all patients over age 65 who underwent TJA. Based on GNRI value, patients were divided into three groups: normal nutrition (GNRI>98), moderate malnutrition (GNRI= 92-98), and severe malnutrition (GNRI<92). After adjusting for potential confounders, multivariable regression models were used to analyze the association between GNRI and patient outcomes.

Results: A total of 191,087 patients were included in the study. Prevalence of malnutrition based on BMI (<18.5), albumin (<3.5 mg/dL) and GNRI (≤98) was 0.41% (784), 4.17% (7,975), and 15.83% (30,258). Adjusted analysis showed that compared to normal nutrition, moderate and severe malnutrition were associated with a higher rate of transfusion, readmission, and postoperative length of stay over eight days (p<0.05). Severe malnutrition was also associated with pneumonia, surgical site infection, urinary tract infection, sepsis, and revision surgery (p<0.05).

Conclusion: Malnutrition, as defined by GNRI, is an independent predictor of adverse outcomes for patients undergoing TJA. The results indicate that preoperative screening with GNRI can be considered in determining patients' nutrition status.

Onodera's Prognostic Nutritional Index: A Valuable Measure in Predicting Complications After TKA

Notes

Alisina Shahi, MD, PhD, Ali Oliashirazi, MD, Jack Shilling, MD, Elie S. Ghanem, MD

Introduction: The best marker for assessing nutritional status prior to total knee arthroplasty (TKA) remains unknown. The purpose of this study was to investigate the utility of Onodera's prognostic nutritional index (OPNI) in predicting early complications following TKA, and to determine the threshold above which the risk of complications increases significantly.

Methods: This prospective multi-center study evaluated primary TKAs. The OPNI was measured in patients within 14 days of surgery. Complications were assessed for 12 weeks from surgery and included prosthetic joint infection (PJI), wound complications, re-admission, and re-operation. The Youden's index was used to determine the cut-off for OPNI and albumin. Multiple regression model was also performed using the Charlson comorbidity index to compare the outcomes using OPNI and albumin levels as independent variables.

Results: Overall, 1,325 patients (562 males, 763 females) were included in the study. OPNI cutoff score of 45.1 was determined as the optimal threshold associated with complications. Patients with lower OPNI (<45.1) were 9.8 times more likely to develop PJI compared to patients with higher OPNI (p=0.001). Re-admission and re-operation rates were 4.6 and 4.2 times higher in patients with OPNI below the threshold (p=0.017 and p=0.005, respectively). These complications remained statistically significant in multiple regression analysis. Unlike OPNI, albumin failed to show a significant association with complications (cutoff: 38.2 g/L).

Conclusion: OPNI is a valid and an excellent predictor of complications following TKA. It better reflects the nutritional status, has greater predictive power for complications, and can determine whether the body is in anabolic or catabolic status. Based on these findings, we recommend screening of all patients undergoing TKA using OPNI. For those who have a score lower than 45.1, the risk of surgery should be carefully weighed against its benefit and nutritional optimization should be considered.

Symposium VIII

The Painful Total Hip Arthroplasty - Looks Good, But Feels Bad

Moderator: R. Michael Meneghini, MD

Faculty: Young-Min Kwon, MD, PhD, Javad Parvizi, MD, FRCS, Ran Schwarzkopf, MD, MSc

This symposium will highlight the latest in diagnosis and treatment for the challenging scenario of a painful total hip arthroplasty (THA) that has relatively normal radiographs. The etiologies covered will include adverse local tissue reaction from metallosis, culture-negative infection, subtle aseptic loosening and musculotendinous injuries and deficiencies such as iliopsoas impingement and abductor deficiency.

Learning Objectives:

- **1.** To understand how to workup the painful THA patient.
- **2.** To learn how to diagnose and treat the more challenging causes of pain after THA.
- **3.** To learn the latest in diagnosis, treatment, and outcomes for culture negative THA periprosthetic joint infection (PJI).

Outline:

Introduction

R. Michael Meneghini, MD

Metal Articulations as a Source of Pain

Young-Min Kwon, MD, PhD

Diagnosis and Treatment of Culture Negative Infection

Javad Parvizi, MD, FRCS

Diagnosis and Detection of Subtle Aseptic Loosening

Ran Schwarzkopf, MD, MSc

Diagnosis and Treatment of Musculotendinous Deficiencies

R. Michael Meneghini, MD

Discussion

All Faculty

		_

Extensive Preoperative Work Is Required for Revision Hip and Knee Arthroplasty

Samantha Mohler, MS, Jeffrey B. Stambough, MD, Ashleigh Kathiresan, MEd, C. Lowry Barnes, MD, Simon C. Mears, MD, PhD, Benjamin M. Stronach, MD, MS

Notes

Introduction: Revision total joint arthroplasty (RevTJA) is to be removed from the in-patient only (IPO) list by 2024. Efforts to determine the clinical effort associated with preparing for RevTJA are necessary to maintain the appropriate work-relative value unit rating. Our study aims to quantify preoperative work (POW) required for RevTJA.

Methods: We performed a retrospective analysis of electronic medical record (EMR) activity for 100 hip and 100 knee RevTJAs. EMR audit logs were generated to represent the time-period from decision for surgery to the day prior to surgery. The time between mouse-clicks was calculated for each clinical team member. Time between clicks >5 minutes was assumed to reflect inactivity and excluded. Independent samples t-tests were conducted to compare total POW for procedure, age, gender, insurance, and health literacy (p<0.05).

Results: The POW time-period was 57.5 days (SD: 40.7, range: 3-197). Total POW was 97.7 minutes (SD: 53.1). Surgeon POW accounted for 10.5 minutes (SD: 9.3). Nurses spent 29.9 minutes (SD: 34.2), physician extenders 22.1 minutes (SD: 17.0), and office staff 34.1 minutes (SD: 35.2). Most work involved obtaining records, medication review, order sets, patient communication, and prior authorization. There was no difference in total POW based on procedure (hip vs. knee, p=0.40), age (<65 years vs. ≥65 years, p=0.58), gender (male vs. female, p=0.63), insurance (government-subsidized vs. private, p=0.33), and health literacy (adequate vs. inadequate, p=0.66).

Conclusion: We found RevTJA requires substantial preoperative preparation from the surgical team. EMR audit logs capture the bare minimum POW required to prepare a patient for RevTJA. These may not include surgical planning outside the EMR or POW with >5 minutes between clicks, which was not counted to remove any effect of EMR inactivity. Prior to RevTJA removal from the IPO list, more research should be conducted to facilitate fair compensation of surgeon effort.

Evaluation of Dietary Markers of Malnutrition and Their Utility to Predict Failure Post-Revision TJA

Notes

Allina A. Nocon, PhD, Peter K. Sculco, MD, Kathleen W. Tam, MPH, Rebecca Tonnessen, BS, Alberto V. Carli, MD, FRCSC

Introduction: Orthopaedic literature has identified robust associations between several nutritional markers in total joint arthroplasty (TJA) patients and the occurrence of postoperative complications. Conversely, the literature on nutrition rarely discusses serum markers, instead emphasizing comorbidities, measures of body mass index, sarcopenia, and results of food intake questionnaires. This study attempts to bridge orthopaedic and nutritional literature, comparing several orthopaedically recognized nutritional markers with the recommended assessment from the American Academy of Nutrition and Dietetics, the Malnutrition Screening Tool (MST).

Methods: MST scores and preoperative serological markers (Vitamin D, Albumin, total lymphocyte count) were retrospectively analyzed in 2,698 patients undergoing revision TJA (rTJA) at a single institution from 2017-2020. Endpoints included hospital readmission within 90 days. An MST score >2 defined patients at risk for malnutrition. Sensitivity and specificity for preoperative variables were calculated, and relationships with early readmission were calculated using Fishers exact test. Combinations of serum tests with MST scores were also assessed, and Spearman's rank correlation examined degree of association between serum tests and MST.

Results: 5% (n=133) of rTJA patients had MST >2. Of 2,698 patients, 97% (2,630) had preoperative lymphocyte counts, 84% (2,273) had albumin and 70% (1,891) had Vitamin D. Albumin (AUC=0.74) was the best diagnostic predictor of MST >2. Furthermore, low albumin (<3.5g/dL) was the only independent serum marker significantly associated (p=0.006) with early readmission. When combinations were assessed, low albumin with MST >2 was found to be significantly associated with early readmission, p=0.01. A significant correlation was found between MST score and albumin levels (p<0.0001).

Conclusion: This study is the first to evaluate serum markers and intake questionnaires with readmissions post-rTJA. Serum albumin continues to be an important preoperative marker of postoperative events. The MST is associated to serum albumin and deserves further investigation as both a marker and possible therapeutic target.

Tourniquet Use Is Associated with Improved Outcomes in Aseptic Revision Total Knee Arthroplasty

Vivek Singh, MD, MPH, Joseph X. Robin, MD, Benjamin Fiedler, BA, Chelsea S. Sicat, MS, Trevor Simcox, MD, Joshua C. Rozell, MD, Ran Schwarzkopf, MD, MSc, Vinay K. Aggarwal, MD

Notes

Introduction: Although tourniquet use in primary total knee arthroplasty (TKA) has been widely studied, the outcomes associated with tourniquet use in revision TKA (rTKA) remains unexplored. This study aims to investigate whether the use of a tourniquet in aseptic rTKA influences surgical outcomes and patient satisfaction compared to rTKA performed without a tourniquet.

Methods: We retrospectively reviewed all patients who underwent rTKA for all aseptic causes at a single institution from 2011-2020. Patients were separated into two cohorts based on tourniquet inflation during the procedure. Demographic differences were assessed with chi-square and independent sample t-tests. Outcomes were compared using multilinear and logistic regressions, controlling for demographic differences.

Results: Of the 1,212 patients included, 1,007 (83%) underwent aseptic rTKA with the use of a tourniquet and 205 (17%) without one. The mean tourniquet inflation time was 93.0 minutes with a median of 100.0 minutes. EBL was significantly less for patients who had a tourniquet used (224.1 vs. 325.1 mL, p<0.001). Patients who had a tourniquet inflated intraoperatively had a significantly lower decrease in Hb from pre- to postoperatively (1.75 vs. 2.04 g/dL, p<0.001). Although 90-day readmissions did not statistically differ between the two cohorts (p=0.059). reoperation rate was significantly greater for patients who did not have a tourniquet utilized (20.5% vs. 15.0%, p=0.038). Delta improvement in KOOS, JR scores from baseline to 3-months did not statistically differ between the cohorts (p=0.560). The results remained similar when the cohorts were analyzed based on whether patients underwent isolated polyethylene tibial liner or component (single-component and/or full revision) exchange.

Conclusion: While delta improvements in KOOS, JR scores were similar for both cohorts, patients who did not have a tourniquet inflated had larger blood loss and were more likely to require subsequent reoperation compared to patients who did. Further prospective investigation is warranted to confirm the benefit of using tourniquet for aseptic rTKA.

Extended Oral Antibiotic Prophylaxis After Aseptic Revision TKA: Does It Decrease Infection Risk?

Brandon R. Bukowski, MD, Aaron R. Owen, MD, Travis W. Turner, BS, Kristin M. Fruth, BS, Douglas R. Osmon, MD, Mark W. Pagnano, MD, Daniel J. Berry, MD, Matthew P. Abdel, MD

Notes

Introduction: Extended oral antibiotic prophylaxis (EOA) has been shown to potentially reduce infection rates after high-risk primary total knee arthroplasties (TKA) and reimplantations. However, data are limited regarding EOA after aseptic revision TKA. This study evaluated the impact of EOA on infection-related outcomes after aseptic revision TKA.

Methods: We retrospectively identified 904 consecutive aseptic revision TKAs performed between 2014 and 2019. Patients who received EOA >24 hours perioperatively (n=267) were compared those who did not (n=637) using an inverse probability of treatment-weighted model. The mean age was 66 years, mean BMI was 33 kg/m2, and 54% were female. Outcomes included cumulative probabilities of any infection, periprosthetic joint infection (PJI), superficial infection, and reoperation and re-revision for infection. Mean follow-up was 2 years.

Results: The cumulative probability of any infection following aseptic revision TKA was 1.9% at 90 days, 3.5% at 1 year, and 8.8% at 5 years. Patients without EOA had a higher risk of any infection at 90 days (HR=7.1; p=0.01), but not at 1 year (p=0.8) or 5 years (p=0.7). The cumulative probability of PJI following aseptic revision TKA was 0.8% at 90 days, 2.3% at 1 year, and 6.5% at 5 years. Patients without EOA did not have an increased risk of PJI. There was a trend towards increased risk of superficial infection in patients without EOA at 90 days (HR=4.4; p=0.09) and 1 year (HR 1.9; p=0.06), but not at 5 years (p=0.5). There were no differences in re-revision or reoperation for infection at any timepoint between groups.

Conclusion: EOA following aseptic revision TKA was associated with a 7-fold decreased risk of any infection at 90 days. EOA was not associated with decreased risk of deep PJI, however. There were no differences in reoperation for infection at any timepoint based on EOA status.

High Incidence of Mechanically Assisted Crevice Corrosion at 10 Years in Non-Cemented, Non-Recalled, Contemporary Total Hip Replacement

Notes

Brian J. McGrory, MD, MS

Introduction: One to three percent of contemporary noncemented total hip arthroplasties (THAs) with cobalt (Co) alloy femoral heads present with symptomatic mechanically assisted crevice corrosion (MACC). The incidence of this problem, however, as well as the rate of asymptomatic elevations in serum Co, has not yet been established.

Methods: Serum Co and chromium (Cr) levels were obtained in conjunction with radiographs at routine 10-year surveillance follow-up of a non-recalled, non-cemented, non-modular, contemporary THA with a titanium stem, Co alloy femoral head and cross-linked polyethylene countersurface.

Results: Ten-year follow-up of patients with 162 consecutive THAs revealed that 17 patients with 18 hips had died of unrelated causes prior to metal ion testing. Two hips were revised for other reasons, and of the remaining 144, 33 were in patients who were lost or refused to return, leaving 109 hips (77% of those in alive patients and unrevised for other reasons and 68% of the entire cohort) for investigation. 63 (58%) had a serum cobalt less than 1 ppb, and 35 (32%) a cobalt of 1 ppb or greater, a cutoff consistent with MACC. 11 hips are possible positive, as the Co is elevated, but it is unclear if the hip from 2009 is the cause. Of the 32 hips with definite MACC, 15/32 (47%) were symptomatic, 16/27 (53%) had adverse local tissue reaction (ALTR) on magnetic resonance imaging, and 19/32 (59%) have undergone revision surgery for MACC to date.

Conclusion: 10 years following a non-recalled, currently available THA, a minimum of 22% (35/162) hips had a cobalt level more than 1 ppb, consistent with MACC at the head-neck junction. Symptoms and ALTR are each present about one-half of the time, and 59% of those with documented MACC have undergone revision surgery.

Changing Surgical Approach from Index to Revision THA: No Increased Risk of Dislocation or Revision

Notes

Joshua R. Harmer, MD, Cody C. Wyles, MD, Dirk R. Larson, MS, Michael J. Taunton, MD, Mark W. Pagnano, MD, Matthew P. Abdel, MD

Introduction: Many considerations dictate preferred surgical approach in revision total hip arthroplasty (THA). No prior studies have examined outcomes based on utilizing a concordant vs. discordant approach between the primary and revision THA. This study aimed to quantify approach concordance/discordance from primary to revision THA, and assess impact on incidence of dislocation, re-revision, reoperation, and non-operative complications.

Methods: Between 2000 and 2018, 790 revision THAs were retrospectively identified in patients who underwent primary THA at the same academic center. Patients with primary THA performed for oncologic resection or using uncommon approaches were excluded. Surgical approach was determined for primary and revision THA with dislocations, re-revisions, reoperations, and complications determined from our total joint registry. Complication rates were compared between those with concordant and discordant surgical approaches. Mean age was 61 years, 51% were female, mean BMI was 31 kg/m2, and mean follow-up was 4 years.

Results: Surgical approach discordance occurred in 106 cases (13%), which was more frequent (71%, p<0.001) when the direct anterior approach was used for primary THA compared to lateral (12%) or posterior (10%) approaches. There were no statistically significant differences in the incidence of dislocations, re-revisions, reoperations, and non-operative complications among those with concordant and discordant approaches for the overall cohort and when analyzed by primary approach (p>0.13 for all). Among patients with a posterior approach during primary THA, there was a trend toward decreased dislocation risk with a revision lateral approach compared to posterior approach (5-year rate: 8% vs. 16%, respectively; p=0.24).

Conclusion: Comparable dislocation and complication rates were observed among revision THAs with concordant and discordant approaches between primary and revision THA. These data provide reassurance that changing vs. maintaining the surgical approach from primary to revision THA does not significantly increase dislocation risk or that of re-revision, reoperations, and non-operative complications.

Proximal Femoral Replacement Implants for Non-Oncologic Revision Total Hip Arthroplasty

Notes

Nathanael D. Heckmann, MD, Haley Nakata, MD, Brian C.H. Chung, BS, Jackson Baker, BS, Alexander B. Christ, MD, Donald Longjohn, MD, Jay R. Lieberman, MD, Daniel A. Oakes, MD

Introduction: Proximal femoral replacement (PFR) is a well-established salvage procedure when extensive proximal femoral bone loss is encountered. The purpose of this study is to assess outcomes of PFRs used for non-oncologic indications.

Methods: All patients who received a cemented PFR between 2015-2020 were screened for inclusion. Participants completed a telephone questionnaire to assess patient satisfaction, complications, revision procedures, and Oxford Hip scores. Relationships between patient demographics, surgical factors, and outcome scores were investigated. Implant survivorship was estimated using the Kaplan-Meier method.

Results: 27 PFRs (24 patients) with an average age of 69.3±12.9 years and average BMI of 27.4±5.6 kg/m2 were followed for an average of 2.4 years. Of these, 62.5% were female and 50.0% were white. The mean Oxford Hip Score at final follow-up was 31.7±10.2 and average patient satisfaction was 4.9/5. Indications for PFR were secondstage reconstruction for periprosthetic joint infection (n=6), aseptic loosening/osteolysis (n=6), fracture nonunion (n=5), periprosthetic fracture (n=5), nonunion of prior trochanteric osteotomy (n=2), and acute intertrochanteric femur fracture (n=1). The average number of operations on the ipsilateral hip prior to PFR was 3.1±2.1. Four patients (16.7%) required a reoperation, and six patients (25.0%) experienced a postoperative complication. Dislocation occurred in three patients (10.3%), 2 with a conventional bearing and 1 with a constrained liner. No patient with a dual-mobility articulation (n=4) dislocated. Three-year survivorship was 85.2% (95% CI 71.8%-98.6%) with all-cause reoperation as the endpoint and 100% (95% CI 100.0%-100.0%) with revision for aseptic loosening as the endpoint.

Conclusion: The current study demonstrates good short-term survivorship, satisfactory patient-reported outcomes, and high patient satisfaction following PFR for non-oncologic indications. Overall, 25.0% of patients experienced a postoperative complication. Surgeons should avoid the use of conventional bearings during PFR, and instead consider the use of constrained liners or dual mobility articulations when possible.

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QT Ultrasound: Stock or stock

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Zimmer: Research support

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Genovel: Stock or stock Options MyarthritisRX: Stock or stock Options Proventus Health: Stock or stock Options

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Saunders/Mosby-Elsevier:

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American Association of Hip and Knee Surgeons: Board or

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Clinical Orthopaedics and Related Research: Editorial or

governing board

Convatec: Paid consultant Ethicon: Paid consultant European Knee Association: Board or committee member GLG: Paid consultant Graftworx: Stock or stock

Options

Guidepoint: Paid consultant
Heraeus: Paid consultant
Hyalex: Stock or stock Options
Irrimax: Paid consultant; Stock
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Joint Purification Systems:
Stock or stock Options
Journal of Arthroplasty:

Editorial or governing board
Journal of Bone & Joint
Infection: Editorial or governing

ooard

Journal of Bone and Joint Surgery - American: Editorial or governing board

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Journal of Orthopaedic
Research: Editorial or
governing board

Knee Surgery, Sports
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Journal of the American Academy of Orthopaedic Surgeons: Editorial or governing board; Publishing royalties, financial or material support

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www.AAHKS.org/Meeting 81

support

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Journal of Arthroplasty:
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Knee Society: Board or
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Porosteon: Stock or stock

Options

Wolters Kluwer: IP royalties
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Wellbe: Stock or stock Options

Derek R. Jenkins, MD

Johns Hopkins University Press: Publishing royalties, financial or material support

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DePuy, A Johnson & Johnson Company: Research support

Total Joint Orthopedics: IP royalties; Paid consultant Xenex: Paid consultant; Stock or stock Options

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

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Signature Orthopaedics: Research support

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Elsevier: Editorial or governing board

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Stock or stock

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Western Orthopaedic
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Journal of Arthroplasty: Editorial or governing board Journal of Bone and Joint Surgery - American: Editorial or governing board Journal of Orthopaedics and

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Orthopedics: Editorial or governing board

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Up-to Date: Publishing royalties, financial or material support

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American Association of Hip and Knee Surgeons: Board or committee member OrthoSensor Inc: Paid consultant

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Journal of Orthopaedic Surgery and Research: Editorial or governing board

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Becton Dickenson: Publishing royalties, financial or material support

Ceribell: Stock or stock Options

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

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Joint Purification Systems: Stock or stock Options

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MDValuate: Stock or stock Options

MicroGenDx: Paid consultant;

Stock or stock Options Molecular Surface

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Nanooxygenic: Stock or stock Options

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Springer: Publishing royalties, financial or material support Taylor and Francis: Publishing royalties, financial or material support

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Zimmer: Paid consultant

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Pattern Health: IP royalties Restor3d: IP royalties Smith & Nephew: Paid consultant

Total Joint Orthopedics, Inc: IP royalties

Total Joint Orthopedics, Inc.: Paid consultant

Zimmer: Research support

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Microport: Paid consultant
Smith & Nephew: Paid
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Journal of Arthroplasty:
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Arthroplasty Today: Editorial or governing board

Convatec: Paid consultant ICJR: Board or committee member

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American Orthopaedic
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Journal of Surgical Education:
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Notes	

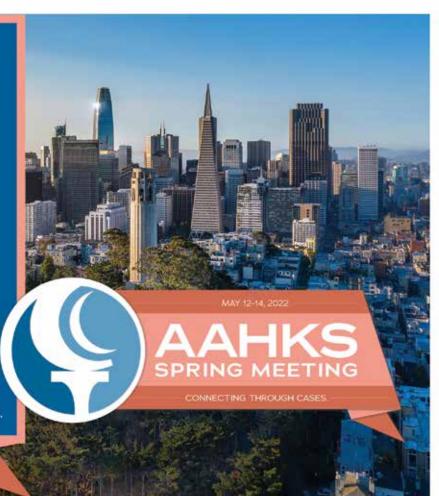
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May 4-6, 2023 | Chicago, IL

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November 2–5, 2023 Gaylord Texan Resort & Convention Center Grapevine, TX

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2024 AAHKS Annual Meeting

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