AAHKS 2022 ANNUAL MEETING

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AAHKS 2022 ANNUAL MEETING

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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
- Staff guidelines
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- Meal functions
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EDUCATIONAL ACTIVITY SCOPE

The 2022 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 in the educational activity.

DISCLAIMER

The material presented at this 2022 Annual Meeting has been made available by AAHKS for educational purposes only. This content is not intended to represent the only method or practice appropriate for the medical situations discussed; it is intended to present a balanced and scientifically sound view, approach, statement or opinion of the faculty, which may be helpful to others who face similar situations, or afford a forum to discuss, debate and explore new and evolving topics. The presentation of topics and any data about clinical practices should not be interpreted as advocating for, or promoting, practices that are not, or not yet adequately based on current science, evidence and clinical reasoning.

CONSENT AGREEMENT

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

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

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for their generous in-kind donations to support the AAHKS Resident Bioskills Lab Course

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.

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For the most up to date disclosure list, please visit www.AAHKS.org/Meeting.

AAHKS 2022 ANNUAL MEETING

Presenting the 2022 Lawrence D. Dorr, MD Humanitarian Award to Steven J. Meyer, MD

AAHKS is proud to present the 2022 Lawrence D. Dorr, MD Humanitarian Award to Steven J. Meyer, MD. Through Dr. Meyer's organization, STEMM (Siouxland Tanzania Educational Medical Ministry), he has provided more than 1,000 free surgeries, imported over $5 million dollars of equipment and spent countless hours educating healthcare professionals. This award recognizes his leadership in medical mission trips to remote Massai villages providing healthcare to totally isolated people groups and introducing TJA to the country of Tanzania.

STEMM was founded in 1996 and, since its conception, the philosophy of the organization has been to provide aid to persons of extreme poverty regardless of color, creed, gender or religion. A large focus has been to educate impoverished children and provide orphan care, humanitarian relief, medical services and training, agricultural improvement and community development, which includes feeding 5,500 children school lunch daily.

"Dr. Meyer is a true advocate for the people of Tanzania, especially the orphans. I've witnessed his relentless drive and dedication personally. After a 24-hour flight home from Africa and with no hesitation, immediately resuming his clinical duties to balance responsibilities with his partners but all to remain devoted to his trips to Tanzania. Dr. Meyer's care for the people of Tanzania is not a theoretical experience, but a real one," says Brian D. Johnson, MD, a partner and friend of Dr. Meyer.

Dr. Meyer graduated from the University of Iowa College of Medicine and completed his residency at the University of Kentucky, Shriner's Hospital. He is fellowship trained in general orthopaedics and pediatric orthopaedics.

The 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.

For more information on the Lawrence D. Dorr, MD Humanitarian Award, please go to **www.AAHKS.org/Humanitarian.**

AAHKS 2022 ANNUAL MEETING

Presenting the 2022 Presidential Award to William G. Hamilton, MD

AAHKS is proud to present the 2022 Presidential Award to William G. Hamilton, MD for all the outstanding service he has given to AAHKS since 2006. Since the beginning of his membership, Dr. Hamilton has been heavily involved, serving as faculty for the Orthopaedic Team Member Course, Resident Course, Ask the Experts sessions and many other capacities at AAHKS Annual and Spring Meetings throughout the years. Dr. Hamilton has also held various Committee positions as an AAHKS member, including the Patient and Public Relations, Quality Measures, Fellowship Match Oversight Committees and, of course, as the Chair of the Fellows Orthopaedic Continued AAHKS Learning (FOCAL) Committee – one that Dr. Hamilton was very instrumental in creating.

FOCAL arose as a response to the COVID-19 pandemic. Because elective surgeries were postponed at many institutions, there was concern that the pandemic might significantly impair the fellowship learning experience. To help augment the fellows' learning experience, the FOCAL Initiative was created – a free, online, interactive learning experience for surgeons in training that have chosen adult reconstruction as a specialty. Through FOCAL, arthroplasty fellows and senior residents are invited to listen to lectures from many of the country's top adult reconstruction surgeons and participate in case discussions. As a result of the success of the initiative, AAHKS created the FOCAL Committee. Under Dr. Hamilton's leadership, the FOCAL Committee continues to offer monthly webinars to augment fellowship training as well as promoting a fellowship training curriculum.

"During a potential time of crisis for orthopaedic education due to the onset of the COVID pandemic, Dr. Hamilton and his team quickly filled the potential void with the establishment of the FOCAL curriculum. This educational platform, which continues today, provided the foundation at a time when other traditional opportunities were in jeopardy" says Bryan D. Springer, MD.

Throughout Dr. Hamilton's 20-plus year career as a board-certified orthopaedic surgeon, he has been recognized countless times for his work. Dr. Hamilton graduated from the University of Cincinnati and completed his residency at the University of Pennsylvania.

It is a great honor to recognize Dr. Hamilton as this year's Presidential Award recipient – an amazing resource for AAHKS who advocates for patients, his colleagues and the profession.

AAHKS 2022 ANNUAL MEETING

Presenting the 2022 AAHKS Diversity Award to Richard E. Grant, MD

It is with great joy that we present the inaugural AAHKS Diversity Award to Richard E. Grant, MD. Dr. Grant is a semi-retired board-certified orthopaedic surgeon, who is truly devoted to promoting diversity in orthopaedics. Dr. Grant has specialized in treating complex musculoskeletal conditions of the hip, knee and spine. During his time at Howard University Hospital, where he was the chair of the Department of Orthopaedic Surgery, Dr. Grant was famously known for his community outreach endeavors, encouraging community members to tap into the orthopaedic care available at hospitals like Howard University, University Hospital of Cleveland, Ohio and Einstein Medical Center in Philadelphia. His labors at each academic center focused on his love of teaching young orthopaedic residents to develop their surgical skills in the surgical sub-specialties of lumbar spine surgery and total joint arthroplasty. He specialized in revision arthroplasty and complex primaries, particularly in those patients with sickle cell disease.

Dr. Grant is a retired United States Air Force Lt. Col. veteran who earned his medical degree from Howard University School of Medicine. He completed his internship at the Kaiser Foundation Hospital in Oakland, California and his orthopaedic residency at the United States Air Force Wilford Hall Medical Center in San Antonio, Texas under the guidance of Dr. John L. Eady. Following his residency, he completed two prestigious fellowships in Joint Arthroplasty and Adult Spine Surgery.

What makes Dr. Grant so remarkable and the best candidate for the Diversity Award is that, after all his years of residency and post residency training, he returned to the inner city to practice and remained in the urban community throughout his illustrious career. Promoting the same quality care that carefully addresses the orthopaedic needs of underserved patients in both majority and minority urban settings. It was important for him to share his expertise in joint replacement surgery, gender-specific knee replacement and sickle cell disease-related osteonecrosis with a community that could benefit from both research and academia. The majority of the patients in the community that Dr. Grant served were African Americans who usually exhibited more advanced diseases and debilitating deformities.

In addition to his clinical work, Dr. Grant served on the AAOS Diversity Advisory Board and was the first African American president of the American Board of Orthopaedic Surgery (ABOS), where he advised the board to become more inclusive toward women and minority orthopaedic surgeons. Throughout Dr. Grant's 30-plus year career of working with orthopaedic residents, he empowered minority students and women to enter the field. He personally trained and educated more than 60 minority and female residents between 1988 and 2001 when he was the chairman of the Department of Orthopaedic surgery and associate professor of Orthopaedic Surgery at Howard University Hospital in Washington, D.C.

"We are excited to honor Dr. Grant as the inaugural AAHKS Diversity Award recipient. He has been a long-standing champion for ethnic and gender diversity in orthopaedics, and specifically hip and knee arthroplasty. His dedication to diversity and orthopaedic education evolved most notably as chair of orthopaedics at Howard University for 13 years. While the objective data on his impact is impressive, we were most struck by comments we received on how Dr. Grant made his residents and medical students feel. It is his ability to make minority and female surgeons-in-training feel not just competent and capable, but also included and important, that we wish to honor most," says Muyibat A. Adelani, MD, Co-Chair of AAHKS Diversity Advisory Board (DAB).

AAHKS 2022 ANNUAL MEETING

Presenting the 2022 Women in Arthroplasty Empowerment Award to Amy Turk

It is with great pleasure that AAHKS presents the Women in Arthroplasty (WIA) Empowerment Award to Amy Turk. Amy is the Director of Strategy and Innovation Global Hip Marketing for DePuy Synthes (Johnson and Johnson) and has experience in global strategic marketing, acquisitions and commercial integration. The WIA Empowerment Award recognizes a person in the orthopaedic community that has gone above and beyond to elevate and support women in arthroplasty in a unique and impactful way. Amy Turk's work with DePuy Synthes' Women of Orthopaedics, dedication and most importantly her advocacy for women in arthroplasty has elevated our female members in AAHKS. These acts of leadership directly align with the WIA mission of promoting, mentoring and professionally developing women in arthroplasty.

"Amy has been instrumental in rallying women in arthroplasty and creating the Women in Arthroplasty Committee (WIA) back in 2018. When I first met Amy, she asked where are the other women and how do we get women together? Like in industry, she saw a clear lack of representation and few women having a voice in our specialty. She has worked tirelessly to connect women in arthroplasty by hosting events to help develop our leadership skills, networking and connecting us with other non-female arthroplasty surgeons as mentors and advocates. She advocates within her own business to make sure women in arthroplasty are on the podium and teaching courses," says Linda I. Suleiman, MD.

Amy is an active player in changing culture. She is a change agent that truly deserves to be honored as the recipient of the Women in Arthroplasty Empowerment Award.

Notes

Symposium I

The Economics of Arthroplasty in 2022 and Beyond

Moderator: Ryan M. Nunley, MD
Faculty: Michael P. Ast, MD, R. Michael Meneghini, MD, Michael P. Bolognesi, MD, James I. Huddleston III, MD

This symposium will educate arthroplasty surgeons on the forces driving change in the practice models and economics of a modern arthroplasty practice. We will cover topics from the drive to bundled payments, changes to regulatory framework, the role of outside capital, to the shift to population health moving forward. Specific focus will be paid to changes to Stark Law and Gainsharing rules which govern financial relationships in both hospital employed and private practice settings, the significant interest and influx of Private Equity funding, the ongoing evolution of legislative interventions in healthcare spending and the specific implications of the transition from fee-for-service medicine to value-based care and ultimately population health for musculoskeletal care.

Learning Objectives:

1. To review the current economic, regulatory and legislative landscape driving change in the world of arthroplasty.
2. To critically evaluate the role of Private Equity and outside capital as it relates specifically to orthopaedic practices.
3. To identify where value-based care and specifically population health are changing the way arthroplasty surgeons practice today and into the future.

Outline:

Introduction
Ryan M. Nunley, MD

Regulatory Principles Guiding Arthroplasty Economics- Update for 2022
Michael P. Ast, MD

Need Some Extra Help? The Role of PE and Outside Capital in Orthopaedics
R. Michael Meneghini, MD

The Legislative Push to Population Health
James I. Huddleston III, MD

The Future of Value Based Care in Arthroplasty: Principles We All Need to Know
Michael P. Bolognesi, MD

Discussion
All Faculty

Notes

Paper #1

Lessons Learned from the CJR Model at an Academic Tertiary Center: The Good, the Bad, and the Ugly

Chancellor F. Gray, MD, Hernan A. Prieto-Saavedra, MD, Hari K. Parvataneni, MD, Dennis Chen, MD, Justin T. Deen, MD, Luis Pulido, MD

Introduction: Our institution participated in the Comprehensive Care for Joint Replacement (CJR) model from 2016 to 2020. Here we review lessons learned from a total joint arthroplasty (TJA) care redesign at a tertiary academic center amid changing 1) CJR rules, 2) inpatient only rules and 3) outpatient trends.

Methods: Quality, financial and patient demographic data from the years prior to and during participation in CJR were obtained from a combination of institutional and Medicare provided, reconciled CJR performance data.

Results: During CJR participation, there was significant improvement in quality metrics and efficiency of care: decreased LOS (3.94 to 2.17 days, $p< 0.001$), increased home discharge rate (63.64% to 80.92%, $p< 0.001$), decreased readmission rate (13.99% to 6.53%, $p=0.06$), and decreased complication rate (4.90% to 1.02%, $p=0.02$). Despite an increase in true outpatients as well as new challenges that arose from changing inpatient-only rules, which led voluntary misclassification of some inpatients as outpatient due to unclear outpatient classification rules (effectively removing the highest performing patients from CJR), our institution's Composite Quality Score increased from 4.4 to 17.6 (top quintile). Over the five-year period, CMS saved an estimated $8,285,536 on 1,486 CJR cases, $7,488,206 on 1,343 non-CJR cases, and $445,536 from the voluntary misclassification of 272 inpatients (25.7% of all Medicare patients in final year)—a total savings of $16,219,278 over 5 years. Despite significant physician time and effort leading to marked improvements in efficiency, quality, and significant cost savings for CMS, CJR participation resulted in a net penalty of $304,456 to our institution with no physician gainsharing.

Conclusion: The benefits of CJR were tempered by the malalignment of incentives among payer, hospital and physician as well as a lack of transparency. Future payment models will need to be refined and built upon the lessons learned from CJR, including the successes and challenges.

Notes

Paper #2

Lower Revenue Surplus in Medicare vs Non-Medicare Total Joint Arthroplasty

Justin A. Magnuson, MD, John Hobbs, Kalpak Sarangdhar, Peter A. Gold, MD, P. Maxwell Courtney, MD, Chad A. Krueger, MD

Introduction: Since the ACA was passed in 2010, reductions in Medicare reimbursement have led to larger discrepancies between the relative cost of Medicare patients and privately insured patients. The purpose of this study was to compare the medical costs and reimbursement of Medicare as compared to private insurance in patients undergoing total hip (THA) and total knee (TKA) arthroplasty.

Methods: Patients of a single payer source who underwent primary TKA or THA arthroplasty at one institution between the dates of 1/4/21 and 6/30/2021 were included (n=833). Variables included insurance type, medical costs, prescriptions costs, target costs and surplus amounts. The primary outcome measure were the surplus values and magnitude between Medicare and non-Medicare groups. T-tests, ANOVA and Chi-Squared tests were used for analysis.

Results: THA represented 47% of cases while TKA represented 53%. Of these patients, 31.5% were Medicare and 68.5% were non-Medicare. Overall, average medical cost was $27,534, average total cost was $27,914, average adjusted target cost was $35,431 and average surplus was $7,517. Significant differences were observed between Medicare and non-Medicare in medical cost ($16,893 vs $32,416, $p< 0.001$), total cost ($17,334 vs $32,768, $p< 0.001$), adjusted target cost $22,083 vs $41,556 ($p< 0.001$) and surplus ($4,748 vs $8,788, $p< 0.001$). Deficits were reported in 12.7% of overall cases (6% Medicare vs 16% non-Medicare, $p< 0.001$).

Conclusion: Medicare target prices, total costs and surplus were significantly lower compared to non-Medicare insurance plans. While fewer Medicare cases resulted in absolute institutional deficits, the lower average surplus demonstrates that reimbursement for these cases may lead to consistent strain on provider groups who may face additional overhead costs. This finding warrants further investigation.

Notes

Paper #3

27130: A Reimbursement Retrospective

Richard D. Southgate, MD, Erik Woelber, MD, Kathryn L. Schabel, MD

Introduction: Although total hip arthroplasty (THA) is one of the most successful operations in modern medicine, its reimbursement is tightly monitored by Centers for Medicare & Medicaid Services (CMS) and is regularly decreased both to reflect changing effort associated with the procedure and to balance the CMS budget. Previous studies have reported on decreasing THA reimbursement, but none have evaluated these changes across the lifespan of CMS's RVU-based fee schedule. The purpose of this study is to report the reimbursement of THA from the advent of the Medicare-Resource-Based Relative Value Schedule (RBRVS).

Methods: We performed a retrospective review of the CMS physician fee schedule for CPT code 27130 (THA) from 1992 to 2022 as published in the RBRVS. For each year during the study period, we recorded components of the total relative value unit (RVU) including work (wRVU), practice expenses (PE), malpractice, and the conversion factor (CF). We adjusted for inflation using the consumer price index (CPI), with a January 2022 reference date.

Results: Between 1996 and 2022, there was a decrease in nominal CMS physician payments from $1,924 to $1,316 (32%), which translated to a real, CPI-adjusted decrease of 62% ($3,504 to $1,316). Over the same period, total RVUs dropped 19% (47.17 to 38.02). The PE component of RVU decreased most dramatically, from 23.91 to 14.3 (40%). The conversion factor peaked in 1996 at 40.80 and has fallen 15% to 34.61 in 2022.

Conclusion: Over three decades, there has been a substantial decline in both nominal and inflation-adjusted Medicare surgeon reimbursement for CPT code 27130, corresponding to a decrease in the total RVUs allocated to the procedure by CMS. Downward trends in reimbursement could create unintended access limitations or health care inequalities for Medicare patients as surgeons skew their payer mix to reflect financial pressures.

Notes

Paper #4

Should Medicare Surgeon Reimbursement for Arthroplasty Be Risk-Adjusted for Patient Complexity?

Jack M. Haglin, MD, Joseph C. Brinkman, MD, David G. Deckey, MD, Sailesh Tummala, MD, Michael L. Moore, BS, Joshua S. Bingham, MD, Mark J. Spangehl, MD

Introduction: The purpose of this study was to assess surgeon reimbursement among total joint arthroplasty patients with differing risk profiles within the Medicare population.

Methods: The "2019-Medicare-Physician-and-Other-Provider" Medicare file was utilized. Data was filtered for all primary hip and knee arthroplasty procedures billed to Medicare in 2019. Patient demographics and comorbidity profiles were collected, including frequency of atrial fibrillation, Alzheimer's, congestive heart failure, chronic kidney disease, depression, diabetes, hypertension, ischemic heart disease, history of cancer and history of stroke. The mean patient hierarchal condition category (HCC) risk score, a standardized metric accounting for patient comorbidities which is normalized to 1.0 for a typical patient, was collected. Medicare surgeon reimbursement was collected. All procedure episodes were split into two cohorts: those with an HCC risk score of 1.5 or greater (higher risk cohort), and those with patient HCC risk scores less than 1.5 (lower risk cohort). Variables were compared utilizing Student T-tests, and Chi-squared analysis.

Results: In 2019, 441,584 primary total hip and knee arthroplasty procedures were billed to Medicare and included. The mean reimbursement across all procedures was $1068.03. For the higher risk cohort (50,004 patients), these patients had a higher rate of all comorbidities compared to the lower risk cohort of 391,580 patients ($p \leq 0.001$ for all variables). The mean payment across the higher risk cohort was $1059.21, while the mean payment among the lower risk cohort was $1073.32 ($p=.0324$).

Conclusion: Mean surgeon reimbursement within Medicare in 2019 was lower for primary total joint arthroplasty among higher-risk arthroplasty patients in comparison to their healthier counterparts. Risk-adjustment has been implemented for hospital payment, but does not yet exist for surgeon reimbursement. This study may suggest that risk-adjustment for surgeon reimbursement in total joint arthroplasty should be implemented to properly incentivize the surgical care of patients likely requiring increased resources for care.

Notes

Paper #5

Do PROs Reflect Objective Measures of Function? Implications for Value-Based Care in TKA

Brandon Hill, MS, Shivesh Shah, BA, Wayne E. Moschetti, MD, MS, Peter L. Schilling, MD, MSc

Introduction: PROs are commonly used in research, clinical practice and by federal reimbursement models to assess outcomes for patients with knee osteoarthritis (OA) and TKA. This study examined a large cohort of these patients to determine whether commonly used PROs reflect performance, measured by standardized functional tests (SFTs), the gold-standard objective measures of functional outcome.

Methods: We used prospective PRO and SFT measurements through the Osteoarthritis Initiative (OAI), a ten-year observational study of patients with, or at risk for, symptomatic femoral-tibial knee osteoarthritis. From this data two cohorts were examined: 1) patients who received a TKA (n=292) and 2) patients with native OA (n=4687). PROs included WOMAC, KOOS, SF-12, and ICOAP. SFTs included 20M walk pace, 400M walk pace and chair stand times. Spearman and Pearson correlation coefficients were used to determine the relationship between PROs and SFTs.

Results: There was a low level of correlation between PROs and objective measures of functional outcomes across nearly all SFT and PRO metrics and in both cohorts. The magnitude of correlation between WOMAC/KOOS subscale and SFT measurements in native OA patients ranged as follows: 400-M walk pace (.16-.23), chair stand time (.23-.29) and 20-M pace (.21-.3). In the TKA cohort, values ranged as follows: 400-M walk pace (.11-.28), chair stand time (.17-.32) and 20-M pace (.18-.37). All were statistically significant to $p< 0.05$. Similar relationships were found between SFTs and SF-12/ICOAP.

Conclusion: PROs are not strongly associated with SFTs in either OA or TKA patients, even when SFTs are collected in a controlled environment. If SFTs are the gold standard for objective evaluation of functional capacity, then today's PROs are a poor indicator of functional outcome and must be influenced by other factors. Adoption of PROs as a proxy for functional outcomes warrants caution due to an incomplete understanding of their limitations.

Notes

Paper #6

Preoperative Patient Reported Outcome Measure Thresholds Should Not be Used for Indicating Total Knee

Ryan M. Sutton, MD, Colin M. Baker, BS, Taylor D'Amore, MD, Chad A. Krueger, MD, P. Maxwell Courtney, MD

Introduction: While Medicare requires patient reported outcome measures (PROM) for many quality programs, some commercial insurers have begun requiring preoperative PROMs when determining patient eligibility for total knee arthroplasty (TKA). Concerns exist that this data may be used to deny TKA to patients above a specific PROM score, but the optimal threshold is unknown. This study's purpose was to evaluate postoperative outcomes following TKA based on theoretical PROM thresholds.

Methods: We retrospectively analyzed 25,246 consecutive primary TKA patients from 29 facilities and 44 surgeons from 2016 to 2019. Hypothesized preoperative KOOS-Jr. cutoffs of 40, 50, 60, 70 points were used. Preoperative scores below each threshold were considered “approved” surgery, while preoperative scores above each threshold were considered “denied” surgery. In-hospital complications, 90-day readmissions, discharge disposition were evaluated. KOOS-Jr. scores were collected preoperatively and one year postoperatively. Minimum clinically important difference (MCID) achievement was calculated using previously validated anchor-based methods.

Results: In patients approved for surgery using KOOS-Jr. thresholds of 40, 50, 60, 70 points, MCID achievement at one year was 88.3%, 85.9%, 79.6%, 77%, respectively. In-hospital complication rates for approved patients were 2.16%, 2.25%, 2.14%, 2.13%, respectively. 90-day readmission rates for approved patients were 4.61%, 4.51%, 4.32%, 4.28%, respectively. Approved patients had a higher rate of achieving MCID ($p< 0.001$) for all thresholds, but a higher rate of non-home discharge ($p=0.01$) for thresholds of 40 ($p< 0.001$), 50 ($p=0.002$), and 60 ($p=0.024$) compared to denied patients. Approved patients had similar in-hospital complication and 90-day readmission rates to denied patients.

Conclusion: The majority of patients achieved MCID at all theoretical PROMs thresholds for TKA eligibility with low complication and readmission rates. Setting preoperative PROM thresholds to approve TKA did not guarantee clinically successful outcomes. Such a future policy will create access to care barriers for patients who would otherwise benefit from a TKA.

Notes

Paper #7

Loss to Patient Reported Outcome Measure (PROM) Follow-up After Hip and Knee Arthroplasty

Lauren A. Ross, Sara O'Rourke, Gemma Toland, Deborah J. Mac Donald, BA, Nick D. Clement, MD, PhD, Chloe E. H. Scott, MD, FRCS (ORTHO)

Introduction: No study or registry achieves 100% response rates to PROMs. This study aims to determine satisfaction rates after hip and knee arthroplasty in patients who did not initially respond to PROMs, characteristics of non-responders and exploring contact preferences to maximize response rates.

Methods: Prospective cohort study of 709 patients planned to undergo hip arthroplasty and 737 patients planned to undergo knee arthroplasty at a single center in 2018. PROMs questionnaires including the EQ-5D health related quality of life score and Oxford Hip/Knee Scores (OHS/OKS) were completed prior to surgery. Follow-up questionnaires were sent by post at 1 year including additional satisfaction scoring. Univariate, multivariate and receiver operator curve analysis was performed.

Results: Among hip patients 151/709 (21.2%) were true non-responders, 83 (55.0%) of whom were contactable. Among knee patients 108/737 (14.6%) were true non-responders, 91 (84.3%) of whom were contactable. There was no difference in satisfaction after arthroplasty between initial non-responders and responders for hips (74/81 vs 476/516, p=0.847) or knees (81/93 vs 470/561, p=0.480). Initial and persistent non-response was associated with younger age, higher BMIs and significantly worse preoperative PROMs for both hip and knee patients ($p< 0.05$). Multivariate analysis demonstrated that younger age ($p< 0.001$), higher BMI (p=0.003) and poorer preoperative OHS (p=0.019) were independently associated with persistent non-response to hip PROMs, no independent association with persistent non-response were identified for knees. For the entire cohort (n=1352) compared to older patients, patients < 67 years were less likely to respond to postal PROMs with OR 0.63 (0.558 to 0.711). Using a threshold of >66.4 years predicted a preference for contact by post with 65.4% sensitivity and 68.1% specificity (AUC 0.723 (0.647-0.799 95%CI, $p< 0.001$)).

Conclusion: The majority of initial non-responders were ultimately contactable with effort. Satisfaction rates were not inferior in patients who did not initially respond to PROMs.

Notes

Paper #8

Patient Reported Outcome Measures for Total Joint Arthroplasty: Evaluation of Cost and Compliance

Ryan M. Sutton, MD, Colin M. Baker, BS, Taylor D'Amore, MD, P. Maxwell Courtney, MD, Chad A. Krueger, MD, Matthew S. Austin, MD

Introduction: The Centers for Medicare and Medicaid Services (CMS) Comprehensive Care for Joint Replacement (CJR) model links quality with hospital reimbursement for total joint arthroplasty (TJA). Patient reported outcome measures (PROMs) serve as a component of quality scores. CJR has mandated 100% preoperative and 90% postoperative PROMs compliance by 2023. This study evaluates PROM compliance and resource utilization to capture PROMs at a high-volume center with extensive experience in alternative payment models (APMs).

Methods: This is a retrospective analysis of a consecutive series of patients undergoing primary TJA from 2016-2019 at a single institution. Compliance rates were obtained for HOOS-JR, KOOS-JR and SF-12 surveys. Direct supply and staff labor costs for PROMs collection were obtained. Time-driven activity-based costing (TDABC) estimated resource utilization for PROMs collection. Descriptive statistics were presented as mean and standard deviation for normally distributed data by Kolmogorov-Smirnov testing. Chi-square testing was used to compare compliance rates between groups.

Results: 43,252 (25,246 TKA;18,006 THA) total procedures were evaluated. Of these, 25,315 (15,797 TKA; 9,518 THA) were performed in CMS-eligible patients. In the CMS-eligible cohort, preoperative HOOS-JR/KOOS-JR compliance was 66.6%. Postoperative HOOS-JR/KOOS-JR compliance was 29.9%, 46.1% and 27.8% at six-months, one-year and two-years, respectively. Preoperative SF-12 compliance was 70%. Postoperative SF-12 compliance rate was 35.9%, 49.6% and 33.4% at six-months, one-year and two-years. Medicare patients had lower PROM compliance than the overall cohort ($p< 0.05$) at all time points except preoperative KOOS-JR and SF-12 in TKA patients. The estimated annual cost for PROM collections was $273,682 ($27,914 for personnel, $245,768 for fixed costs) with a total cost for the entire study period of $986,369.

Conclusion: Despite extensive experience with APM's and a total expenditure of nearly $1,000,000, our center demonstrated low preoperative and postoperative PROM compliance rates. These results question the feasibility of widespread adoption of CMS PROMs reporting requirements.

Notes

Symposium II

Advances in Arthroplasty Practice with Artificial Intelligence - The Future is Now

Moderator: Michael J. Taunton, MD
Faculty: Cody C. Wyles, MD, Prem N. Ramkumar, MD, MBA, Viktor E. Krebs, MD

This dynamic session featuring didactics and demonstration videos will highlight how artificial intelligence tools are already positively impacting clinical hip and knee arthroplasty practice.

Learning Objectives:

1. Identify opportunities for orthopaedic practice enhancement with artificial intelligence tools.
2. Evaluate the biggest opportunities for machine learning for clinical practice, research and payor relations.
3. Review the current state of research and identify the future avenues for innovation in AI.
4. Identify gaps in our knowledge and better evaluate the ethics and research methodologies around AI.

Outline:

1. **Computer Vision: Getting the Most Out of Clinical Imaging**
   - **a.** Implant Identification – Viktor E. Krebs, MD
   - **b.** Automated Annotation of Implant Position and Change in Position – Cody C. Wyles, MD
   - **c.** Intraoperative Enabling Technologies – Michael J. Taunton, MD
2. **Machine Learning and Value-Based Care**
   - **a.** Predicting Inpatient vs Outpatient Surgery – Michael J. Taunton, MD
   - **b.** Patient-Specific and Dynamic Risk Calculators for Dislocation and Periprosthetic Fracture – Cody C. Wyles, MD
   - **c.** AI and Value-Based Care, Prediction of Outcomes and Implications for Payment Models – Prem N. Ramkumar, MD, MBA
   - **d.** Discussion
3. **Big Opportunities: Focus on the Near Future**
   - **a.** Big Data and AI: Dangers and Opportunities – Prem N. Ramkumar, MD, MBA
   - **b.** Natural Language Processing as a Tool to Restore the Doctor-Patient Relationship – Prem N. Ramkumar, MD, MBA
   - **c.** National Data and Registry Data – Viktor E. Krebs, MD
   - **d.** Discussion / Q+A

Notes

Paper #9

Timing of Elective Total Joint Arthroplasty Following the COVID-19 Infection

David Novikov, MD, Nicholas J. Ogrinc, BA, Tucker Berk, BS, Noelle Wojciechowski, BA, Hannah J. Szapary, BS, Alexander R. Farid, BA, Afshin A. Anoushiravani, MD, Antonia F. Chen, MD, MBA, Michael S. Kain, MD

Introduction: Currently, there is no consensus as to when to safely perform elective total joint arthroplasty (TJA) after a COVID-19 infection. The purpose of this study was to evaluate how timing between infection and TJA affected complications and venous thromboembolism (VTE) rates. We hypothesized that a period of 90 days would improve complications and minimize VTE rates.

Methods: A multicenter, retrospective review of consecutive unilateral primary TJA recipients was performed between 8/1/2020-11/30/2021. Patients were stratified into two cohorts based on whether they had COVID-19 within 1 year prior to elective TJA: COVID+ (n=221), COVID– (n=433). Further, COVID+ patients were sub-divided into two cohorts based on when they had their TJA in relation to a positive test result: TJA<90 days from COVID+ test (n=9) and TJA>90 days from COVID+ test (n=212). Chi-Square and student t-tests were used to analyze complications between groups.

Results: Mean time from COVID+ diagnosis to TJA was 8.7 months. VTE rates (1.4% vs 0.9%; p=0.6), cardiopulmonary events (4.1% vs 3.5%; p=0.7), wound complications (p=0.78), superficial (p=0.86) and deep infections (p=0.08) were similar between COVID+ and COVID- patients, respectively. Patients that had TJA within 90 days of a positive test had a significantly higher rate of VTE (22.2% vs 0.5%; p< 0.001), cardiopulmonary complications (88.9% vs 0.5%; p< 0.001) and visits to the ED (88.9% vs 6.6%; p< 0.001). Severity of infection data was available on 43 patients. Of these 3.6 % were asymptomatic, 11.8% were symptomatic, and 4.1% were hospitalized; outcomes among these were not different.

Conclusion: COVID positive patients at a mean time of 8 months from positive test result had similar VTE and cardiopulmonary complications compared to COVID negative patients. However, rates of VTE, cardiopulmonary complications and visits to ED were higher in COVID+ patients that underwent TJA within 90 days of positive test result.

Notes

Paper #10

Hyponatremia is An Overlooked Sign of Trouble Following TJA

Colin M. Baker, BS, Graham S. Goh, MD, Saad Tarabichi, MD, Matthew Sherman, BS, Javad Parvizi, MD, FRCS

Introduction: Hyponatremia is a common electrolyte abnormality in arthroplasty patients. However, these values are often overlooked by surgeons. There is currently a lack of institutional data evaluating the implications of sodium disturbances following TJA. This study aimed to (1) report the incidence of hyponatremia, and (2) examine the impact of postoperative hyponatremia as well as the change in sodium levels on the perioperative course of arthroplasty patients.

Methods: This was a retrospective analysis of 3,071 primary and revision TJAs performed at a single institution between 2015 and 2017. Patients with at least one preoperative and postoperative serum sodium measurement were included. Based on preoperative and postoperative sodium values (pre-post), patients were classified into four groups: normonatremic-normonatremic (Group 1), normonatremic-hyponatremic (Group 2), hyponatremic-normonatremic (Group 3), and hyponatremic-hyponatremic (Group 4). Primary endpoints were length of stay (LOS), non-home discharge, 90-day complications and readmissions.

Results: The distribution of cases was: Group 1 (84.6%), Group 2 (9.4%), Group 3 (2.1%) and Group 4 (3.8%). Overall, 13.2% developed hyponatremia after TJA. Older age, hip arthroplasty, revision surgery, general anesthesia, Charlson Comorbidity Index, history of stroke, congestive heart failure, liver disease and chronic kidney disease were risk factors for postoperative hyponatremia. Mortality rate was 2.6% in Group 4 compared to 0% in the other groups ($p < 0.001$). Patients with postoperative hyponatremia (Group 2 and 4) had a greater likelihood of having a 90-day complication, non-home discharge and greater LOS. Similarly, a greater decrease in sodium level was also associated with poorer perioperative outcomes.

Conclusion: Postoperative hyponatremia was a relatively common occurrence in patients undergoing TJA, and was associated with increased complications, LOS and non-home discharge. Surgeons should identify patients at risk of developing sodium abnormalities in order to optimize these patients and avoid increased resource utilization.

Notes

Paper #11

The Fate of the Patient with Superficial Dehiscence Following Direct Anterior Total Hip Arthroplasty

Jacob M. Wilson, MD, Matthew L. Hadley, MD, Cameron K. Ledford, MD, Joshua S. Bingham, MD, Michael J. Taunton, MD

Introduction: Direct anterior approach (DAA) total hip arthroplasty (THA) has been associated with higher rates of superficial incisional dehiscence following surgery. However, limited data is available regarding outcomes following initial treatment of this complication. This study aimed to evaluate patient risk factors, repeat reoperations and survivorship free from any revision in those who develop superficial wound dehiscence following DAA THA.

Methods: We identified 3687 patients who underwent a primary DAA THA between 2010-2019 from our institutional total joint registry. Of these, 98 (2.7%) patients developed a superficial wound dehiscence requiring intervention [irrigation and debridement (I&D; n=40, 1.1%) or wound care with or without antibiotics (n=58, 1.6%)]. Dehiscence was noted at median 27 (range 2-105) days. These patients were compared to patients who did not have a superficial wound complication (n=3589). Landmark Kaplan-Meier survivorship analysis was performed to account for immortal time bias with a 45-day landmark time. Mean follow-up was 4 years.

Results: Patients with superficial wound dehiscence compared to those without, respectively, were more often female (65% vs. 53%, p=0.018), had increased mean body mass index (BMI; 34 vs. 28 kg/m2, p< 0.001), and had higher American Society of Anesthesiologist scores (ASA 3; 44% vs. 29%, p=0.006). There were 3 (3.1%) non-revision re-reoperations (index I&Ds excluded): 2 repeat superficial I&Ds and 1 iliopsoas tendon release. There was no difference in 4-year survivorship free from any revision in those with superficial dehiscence compared to those without (96% vs. 98%, respectively, p=0.1). There were 2 (2.0%) revisions in the superficial dehiscence group: 1 for periprosthetic joint infection (PJI) and 1 for aseptic femoral loosening.

Conclusion: Superficial wound dehiscence following DAA THA was associated with female sex, higher BMI, and increased comorbid status. Fortunately, with proper index management, the risk of revision THA and PJI was not increased for these patients.

Notes

Paper #12

Impact of Prior Fragility Fractures on Complications After Total Hip Arthroplasty

Amy Zhao, BA, Amil R. Agarwal, BA, Alex Gu, MD, Jordan S. Cohen, MD, Rachel Ranson, DO, MS, Gregory J. Golladay, MD, Savyasachi C. Thakkar, MD

Introduction: Fragility fractures (FFs) are common in the United States, affecting over 1.5 million Americans annually. Fragility fractures are pathognomonic for osteoporosis, yet osteoporosis is often undertreated. Many patients undergoing total hip arthroplasty (THA) have a history of FF. However, only a few studies have examined FFs impact on outcomes after THA patients. The purpose of this study was to characterize the effects of prior FF on the incidence of secondary FF following THA, periprosthetic fractures (PPF), and revision THA (rTHA).

Methods: Patients older than 49 who underwent THA for osteoarthritis were identified in the PearlDiver Database. Patients were stratified based on whether they sustained a FF within three years of THA. Univariate analysis was conducted on demographic characteristics, comorbidities, and postoperative outcomes using Pearson chi-square analysis. Patients were followed for as long as data were available, with a maximum follow up of 10 years. If a postoperative outcome was significant on univariate analysis ($p < 0.05$), a multivariable analysis using Cox proportional hazard's model was conducted to adjust for other potential risk factors. In order to determine such factors, demographics and comorbidities with p-values < 0.2 were included in the multivariable analysis.

Results: In total, 6,181 patients who underwent THA had a prior FF and 179,074 did not. Univariate analysis demonstrated that patients with prior FF had higher incidences of secondary FF, PPF and rTHA ($p < 0.001$). After adjusting for risk factors, Cox proportional hazard's model demonstrated that patients with prior FF had higher risks of rTHA (HR 1.32; $p < 0.001$), secondary FF (HR 3.54; $p < 0.001$), and PPF (HR 1.42; $p < 0.001$).

Conclusion: Recent FF before THA is associated with an increased postoperative risk for rTHA, PPF and secondary FF. It is thus important to educate patients about the increased risks of these potential complications.

Notes

Paper #13

How Much Protection Does a Collar Provide? Risk of Early PPFx Following THA in Elderly Patients

Samuel Rodriguez, MD, Simarjeet Puri, BS, Jennifer Bido, MD, Austin C. Kaidi, MD, MSc, Jose A. Rodriguez, MD, Elizabeth B. Gausden, MD, MPH

Introduction: Periprosthetic fractures (PPFx) account for 25% of early revisions following total hip arthroplasty (THA). Cemented femoral fixation is associated with lower risk of PPFx, and collared, cementless stem may reduce risk of PPFx as well. The objective of this study was to compare early PPFx rates between cemented, collared and non-collared cementless stems in elderly patients.

Methods: A consecutive series of 11,522 primary THAs performed between 2016-2021 at our institution in patients >65 years old was identified. Stem types used were categorized as cemented, collared-cementless or non-collared cementless. Patients undergoing THA with cemented stems were older, more commonly female and more likely to have a posterior approach. In order to reduce confounding of patient characteristics, we matched patients in the 3 stem categories according to age, sex and BMI. This generated 3 groups (cemented, collared cementless and non-collared cementless) consisting of 936 patients per group. Mean age of these 2,808 patients was 73 years, mean BMI was 27 and 67% were female. Logistic regression was used to evaluate the odds for early PPFx per stem type.

Results: In the entire cohort of primary THA in elderly patients over the study period there were 86 early PPFx (0.7%). After matching according to age, sex and BMI, non-collared cementless stems were associated with increased risk of early PPFx (OR: 2.89; p=0.022) compared to collared-cementless stems. There were 0 early PPFx in the matched cemented cohort, 6 early PPFx in the matched collared-cementless cohort and 18 early PPFx in the matched non-collared cementless cohort (0% vs 0.64% vs 1.92%, p< 0.001).

Conclusion: In this large series of elderly patients undergoing primary THA, cemented stem fixation produced lowest incidence of early PPFx, but collared-cementless femoral stems had a 3-fold decrease in risk for early PPFx compared to collarless-cementless femoral stems.

Notes

Symposium III

Cemented Femoral Stem Fixation: Back to the Future

Moderator: Bryan D. Springer, MD
Faculty: Joseph T. Moskal, MD, Jonathan R. Howell, FRCS, Matthew J.W. Hubble, FRCS

There is clear history and continued emerging evidence from large studies and registry data supporting the use for cemented femoral stem fixation in hemiarthroplasty and total hip arthroplasty. This includes dramatically lower risk of periprosthetic fractures, reduced overall revision risk and improved functional outcomes in certain patient populations. Yet despite this overwhelming data, cemented stem fixation continues to be utilized in less than 10% of all elective THA in the United States. This is posited to be for several reasons including time and unfamiliarity with the advantages as well as the surgical technique. This symposium will bring together faculty from the US and the UK to address all of these issues and will discuss the history of cement and cemented stem fixation, current indications and advantages as well as surgical techniques.

Learning Objectives:

1. Review the risk stratification and mitigation of femoral stem fixation and periprosthetic fracture.
2. Gain a better understanding of cement fixation and design history.
3. Elucidate the pros and cons for cemented stem fixation.
4. Discuss and review the surgical technique of cemented stem fixation.

Outline:

Introduction
Bryan D. Springer, MD

Periprosthetic Fractures: Registry Data and Risk Stratification
Bryan D. Springer, MD

Cemented Stems: History, Design and Outcomes
Matthew J.W. Hubble, FRCS

Cemented Femoral Stems: What Are the Potential Wins?
Jonathan R. Howell, FRCS

Cemented Stems: How to Get It Right, Surgical Technique
Joseph T. Moskal, MD

Discussion
All Faculty

Notes

Paper #14

RAPT Score Predicts Postoperative Function, Length of Stay and Discharge Destination After TKA/THA

Drake G. Lebrun, MD, Charles M. Fisher, PT, Sharlynn Tuohy, PT, Joseph T. Nguyen, MPH, Alejandro G. Della Valle, MD, Michael P. Ast, MD, Alberto V. Carli, MD, FRCSC

Introduction: Accurately predicting an arthroplasty patient's postoperative physical function and associated discharge disposition and length of stay is helpful because it allows for preoperative patient optimization, planning, expectation management and a rational allocation of hospital resources. The goal of this study was to determine the capability of the Risk Assessment and Prediction Tool (RAPT) score to predict perioperative function, discharge destination and length of stay in patients undergoing primary THA and TKA.

Methods: : Primary unilateral THAs (n=12,270) and TKAs (n=13,043) performed for primary osteoarthritis at our institution from 2018-2021 (excluding March-September 2020) were identified using a validated and prospectively maintained database (mean age 65.4; 59.3% female). We sought to evaluate the associations between preoperative RAPT score and (1) postoperative Activity Measure for Post-Acute Care (AM-PAC) “6-Clicks” score (2) time to first-ambulation, (3) discharge destination and (4) in-hospital length of stay, using univariate analysis.

Results: RAPT score was inversely associated with AM-PAC score among TKA ($r=0.38$; $p< 0.0001$) and THA patients ($r=0.34$; $p< 0.001$). RAPT score was inversely associated with time to first ambulation in TKA ($r=-0.12$; $p< 0.001$) and THA ($r=-0.17$; $p< 0.001$). RAPT score was inversely associated with length of stay in TKA ($r=-0.36$; $p< 0.001$) and THA ($r=-0.38$; $p< 0.001$). RAPT score was significantly higher among patients discharged home compared to patients discharged to an acute or subacute rehabilitation facility in TKA (9.8+/-1.7 vs. 7.0+/-2.3; $p< 0.001$) and THA (9.8+/-1.8 vs. 6.3+/-2.3; $p< 0.001$).

Conclusion: RAPT score may be helpful for predicting in-hospital course and discharge destination following TKA and THA. In this large retrospective single-institution study, higher preoperative RAPT scores were associated with faster postoperative mobilization, improved postoperative physical function, decreased length of stay and discharge to home. Further research should evaluate how psychological and social support factors affect this relationship.

Notes

Paper #15

Age-Related Differences in Pain, Function and Quality of Life Following Primary TKA

David C. Ayers, MD, Mohamed Yousef, MD, PhD, Wenyun Yang, MS, Hua Zheng, PhD

Introduction: Multiple authors have sought to determine what patient characteristics influence outcome after TKA. Age has shown no effect on outcome in some evaluations, while others reported higher functional improvement in younger patients. The aim of this study was to determine if outcome after TKA varies based on patient age.

Methods: A prospective, multi-center cohort of 11,602 unilateral primary TKA patients was evaluated. PROMs including KOOS(12,JR) were collected pre-op and one-year postop. Descriptive statistics were stratified by age [<55 years (younger adult), 55-64 years (older adult), 65-74 years (early elder), and ≥75 years (late elder)], and differences in pain, function and QoL among the four age groups evaluated. Multivariate regression model was used to assess the role of patient age as a predictive factor for KOOS scores reported after TKA, while adjusting other variables.

Results: Before surgery, patients <55 years reported worse pain, function, and QoL than older patients. One-year after TKA, younger patients <55 years reported worse pain, function, and QoL quality of life but better function than older patients (≥75 years). Differences in mean one-year scores among the 4 age groups reached the MCID for pain and QoL, but not for function. Younger patients (<55 years) achieved pain (36.8 points), function (30.3 points), and quality of life (40.7 points) improvements from baseline that were comparable to other groups. Regression analysis showed that age was predictive of KOOS pain (P< 0.001) in older patients (≥75 years), when compared to younger patients (<55 years). Age was not predictive of KOOS ADL (p=0.74) in older patients (≥75 years).

Conclusion: Large improvements of PROMs were reported 1-year after TKA across all four age groups. Age-related differences in pain and QoL exist as patients ≥75 years achieved better pain relief and improved QoL when compared to patients <55 years.

Notes

Paper #16

Uncemented Knee Survivorship Varies by Age and Sex in MARCQI

Brendan J. Comer, MD, Dexter T. Powell, MD, Brian R. Hallstrom, MD, Huiyong Zheng, PhD, Richard E. Hughes, PhD, David C. Markel, MD

Introduction: Multiple national database reports have shown higher cumulative percent revision (CPR) and decreased long term survivorship of uncemented TKAs. Despite this finding, uncemented TKAs have increased in popularity particularly with the introduction of new press-fit technologies that have shown promising initial results. A state-wide quality improvement registry was used to analyze the effect of this fixation shift on outcomes in Michigan.

Methods: Data from 2017 through 2019 was analyzed to determine the incidence, distribution, and survival outcomes of cemented vs. uncemented TKAs. CPR was calculated yearly based on fixation method (cemented vs uncemented), including the patella. The primary endpoint was time to first revision using Kaplan-Meier survival curves. Sub-analysis based on age, gender and implant type was also performed. Confidence intervals were set to 95%.

Results: Between 2017 and 2019, uncemented TKAs increased from 7.0% to 11.3% in the state. Uncemented TKAs were more likely to be male, younger, heavier and smokers. At 3 years, uncemented TKAs demonstrated a higher CPR of 3.33 (2.60, 4.25) vs. cemented (2.27; 2.07, 2.48). Females had a higher CPR at 3 years with uncemented TKA (3.35; 2.52, 4.44) as compared to cemented (1.96; 1.77, 2.16). Patients over 70 had lower revision hazards with cemented knees (HR 0.969; 0.962, 0.975) as compared to uncemented. Survivorship variations existed between different implants.

Conclusion: Despite the increased use of uncemented TKAs, this analysis suggested uncemented knees had an increased risk of revision compared to those that were cemented. Outcomes should be tracked closely as the findings appeared to be both patient and design dependent. Registries should, when possible, report results by implant and fixation method in attempt to distinguish implant design and patient demographics that may portend more successful outcomes. This data supports continued investigation regarding the appropriate utilization of uncemented TKA technologies.

Notes

Paper #17

Randomized Clinical Trial of Cementless Tantalum Tibial Components: Durable and Reliable at 10 Years

Emmanuel Gibon, MD, PhD, David G. Lewallen, MD, Dirk R. Larson, MS, Michael J. Stuart, MD, Mark W. Pagnano, MD, Matthew P. Abdel, MD

Introduction: Cementless fixation is gaining popularity for primary total knee arthroplasties (TKAs) largely due to innovations in implant design and surgical technique. We previously reported the 5-year results of our randomized clinical trial (RCT) that included 3 different tibial designs (traditional modular cemented tibia, cemented porous metal tibia and cementless porous metal tibia) and found no differences. The purpose of the current study was to investigate the 10-year results in the same cohort.

Methods: Between 2003 – 2006, 389 patients (389 knees) underwent a primary TKA and were randomized into three groups: traditional modular cemented tibia (132), cemented porous metal tibia (128) and cementless porous metal tibia (129). Implant survivorship (via intention-to-treat analysis), Knee Society scores (KSSs), range of motion (ROM), complication and radiographs were compared between groups. Mean age at TKA was 68 years, 46% were male and mean BMI was 32 kg/m2. The median follow-up was 11 years.

Results: The 10-year survivorship free of any revision was similar between all 3 groups at 91%, 96% and 95% (p=0.5) in the cemented traditional tibia, cemented porous metal tibia and cementless porous metal tibia groups, respectively. In addition, the most recent KSSs were similar between all 3 groups at 74, 75 and 79, respectively, as were ROM (104°, 106° and 108°, respectively) and complications. However, traditional modular cemented tibia had significantly more non-progressive radiolucent lines below the tibial tray in zones 1 and 4 on AP radiographs (23%, 12%, 10%, respectively).

Conclusion: Cementless porous metal tibial components have excellent implant survivorship (95%), clinical outcomes and knee motion with less radiolucent lines when compared to cemented modular and cemented porous metal tibial components in a randomized clinical trial at 10 year follow up.

Notes

Paper #18

Cementless TKA in Patients Over Seventy-Five: A Single Practice Review Using Statewide Registry Data

Brendan J. Comer, MD, David C. Markel, MD, Michael Fry, MD, Dexter T. Powell, MD

Introduction: While cemented total knee arthroplasty (TKA) has been the gold standard, newer uncemented implants have yielded positive initial results. However, concerns about early failure in older populations persist. We hypothesized that early outcomes and revision rates would be similar using a modern implant, even in older patients. As such, the 90-day outcomes and 2-year revision rates of uncemented TKAs in patients over 75 years were compared to an age-matched cohort of cemented TKAs.

Methods: A statewide arthroplasty registry was queried for all primary TKAs (01/2016-05/2020) performed in patients >75 years by a single practice in a single hospital. This yielded 150 cementless TKAs that were matched to 150 cemented TKAs for age and sex. The same implant was used in all cases. 90-day ED visits, readmissions, return to the OR and 2-year revision rates were compared. Fisher's exact and Chi squared tests were used for categorical data, and paired t-tests for continuous data. Log-rank was applied for survival analysis.

Results: Cementless TKA had significantly less 90-day post operative events (ED visits, medical readmissions, return to OR) vs cemented (123/150 vs. 104/150; p=.011). There were more deep vein thromboses in cemented TKAs (0 vs. 5, p=.024). There were 5 total revisions in each cohort. The uncemented cohort had 2 fractures requiring revision and 3 periprosthetic joint infections (PJI). The cemented cohort had one TKA revised for pain/stiffness, 3 PJI, and one TKA revised for unknown reasons. The survival analysis yielded no difference between cohorts at 2 years (p=.431).

Conclusion: Cementless TKAs performed as well or better than a matched cemented cohort in patients >75 years old for 90-day outcomes and 2 year (early) revision rates. The data supports continued investigation regarding optimal indications and patient selection when utilizing uncemented TKA technologies.

Notes

Paper #19

Variables in TKA Cementing Technique Amongst Arthroplasty Surgeons – A Survey of the AAHKS Members

Christopher E. Pelt, MD, Michael J. Archibeck, MD, Ran Schwarzkopf, MD, MSc, Gregory G. Polkowski, MD, J. Ryan Martin, MD

Introduction: Aseptic loosening persists as one of the leading causes of failure following cemented primary total knee arthroplasty (TKA). Surgical factors, specifically cement technique, may impact implant fixation. We hypothesized that there is significant variability in TKA cement technique amongst arthroplasty surgeons.

Methods: A 28-question survey regarding variables in a surgeon's preferred TKA cementation technique was distributed to 2,791 current AAHKS members. Descriptive statistics were performed.

Results: Questions that demonstrated the most consensus included vacuum mixing of cement (80.8%), the use of two packages (76.9%), tibial implant first (95.9%), cementing all implants in a single stage (97%) and compression of the implants in extension (92.3%). While the use of a tourniquet was common (82.9%), there was significant variability in the duration and timing. Low viscosity cement represented the lowest use (22.9%) compared to medium and high viscosity (38.2% and 36.8% respectively). Finger pressurization was the most common (77.5%) and often based on consistency or timing of cement curing (72.4%). Of interest, while the tibial implant was commonly precoated, 2.4% of respondents reported not precoating the tibial implant compared to only 0.8% with the femoral component ($p=0.016$). The tibial bone was more commonly fully precoated (73.1%) compared to the femur which was most commonly partially precoated (67.4%) ($p< 0.001$).

Conclusion: There appears to be substantial variability in cemented TKA technique amongst arthroplasty surgeons. We noted relative consensus (>75%) with regards to vacuum mixing of cement, order of cementation and two batches. Greater variation was present in cement viscosity, application to bone and implant, bone preparation, tourniquet use and steps taken prior to cement curing. Further studies that look at the impacts of variable techniques on outcomes may be warranted.

Notes

Paper #20

Preoperative VR-12 Mental Composite Score >60 Associated with Increased Satisfaction Post THA

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Introduction: Up to one-third of patients undergoing primary elective total hip arthroplasty (THA) report symptoms of psychological distress. The Veterans RAND 12-Item Health Survey (VR-12) mental component score (MCS) is a patient-reported outcome measure quantifying mental health problems, vitality and social functioning. To date, a quantifiable risk threshold for baseline VR-12 MCS has not been developed. We aimed to determine 1) VR-12 MCS distribution for patients undergoing primary THA; and 2) thresholds that predict higher healthcare utilization and 1-year patient-reported outcome measures (PROMs).

Methods: A prospective cohort of 4,194 primary THA patients (January 2016–December 2019) were included. Multivariable and cubic spline regression models were used to test for associations between preoperative VR-12 MCS and postoperative outcomes including: 90-day hospital resource utilization (non-home discharge, prolonged length of stay[LOS](i.e.≥3 days), all-cause readmission), attainment of Patient Acceptable Symptom State(PASS) at 1-year postoperative, as well as Substantial Clinical Benefit (SCB) in the Hip Disability, Osteoarthritis Outcome Score (HOOS)-pain, and HOOS-physical short form (-PS).

Results: Lower VR-12 MCS was independently associated with older age ($p< 0.001$), obesity ($p< 0.001$), Black race ($p< 0.001$), females ($p< 0.001$) and smokers ($p< 0.001$). Preoperative VR-12 MCS< 20 was associated with more than twice the odds of non-home discharge (odds ratio [OR]:2.31, 95%confidence interval [CI]:1.00-4.94) and prolonged LOS (OR:3.46, 95%CI:1.72–6.80). VR-12 MCS >60 was associated with increased odds of achieving PASS (OR:2.00, 95% CI:1.52–2.68), and SCB in HOOS-JR (OR:1.16, 95%CI:1.00–1.35). Spline regression models demonstrated that starting VR-12 MCS ≤40 there were exponentially higher odds of poorer outcomes.

Conclusion: Low preoperative VR-12 MCS, specifically less than 40 (or >1 standard deviation away from the mean of the general population), may predict increased healthcare utilization. Further, preoperative VR-12 MCS>60 predicts greater overall satisfaction at 1-year as well as achieving SCB in HOOS-JR. Quantifiable thresholds for VR-12 MCS may aid in shared decision-making and patient counseling in setting expectations or may guide specific care pathway interventions to address mental health during THA.

Notes

Paper #21

Hospital Teaching Status and Patient-Related Outcomes Following Primary THA—an AJRR Study

Christian T. Oakley, BS, Jerrt Arraut, BS, Simon Lalehzarian, MD, Jeremiah Thomas, BS, Vinay K. Aggarwal, MD, Ran Schwarzkopf, MD, MSc, Joshua C. Rozell, MD

Introduction: Previous studies have shown lower morbidity and mortality rates during total hip arthroplasty (THA) at academic teaching hospitals. This study sought to determine the relationship between hospital teaching status and PROMs following primary THA using the American Joint Replacement Registry (AJRR) data.

Methods: Using AJRR data from 2012-2020, 4,447 primary, elective THAs with both preoperative and one-year postoperative HOOS, JR scores were analyzed. This study was powered to detect the minimal clinically important difference (MCID). The main exposure variable was hospital teaching status. Three cohorts were formed based on hospital teaching status as defined by the American Hospital Association (AHA) Data Survey Fiscal Year 2015: major teaching hospital, minor teaching hospital and non-teaching hospital. Mean preoperative and one-year postoperative HOOS, JR scores were compared.

Results: Preoperative HOOS, JR scores (non-teaching: 49.69±14.42 vs. major teaching: 47.68±15.10 vs. minor teaching: 42.46±19.19, $p< 0.001$) were significantly higher at non-teaching hospitals than at major and minor teaching hospitals, and these differences persisted at one-year postoperatively (87.40±15.14 vs. 83.87±16.68 vs. 80.37±19.27, $p< 0.001$). Both preoperative and postoperative differences in HOOS, JR scores were less than the MCID at both time points. In multivariate regression, non-teaching and minor teaching hospitals had similar odds of MCID achievement in HOOS, JR scores compared to major teaching hospitals.

Conclusion: Using the HOOS, JR score as a validated patient-reported outcome measure, undergoing primary THA at an academic teaching hospital did not correlate with higher postoperative HOOS, JR scores or greater chances of MCID achievement in HOOS, JR scores compared to non-teaching hospitals. Further study is required to determine the most important factors leading to the greatest degree of improvement in patient-reported outcomes following THA.

Notes

Paper #22

Does Race Predict Outcomes and Revision Rates after Primary Total Hip Arthroplasty?

Jaclyn A. Konopka, MD, Utkarsh Anil, MD, Charles C. Lin, MD, Claudette M. Lajam, MD, Ran Schwarzkopf, MD, MSc

Introduction: Various socioeconomic disparities exist in total hip arthroplasty (THA) patients; however, most studies on this topic contain small sample sizes and few control for confounding variables. This study aims to evaluate postoperative outcomes and survivorship after THA in patients of different races and is the first to our knowledge to analyze these rates with a large-scale multivariate regression analysis.

Methods: Patients who underwent a primary unilateral THA were identified in the New York Statewide Planning and Research Cooperative System (SPARCS) database with ICD 9/10 PCS codes, excluding patients with hip fractures or oncologic diagnoses. Patients were stratified into four groups based on race: white, black, Hispanic, or Asian. Categorical variables and continuous variables were compared, and revision free survival was calculated using Kaplan Meier survival analysis. Multivariate Cox proportional hazard regression was used to calculate revision hazard ratios.

Results: In total, 203,443 white, 19,282 black, 11,669 Hispanic and 2,179 Asian patients were identified. Across races, the most common indication for surgery was osteoarthritis. Length of stay, discharge disposition, postoperative anemia, blood transfusions, three month inpatient readmission and emergency room visit rates, and three and 12 month periprosthetic joint infection rates were all worse in minority races ($p< 0.001$, $p< 0.001$, $p< 0.001$, $p< 0.001$, $p=0.014$, $p=0.003$, respectively); however, twelve month mortality rates were similar. Regression analysis demonstrated that black race had a slightly lower risk of revision than white patients (HR: 0.90, 95% CI: 0.82-0.98, $p=0.021$). There were no significant differences across all races in the cumulative revision event rate up to 10 years postoperatively.

Conclusion: Primary THA patients of minority race are more likely to have worse short-term outcomes and complications. However, the overall rates of revision are similar across races, with a slightly lower rate of revisions in black patients after controlling for confounding factors.

Notes

Paper #23

No Difference in Risk of Dislocation with Lumbar Spine Fusion Prior to or After Total Hip Arthroplasty

Sebastian Welling, MD, Ryland P. Kagan, MD, Mark E. Mildren, MD, Travis C. Philipp, MD, Jung Yoo, MD

Introduction: In patients with concomitant hip and lumbar spine disease the questions of which surgery, total hip arthroplasty (THA) or lumbar spine fusion (LSF) should be done first has not been adequate answered. Previous investigations have noted increased risk of dislocation after THA in patients with LSF but it is not clear if the risk is decreased if the LSF is delayed. We aimed to evaluate risk of dislocation after THA in patients with LSF within one year prior to or after THA.

Methods: A retrospective review was performed (Medicare Standard Analytical Files from the PearlDiver database) by querying International Classification of Disease, tenth revision (ICD-10) procedure codes for LSF in the year prior to (LSF first group) or in the year after THA (THA first group). We identified post-operative hip dislocation as our primary outcome variable. Demographic data collected included age, sex and obesity. Risk of dislocation was described as a proportion of the cohort with chi-square tests.

Results: We identified 312,947 patients with THA from 2012-2019. Of these, there were 1,593 in the LSF first group and 755 in the THA first group. There was no difference in age, sex or obesity between the LSF first and THA first groups. No difference in rate of dislocation was noted comparing rates of dislocation in the LSF first 77/1,593 (4.8%) to the THA first groups 36/755 (4.8%), p=1).

Conclusion: There was no difference in the risk dislocation after THA if a LSF is performed prior to or after THA. This can help surgeons as they counsel patients with concomitant lumbar spine and hip degeneration. Additionally, this suggests that decreased spine mobility leading to increased risk of dislocation is likely present in lumbar degeneration and not caused by surgical fusion.

Notes

Paper #24

Blame the Opioid not the Spine Surgeon: Dislocation After Total Hip Arthroplasty with Prior Lumbar Surgery

Ryland P. Kagan, MD, Sebastian Welling, MD, Travis C. Philipp, MD, Mark E. Mildren, MD, Jung Yoo, MD

Introduction: Risk for dislocation after total hip arthroplasty (THA) is increased with prior lumbar spine fusion (LSF), potentially related to decreased spine mobility. However, prior LSF patients also have elevated rates of opioid use. We aimed to evaluate the influence of opioid use at the time of THA and the risk of dislocation in patients with prior LSF.

Methods: A retrospective review was performed (Medicare Standard Analytical Files from the PearlDiver database) by querying International Classification of Disease, tenth revision procedure codes for LSF and THA. Patients with post-operative hip dislocation were identified, and patients were stratified to opioid use within 90 days prior to THA. Multivariate analysis with adjusted ORs evaluated the association of opioid use and dislocation after adjusting for demographic characteristics: age, sex, obesity.

Results: We identified 312,947 patients with THA from 2015-2020. 16,864 had LSF prior to THA, 9,341 with opioid prior to THA and 7,523 without. In patients with prior LSF there was increased odds for dislocation for opioid use at THA (aOR = 1.82, 95% CI 1.75, 1.89, p< 0.00001) compared to those without. There was no difference in odds for dislocation in LSF patients without opioid at THA compared to THA patients without prior LSF, (aOR = 1.10, 95% CI 0.85-1.41, p 0.456).

Conclusion: There are increased odds for dislocation in patients with prior LSF if opioid use was present at time of THA. However, LSF patients without opioid use at time of THA have similar risks for dislocation to patients without LSF. This suggests that the increased risk of dislocation in LSF patients is not fully explained by decreased spine mobility and factors such as pain or altered sensorium related to opioid use should be considered.

Notes

Paper #25

Are Metal Ion Levels Elevated After Dual Mobility Acetabular Systems: Minimum Five-Year Analyses

Steven F. Harwin, MD, Zhongming Chen, MD, Nipun Sodhi, MD, Michael A. Mont, MD

Introduction: The purpose of this study was to investigate metal ion levels in patients at a minimum five-year follow-up after dual mobility (MDM) total hip arthroplasty (THA) implantation. Specifically, we analyzed: (1) Overall blood and urine cobalt levels; (2) Overall blood and urine chromium levels; (3) Cobalt levels stratified by length of follow-up and various implant-related metrics (i.e., offset, cup size, stem, and neck angle); as well as (4) Chromium levels stratified by length of follow-up and these various implant-related metrics.

Methods: Cobalt and chromium serum and plasma, blood, as well as urine levels of 41 MDM THAs were obtained. Additional parameters analyzed included: head material and size, stem offset, cup size, as well as stem-neck angle.

Results: Concentrations of cobalt were low as the mean blood and urine levels for all patients were 0.6ug/L (normal< 1.8ug/L) and 0.8ug/L (normal< 2.8ug/L), respectively. One patient had minimally elevated blood cobalt level by 0.1ug/L. These levels were not substantially different when subgroup analyses were performed for ceramic and cobalt-chrome heads. Mean chromium levels in blood and urine were also found to be low for all patients as values were 0.8ug/L (normal< 1.2ug/L) and 1.2ng/mL (normal< 2ng/mL), respectively. Similarly, only one patient had a very slightly elevated blood chromium level of 1.3ug/L. Additionally, analyses of ceramic or cobalt-chrome heads separately did not demonstrate differences in blood or urine levels. Blood cobalt or chromium concentrations had minimal changes with longer lengths of follow-ups, or with different stem offsets, cup sizes, stems or neck angles.

Conclusion: To the best of our knowledge, this is the first study to demonstrate low levels of metal ions at longer than four-year follow-up. These data may be of importance to surgeons deciding on the appropriate implants to use for their high-risk patients.

Notes

Paper #26

MARS-MRI Abnormalities in Asymptomatic Primary THA Patients with Dual Mobility Hip Prostheses

Nathanael D. Heckmann, MD, Brian C. H. Chung, MD, Xiao T. Chen, MD, Luke R. Lovro, MD, Eric White, MD, Alexander B. Christ, MD, Donald B. Longjohn, MD, Daniel A. Oakes, MD, Jay R. Lieberman, MD

Introduction: Modular dual mobility (DM) articulations are increasingly utilized during total hip arthroplasty (THA) to enhance construct stability. However, concerns remain regarding the potential for adverse local tissue reactions secondary to metal ion release. The purpose of this study is to determine the prevalence of metal artifact reduction sequence-magnetic resonance imaging (MARS-MRI) abnormalities in asymptomatic primary THA patients with DM articulations and correlate these findings with serum metal ion levels.

Methods: All patients with a pain-free primary elective THA, DM articulation and >2-year follow-up were screened for inclusion. Patients underwent MARS-MRI of the operative hip and had serum cobalt, chromium and titanium levels drawn. Patient satisfaction, Oxford Hip score and Forgotten Joint Score-12 (FJS-12) were collected. Fellowship-trained musculoskeletal radiologists blinded to serum metal ion levels read each MARS-MRI.

Results: Twenty-two patients (24 hips) with a DM articulation were included with average age of 67.6±8.1 years and average BMI of 29.7±4.8 kg/m2. At mean follow-up of 3.7±1.0 years (range: 2.1-5.8), mean patient satisfaction was 4.9/5, Oxford Hip Score was 44.0±3.7 (range: 35-48) and FJS-12 score was 81.5±17.6 (range: 43.2-100.0). Three patients (12.5%) had serum cobalt levels >1.0 µg/L (range: 1.4-3.4 µg/L). Of these, two patients had abnormal periprosthetic fluid collection on MARS-MRI with associated serum cobalt levels >3.0 µg/L. Another two patients (8.3%) were noted to have greater trochanteric bursitis on MARS-MRI, both with serum cobalt levels <1.0 µg/L. Serum cobalt levels were <1.0 µg/L in 16/17 remaining patients (94.1%) without MARS-MRI abnormalities; the final patient had a cobalt level of 1.4 µg/L. One patient (4.2%) had serum chromium level >3.0 µg/L with associated abnormal periprosthetic fluid collection. None of the patients had serum titanium levels >5.0 µg/L.

Conclusion: Approximately 1 in 12 well-functioning patients with DM articulations had elevated serum cobalt levels associated with abnormal fluid collections identifiable on MARS-MRI.

Notes

Symposium IV

Practice Norms in Primary Hip and Knee Arthroplasty: What is Everyone Else Doing?

Moderator: Daniel J. Berry, MD

The moderator will conduct a poll of the membership using an audience response system with real time display of results and commentary and will ask the audience a series of questions about their current practices in perioperative and intraoperative management of primary THA and TKA. The audience will respond using the audience response system and results will be displayed immediately. The moderator will weave in comparison of the current year's responses to data gathered in previous years to demonstrate areas of practice evolution. The symposium will place emphasis on areas of rapid practice change.

Learning Objectives:

1. Identify what AAHKS peers are currently doing for perioperative management of primary THA and TKA and how this has changed in the key areas in the past two years.
2. Identify what AAHKS peers are currently doing with respect to intraoperative decisions, choices, and practices in primary THA and TKA and how this has changed in the past two years.

Outline:

Introduction

Primary THA: Perioperative management

Primary THA: Intraoperative decisions/choices/ practices

Primary TKA: Perioperative management

Primary TKA: Intraoperative decisions/choices/ practices

Discussion

Notes

Paper #27

Total Knee Arthroplasty Can Save Lungs

Alisina Shahi, MD, PhD, Ali R. Oliashirazi, MD, Matthew L. Brown, MD

Introduction: Total knee arthroplasty (TKA) is a life-changing event. Many patients stop smoking prior to their elective surgery as part of preoperative optimization. However, it is unknown how many of these patients relapse to smoking after their surgery. The aim of this study was to investigate the incidence of smoking relapse and its association with periprosthetic joint infection (PJI) in a large non-select cohort of patients.

Methods: We conducted a multicenter study and retrospectively identified patients who underwent primary TKA between 2000 and 2020. Patients were stratified into four groups: current smokers (A), former smokers (B), ceased smoking for the procedure (C), and nonsmokers (D). Patients were followed for at least two years and the relapsed cases were identified. The association between smoking status and PJI was investigated using multivariate regression analysis.

Results: 16,322 patients were identified who underwent 19,986 total knee arthroplasties during the study period. Of these patients, 1,352 (8.2%) were current smokers, 4,522 (27.7%) were former smokers, 3,575 (21.9%) ceased smoking for their procedure and 6,873 (42.1%) were nonsmokers. Current smokers were significantly more likely than nonsmokers to undergo reoperation for infection (OR:2.12[95%CI:1.42-3.25];p=0.04), and former smokers were at no increased risk (OR,1.12[95%CI,0.63-1.45];p=0.71). Of group C patients only 1,258 (35.1%) had relapse within two years after surgery. The rate of infection was significantly higher in patients who returned to smoking compared to those who didn't (5.0% vs. 0.4%; OR:2.1[95% CI, 1.53-2.44]).

Conclusion: Majority of patients who stopped smoking did not have a relapse within two years after surgery. It appears that TKA not only can improve patients' functionality but also is a turning point that prevents future smoking in majority of patients. Smoking is a major risk factor for PJI and patients who return to smoking are at a higher risk.

Notes

Paper #28

Second Dose of Dexamethasone Reduces Opioid Consumption, Pain and Length of Stay in Primary TKA

Jerry Arraut, BS, Christian T. Oakley, BS, Mark Kurapatti, BS, Omid S. Barzideh, MD, Joshua C. Rozell, MD, Ran Schwarzkopf, MD, MSc

Introduction: The optimal administration of dexamethasone for postoperative pain management and recovery following primary, elective total knee arthroplasty (TKA) remains unclear. This study aimed to evaluate the effect of a second intravenous (IV) dose of dexamethasone on postoperative pain scores, inpatient opioid consumption and functional recovery after primary elective TKA.

Methods: A retrospective review of 1,951 patients who underwent primary elective TKA between May 2020 and April 2021 was conducted. A total of 399 patients who received two perioperative doses (2D) of dexamethasone 10 mg IV were propensity-matched 1:1 to a control group of 399 patients who received one perioperative dose (1D) of dexamethasone 10 mg IV. To assess the primary outcome of opiate consumption, nursing documented opiate administration events were converted into morphine milligram equivalences (MMEs) for consecutive 24-hour postoperative intervals. Postoperative pain and functional status were also assessed using the Verbal Rating Scale (VRS) for pain and the Activity Measure for Post-Acute Care (AM-PAC) scores, respectively.

Results: A total of 798 patients were included in the analysis (1D = 399, 2D = 399). Compared to the 1D control group, the 2D group demonstrated significantly lower overall inpatient opiate consumption (33.4±59.3 vs. 54.2±119.0 MME; 38.4% decrease, p=0.004) and lower VRS pain scores at 36-48 hours (4.70±2.03 vs. 5.27±1.84; p=0.021) and 48-60 hours (4.71±2.07 vs. 5.50±2.08; p=0.020) postoperatively. The 2D cohort also had a shorter hospital length of stay (1.61±1.21 vs. 1.87±2.34 days; p=0.048) than the 1D control group. AM-PAC scores did not significantly differ between cohorts.

Conclusion: The administration of a second perioperative dexamethasone dose significantly decreased opioid consumption in the immediate postoperative period. Length of stay and inpatient opioid administration can be significantly reduced while maintaining a comparable functional recovery and superior pain control.

Notes

Paper #29

Aspirin and Venous Thromboembolism Following Total Joint Arthroplasty: An Analysis of Efficacy

Nathanael D. Heckmann, MD, Amit S. Piple, MD, Jennifer C. Wang, BS, Daniel A. Oakes, MD, Alexander B. Christ, MD, Jay R. Lieberman, MD

Introduction: Recent data suggest that aspirin may be as effective at preventing venous thromboembolism (VTE) as other commonly utilized agents such as warfarin. However, all data to date is limited by selection bias as many surgeons who use aspirin selectively give high-risk patients alternative agents. Therefore, this study aims to compare rates of VTE in patients who received aspirin compared to warfarin while accounting for surgeon-selection-bias using instrumental variable analysis (IVA).

Methods: The Premier Database was queried to identify patients undergoing primary elective total knee (TKA) or total hip arthroplasty (THA) from 2015-2020. Patients who underwent THA or TKA by surgeons who used aspirin in >90% of their patients were compared to patients whose surgeon utilized warfarin in >90% of their patients. Patients were grouped based on their surgeon allocation regardless of the regimen they received. Univariate and multivariate analysis was performed to assess the 90-day risk of pulmonary embolism (PE), deep vein thrombosis (DVT), and bleeding complications. IVA was performed to account for surgeon-selection-bias using surgeon preference as an instrument.

Results: Overall, 175,707 patients were identified in the aspirin-surgeon-cohort and 39,681 patients in the warfarin-surgeon-cohort. In the aspirin-surgeon-cohort, 93.9% received aspirin and in the warfarin-surgeon-cohort, 96.8% received warfarin. Rates of DVT (0.49% vs. 0.45%, p=0.336) and PE (0.26% vs. 0.30%, p=0.180) were not significantly different between cohorts. IVA demonstrated an increased risk for DVT (OR 1.07, p=0.018), decreased risk of transfusion (OR 0.70, p< 0.001) and no difference in the risk of PE (OR 1.01, p=0.798) associated with the aspirin cohort compared to warfarin cohort. These findings were consistent on multivariate analysis.

Conclusion: After accounting for surgeon-selection-bias, aspirin use was associated with an increased risk for DVT but decreased risk for transfusion compared to warfarin. These data call for high-quality randomized trials to assess the efficacy of aspirin compared.

Notes

Paper #30

One Year Outcomes of Smartphone-Based Care Management Platform After Total Knee Arthroplasty

David A. Crawford, MD, Paul J. Duwelius, MD, Adolph V. Lombardi, Jr., MD, FACS, Keith R. Berend, MD, Alexander M. DeHaan, MD, Roberta E. Redfern, PhD

Introduction: Outpatient physical therapy following knee arthroplasty has been standard practice; however evidence suggests in-person physical therapy (PT) may not be necessary for all patients. This study aimed to provide mid-term follow up data from a study that demonstrated reduced PT use with a mobile application for self-directed rehabilitation.

Methods: This study presents mid-term follow up data from a multicenter, prospective, randomized controlled trial comparing a smartphone-based care management platform (sbCMP) to standard of care following knee arthroplasty procedures. KOOS JR scores one year postoperatively and changes from baseline scores were compared between control and treatment group using t-tests.

Results: 245 patients were randomized to the control group and 160 patients received the sbCMP following knee arthroplasty. Baseline patient characteristics including gender, age, BMI and KOOS JR were similar between control and treatment groups. 60.6% of patients prescribed the sbCMP utilized adjunct PT postoperatively. The change in KOOS JR scores from preoperative levels were similar at one year (32.2±16.6 vs 31.3±17.6 points, p=0.70). Overall KOOS JR scores were similar between controls and the sbCMP group at one year (83.0±14.9 vs 84.0 ±14.0, p=0.6). Those in the treatment group not requiring adjunct PT had significantly higher KOOS JR compared to controls at one year postoperatively (88.7±11.8 vs 83.0±14.9, p=0.01).

Conclusion: A sbCMP can be effectively used to guide rehabilitation after knee arthroplasty and can help avoid the need for outpatient PT. Mid-term follow up data suggests equivalent outcomes for those requiring adjunct PT compared to controls and those using the sbCMP alone.

Notes

Paper #31

Lateral Patella Facet OA Is Not Contraindicated for Medial UKA: Mean 10-Year Outcomes & Survivorship

Kevin D. Plancher, MD, MPH, Karina Wang, BS, Sarah Commaroto, Kathryn Dotterweich, Karen K. Briggs, MPH, Stephanie C. Petterson, PhD

Introduction: A recent consensus meeting reported caution when performing medial UKA in patients with lateral patellar facet osteoarthritis (LPFOA). The purpose was to determine if LPFOA revealed lower survivorship or patient-reported outcomes following medial UKA.

Methods: 144 fixed-bearing medial UKAs were performed by a single surgeon and included. Patient selection used a specific clinical algorithm. LPFOA was defined as Outerbridge grade 3 or 4 on the lateral patellar facet. Same-day knee arthroscopy was performed to examine the patella prior to UKA and chondral damage was recorded. Open patelloplasty was performed in all patients with LPFOA. Patients completed a subjective questionnaire to determine Patient Acceptable Symptom State (PASS) for KOOS subscales (ADL, Sport, QOL) and clinical exam at minimum 5-year follow-up.

Results: 109 patients did not have LPFOA and 35 patients had LPFOA (7 isolated LPFOA; 28 both medial/lateral PFOA). Patients with noLPFOA were younger than those with LPFOA (63±9 vs. 69±10years; p=0.006). There were more females in the LPFOA group (66%) compared to the noLPFOA (46%) (p=0.032). Four patients in the noLPFOA group required TKA, while no revisions were performed in the LPFOA cohort. There was no difference in mean survival time: noLPFOA=9.6 [95%CI:8.9-10.3] and LPFOA=10.4 [95%CI:9.3-11.4] (p=0.25). At mean follow-up of 10 years, there was no difference in knee flexion (noLPFOA=129°, LPFOA=130°; p=0.439) or extension (noLPFOA=0.46°, LPFOA=0.52°; p=0.886). PASS KOOS ADL was achieved in 78% in the noLPFOA group and 81% in the LPFOA group (p=0.807). PASS KOOS Sport was achieved in 82% in the noLPFOA group and 74% in the LPFOA group (p=0.441). PASS KOOS QOL was achieved in 85% in the noLPFOA group, and 88% in the LPFOA group (p=0.723).

Conclusion: At mean 10 years, there were no differences in survivorship or outcomes in patients with and without LPFOA. These long-term results support the use of fixed-bearing medial UKA in patients with LPFOA, however, clinical and radiologic patient selection algorithms are essential.

Notes

Paper #32

Individualized Functional Alignment Improves Clinical Outcomes in TKA Patients with Constitutional Varus

Gavin W. Clark, FRACS, Dermot Collopy, MD, Richard Steer, MD, Nazim Khan, PhD

Introduction: Functional alignment (FA) strives to balance the knee soft tissue envelope during total knee arthroplasty (TKA) using implant alignment adjustments rather than soft tissue releases. There is an ongoing debate for how best to achieve FA. We compare 2-year outcomes between FA with a mechanical alignment plan [FA(m)] and FA with a kinematic alignment plan [FA(k)]. The null hypothesis is that coronal limb alignment achieved will be the same between FA(m) and FA(k) techniques, and there will be no difference in 2-year outcomes.

Methods: Prospective data was collected from 300 consecutive primary TKAs [135 FA(m) and 165 FA(k)]. Functional alignment was achieved by adjusting implant alignment from the MA or KA starting plan to achieve balance with robotic assistance. Patient reported outcomes were obtained pre-operatively and 2 years post-operatively (93% follow-up). The coronal plane alignment of the knee (CPAK) classification was used to classify knee alignment phenotypes.

Results: Overall limb alignment was equivalent between groups. Final implant alignment was different between FA(m) and FA(k) groups, with FA(k) TKAs having higher tibial varus ($p < 0.01$), higher femoral valgus ($p < 0.01$), higher joint line obliquity ($p < 0.01$) and more femoral internal rotation relative to the TEA ($p < 0.01$). Patients reported higher FJS-12 scores with FA(k) TKAs (79.4 versus 71.6, $p=0.018$), and greater range of motion (125° versus 121°; $p=0.003$). Patients with constitutional varus (CPAK Type I) knees reported the greatest improvement in outcomes when comparing FA(k) versus FA(m) TKAs (FJS at 2 years of 89 versus 65; $p < 0.001$).

Conclusion: Utilizing an implant alignment plan that considers a patient's native joint line (FA(k)) led to a final implant position with greater joint line obliquity, yet the same overall limb alignment. This was associated with improved outcomes at 2 years post TKA. Three-dimensional component position and joint line obliquity affect outcomes independent of coronal limb alignment.

Notes

The James A. Rand Young Investigator's Award

Increased Revision Risk with Rotating Platform Bearings in Total Knee Arthroplasty

Vishal Hegde, MD, Jamil S. Kendall, MD, Kathryn L. Schabel, MD, Christopher E. Pelt, MD, Patrick J. Yep, MPH, Kyle Mullen, MPH, Ayushmita De, PhD, Ryland P. Kagan, MD

Introduction: Rotating Platform (RP) bearings in total knee arthroplasty (TKA) have the potential to reduce polyethylene wear and improve patellar tracking due to axial freedom. However, concerns for increased risk of revision have been described due to the associated tibial component design, added complexity with balance and risk of bearing dislocation. We examine the risk of revision with use of RP compared to fixed bearing (FB) designs in TKA.

Methods: An analysis of primary TKA cases in patients age >65 years was performed with American Joint Replacement Registry data linked to Centers for Medicare and Medicaid Services data from 2012-2019. Patient demographics, and cause for revision were recorded. Analysis compared RP to FB designs using Cox proportional regression modeling for all-cause and revision for infection, adjusting for gender, age and the competing risk of mortality. Event-free survival curves evaluated time to revision for all-cause and revision for infection.

Results: We identified 485,024 TKAs, with 452,199 (93.2%) FB and 32,825 (6.8%) RP bearings. Compared to FB the RP were at increased risk for all-cause revision HR 1.36 ([95% CI 1.24, 1.49], p< 0.0001). There was no difference in revision for infection, HR 1.06 ([95% CI 0.90, 1.25], p=0.516). Event-free survival curves demonstrated increased risk for all-cause revision for RP bearings across all time points, with a greater magnitude of risk as time elapsed out to 8 years.

Conclusion: Similar to other national registry investigations, RP designs in this study demonstrated increased risk for all-cause revision. Given no difference in risk of revision for infection, additional investigation is needed to determine if the increased failure rates could be related to unaccounted for patient selection factors, surgical technique, bearing issues or potentially implant related issues including tibial baseplate fixation.

Notes

AAHKS Surgical Techniques and Technologies Award

Resurfacing the Thin Native Patella: Is It Safe?

Jacob M. Wilson, MD, Mikaela H. Sullivan, MD, Mark W. Pagnano, MD, Robert T. Trousdale, MD

Introduction: Whether to resurface the patella during total knee arthroplasty (TKA) remains debated. One often cited reason for not resurfacing is inadequate patellar thickness. However, when left un-resurfaced, this cohort has known relatively high revision rates. The aim of this study is to describe the implant survivorships, reoperations, complications and clinical outcomes in patients who underwent patellar resurfacing of a thin native patella.

Methods: Our institutional total joint registry was used to identify patients undergoing primary TKA with patellar resurfacing from 2000 to 2010. Of the 11,333 identified patients, 200 (1.8%) had a pre-resection patellar thickness of ≤19mm. Pre-resection and post-resection patella thickness was measured intraoperatively using calipers. Median pre-resection and post-resection thickness was 19 (range 12-19) and 12.5 (range 10-17), respectively. Mean age was 69 years, mean BMI 31 kg/m2, and 93% were female. Indications for surgery included: osteoarthritis (n=153), rheumatoid arthritis (n=33), post-traumatic arthritis (n=14). Median follow-up was 10 years (range 2-20).

Results: At 10 years, survivorships free of any patella revision, patella-related reoperation, periprosthetic patella fracture and patella-related complication were 98%, 98%, 99%, and 97%, respectively. There were 2 patella revisions: 1 for aseptic loosening and 1 for PJI. There were 2 additional patella-related reoperations, both arthroscopic synovectomies for patellar clunk. Two patients underwent MUA. There were 3 periprosthetic patella fractures managed nonoperatively, all with well-fixed components and intact extensor mechanisms. Radiographically, the patella appeared well fixed in all non-revised knees. Knee society scores improved from mean 36 preoperatively to mean 81 at 10-years postoperatively.

Conclusion: Resurfacing the thin native patella was associated with high survivorship free of patellar revision at 10-year follow-up. None-the-less there was one case of patellar loosening and 3 periprosthetic patella fractures. These risks must be weighed against the known higher incidence of revision when the thin native patella is left un-resurfaced.

Notes

AAHKS Clinical Research Award

Oral Dexamethasone Following Total Knee Arthroplasty: A Double-Blind, Randomized Controlled Trial

Jonathan H. Shaw, MD, Luke D. Wesemann, BS, Trevor R. Banka, MD, Wayne T. North, MD, Michael A. Charters, MD, Jason J. Davis, MD

Introduction: Dexamethasone has been shown to reduce pain in total joint arthroplasty beyond a single preoperative dose, and extended duration of steroid use has precedence for nausea prevention during some chemotherapy regimens. This double-blind, randomized, placebo-controlled trial investigates the postoperative effects and safety of oral dexamethasone as a potential augment to multimodal use in outpatient knee arthroplasty.

Methods: The authors prospectively randomized 109 consecutive patients undergoing primary total knee arthroplasty at one institution. Patients were assigned to one of two groups: Group A (57 patients) received 4 mg of dexamethasone by mouth twice per day starting postoperative day (POD) one for four days and Group B received placebo capsules. All healthcare professionals and patients were blinded to group allocation. The primary outcome was defined as postoperative pain scores for POD 1-7. Secondary outcomes included 90-day postoperative complications, nausea and vomiting, daily opioid usage, assistance for ambulation, difficulty sleeping and early patient reported outcomes.

Results: Demographics and comorbidities were similar between groups. The patients who received dexamethasone had statistically significant decrease in VAS scores when averaging POD 1-4 ($p=0.01$). The average VAS scores amongst individual days were significantly lower with dexamethasone on POD 2-4. While taking dexamethasone, morning and midday VAS scores were significantly lower. The dexamethasone group took less oxycodone than the placebo group, but this was not statistically significant ($p> 0.05$). There was no difference between the groups with nausea or vomiting, 90-day complications, ability to walk with/without assistance, difficulty sleeping and early patient reported outcomes (Table 2).

Conclusion: This double-blind, randomized, placebo-controlled trial demonstrated that oral dexamethasone following primary total knee arthroplasty reduces pain scores postoperatively when added to a multimodal pain control regimen. This stands as a beneficial and safe option in ambulatory surgery where patients are unable to receive the traditional postoperative intravenous dose of dexamethasone.

Notes

Symposium V

Current Concepts in Alignment in Total Knee Replacement

Moderator: Jonathan M. Vigdorchik, MD
Faculty: Fares S. Haddad, FRCS, Michael T. Hirschmann, MD, Mark W. Pagnano, MD

This symposium will provide the latest information on a hotly debated topic in total knee replacement. With the recent spike in interest in alternative alignment techniques and with the advent of new technologies, surgeons are slowly evolving away from classical mechanical alignment. However, the literature is polluted with confusing terminology and techniques. Audience members will leave with an understanding of knee alignment and a simple/easy way to incorporate it into their practice.

Learning Objectives:

1. To identify the differences in alignments techniques for total knee arthroplasty.
2. To review how to a perform each technique using conventional instruments and/or computer-assisted technologies.
3. To review native knee kinematics and when to utilize each technique.

Outline:

Introduction
Jonathan M. Vigdorchik, MD

How do you Define all these Different Alignment Strategies?
Fares S. Haddad, FRCS

Knee Phenotypes – Does this Really Matter?
Michael T. Hirschmann, MD

Is Mechanical Alignment still the Gold Standard or Should we Consider Alternative Alignments for TKA?
Mark W. Pagnano, MD

How to Safely Introduce these Strategies into your Practice?
Jonathan M. Vigdorchik, MD

Discussion
All Faculty

Notes

Paper #33

Fibromyalgia Increases Post-Operative Healthcare Utilization Following Total Hip Arthroplasty

Ryland P. Kagan, MD, Mark E. Mildren, MD, Spencer Smith, BS, Jung Yoo, MD

Introduction: Pre-operative factors can complicate the post-operative course and increase healthcare utilization following total hip arthroplasty (THA). Fibromyalgia is not generally recognized as a modifiable risk factor prior to THA and the aim of this investigation was to assess its effect on post-operative healthcare utilization following THA.

Methods: A retrospective review using Medicare Standard Analytical Files (PearlDiver Database) was performed querying International Classification of Disease, tenth revision (ICD-10) procedures codes for THA procedures between 2015-2020. Patient demographics, age, sex, pre-operative opioid use were collected. Analysis compared patients with or without fibromyalgia for post-operative healthcare utilization metrics, length of stay (LOS), 90-day post-operative opioid use, dislocation and emergency room visits. Independent t-test was used to compare LOS and rates of ongoing opioid use. Logistic regression analysis with adjusted Odds Ratios (aORs) evaluated the association of fibromyalgia and odds for dislocation or emergency room visit after adjustment for demographic characteristics.

Results: 28,138 patients with THA were identified over the study period, 1,455 (5.2%) carried the diagnosis of fibromyalgia. The patients with fibromyalgia were younger (62.6 ± 10.1 vs 66.5 ± 10.6, $p< 0.0001$) and more likely to be female (8.2% vs 1.0%, $p< 0.000001$). LOS was increased in the fibromyalgia group (8.44 days ± 8.12 days vs 2.65 days ± 3.01, $p< 0.000001$). 90-day post-operative opioid use was higher in the fibromyalgia group 68.7% vs 59.4% ($p< 0.000001$). The odds for dislocation was increased in the fibromyalgia group aOR 1.67 (95% CI 1.24-1.87, $p< 0.02$). Odds for emergency room visit was increased in the fibromyalgia group OR 1.46 (95% CI 1.35-1.58, p< 0001.

Conclusion: Fibromyalgia can complicate post-operative care following THA with increased LOS, higher rates of opioid use and increased odds of dislocation and emergency room visits. As focus shifts to pre-operative optimization and risk stratification, more attention should be placed on fibromyalgia prior to THA.

Notes

Paper #34

Treating Hepatitis-C Prior to Total Hip Arthroplasty is Cost-Effective: A Markov Analysis

Afshin A. Anoushiravani, MD, Gokul V. Kalyanasundaram, BS, James E. Feng, MD, MS, Frank Congiusta, MD, Richard Iorio, MD, Matthew Dicaprio, MD

Introduction: Patients with hepatitis-C virus (HCV) have high mortality and complications after total hip arthroplasty (THA). Recent advances in HCV therapy have enabled clinicians to eradicate disease using antiretroviral therapy (ART) and direct-acting antivirals (DAA), but these therapies are not commonly prescribed for patients prior to THA. The purpose of this study was to perform a cost-effectiveness analysis comparing no therapy, ART and DAA prior to THA among HCV-positive candidates.

Methods: A Markov model was constructed with costs, probabilities and quality-adjusted-life-year (QALY) values obtained from published literature. The incremental cost-effectiveness ratio (ICER) was compared to a willingness-to-pay threshold of $100,000/QALY to determine the cost-effectiveness of ART and DAA compared to no therapy prior to THA. Costs were calculated in 2021 dollars, and they were discounted 3% annually for inflation. Sensitivity analysis was performed to investigate the uncertainty associated with input variables.

Results: Our Markov model indicates that both ART and DAA prior to THA are cost-effective. HCV patients were modeled with increased rate of deep infection (9.5%) compared to healthy patients (1.3%). THA in the setting of no therapy, ART and DAA added 8.06, 11.62 and 14.39 QALYs at an average total cost of $28,800, $65,400 and $115,800. The ICER associated with ART and DAA in comparison to no therapy was $10,300/QALY and $13,800/QALY, both under the willingness-to-pay threshold of $100,000/QALY. Sensitivity analysis demonstrated that the ICER was influenced primarily by patient age, ART/DAA cost and effectiveness and HCV-associated mortality.

Conclusion: Total hip arthroplasty is exceptionally cost-effective, and our results highlight that ART and DAA prior to THA are cost-effective at current price points for HCV patients who have increased risk of poor outcomes. Our cost-saving estimates remain conservative as they do not account for HCV-associated medical complications. Strong consideration should be given to treating HCV prior to THA.

Notes

Paper #35

Bilateral Total Hip Arthroplasty Staged within 6 Weeks Increases Risk of Adverse Events

Joseph Serino, MD, E. Bailey Terhune, MD, Robert A. Burnett, MD, Jonathan A. Guntin, BA, Craig J. Della Valle, MD, Denis Nam, MD, MSc

Introduction: The ideal timing for bilateral total hip arthroplasty (THA) to avoid an increased risk of adverse events remains controversial. The purpose of this study was to evaluate 90-day outcomes after simultaneous and staged bilateral THA.

Methods: Laterality-specific International Classification of Disease, 10th Revision codes were used to retrospectively identify 273,281 patients undergoing primary THA during 2015-2020. Of these, 39,905 (14.6%) were bilateral. Patients were divided into cohorts of unilateral THA, simultaneous bilateral THA and staged bilateral THA at 1-14 days, 15-42 days, 43-90 days and 91-365 days. Bilateral THA cohorts were matched one-to-one with unilateral THA patients based on age, gender, year, Elixhauser Comorbidity Index (ECI), and a preoperative diagnosis of obesity, tobacco use and diabetes. Univariate and multivariate analysis were used to compare 90-day outcomes between matched groups with a significance level of $p < 0.05$. Outcomes were collected beginning after the second THA in staged bilateral groups.

Results: Simultaneous bilateral THA was associated with an increased risk of transfusion (odds ratio [OR] 4.43, 95% confidence interval 2.31-2.63, $p < 0.001$), readmission (OR 2.60, 2.01-3.39, $p < 0.001$), and any complication (OR 1.86, 1.55-2.24, $p < 0.001$) compared to unilateral THA. Bilateral THA staged at 1-14 days increased the risk of readmission (OR 1.83, 1.49-2.24, $p < 0.001$) and any complication (OR 1.45, 1.26-1.66, $p < 0.001$) relative to unilateral THA. Bilateral THA staged at 15-42 days also increased the risk of adverse events, including periprosthetic joint infection (OR 3.15, 1.98-5.19, $p < 0.001$), transfusion (OR 2.90, 1.84-4.70, $p < 0.001$), readmission (OR 1.92, 1.55-2.39, $p < 0.001$) and any complication (OR 1.70, 1.46-1.97, $p < 0.001$). Bilateral THA staged at 43-90 days and 91-365 days resulted in similar or decreased rates of individual complications, reoperation, readmission and any complication relative to unilateral THA.

Conclusion: Bilateral THA should be staged a minimum of 6 weeks apart in appropriately selected patients to avoid an increased risk of adverse events.

Notes

Paper #36

Patient Reported Outcome Measures in Conventional Total Hip Arthroplasty Versus Robotic-Arm Assisted

Babar Kayani, MD, PhD, Andreas Fontalis, MD, MSc, Isabella C. Haddad, Christian Donovan, Jenni Tahmassebi, BS, Fares S. Haddad, MD, FRCS (ORTHO)

Introduction: Robotic-arm assisted total hip arthroplasty (RO THA) has been shown to improve the accuracy of component positioning compared with conventional total hip arthroplasty (CO THA), but it remains unknown how this translates to any differences in patient-reported outcome measures (PROMS). This study reports the clinical outcomes of a previous trial that showed RO THA was associated with improved accuracy and reduced outliers in acetabular component positioning compared with CO THA.

Methods: This prospective cohort study included 50 patients undergoing CO THA versus 50 patients receiving RO THA. Predefined outcomes including the Oxford hip score (OHS), Forgotten joint score (FJS), and University of California at Los Angeles hip (UCLA) score and any associated complications were recorded annually for three years. Patients in both treatment groups were comparable for age, gender, body mass index, laterality of surgery and ASA scores.

Results: At three year follow-up, there was no statistically significant difference in CO THA versus RO THA with respect to the OHS (41.7 ± 5.4 vs 42.3 ± 4.9, p=0.478), FJS (84.7 ± 9.1 vs 89.2 ± 7.8, p=0.063) and UCLA score (7.6 ± 1.4 vs 7.9 ± 1.9, p=0.243). None of the study patients had dislocations or underwent revision surgery. Spearman's rank correlation coefficient showed no statistical correlation between accuracy of achieving the planned cup inclination and version with the OHS, FJS or UCLA score.

Conclusion: Improved accuracy of acetabular component positioning in RO THA in a high-volume setting does not appear to significantly improve short-term functional outcomes or complication risk compared to CO THA. Further studies are needed to assess the significance of these findings on longer term clinical outcomes and implant survivorship, and also explore the impact of the enhanced RO THA workflow and functional positioning for both acetabular and femoral component placement on these outcomes.

Notes

Paper #37

HXLPE Liner Thickness in THA Does not Influence Survival in 2584 Hips with Mean 13.2 Years Follow-up

Bas L. Fransen, MD, PhD, Lisa C. Howard, MD, Tanya Mac Donell, MD, Francisco J. Bengoa, MD, Donald S. Garbuz, MD, Gerard A. Sheridan, MD, Michael E. Neufeld, MD, MSc, FRCSC

Introduction: Short to midterm follow-up studies have not demonstrated a negative effect of using larger femoral heads at the cost of thinner highly crosslinked polyethylene (HXLPE) liners in modern total hip arthroplasty (THA). However, concern remains that these thinner liners may prematurely fail in the long term. The aim of this study was to evaluate the long-term survival and revision rates of HXLPE in primary THA and the effect of liner thickness.

Methods: We retrospectively identified all primary THA done in a single center using HXLPE from 2010 and earlier, including all head and liner sizes/thickness. We included 2565 THA with a mean follow-up of 13.2 years (range 11.0-18.8). Mean age was 67.7 years, mean BMI was 29.0 and 47.6% were female. Patient characteristics, implant details, death and revisions were collected. Patients were grouped for analysis for each millimeter of PE thickness (e.g. 4.0-4.9mm, 5.0-5.9mm). Kaplan-Meier survival was used to determine all-cause and aseptic loosening revision rates.

Results: Liner thickness varied from 4.9 to 12.7 mm, with one third < 6mm. Head sizes ranged from 28 to 40 mm, with 92.5% being 32 or 26mm and 98.4% of them being metallic heads. Liner-related revision rates were 0.08%, all-cause revision rates were 4.4% and reoperation rates were 7.3%. Estimated survival rates were 96% at 10 years and 94.8% at 20 years. When grouped by liner thickness, there were no significant differences in all-cause revisions (p=0.112) or aseptic revisions (p=0.116).

Conclusion: There were no significant differences in all-cause or aseptic revisions between any of the liner thickness groups at long-term follow-up. Our results indicate that using thinner HXPE liners to maximize femoral head size in THA does not lead to increased revision or liner failures at long term follow-up and is a safe practice when using HXLPE.

Notes

Paper #38

Displaced vs Nondisplaced Femoral Neck Fractures: Is Arthroplasty the Answer for Both?

Graham J. DeKeyser, MD, Jeffrey J. Frandsen, MD, Brenna E. Blackburn, PhD, Jeremy M. Gililland, MD

Introduction: Traditionally, nondisplaced geriatric femoral neck fractures have undergone operative fixation while displaced geriatric femoral neck fractures have undergone hip arthroplasty (HA). The purpose of this study was to evaluate differences between outcomes in patients with nondisplaced (Garden 1/2) fractures and displaced (Garden 3/4) fractures that were treated with arthroplasty.

Methods: This was a retrospective review of patients with a minimum of 1 year follow up from nine academic medical centers who underwent HA for femoral neck fractures between 2010-2020. Chi-square, Fisher's Exact, and t-tests were used to compare demographics and outcomes between patients who had a displaced fracture and those who had a nondisplaced fracture.

Results: One thousand six hundred and twenty patients met inclusion criteria with 128 patients in the non-displaced cohort and 1492 in the displaced cohort. The mean follow-up in the study was 26.4 months. Both groups were similar in terms of demographic variables including age, sex, body mass index diabetes, tobacco use, injury mechanism and injury severity score (all p> 0.05). At 1-year follow up, there were no revisions (0/128) for nondisplaced femoral neck fractures that underwent HA and a 2.1% revision rate for displaced femoral neck fractures that underwent HA. Heterotopic ossification (HO) was significantly higher in displaced (23.6%) vs nondisplaced fractures (11.7%) (p=0.0021). Interestingly, operative times [120 vs 104 min (p=0.0002)] and blood loss [424 vs 332 ml (p=0.001)] were significantly higher in nondisplaced than displaced fractures that underwent HA.

Conclusion: Hip arthroplasty is an excellent treatment option for nondisplaced and displaced geriatric femoral neck fractures, with no revisions at 1 year for nondisplaced fractures and a 2% revision rate for displaced fractures. HO is higher in patients with displaced femoral neck fractures. HA is a reasonable treatment option for non-displaced femoral neck fractures to potentially decrease revision surgeries in a frail patient population.

Notes

Symposium VI

Go Big or Go Home: Optimizing Outcomes in Obese Patients

Moderator: Michael Blankstein, MD, MSc, FRCSC
Faculty: James A. Browne, MD, Kevin A. Sonn, MD, Ran Schwarzkopf, MD, MSc

As the prevalence of obesity continues to rise, the proportion of patients undergoing total joint arthroplasty (TJA) has followed suit. Extensive literature has reported on obesity as an independent modifiable risk factor for increased complications, readmissions and reoperations. However, the influence of weight loss prior to TJA on adverse events remains elusive. Obesity is a very complex systemic and societal problem and the lack of successful weight loss strategies by arthroplasty patients have been reported in the literature. Strict BMI cutoffs may limit access to care not only for patients who could have safely undergone TJA, but also may disproportionately affect certain disadvantaged populations. Evidence-based perioperative measures can mitigate risk in obese patients and enable safe TJA with low risk of complication. This symposium is aimed at interpreting the best available literature to help participants discern how best to safely care for the ever-growing obese arthroplasty population.

Learning Objectives:

1. Recognize the risks associated with performing total joint arthroplasty on obese patients.
2. Review the implications of BMI cutoffs on access to care.
3. Review the implications of preoperative weight loss on outcomes.
4. Discern the best way to optimize obese patients prior to total joint arthroplasty.
5. Outline the optimal surgical techniques, perioperative protocols and care pathways for total joint arthroplasty for the obese patient.

Outline:

Introduction
Michael Blankstein, MD, MSc, FRCSC

What Does the Data Say about the Perioperative Risks of Obesity and BMI?
James A. Browne, MD

Is there an Optimal BMI Cutoff? Or Do BMI Cutoffs Needlessly Reduce Access to Care? Employed Surgeons and Hospitals
Michael Blankstein, MD, MSc, FRCSC

Weight Loss Before Surgery: Does it Reduce Risk?
Kevin A. Sonn, MD

How to Safely Operate on the Obese Patient: Tips and Tricks for THA and TKA
Ran Schwarzkopf, MD, MSc

Discussion
All Faculty

Notes

Paper #39

Declining Geographic Access to High-Volume Revision Hip Arthroplasty Surgeons (2013-2019)

Tarun K. Jella, MPH, Thomas B. Cwalina, MBA, Alexander L. Roth, MD, Nathan W. Mesko, MD, Atul F. Kamath, MD

Introduction: Reimbursements for revision Total Hip Arthroplasty (revTHA) procedures have substantially declined; however, the population-level effects of these trends on patient access are not well understood. The present study aimed to evaluate the trends in (1) the number of high volume primary and revision THA surgeons between 2013 to 2019 and (2) county-level geographic access to these surgeons over the same period.

Methods: The Medicare Fee-for-Service Provider Utilization and Payment Public Use Files (POSPUF) were used to extract data for primary and revision THA procedures using the Healthcare Common Procedure Coding System codes (HCPCS) 27130 for primary and 27132, 27134, 27137, or 27138 for revision cases. Geospatial analyses were performed by aggregating surgeon practice locations at the level of individual counties, Hospital Service Areas (HSA) and Hospital Referral Regions (HRR).

Results: The number of surgeons performing at least 10 primary THA within the Medicare population increased by 17.6% over the study period (from 3,838 in 2013 to 4,515 in 2019). Conversely, the number of surgeons submitting at least 10 revTHA Medicare claims decreased by approximately 36.1% over the same timeframe (from 178 in 2013 to 129 in 2019). The number of counties with at least one high volume primary THA surgeon increased by 6.1% from 2013 to 2019. Meanwhile, the number of counties with at least one high volume revTHA surgeon decreased by 30.2% over the study period.

Conclusion: Declining geographic access to high volume revTHA surgeons may represent a consequence of shifting economic incentives and declining reimbursements for the care of complicated revTHA patients. Key stakeholders in the surgeon, hospital and payer community must consider the impact of future fee schedule changes on economic disincentives surrounding the care of challenging complications.

Notes

Paper #40

Does an Extended Trochanteric Osteotomy Increase the Risk of Tapered Splined Stem Subsidence?

Samuel Rodriguez, MD, Leonardo Albertini-Sanchez, BS, Travis R. Weiner, BS, Elizabeth B. Gausden, MD, MPH, Jason L. Blevins, MD, Jose A. Rodriguez, MD, Peter K. Sculco, MD

Introduction: Revision hip arthroplasty (RHA) is usually accompanied by metaphyseal bone-loss and the need for a diaphyseal-engaging tapered-splined-titanium-stem (TSTS). The impact of an extended-trochanteric-osteotomy (ETO) on TSTS subsidence is unknown. Thus, we sought to investigate whether an ETO increased mean-subsidence and the associated radiographic-factors.

Methods: This single-center retrospective-cohort study collected all-TSTS implanted at time of femoral revision between 9/1/2016 and 11/23/2020. Patients with <3-months of follow-up or incomplete radiographic follow-up were excluded. All radiographic measurements were performed by a single observer. The stem contact-length was measured above and below the transverse-segment of the ETO. Intra-class correlation-coefficient was used to determine intra-rater reliability. Mann-Whitney U test was used to compare continuous variables and a Pearson's correlation was used to determine the association between contact-length and subsidence.

Results: Two-hundred-ninety-eight (299 hips) patients were identified with a mean-age of 67±11.8 years, mean BMI of 28±7.2 kg/m2, and mean follow-up of 19.3±11.8 months. There were 66 ETOs (22.1%) performed. Intra-rater reliability was 0.89 and 0.94 for subsidence and contact-length respectively. Overall mean-subsidence at latest follow-up was 3.0±0.2 mm. The mean-subsidence for Non-ETO patients was 2.5±0.2mm versus 5.1±0.7mm with an ETO ($p< 0.001$). The mean contact-length for Non-ETO patients was 64±1.9mm versus 61±4.2mm in ETO patients ($p=0.12$). Specifically, the contact-length above the ETO was 23±3.2mm versus 38±3.8mm below (intact-diaphysis). We found a significant inverse-relationship between TSTS contact-length and subsidence in non-ETO patients (-0.33, $p< 0.001$). Contact-length below the ETO was also an inversely related to subsidence (-0.26, $p=0.037$). However, the overall contact-length within the ETO did not correlate with stem-subsidence (-0.12, $p=0.359$).

Conclusion: An ETO performed during RHA was associated with significantly higher subsidence. Contact-length was inversely related (lower contact-length/more stem-subsidence) with stem-subsidence below the ETO and in Non-ETO patients. Surgeons should focus on contact-length below-ETO level when assessing contact-length during revision-THA.

Notes

Paper #41

Dual Mobility Articulation in Revision Total Hip Arthroplasty: An AJRR Analysis

Jesse E. Otero, MD, PhD, Nathanael D. Heckmann, MD, Kyle Mullen, MPH, Jay R. Lieberman, MD, Bryan D. Springer, MD

Introduction: Dual mobility (DM) articulations have been used in revision total hip arthroplasty (THA) with increased frequency in recent years to prevent postoperative hip instability. The purpose of this study is to report on outcomes of DM implants used in revision THA from the American Joint Replacement Registry (AJRR).

Methods: Patients ≥65 years old who underwent a revision THA from 2012-2018 were screened for inclusions. Patients were divided into 3 groups: (1) DM articulation, (2) ≤32 mm solid bearing and (3) ≥36 mm solid bearing cohorts. The dataset was merged with Medicare claims data available through Jun 2020 to supplement outcome cases not captured in the AJRR. Patient and hospital characteristics were analyzed using multivariate statistical modeling to minimize potential confounding and identify independent associations with re-revision. All-cause re-revision for any reason and re-revision for instability were assessed using Cox proportional hazards regression analyses.

Results: Overall, 20,728 revision THAs were identified, of which 3,043 (14.7%) received a DM articulation, 6,565 (31.7%) a ≤32 mm femoral head, and 11,120 (53.6%) a ≥36 mm femoral head. At eight-year follow up, the cumulative all-cause re-revision rate for the ≤32 mm group (21.9%, 95%-CI 20.2-23.7%) was significantly higher than the DM (16.5%, 95%-CI 15.0-18.2%) and ≥36mm (15.2%, 95%-CI 14.2-16.3%) groups ($p < 0.0001$). At eight years, the ≥36 mm group showed the lowest rate of re-revision for instability (3.3%, 95%-CI 2.9-3.7%) while the DM (5.4%, 95%-CI 4.5-6.5%) and ≤32 mm groups (8.6%, 95%-CI 7.7-9.6%) had higher rates ($p < 0.0001$).

Conclusion: DM bearings are associated with lower rates of revision for instability compared to patients with ≤32 mm heads, but marginally higher rates of revision for patients with ≥36 mm heads. These results may be limited by unidentified confounding factors as patients at higher risk of dislocation may have preferentially received a DM articulation.

Notes

Paper #42

Dislocated Dual Mobility THA: Most Need Open Reduction and Intraprosthetic Dissociation Often Missed

Katherine E. Mallett, MD, Michael J. Taunton, MD, Matthew P. Abdel, MD, Rafael J. Sierra, MD

Introduction: Dual mobility (DM) implants reduce the risk of dislocation in total hip arthroplasty (THA). Dislocated DM can present as a true dislocation of the entire modular head from the acetabulum, or as an intraprosthetic dislocation (IPD), where the inner head dissociates from the outer polyethylene bearing. This study reports the incidence of DM dislocations and IPD and evaluates the treatment and long-term outcomes of dislocated DM THA.

Methods: 695 primary and 758 revision DM THA were implanted at our institution from 2010-2021. 54 DM THA in 48 patients sustained at least one dislocation event. Mean time to dislocation was 41 weeks, mean age was 64 years, 54% were female and mean follow-up was 2.5 years. Patient outcomes were evaluated by retrospective chart review.

Results: 44 hips presented with true dislocations (3% incidence) and 10 presented with IPD (0.7% incidence). 9 of 10 IPD were missed at presentation and four additional iatrogenic IPD occurred during reduction attempts, increasing IPD incidence to 1%. Reduction attempts in the emergency department failed in 63% of DM, closed reduction attempts in the operating room failed in 53% and second attempts at closed reduction failed in 95%. Closed reduction was more successful under anesthesia with paralysis (p=0.03). Ultimately 65% required open reduction or revision to treat the dislocation, 33% re-dislocated and five hips underwent subsequent revision at a mean 1.8 years after dislocation.

Conclusion: The incidence of DM dislocation and IPD remains low; however, 90% of IPD were missed, highlighting the importance of DM identification at presentation. Closed reductions were more successful with paralysis; however, the majority of dislocated DM required open management. Given the high conversion rate to open management and risk of iatrogenic IPD, we recommend attempting closed reduction in the operating room, where one may convert to open management as needed.

Notes

Symposium VII

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

Moderator: Matthew P. Abdel, MD
Faculty: Scott M. Sporer, MD, MS, Daniel J. Berry, MD, Elizabeth B. Gausden, MD

This symposium will provide the latest information on managing patients with failed THAs who require complex exposures, biologic fixation to manage bone loss and advanced techniques to treat and mitigate complications such as infection.

Learning Objectives:

1. Review how to safely expose complex revision THAs with a variety of surgical techniques based upon video demonstrations.
2. Identify 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 and periprosthetic femur fractures) most successfully in revision THA.
3. Review the best techniques when using antibiotic spacers for infection.

Outline:

Introduction
Matthew P. Abdel, MD

Extended Trochanteric Osteotomies and Component Removal: It's An Art!
Matthew P. Abdel, MD

Hemispherical Cups, Augments, and Cages: How to Make Them All Work
Scott M. Sporer, MD, MS

Modular Fluted Tapered Stems: How I Use Them for Vancouver B2 and B3 Periprosthetic Fractures and Revisions
Daniel J. Berry, MD

Articulating & Non-Articulating Spacers for PJI: What Are the Options in 2022?
Elizabeth B. Gausden, MD

Discussion
All Faculty

Notes

Paper #43

Hip & Knee Surgery Is the Most Litigated in Contemporary Orthopaedic Malpractice Claims

Nicholas Sauder, BS, Ahmed K. Emara, MD, Pedro J. Rullan, MD, Viktor E. Krebs, MD, Robert M. Molloy, MD, Nicolas S. Piuzzi, MD

Introduction: Approximately 80% of hip and knee surgeons will face malpractice litigation. Previous malpractice studies limit their review to primary total joint arthroplasties (TJAs), do not compare hip and knee surgery to other subspecialties and do not analyze contemporary litigation. This study aimed to determine 1) damages and negligence claimed; 2) proportion of different case outcomes; 3) factors associated with defense verdicts; and 4) differences in litigation patterns between orthopaedic subspecialties.

Methods: VerdictSearch, a nationwide database, was queried for all orthopaedic medical malpractice claims from 2015-2020. Variables included: case outcome, indemnity payment, damages, negligence claimed, treatment, patient characteristics. A binary logistic regression determined if any collected variable increased the likelihood of defense verdict.

Results: A total of 164 claims from 17 states were reviewed. Hip and knee surgery was the most frequent subspecialty (n=58, 38.4%; Knee: n=35, 21.3%; Hip: n=23, 14.0%). Other orthopaedic subspecialties represented were Spine (n=36; 22.0%), Trauma (n=28;17.1%), Hand & Wrist (n=16; 9.8%), Foot & Ankle (n=7; 4.3%), Sports (n=7; 4.3%), Pediatric (n=6; 3.7%), and Shoulder (n=6; 3.7%). Within hip and knee surgery, the most frequent treatments were primary TJAs (n=34; 56.8) and revision TJAs (n=7; 12.1%). Defense verdicts occurred in 44 cases (75.8%), while 12 (20.7%) resulted in plaintiff verdicts (Mean Award: $4,241,965) and 2 (3.4%) resulted in settlements (Mean Amount: $1,550,000). The most common damages were nerve injuries (n=13; 22.4%) and infections (n=9; 15.5%). The most common negligence were procedural errors (n=33; 56.9%) and diagnostic errors (n=21; 36.2%). The only variable independently associated with decreased likelihood of defense outcome was non-reversible damages (e.g., paralysis, amputation, death; $p< 0.001$).

Conclusion: Hip and knee surgery was the highest-represented subspecialty in orthopaedic malpractice litigation. Surgeons are more frequently found negligent when non-reversible damages occurred. Hip and knee surgeons should be cognizant of litigation patterns while ensuring patient-centered high-quality care.

Notes

Paper #44

Chronic Anticoagulation: Increased Risk for Complication Following Primary Total Knee Arthroplasty

Rahul K. Goel, MD, Jacob M. Wilson, MD, Philip O. Oladeji, MD, Alexander M. Dawes, BS, Keerat Singh, MD, George N. Guild, MD

Introduction: Total knee arthroplasty (TKA) is a reliable and safe procedure that is associated with predictably good outcomes. As perioperative management of patients undergoing TKA has advanced, more medically frail patients have become candidates. One such cohort is patients requiring chronic anti-coagulation (CA) for underlying medical comorbidities. We aimed to explore if these patients can expect similar complication rates following TKA as patients not requiring CA.

Methods: This is a retrospective cohort study using The Truven Marketscan® databases. Patients undergoing primary TKA were identified and divided into cohorts based on preoperative medication status (i.e., having an anti-coagulation prescription filled six prior to and six months following surgery). Patients undergoing revision surgery, those <18 years-old, and those without 6-month preoperative and 2-year postoperative enrollment were excluded. Patient demographics and comorbidities were collected and controlled for in the analysis of 90-day and two-year outcomes. Univariate and multivariate analyses were performed to compare outcomes between cohorts.

Results: 53,168 patients were included with 12,367 on preoperative CA (18.9%). At 90 days, CA patients had increased odds of wound complications (OR 1.64, 95% CI 1.42-1.91, p< 0.001), hematoma formation (OR 2.35, 95% CI 1.82-3.04, p< 0.001), and revision surgery (OR 1.26, 95% CI 1.06-1.50, p=0.01). At two-years, CA patients had increased odds of periprosthetic joint infection (PJI) (OR 1.63, 95% CI 1.44-1.86, p< 0.001) as well as non-infectious revision surgery (OR 2.03, 95% CI 1.50-2.76, p< 0.001).

Conclusion: Preoperative CA is associated with significantly higher odds of 90-day and 2-year complications after primary TKA. In particular, the increased odds of PJI and aseptic revision should be noted given their significant associated morbidity. Patients receiving CA should be counseled preoperatively regarding these risks.

Notes

Paper #45

The Three Strongest Oxford Knee Score Questions that Predict Subsequent Knee Arthroplasty Revision

Mei Lin Tay, MS, Andrew P. Monk, FRCS, Chris M.A. Frampton, PhD, Gary J. Hooper, MD, Simon W. Young, FRACS

Introduction: The Oxford Knee Score (OKS) is a 12-item questionnaire used to track knee arthroplasty outcomes. Validation of such patient reported outcome measures is typically anchored to a single question based on patient 'satisfaction'; however risk of subsequent revision surgery is also recognized as an important outcome measure. The OKS is a strong predictor of subsequent revision risk within two years; however, it is not known which item(s) are the strongest predictors. Our aim was therefore to identify which questions were most important in the prediction of subsequent knee arthroplasty revision risk.

Methods: All primary TKAs (n=27,708) and UKAs (n=8,415) captured by the New Zealand Joint Registry between 1999 and 2019 with at least one OKS response at six months, five years and ten years post-surgery were included. Logistic regression and receiver operating characteristics (ROC) curves were used to assess prediction models at six months, five years, and ten years.

Results: Q1 'overall pain' was the strongest predictor of revision within two years (TKA: 6 months, odds ratio (OR) 0.70; 5 years, OR 0.56; 10 years, OR 0.70; UKA: 6 months, OR 0.76; 5 years, OR 0.35; 10 years, OR 0.54; all $p< 0.05$). A reduced model with just three questions (Q1, Q6 'limping when walking',Q10 'knee giving way' showed comparable diagnostic ability with the full OKS (area under the curve (AUC): TKA: 6 months, 0.77 vs. 0.76; 5 years, 0.78 vs. 0.75; 10 years, 0.76 vs. 0.73; UKA: 6 months, 0.80 vs. 0.78; 5 years: 0.81 vs. 0.77; 10 years, 0.80 vs. 0.77; all NS).

Conclusion: The three questions on overall knee pain, limping when walking and knee 'giving way' were the strongest predictors of subsequent revision within two years. Attention to the responses for these three key questions during follow-up may allow for prompt identification of patients most at risk of revision.

Notes

Paper #46

Tibial Tubercule Osteotomy in Revision Total Knee Arthroplasty: Contemporary Outcomes in 135 Knees

Cecile Batailler, MD, PhD, Nicolas Cance, MD, Robin Canetti, MD, Arman Vahabi, MD, Elvire Servien, MD, PhD, Sebastien Lustig, MD, PhD

Introduction: Tibial tubercle osteotomy (TTO) allows good exposure and reduces the complications' risks on the extensor mechanism during Revision Total Knee Arthroplasty (RTKA). The purposes were: 1) to determine the rates of bone healing, complications and revisions secondary to TTO; 2) to assess the functional outcomes of RTKA with TTO; 3) to identify the risk factors of failure.

Methods: Between 2010 to 2020, 810 RTKA were included in a prospective database. Inclusion criteria were RTKA with TTO, without extensor mechanism allograft, with at least two years of follow-up. 135 RTKA were included, with a mean age of 65±9 years old, a mean BMI of 29.8kg/m^2±5.7. Most frequent indications for revision were: 50% infections, 25% aseptic loosening, 13% stiffness. Bone healing was confirmed on radiographs or CT scan. Complications and revisions were evaluated at the last follow-up. Functional outcomes were assessed using the Knee Society Score (KSS) and range of motion.

Results: The mean follow-up was 51±26 months [24-121]. Bone healing was confirmed for 95% of patients after a delay of 3.4±2.7months. Complication rate was 15% (n=20): 9 tibial tubercle fracture (6.7%), 7 non-union (5%), 2 delayed union, 1 tibial fracture, 1 wound dehiscence. Seven patients (5%) required eight revision surgeries (6%): 3 bone grafts of TTO, 3 osteosyntheses, 1 extensor mechanism allograft, 1 wound revision. The functional scores and the knee flexion were significantly improved after surgery: KSS knee pre-op 48.8±17 versus post-op 79.6±20 ($p< 0.001$); KSS function pre-op 37.6±21 versus post-op 70.2±30 ($p< 0.001$); flexion pre-op 81.5°±33 versus post-op 93°±29 ($p=0.004$). 98% (n=132) of patients had no extension deficit. No risk factor of failure of the procedure was highlighted.

Conclusion: TTO during RTKA is an efficient procedure to improve knee exposure, with a high bone healing rate, despite significant specific complications. Functional outcomes are improved at mid-term.

Notes

Paper #47

A Comparison of NASA Task Load Index in Primary and Revision Total Knee Arthroplasty

Kunal S. Panwar, DO, Eric Huish, DO, Jesua Law, DO, Justin T. Deans, DO, Jonathon R. Staples, MD, Eric O. Eisemon, MD, Zachary C. Lum, DO

Introduction: Perceived surgeon workload of performing total knee arthroplasty (TKA) is poorly understood and variable in nature. The National Aeronautics and Space Administration-Task Load Index (NASA-TLX) survey was developed to quantify subjective experience following aviation and has been applied to healthcare fields. NASA-TLX measures workload across 6 domains (mental, physical, temporal, performance, effort, and frustration). Our purpose is to: 1) quantify the workload endured by surgeons who are performing primary and revision TKA and 2) compare these values in relationship to their Center for Medicare & Medicaid Services (CMS) compensation.

Methods: A prospective observational cohort of 5 fellowship-trained adult reconstruction surgeons completed NASA-TLX surveys following conclusion of primary TKA (CPT 27447) and revision TKA (CPT 27486 and 27487). We excluded from analysis any cases with intraoperative complication. Operative time, surgical indication, patient age, sex, body mass index and American Society of Anesthesiologist category were recorded. Final NASA-TLX workloads were compared to 2021 CMS data for work relative value units. Statistical analysis was performed using SPSS.

Results: 70 surveys (48 primaries and 22 revisions) were completed averaging 9.6 primaries and 4.4 revisions per surgeon. All 6 NASA-TLX domains were significantly higher in revision than primary TKA ($p < 0.008$). Revision TKA represented a 176% increased workload compared to primary TKA ($p < 0.001$), primary 3.13 (IQR 2.10-5.30) vs. revision 8.67 (IQR 7.53-9.80). Subgroup analysis revealed increased workload in primary TKA for post-traumatic arthritis versus primary osteoarthritis ($p=0.005$), 8.43 (IQR 6.75 – 9.18) versus 2.80 (IQR 2.00 – 4.27), respectively. Operative time was higher in revision versus primary TKA - 118 vs 84.5 minutes ($p=0.05$). Post-hoc power analysis demonstrated likelihood of β-error <0.001. Based upon 2021 CMS data, revision TKA is compensated at 50.1% of the actual workload.

Conclusion: Revision TKA places a significant workload upon surgeons and is disproportionately compensated by CMS.

Notes

Paper #48

Declining Inflation-Adjusted Medicare Hospital Reimbursement for Revision Total Joint Arthroplasty

Adam A. Rizk, BA, Tarun K. Jella, MPH, Thomas B. Cwalina, MBA, Thomas J. Pumo, MD, Michael P. Erossy, MD, Atul F. Kamath, MD

Introduction: While the burden of revision total joint arthroplasty (TJA) procedures increases within the United States, it is unclear whether healthcare resource allocation for these complex cases has kept pace. This study examined trends in hospital-level reimbursements for revision TJA hospitalizations.

Methods: The CMS Inpatient Utilization and Payment Public Use Files from 2014 to 2019 were queried for diagnostic-related groups (DRGs) for revision TJA; DRG 467 (revision of hip or knee replacement with complication or comorbidity [CC]) and DRG 468 (revision of hip or knee replacement without CC or major CC). After adjusting to 2019 US dollars with the Consumer Price Index, a multiple linear mixed-model regression analysis was performed. Analysis of covariance (ANCOVA) compared regressions from 2014 to 2019 for mean adjusted Medicare payment and mean adjusted charge submitted for these DRGs.

Results: From 2014 to 2019, a total of 170,808 revision total knee and hip arthroplasty hospitalizations were billed to Medicare. The annual number of revision total knee and hip arthroplasty procedures increased by 3,121 (10.7%) from 29,058 in 2014 to 32,179 in 2019. After adjusting to 2019 dollars, the average Medicare payment for DRG 467 decreased by $804.37 (-3.5%) from $22,821.56 in 2014 to $22,017.19 in 2019. The average Medicare payment for DRG 468 decreased by $647.33 (-3.6%) from $17,951.97 in 2014 to $17,304.65 in 2019. ANCOVA showed that the average inflation-adjusted Medicare payment for DRG 467 decreased at a greater rate during the study period, compared to that for DRG 468 (p=0.02).

Conclusion: The decline in reimbursement for DRGs 467 and 468 from 2014 to 2019 reveals decreasing incentives for revision TJA hospitalizations. Further research should assess the efficacy of current Medicare payment algorithms and identify modifications which may provide for fair hospital level reimbursements.

Notes

Paper #49

Trends in Revenue and Cost for Revision Total Knee Arthroplasty

Thomas H. Christensen, BS, Christian T. Oakley, BS, Joseph A. Bosco, MD, Claudette M. Lajam, MD, James D. Slover, MD, Ran Schwarzkopf, MD, MSc

Introduction: Over the past ten years, reimbursement models and target payments have been modified in an effort to decrease costs of revision total knee arthroplasty (rTKA) while maintaining a high quality of care. The goal of this study was to investigate trends in revenue and costs associated with rTKA.

Methods: A retrospective review was conducted investigating all patients who underwent rTKA at our large urban institution from June 1, 2011 to May 31, 2021. Demographic data as well as revenue, direct and total cost associated with each patient's hospital stay were collected. Contribution margin, a financial variable used to estimate the amount of revenue left to cover fixed costs, was calculated by subtracting direct cost from revenue. Revenue, cost and contribution margin values were recorded as percentages of 2011 values. Linear regression analysis was used to determine significance of trends and establish confidence intervals.

Results: In the ten-year period studied, 1601 patients were identified with complete revenue and cost data. Over the time period studied, there was no significant linear trend in revenue (p=0.177), contribution margin (p=0.423), or total cost (p=0.562). There was a significant upward trend in direct cost from 2011 to 2021 (Slope [95% CI]: 3.49 [1.26, 4.51], p=0.003). Since 2018, total cost increased by 0.9% and direct cost by 9.3% relative to 2011 values. In the same time period, revenue decreased by 10.2% leading to a reduction in contribution margin of 32.5%.

Conclusion: Since 2018 while direct and indirect costs associated with rTKA have been consistently high, revenue has steadily decreased, leading to the lowest contribution margin in over a decade. This trend is concerning and may potentially lead to decreased access to care. Reevaluation of reimbursement models for rTKA may be necessary to ensure the continued financial viability of this procedure.

Notes

Symposium VIII

Periprosthetic Joint Infection: Practical Guide to Address FAQs

Moderator: Javad Parvizi, MD, FRCS
Faculty: Antonia F. Chen, MD, MBA, Carlos A. Higuera, MD, Gregory G. Polkowski II, MD, MSc

Periprosthetic joint infection (PJI) is one of the most dreaded complications of joint arthroplasty. PJI has moved to be the main cause of failure of TKA and THA based on AJRR and numerous other joint registries. There are numerous issues with prevention, diagnosis and treatment of PJI. The symposium has assembled recognized experts in the field of orthopedic infections to discuss the current issues related to PJI. The speakers will cover clinically pertinent topics related to prevention, diagnosis and treatment of PJI. The format of presentation will be based on FAQ. Clinically relevant questions that we all face in our practice on a daily basis will be presented, responses (based on evidence as much as possible) and supportive citations will be provided. Questions like should I screen patients for MRSA, should joint replacement be performed in a laminar air flow operating room, what tests do I need to perform on the synovial aspirate, what antibiotics and how much do I add to cement spacer, and so on will be discussed.

Learning Objectives:

1. Discuss current issues related to PJI.
2. Review prevention, diagnosis and treatment options.
3. Identify practical, evidence-based approaches to addressing PJI.

Outline:

Introduction
Javad Parvizi, MD, FRCS

Prevention of PJI: Answering All the FAQ Related to Prevention from Nasal Decolonization to Laminar Flow
Gregory G. Polkowski II, MD, MSc

Diagnosis of PJI: What Test, When, How and all FAQs
Javad Parvizi, MD, FRCS

Treatment of PJI: DAIR to Amputation and Antimicrobials
Antonia F. Chen, MD, MBA

What is on the Horizon: Novel Surfaces, Anti-Biofilm, Antimicrobial Peptides and Many More
Carlos A. Higuera, MD

Discussion
All Faculty

Notes

Paper #50

Invasive GI Endoscopy Within 2 Months of TJA Increases the Risk for Periprosthetic Joint Infection

Enrico M. Forlenza, MD, E. Bailey Terhune, MD, Jeffrey A. Geller, MD, Craig J. Della Valle, MD

Introduction: The safety of postoperative colonoscopy and endoscopy following total joint arthroplasty (TJA) remains largely unknown. The objective of this study was to characterize the risk of developing a postoperative periprosthetic joint infection (PJI) after TJA when an endoscopic procedure is done within 12 months of the index surgery.

Methods: Using the PearlDiver database, patients who underwent an endoscopic procedure (colonoscopy or EGD) within 12 months after primary TJA were identified and matched in a 1:1 fashion based on procedure (primary TKA vs. THA), age, gender, Charlson Comorbidity Index (CCI) and smoking status with patients who did not undergo endoscopy. The impact of timing of endoscopy relative to TJA on postoperative outcomes was assessed. Pre-operative comorbidity profiles and 1-year complications were compared. Statistical analysis included chi-squared tests and multivariate logistic regression with outcomes considered significant at $p< 0.05$.

Results: A total of 142,055 patients who underwent endoscopy within 12 months following TJA (96,804 TKA and 45,251 THA) were identified and matched. Univariate testing revealed that for patients undergoing primary TJA, endoscopy within 12 months resulted in increased rates of PJI (TKA: 2.60% vs. 2.35%, $p< .001$; THA: 2.36% vs. 2.29%, $p=0.494$). Multivariate analysis revealed that endoscopy within 2 months following TKA and 1 month of THA was associated with a significantly increased odds of periprosthetic joint infection (OR: 1.29 [1.08-1.53]; $p=.004$; OR: 1.41 [1.01-1.90]; $p=0.033$, respectively). Patients who underwent endoscopy at later time points were not at significantly greater risk of developing these complications.

Conclusion: Postoperative endoscopy (colonoscopy and EGD) within 12 months of TJA increases the odds of PJI; however if done within 2 months of TKA and 1 month of THA it significantly increases the odds of developing a PJI. This data suggests that invasive endoscopic procedures should be delayed as above.

Notes

Paper #51

Fungal Prosthetic Joint Infections: An Emerging Pathogen?

Kathryn L. Fideler, MD, MPH, Eric M. Kiskaddon, MD, Matthew T. Pigott, MD, Kenan Alzouhayli, BA, Andrew Phillips, BA, Douglas Chonko, DO

Introduction: Fungal prosthetic joint infections (PJIs) are thought to affect 1% of all total knee (TKA) and total hip (THA) PJIs. Recommendations against obtaining routine fungal cultures in the setting of PJI has been recently proposed. However, the goal of this study is to demonstrate the possibility that fungal PJIs may have been previously underreported.

Methods: This is a retrospective case-control study of all PJIs, defined by the Musculoskeletal Infection Society, treated at a single institution between January 1, 2017, until June 20, 2021. A fungal PJI had isolated a fungal pathogen from synovial fluid or tissue culture during treatment, and the remaining PJIs were placed in a control group for comparison. Patient demographics, laboratory results and outcomes were analyzed. Categorical variables were analyzed using chi-squared or Fisher's exact tests and continuous variables with student's t-tests or Mann-Whitney U tests where appropriate.

Results: A total of 296 PJIs were identified with 47 of them defined as fungal PJIs (15.9%). Patient demographics did not differ between the two groups ($p > 0.05$). The number of TKA and THA PJIs between the two groups were similar ($p>0.05$). Candida sp was the most common fungal species isolated (n=40, 85.1%). Most (80.9%) fungal PJIs also isolated a bacterial pathogen in synovial or tissue cultures during their treatment. Compared with controls, there was a significant difference in the presence of corynebacterium striatum ($p=0.003$), vancomycin-resistant enterococcus sp ($p=0.007$), and enterobacter sp. ($p=0.005$) in fungal PJIs. PJI treatment success was significantly different between the cases and controls (19.1 vs 61.0%, $p< 0.001$). Case fatality rate was higher amongst fungal PJIs (25.5 vs 14.5%) but this difference was not significant ($p=0.069$).

Conclusion: Fungal PJIs may have been previously underreported in the literature, which would challenge recent recommendations to discontinue routine fungal cultures during PJI treatment.

Notes

Paper #52

Success of Debridement, Antibiotics and Implant Retention in Prosthetic Joint Infection

Richard Rahardja, MD, Mark Zhu, MD, Joshua Davis, MD, PhD, Laurens Manning, MD, PhD, Sarah Metcalf, MD, Simon W. Young, FRACS

Introduction: The optimum indications for performing debridement, antibiotics and implant retention (DAIR) for prosthetic joint infection (PJI) following total knee arthroplasty (TKA) are unclear. This study aimed to identify the success rate of DAIR in a large multicenter cohort and compare the success rates of DAIR between different PJI classification systems.

Methods: Prospective data from the Prosthetic joint Infection in Australia and New Zealand Observational (PIANO) study was analyzed. This study included first time PJIs occurring after primary TKA that were managed with DAIR between July 2014 and December 2017. Treatment success was defined as the patient being alive with absence of clinical or microbiological reinfection and no ongoing use of antibiotics at 2-year follow-up. The rate of DAIR success was compared against the Coventry (early PJI = ≤1 month), International Consensus Meeting (ICM, early PJI = ≤90 days), Auckland (early PJI = <1 year) and Tsukayama PJI classification systems. Multivariate binary logistic regression models were produced for each classification system with adjustment for patient and microbiological factors.

Results: 189 PJI cases were managed with DAIR with an overall success rate of 45% (85/189). DAIR success was highest in early PJIs defined according to the Coventry system (adjusted OR=3.85, p=0.008), the ICM system (adjusted OR=3.08, p=0.005) and the Auckland system (adjusted OR=2.60, p=0.01). DAIR success was lower in both hematogenous (adjusted OR=0.36, p=0.034) and chronic infections (adjusted OR=0.14, p=0.003) when defined according to the Tsukayama system.

Conclusion: DAIR success is highest in infections occurring within one year of the primary TKA. Late infections had a high failure rate of DAIR irrespective of their classification as hematogenous or chronic. Time since primary can predict DAIR success.

Notes

Paper #53

High Incidence of Mood Disorders After Antibiotic Spacer Placement for PJI Following THA and TKA

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Introduction: Management of periprosthetic joint infection (PJI) often requires multiple surgeries with prolonged antibiotic courses resulting in decreased quality of life and increased postoperative morbidity and mortality. Such stressors adversely affect mental health and are overlooked in PJI treatment. Despite the known effects of mental health on outcomes, the role PJI treatment plays in the development and relapse of mood disorders remains largely unreported. This study reports on the incidence of depression and anxiety following antibiotic spacer placement for PJI.

Methods: Patients who underwent antibiotic spacer for PJI following total hip arthroplasty (THA) or total knee arthroplasty (TKA) were identified through national insurance databases (PearlDiver) using Current Process Terminology (CPT) codes for antibiotic hip and knee spacer and International Classification of Diseases codes specific for PJI. Patients with aseptic revision THA and TKA were similarly identified. Incidence of initial and recurrent depression and anxiety were identified within 1 year following antibiotic spacer among PJI and aseptic revision THA and TKA cohorts, respectively. Descriptive and univariate analysis were subsequently conducted.

Results: 108,858 patients were included; 58,899 revision TKA (rTKA), 11,167 rTKA secondary to PJI, 34,884 revision THA (rTHA), 3,908 rTHA secondary to PJI. Relative to aseptic rTKA, patients receiving antibiotic spacer placement for treatment of PJI have higher incidence of new depression (OR 3.67; $p< 0.01$), anxiety (OR 5.12; $p< 0.01$), and anxiety and depression combined (OR 3.60; $p< 0.01$). Relative to aseptic rTHA, Patients receiving antibiotic spacer placement for treatment of PJI have higher incidence of new depression (OR 4.54; $p< 0.01$), anxiety (OR 6.00; $p< 0.01$), and anxiety and depression combined (OR 4.85; $p< 0.01$).

Conclusion: There is high incidence of depression and anxiety among patients following the first stage of a two-stage revision THA or TKA for PJI and collaborative care with mental health professionals should be considered.

Notes

Paper #54

Skin Microbiome and Effect of Decolonization

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Introduction: The most common organisms causing surgical site infection (SSI) arise from skin and mucosal surfaces. Decolonization of the skin prior to a surgical procedure has been shown to be effective in reduction of SSI. The aim of this prospective study was to determine the organism profile of the skin and evaluate the effect of application of a unique antiseptic solution on the skin microbiome.

Methods: A total of 50 volunteers were recruited into this study. After randomization one arm of these individuals was cleaned with a wipe that had benzalkonium (BZK) antiseptic solution and the contralateral arm was wiped with PBS. Swab samples of each arm were taken at baseline (prior to application of the agents) and at 3 different timepoints after application (5 min, 2h, and 24h). Skin was protected between 5 min and 2h after application with a sterile wrap. Skin swabs were analyzed for NGS sequencing and culture.

Results: The baseline skin bioburden varied greatly among individuals (24 to 32,832 CFU/ml); however, baseline bioburden did not differ between arms (p=0.61). A higher effect of bioburden reduction was observed at 5 min after application of BZK, compared to PBS (median 95.79% vs. 36.26%, p< 0.01). At the 2h after application of BZK, there was still a bacterial reduction of 96.52% (IQR 88.8%-98.56%) and the PBS arm showed a lower reduction (median 31.1% [IQR 0%-56.08%], p< 0.01). By 24h, the reduction in bacterial load was also higher in the BZK arm (median 53.26% vs. 0%, p< 0.01).

Conclusion: There is a wide difference in the skin microbiome of individuals. Application of BZK-based antiseptic solution led to elimination of the skin flora for up to 2h after application. The novel antiseptic solution tested during this study has a broad activity against all organisms including fungi and spores.

Notes

Paper #55

Combining Bacteriophage and Vancomycin is Efficacious Against MRSA Biofilm Formed in Synovial Fluid

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Introduction: Biofilm formation is a major clinical challenge contributing to treatment failure of Periprosthetic joint infection (PJI). Lytic bacteriophages (phages) can target biofilm associated bacteria at localized sites of infection. The aim of this study is to test if phage has a better antimicrobial effect than vancomycin against Staphylococcus aureus biofilm aggregates formed in synovial fluid.

Methods: *S .aureus* BP043, a PJI clinical isolate, methicillin resistant S. aureus (MRSA) and biofilm-former was utilized in this study. Phage Remus, known to infect *S. aureus*, was used. BP043 was grown in human synovial fluid in 96-well for 24hrs as aggregates. Then, these *S. aureus* biofilm aggregates were treated with: A) phage Remus at ~109 PFU/mL, B) vancomycin, 500 ug/mL, or C) phage Remus, followed by vancomycin. Then, the bacterial aggregates were vortexed vigorously and bacterial survival was assessed by plating on tryptic soy agar plates. Aggregates formation in synovial fluid was assessed using flow cytometer by measuring their size and comparing it to S. aureus clumping in Tryptic Soy broth (TSB). The aggregates were also examined by scan electron microscopy (SEM). Each experiment had two technical repetitions and at least two different human synovial fluids were used.

Results: SEM images and flow cytometer data demonstrated the ability of human synovial fluid to promote *S. aureus* aggregates formation. Phage Remus resulted in more than 56% reduction in viable *S. aureus* residing in the synovial fluid aggregates, compared to the aggregates with no treatment ($p=0.015$). Remus is more powerful in breaking down BP043 aggregates and eliminating viable bacteria compared to vancomycin ($p=0.02$). Moreover, combining phage Remus followed by vancomycin is more efficacious in reducing bacterial load than using Remus or vancomycin alone ($p=0.023$, $p< 0.001$, respectively).

Conclusion: We demonstrated synergistic interaction between phage Remus and vancomycin, leading to better clearance of MRSA synovial fluid aggregates.

Notes

Paper #56

Implant Materials Affect Biofilm Formation

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Introduction: Bacterial surgical-site infections are a significant cause of morbidity and mortality globally, and lead to additional medical and surgical treatments, increased costs, and worse outcomes for orthopaedic patients. Bacteria forming extracellular biofilms are particularly resistant to antibiotic and surgical treatments when surgical implants are present. We compared the ability of staphylococcus aureus to form biofilms on common surgical implant materials.

Methods: Test coupons composed of hand-polished stainless steel (HPSS), titanium (Ti), titanium alloy Ti6Al4V (TiAlV), cobalt chrome alloy Co28Cr6Mo F1537 (CoCr), hydroxyapatite (HA), ultra-high molecular weight polyethylene (UHMWPE), polyether ether ketone (PEEK), and poly (methyl methacrylate) (PMMA) bone were coated with biofilms and quantified by CFU count, confocal microscopy and electron microscopy. Surface roughness and water contact angles were assessed with optical profilometer and optical zoom imaging.

Results: After 72 hours, biofilms grew more readily on non-polished 3D-printed metals and plastics, such as TiAlV (4.77e7 CFU) and UHMWPE (5.12e7 CFU) compared to polished and machined metals such as HPSS (1.06e7 CFU), Ti (1.25e7 CFU), and CoCr (2.16e7 CFU), ANOVA $p< 0.0001$. The materials with greater roughness and hydrophobicity developed more biofilm than smoother, hydrophilic materials.

Conclusion: Implant materials and characteristics have a strong correlation with biofilm formation, with hand-polishing of metals predicting resistance to biofilm formation. In addition to being mechanically weak and a poor antibiotic release profile, PMMA is also rougher and more hydrophobic than the metal implants, and thus provides an additional surface for bacteria to readily form biofilm. These results may inform implant designs and surgeons may choose materials with reduced biofilm affinity in both septic and aseptic procedures.

Notes

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Foundation of Orthopaedic Trauma: Board or committee member
Horizon Therapeutics: Paid presenter or speaker
LIfeNet Health: Paid consultant; Research support
Organogenesis: Research support
OrthoGrid: Paid consultant
Orthopaedic Trauma Association: Board or committee member
ORTHOXEL: Paid consultant
SI-Bone: Paid consultant
Springer: Publishing royalties, financial or material support
Stryker: Paid consultant
Synthes: Paid consultant; Research support
Use-Lab: Paid consultant
WNT Scientific: Stock or stock Options

Simon W. Young, FRACS
American Association of Hip and Knee Surgeons: Board or committee member
Auckland Orthopaedics Ltd: Stock or stock Options
Axis Sports Medicine: Stock or stock Options
Saunders/Mosby-Elsevier: Editorial or governing board
Smith & Nephew: Research support
Stryker: Paid consultant; Paid presenter or speaker; Research support
Surgical Solutions: Stock or stock Options

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This individual reported nothing to disclose

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Total Joint Orthopedics: Paid consultant
United Orthopedic Corp: Paid consultant

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Erik N. Zeegen, MD
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Arthroplasty Today: Editorial or governing board
Journal of Arthroplasty: Editorial or governing board
RadLink Inc.: Stock or stock Options
Zimmer: Paid consultant; Research support

Amy Zhao, BA
This individual reported nothing to disclose

Hua Zheng, PhD
This individual reported nothing to disclose

Huiyong Zheng, PhD
This individual reported nothing to disclose

Megan Zheng, BS
This individual reported nothing to disclose

Mark Zhu, MD
This individual reported nothing to disclose

Michael G. Zywiel, MD, MSc, FRCSC
Clinical Orthopaedics and Related Research: Editorial or governing board
Expert Review of Medical Devices: Editorial or governing board
Johnson & Johnson: Paid consultant
Smith & Nephew: Paid consultant

Notes

Notes

AAHKS 2022 ANNUAL MEETING

Future AAHKS Meetings

2023 AAHKS Spring Meeting
May 4–6, 2023 | Chicago, IL

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

2024 AAHKS Spring Meeting
May 2–4, 2024

2024 AAHKS Annual Meeting
November 7–10, 2024
Gaylord Texan Resort & Convention Center
Grapevine, TX

2025 AAHKS Spring Meeting
May 1–3, 2025

AAHKS
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