

GUEST EDITORIAL

What's New in Adult Reconstructive Knee Surgery

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The global rebound from the COVID-19 pandemic may be on its way. Despite the difficulties, the orthopaedic community has demonstrated during the last year its commitment to the improvement of health care through innovation and the constant evaluation of practices and treatments for knee conditions.

Health Policy and Economics

A large nationwide insurance database study revealed that net losses were greater for patients with higher Elixhauser Comorbidity Index (ECI) scores¹. The U.S. Bundled Payments for Care Improvement (BPCI) and Comprehensive Care for Joint Replacement (CJR) payment models may de-incentivize the treatment of sicker patients. As more insurance companies adopt bundled payment models such as CJR, it is important to note that Medicare risk-adjustment equations involving patient-reported outcomes cannot be applied without caution to patient-reported outcomes of commercially insured patients undergoing total knee arthroplasty (TKA). Significant differences in outcomes have been shown between Medicare and commercially insured patients when using Medicare risk-adjustment algorithms². Although the volume of revisions has increased, the Medicare orthopaedic physician fee reimbursement for aseptic and septic TKA revision has not kept up with inflation. After adjusting for it, from 2002 to 2019, the mean aseptic revision reimbursement declined 24.83% for 2-component revision and 24.21% for 1-component revision, and septic revision reimbursement decreased even further, by 23.29% for explantation and 33.47% for reimplantation³. Lastly, it appears that the public reporting of TKA and total hip arthroplasty (THA) risk-standardized readmission and complication rates is associated with improved outcomes after the surgical procedure⁴.

Osteoarthritis of the Knee: Nonoperative Management

Platelet-rich plasma has become increasingly available for the treatment of knee osteoarthritis. However, when direct costs (i.e., injection price) and unpaid indirect costs are

considered, a recent report indicated that platelet-rich plasma injections are not cost-effective primarily because there is no sound clinical efficacy in improving pain relief and function or delaying the need for TKA⁵. A multicenter randomized controlled trial (RCT) showed that cooled radiofrequency ablation significantly improves pain relief and function when compared with a single injection of hyaluronic acid, and both treatments had similar adverse-event profiles⁶.

Patients need to be educated to make sound, informed decisions. In a new prospective study, patients exposed to a poster outlining the American Academy of Orthopaedic Surgeons (AAOS) Knee Osteoarthritis Clinical Practice Guideline significantly improved their comprehensive knowledge assessment when compared with patients who were not exposed to the poster⁷.

Unicompartmental Knee Arthroplasty (UKA)

UKA Compared with TKA

A multicenter, propensity-score-matched study of 10,494 procedures performed in a fast-track setting revealed that patients who underwent UKA had a shorter median hospital length of stay (1 day) compared with patients who underwent TKA (2 days) ($p < 0.001$). This study also showed that patients who underwent UKA had fewer periprosthetic joint infections (PJIs) (odds ratio [OR], 0.50) and reoperations (OR, 0.40) within 90 days after the surgical procedure than patients who underwent TKA⁸. Another report also found that UKA was associated with lower rates of surgical site infection and PJI when compared with TKA⁹. Conversely, patients who underwent UKA were shown in a separate investigation to have higher revision rates at 5 and 10 years after the surgical procedure. Patients who underwent UKA had lower mean longitudinal-related health-care costs than patients who underwent TKA only up to 10 years after the procedure, because, at that time, the mean difference was only \$14¹⁰. In morbidly obese patients, a minimum 2-year follow-up study indicated that UKA, when compared with TKA, was more frequently associated with clinical failure

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(29.2% compared with 2.5%; $p < 0.001$) and component revision (15.7% compared with 2.5%; $p < 0.001$). There were no significant differences between groups with regard to infections¹¹.

Implant Design

A current radiostereometric analysis in an RCT comparing cemented and cementless Oxford unicompartmental knee replacement showed that cementless tibial components had significantly more subsidence (0.28 mm) than cemented tibial components (0.09 mm) during the first year after the surgical procedure ($p < 0.001$). However, between 2 and 5 years, there was no significant difference between cementless and cemented components¹². A 19-year analysis from the New Zealand Joint Registry demonstrated that cemented Oxford III unicompartmental knee replacements used for the treatment of isolated medial compartment knee osteoarthritis had a >1.8-fold greater risk of revision ($p = 0.001$) than cementless Oxford III unicompartmental knee replacements. The type of fixation was identified in this report as an independent risk factor for revision¹³. Also, with regard to medial unicompartmental osteoarthritis, a prospective study evaluating 661 UKAs performed with a cemented minimally invasive inlay prosthesis revealed that their cumulative revision rate was 10.9% at 10 years postoperatively, thus supporting the assertion that UKA is a viable alternative for the treatment of unicompartmental knee osteoarthritis¹⁴.

Clinical Results and Outcomes

After an analysis of 11,633 UKAs queried in an administrative database, longer operative times were associated with higher rates of surgical site infection, transfusions, reoperations, and mortality and longer hospital stay¹⁵. In an independent report from Canada, the intermediate-term survival of the Oxford III implant after UKA in patients with a body mass index (BMI) of ≥ 40 kg/m² was 91.7% at 2 years postoperatively and 86.3% at 5 years postoperatively. Only female sex was associated with decreased implant survival; data from this series support the safety of this particular implant in morbidly obese patients¹⁶. A recent award-winning RCT compared the use of a smartphone-based exercise system for primary UKA and TKA with a traditional in-person physiotherapy model and found no significant differences in the 90-day mean knee range of motion, Timed Up and Go (TUG) test score, Knee injury and Osteoarthritis Outcome Score for Joint Replacement (KOOS JR), and need for manipulation under anesthesia¹⁷.

Primary TKA

Perioperative Care

The treatment of obesity prior to TKA remains challenging. A study using the Scandinavian Obesity Surgery Registry and the Swedish Knee Arthroplasty Register seemed to indicate that undergoing a bariatric surgical procedure before TKA does not

reduce the risk of revision¹⁸. However, it is promising that the use of a risk stratification tool, which includes a comprehensive assessment, and the modification of risk factors make it possible for morbidly obese patients to have postoperative adverse outcomes similar to those of non-obese patients who undergo primary TKA¹⁹. For patients with type-2 diabetes undergoing TKA, the use of metformin significantly reduces the odds of readmissions, emergency department visits, PJI, deep vein thrombosis, acute kidney injury, hypoglycemic events, 1-year revision, and longer length of stay when compared with patients with diabetes who were not taking metformin²⁰. An RCT from South Korea showed that preoperative carbohydrate drinks, in comparison with intravenous dextrose, did not reduce postoperative nausea and vomiting and did not increase perioperative hyperglycemia in patients with type-2 diabetes²¹. Further investigation is needed to elucidate the role of preoperative oral carbohydrates.

Bleeding Control and Thromboprophylaxis

Tranexamic acid does not seem to reduce blood loss in cementless TKA as effectively as in TKA performed with cemented components²², and the first clinical trial comparing oral tranexamic acid with aminocaproic acid found them to be equivalent for reducing blood loss in primary TKA²³. It is important to note that perioperative blood transfusions have been associated with higher risk of deep vein thrombosis²⁴. With regard to thromboprophylaxis, aspirin was shown to be an effective agent for the prevention of venous thromboembolism, and a low dose (81 mg) and regular dose (325 mg) were similar for this purpose²⁵. An award-winning paper also demonstrated that aspirin (325 mg twice daily) was effective in preventing the propagation of infrapopliteal deep vein thrombosis after TKA²⁶.

Anesthesia and Pain Management

The struggle to limit the use of opioids continues. Combining an adductor canal block with the iPACK (the interspace between the popliteal artery and the capsule of the posterior knee) block effectively decreases postoperative pain and appears to be noninferior to periarticular injection after TKA^{27,28}. Another prospective study, comparing intravenous and periarticular corticosteroids, showed that periarticular injection of corticosteroids had better pain management with similar antiemetic effects²⁹. The combination of high-dose intravenous and periarticular corticosteroids was shown in a separate trial to improve pain control without a concomitant increase in wound complications up to 1 year after the surgical procedure³⁰. With regard to epinephrine, its use in periarticular injection with ropivacaine does not seem to significantly reduce postoperative acute pain and opioid usage³¹, but early postoperative administration of 400 mg of celecoxib 2 hours after TKA, followed by 200 mg of celecoxib 6 hours later, significantly reduces pain scores while improving sleep quality and knee range of motion³². Parecoxib and ketorolac seem to be

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equally effective for pain control after TKA³³. With regard to regional anesthesia, a double-blinded RCT demonstrated that spinal anesthesia with mepivacaine yielded a more predictable return of motor function than low-dose bupivacaine; both interventions had a similar safety profile³⁴. Finally, a prospective study of 178 patients revealed that a preoperative assessment of pain sensitivity predicts postoperative analgesic requirements³⁵. It is important to keep in mind that considerable variability exists in baseline pain sensitivity between patients.

Implant Design

Different TKA designs were studied during the last year. The following 3 studies involved a radiostereometric analysis in an RCT. For posterior-stabilized TKA performed with cement, Koster et al. demonstrated a comparable risk of aseptic loosening at 2 years postoperatively when using an asymmetrical tibial baseplate or a proven symmetrical tibial component³⁶. Troelsen et al. indicated that there were no significant differences between bicruciate-retaining and cruciate-retaining designs in terms of tibial migration or patient-reported outcomes at a 2-year follow-up³⁷. In another study, no differences in migration or patient-reported outcomes between a tibial implant with a 3-dimensional interconnecting pore structure surface and a porous plasma spray-coated tibial component were demonstrated at 5 years after the surgical procedure³⁸. A double-blinded RCT showed no difference in the recovery of patient-reported outcomes or knee range of motion during the first postoperative year between cruciate-retaining and posterior-stabilized implants³⁹. In another Level-I study, patients who had both posterior-stabilized and ultra-congruent TKA designs (in same-day bilateral TKA) were examined, and both designs yielded similar joint perception and patient-reported outcomes at the 2-year follow-up⁴⁰.

With regard to the material of the insert, an in vivo wear particle analysis indicated that vitamin E-infused highly cross-linked polyethylene generated more and smaller particles than conventional polyethylene at a mean of 3.4 years postoperatively⁴¹. Lastly, a long-term (27 years) follow-up trial revealed that there were no significant differences in patient-reported outcomes, aseptic loosening, osteolysis, or survival between mobile-bearing and fixed-bearing TKAs in patients younger than 60 years of age⁴².

Surgical Technique

Surgical approach and wound closure may play a critical role in limiting complications. There seems to be higher incidence of proximal wound dehiscence and delayed healing in TKAs performed through a subvastus approach⁴³. In another prospective study, barbed sutures were not shown to be significantly different in terms of superficial or deep infection rates, wound dehiscence, or range of motion when compared with conventional closure with Vicryl (Ethicon)⁴⁴.

With regard to anterior knee pain, in a trial with 241 patients, Thiengwittayaporn et al. suggested that patellar denervation after patellar resurfacing significantly relieves anterior knee pain up to 3 months after the surgical procedure⁴⁵. Circumferential patellar denervation also has been demonstrated to reduce anterior knee pain and improve patient-reported outcomes in patients undergoing bilateral TKA without patellar resurfacing. Patients served as their own controls in this particular trial⁴⁶. Lastly, a meta-analysis of RCTs revealed that sealing the femoral medullary canal significantly decreases blood loss without increasing the rates of infections, deep vein thrombosis, or redness of the incision site⁴⁷.

Technology-Assisted TKA

Multiple technologies attempt to improve the performance and results of TKA. Robotic-assisted TKA provides improved precision between the preoperative plan and the final execution of cuts and insert thickness selection⁴⁸. An accelerometer-based portable navigation system was shown in an RCT to improve coronal prosthetic and limb alignment when compared with conventional techniques without prolonging the operative time or increasing complications⁴⁹. However, it has been questioned whether the implementation of technology-assisted TKA always translates into better outcomes or survival. A recent trial was unable to demonstrate that the use of a sensor-guided knee-balancing system significantly improves patient-reported outcomes or patient satisfaction when compared with a conventional gap-balancing technique⁵⁰. In a comparative study, with a minimum follow-up of 2 years, pressure sensors for knee balancing also failed to demonstrate improvements in patient-reported outcomes, survival, or need for manipulation⁵¹.

A meta-analysis of RCTs comparing computer-navigated TKA with conventional TKA in terms of patient-reported outcomes did not conclusively support the superiority of navigated TKA⁵². In another meta-analysis of RCTs, Bouché et al. found a reduction of small (<3° and >3°) alignment outliers when navigation was used but no improvements in validated outcome scores. A large increase in operative time was seen with navigation⁵³. A population-based survivorship study comparing computer-navigated TKA (n = 75,709) and conventional TKA (n = 75,676) in Medicare patients showed no significant difference in survival at 5 years⁵⁴.

The costs of technology-assisted TKA cannot be overlooked. When compared with conventional TKA, a Markov decision analysis modeling a best-case scenario for robotic TKA indicated that this technology might be cost-effective if a single robotic unit performs a minimum of 253 robotic cases each year⁵⁵. The assertion that alignment predicts success remains unproven. It is important to note that the particulars of robotic techniques should be reported in detail in order to compare results in future studies.

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Miscellaneous

In a prospective study, 2 of 5 patients who anticipated improved satisfaction with sexual activity did not have their expectations met at 1 year after the TKA, regardless of gender⁵⁶. With regard to bilateral TKA, Kahlenberg et al. showed that, after accounting for various factors, employed patients who underwent simultaneous bilateral TKA missed a mean of 17 fewer days of work than patients who underwent staged bilateral TKA⁵⁷. However, it is important to note that a study based on a large administrative database found that bilateral TKA had a higher risk of complications even in the healthiest patients⁵⁸.

Clinical Results and Outcomes

In a multicenter, prospective cohort study in which group-based trajectory modeling analysis of the Oxford Knee Score was performed, Hamilton et al. identified 3 separate trajectories of outcomes after TKA: (1) poor (14%), (2) modest (39.1%), and (3) good (46.9%). Chronic widespread pain, sleep disturbance, higher number of comorbidities, depression, and lower baseline quality of life were associated with higher likelihood of being categorized as a poor responder after TKA⁵⁹. In a separate report, a retrospective analysis of 2,193 patients, manipulation under anesthesia after TKA was associated with worse knee range of motion and Knee Society scores (KSS) and decreased survivorship⁶⁰. Knee osteoarthritis patterns also seem to affect outcomes. Data from an international prospective study showed that patients with lateral compartment osteoarthritis had some of the lowest preoperative and postoperative KOOS results and patients with bicompartamental or tricompartmental knee osteoarthritis had relatively high preoperative and postoperative scores. Interestingly, patellofemoral osteoarthritis did not seem to affect the preoperative KOOS in patients with medial or lateral compartment knee osteoarthritis⁶¹.

Tourniquets have recently been under scrutiny. In an RCT, Zak et al. found that their use did not affect pain scores, opioid consumption, or length of stay⁶². In another RCT, this time on TKA performed without cemented components, tourniquets used for a short time (<10 minutes) had no benefit with regard to pain scores, opioid consumption, length of stay, KSS, or postoperative hemoglobin⁶³. Furthermore, a recent Cochrane meta-analysis of 41 RCTs revealed that the use of tourniquets increased the risk of serious adverse events, pain, and length of stay. The only benefit of using tourniquets was a shorter operative time⁶⁴. This meta-analysis included studies from 1974 to 2020, which may have precluded comparison with current practice. Overall, the most recent Level-I studies suggested no difference in outcomes with the use of tourniquets.

Revision TKA

Implant Design and Surgical Technique

Tibial cones seem promising when addressing metaphyseal bone loss. A retrospective study of 59 patients who had a

particular porous tibial cone implanted showed that the rate of survivorship free from revision for aseptic loosening at 8 years was 95%; however, survivorship declined to 84% when septic cases were included⁶⁵. Survivorship free from reoperation of 3-dimensionally printed titanium metaphyseal cones was 86% at 2 years postoperatively in a different study, and the most common reason for reoperation was infection⁶⁶. Stemmed tibial components are frequently used in patients with metaphyseal bone defects. In a retrospective study of patients with cemented tibial stems (n = 63) and those with uncemented tibial stems (n = 47), Larson et al. did not demonstrate significant differences in terms of postoperative overall pain, satisfaction, and diaphyseal tibial pain⁶⁷. Rotating-hinge components are also part of the revision armamentarium. In a study from the United Kingdom of 41 patients, Wignadasan et al. revealed that rotating-hinge implants had a survival rate of 90.2% at a minimum follow-up of 10 years, which is encouraging for complex revision cases⁶⁸. Extensor mechanism disruptions after TKA remain a potentially devastating complication. A meta-analysis of 30 studies with relevant data comparing allograft and synthetic materials for extensor mechanism repair found that there were no significant differences in the overall failure rates or patient-reported outcomes between the 2 treatment modalities⁶⁹. Periprosthetic tibial fractures remain challenging, as shown by the high rate of reoperations, nonoperative complications, and transfusions presented in a current report⁷⁰. In revision TKA, an RCT indicated that use of incision negative-pressure therapy was associated with significantly lower readmission rates and dressing changes when compared with silver-impregnated dressings⁷¹. Another investigation, a meta-analysis, indicated that negative-pressure dressings in selected primary TKAs and high-risk revision TKAs reduce wound complications, providing savings in health-care costs⁷².

Revision Risk Factors

An in-depth understanding of risk factors is crucial to minimize frequency of revisions. A study examining the effects of surgeon volume on outcomes after revision TKA revealed that high-volume surgeons (performing ≥ 19 revisions per year) had significantly lower re-revision rates and shorter operative times than low-volume surgeons for all types of revisions⁷³. In a different report, patellar resurfacing during primary TKA was associated with a significantly lower all-cause revision risk at 10 years after the surgical procedure⁷⁴. Revision risk also seems to be related to the timing of knee arthroscopy prior to TKA. A new study has indicated that the procedures should be performed ≥ 36 weeks apart in order to minimize revision risk⁷⁵. In a retrospective study of 309,650 patients, those who underwent manipulation under anesthesia within the first year of the primary TKA had a fivefold increase in the risk of subsequent revision⁷⁶. An analysis of the Dutch Arthroplasty Register demonstrated that patients with a BMI of >40 kg/m²

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had a significantly higher risk of septic revisions; nevertheless, there were no significant differences between BMI groups regarding all-cause and aseptic revisions⁷⁷. A register study from the Nordic Arthroplasty Register Association (n = 265,877) demonstrated that, when compared with TKA performed with cemented fixation, uncemented fixation was associated with a higher risk of revision at 10 years postoperatively⁷⁸. Not all isolated tibial insert exchanges in revision TKA seem to share the same fate. When indicated because of insert wear, survivorship free of any re-revision was 74% at 10 years. However, the survival rates were 69% when isolated tibial insert exchange was indicated for instability and 37% when it was indicated for fracture or dissociation⁷⁹. As a final point, BMI and a femoral canal diameter of >19 mm at 20 cm proximal to the joint line on radiographs were shown in a case-control study to be predictive for revision for aseptic loosening after TKAs performed with a rotating-hinge implant⁸⁰.

Infection

PJI is simply devastating. A long-term, single-center study of 1,254 patients showed that septic revisions, when compared with aseptic revisions, had a significantly higher mortality; the patient survivorship was 77.6% compared with 89.5% at 5 years, 68.7% compared with 80.2% at 10 years, and 66.1% compared with 75.0% at 17 years⁸¹. In terms of costs, the direct inpatient medical costs of PJI after TKA or THA are twice those of similar aseptic revisions⁸². Prevention is of the utmost importance. A recent award-winning study demonstrated that extended oral antibiotic prophylaxis for 7 days in high-risk patients led to a significant reduction of infections within 1 year after primary TKA or THA⁸³. Because of the 6.5-fold higher risk of infection in patients who sustain traumatic wound dehiscence after primary TKA, urgent irrigation and debridement with component retention followed by a minimum of 7 days of antibiotic prophylaxis has been recommended⁸⁴. In another awarded study, the use of prophylactic intraosseous vancomycin in primary TKA significantly reduced the postoperative incidence of PJI at 90 days when compared with intravenous vancomycin⁸⁵. The use of antibiotic-laden bone cement in primary TKAs performed at U.S. Veterans Health Administration hospitals was associated with a significantly lower rate of revision for PJI at a mean follow-up of 5 years⁸⁶. It is important to note that, in a separate report, regular cement was non-inferior to antibiotic-laden cement in terms of infection risk and costs across all patients who underwent a primary TKA. However, in patients with diabetes, antibiotic-laden cement significantly reduced the risk of infection⁸⁷. After povidone-iodine lavage, the use of vancomycin powder during closure (deep and superficial to the fascia) significantly reduced the incidence of PJI in patients who underwent primary TKA, regardless of preoperative risk⁸⁸. An international

collaboration of several institutions across the globe showed that *Staphylococcus aureus* and *S. epidermidis* are responsible for almost 50% of all knee and hip PJIs⁸⁹. Unfortunately, PJI diagnosis is extremely challenging on many occasions. The utility of a novel point-of-care test measuring calprotectin in synovial fluid was examined in patients who underwent revision TKA. This biomarker seems promising as a rule-out test (to establish that PJI is unlikely)⁹⁰. Another biomarker, plasma D-dimer, does not seem to anticipate the fate of reimplantation but it also seems useful to rule out a diagnosis of PJI⁹¹. Within 6 weeks after the surgical procedure, a retrospective study of 27,066 primary TKAs indicated that PJI should be suspected if the C-reactive protein is ≥ 82 mg/L, the synovial white blood-cell count is $\geq 8,676$ cells/ μ L, the synovial neutrophil percentage is $\geq 88\%$, and/or the synovial absolute neutrophil count is $\geq 8,346$ cells/ μ L⁹². An award-winning paper showed a high concordance between aspiration cultures and intraoperative cultures, but the authors strongly recommended that surgeons collect multiple tissue samples for culture in order to maximize the ability to diagnose polymicrobial infections⁹³. For the treatment of chronic PJI, single-stage revisions appear to be associated with better patient-reported outcomes when compared with 2-stage revisions, without significant differences in morbidity or mortality⁹⁴. In complex TKA revisions, irrigation and debridement with chronic antibiotic suppression seemed to be as effective as 2-stage revision in preventing reoperations for infection while maintaining better function at a minimum follow-up of 2 years⁹⁵. For patients with acute or hematogenous PJI, the addition of intraosseous antibiotics to a debridement, antibiotics, and implant retention (DAIR) protocol provides improved results when compared with the current literature reporting the use of DAIR without intraosseous antibiotics⁹⁶. Although 14% of patients with normal renal function at baseline developed acute kidney injury after undergoing 2-stage revision with antibiotic-loaded cement spacers and systemic antibiotics, the risk of acute kidney injury among patients with chronic kidney disease was even higher (45%)⁹⁷. The treatment of PJI remains far from perfect and there is room for improvement.

Special Considerations

Malnutrition and frailty, although rare, were shown in a large administrative database study (n = 179,702) to be significant risk factors for mortality and complications in patients who underwent primary TKA. Mortality within 30 days was 0.1% for normal patients, 0.3% for malnourished patients, 0.2% for frail patients, and 1.0% for frail and malnourished patients (p < 0.001)⁹⁸. Lymphedema, also rare, seems to be a significant risk factor for reoperation, revision, and infection in primary TKA⁹⁹. A large administrative database study (n = 350,879) revealed that modifiable comorbidities such as smoking

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status, hypertension, anemia, functional status, and overall morbidity and mortality improved from 2008 to 2018 in patients who underwent primary TKA. Unfortunately, there were no clinically relevant changes during this period for other important factors such as rates of morbidly obese patients or diabetes mellitus¹⁰⁰. There are modifiable and unmodifiable factors at play in adult patients who undergo knee reconstruction, but when it comes to modifiable risk factors, there are always opportunities for improvement.

Evidence-Based Orthopaedics

The editorial staff of *JBJS* reviewed a large number of recently published studies related to the musculoskeletal system that received a higher Level of Evidence grade. In addition to articles

cited already in this update, 10 other articles relevant to adult reconstructive knee surgery are appended to this review after the standard bibliography, with a brief commentary about each article to help guide your further reading, in an evidence-based fashion, in this subspecialty area.

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Evidence-Based Medicine

Banger MS, Johnston WD, Razii N, Doonan J, Rowe PJ, Jones BG, MacLean AD, Blyth MJG. Robotic arm-assisted bi-unicompartmental knee arthroplasty maintains natural knee joint anatomy compared with total knee

arthroplasty: a prospective randomized controlled trial. *Bone Joint J.* 2020 Nov;102-B(11):1511-8.

In an evaluation of 38 patients who underwent TKA and 32 patients who underwent robotic-assisted, cruciate-sparing bi-UKA (separate

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replacements of both the medial and the lateral joint surfaces) from a prospective, single-center RCT, the authors found that bi-UKA preserved joint anatomy in the coronal, sagittal, and axial planes significantly better in comparison with mechanically aligned TKA. It seems that bi-UKA reinstates the pre-disease constitutional alignment better than TKA.

Although this preliminary study of 38 patients found that bi-UKA maintains knee anatomy in all 3 planes, in the long term, it is still uncertain that the restoration of joint anatomy with bi-UKA could actually result in substantially better clinical outcomes.

Benner RW, Behrens JP. A novel skin closure device for total knee arthroplasty: randomized controlled trial versus staples. *J Knee Surg.* 2020 Nov;33(11):1116-20.

On randomization of 25 simultaneous bilateral TKAs to closure of the skin with the Zip device (Zipline Medical) on 1 knee and staples on the other knee, patients experienced significantly less knee pain and showed superior knee scar appearance and range of motion with the Zip device. This is one of the first RCTs to compare these 2 methods of skin closure, and the authors demonstrated the clinical usefulness of the Zip device to close the skin in comparison with staples in the setting of TKA.

These novel results showing superiority of the Zip device over staples for skin closure in TKA shall be interpreted in light of the limited sample size (n = 25). A larger study is warranted.

Berkowitz RD, Steinfeld R, Sah AP, Mack RJ, McCallum SW, Du W, Black LK, Freyer A, Coyle E. Safety and efficacy of perioperative intravenous meloxicam for moderate-to-severe pain management in total knee arthroplasty: a randomized clinical trial. *Pain Med.* 2021 Jun 4;22(6):1261-71.

In this multicenter, double-blinded RCT, 181 patients undergoing TKA were randomly assigned to receive either meloxicam 30 mg or a placebo via an intravenous bolus every 24 hours (the first dose before the surgical procedure) as part of the multimodal pain management protocol. The use of meloxicam significantly decreased opioid consumption in the first 24 hours postoperatively in comparison with placebo, with a lower incidence of opioid-related adverse effects. The authors concluded that meloxicam should be given consideration in multimodal analgesic regimens in the setting of TKA.

It is important to highlight that this report not only presents the efficacy and safety of intravenous meloxicam in the setting of multimodal therapy after TKA, but also shows a 32% reduction in opioid use during the first 24 hours postoperatively.

Bernard L, Arvieux C, Brunschweiler B, Touchais S, Ansart S, Bru JP, Oziol E, Boeri C, Gras G, Druon J, Rosset P, Senneville E, Bentayeb H, Bouhour D, Le Moal G, Michon J, Aumaitre H, Forestier E, Laffosse JM, Begué T, Chirouche C, Dauchy FA, Devaud E, Martha B, Burgot D, Boutoille D, Stindel E, Dinh A, Bemer P, Giraudeau B, Issartel B, Caille A. Antibiotic therapy for 6 or 12 weeks for prosthetic joint infection. *N Engl J Med.* 2021 May 27;384(21):1991-2001.

In patients with confirmed PJI treated with standard procedures (debridement, 1-stage and 2-stage revision), a shorter duration of antibiotic therapy (6 weeks) was not inferior to a longer duration (12 weeks) with regard to functional outcomes, length of hospital stay, and serious adverse events. This is an open-label RCT of 410 patients with PJI who were randomized to either 6 or 12 weeks of antibiotic therapy and treated in a standard manner.

The cohort analyzed included different types of surgery: debridement and implant retention, 1-stage procedures, and 2-stage procedures. Therefore, this diverse case-mix may have limited the generalization of these findings to a particular procedure.

Goh JKM, Chen JY, Yeo NEM, Liow MHL, Chia SL, Yeo SJ. Ten year outcomes for the prospective randomised trial comparing unlinked, modular bi-compartmental knee arthroplasty and total knee arthroplasty. *Knee.* 2020 Dec;27(6):1914-22.

Patient who underwent bicompartamental knee arthroplasty achieved knee outcome scores (Knee Society Function Score, Knee Society Knee Score, Oxford Knee Score, and SF-36 [36-item Short-Form Health Survey] Physical Component Score and Mental Component Score) similar to those of patients who underwent TKA. In this RCT, 48 patients with knee osteoarthritis were randomized to either unlinked modular bicompartamental knee arthroplasty or TKA.

Bicompartamental knee arthroplasty may be an option in the setting of osteoarthritis limited to 2 compartments.

Kim JK, Park IW, Ro DH, Mun BS, Han HS, Lee MC. Is a titanium implant for total knee arthroplasty better? A randomized controlled study. *J Arthroplasty.* 2021 Apr;36(4):1302-9.

In this study, 108 patients (216 knees) undergoing bilateral primary TKA were randomized to undergo TKA with a titanium rotating platform in 1 knee and a cobalt-chromium rotating platform in the contralateral knee. Titanium implants were perceived to be lighter by 30% of the patients and had a lower rate of radiolucent lines on radiographs than the cobalt-chromium implants. However, there were no differences in clinical outcome scores, range of motion, or pain.

The bottom line is that, in terms of pain and function, titanium implants were not better.

Li WT, Bell KL, Yayac M, Barmann JA, Star AM, Austin MS. A postdischarge multimodal pain management cocktail following total knee arthroplasty reduces opioid consumption in the 30-day postoperative period: a group-randomized trial. *J Arthroplasty.* 2021 Jan;36(1):164-172.e2.

The implementation of multimodal pain management for 30 days after TKA significantly decreased opioid consumption to 386.4 morphine milligram equivalents compared with 582.5 morphine milligram equivalents for the opioid-only protocol, but resulted in comparable pain control. This is a prospective comparative study in which 216 patients were randomized to either the multimodal pain management group or the opioid-only group. Patients in the opioid-only group required more refills and other additional medications compared with patients in the multimodal pain management group. The authors recommended the use of multimodal pain management with add-on opioids in patients with inadequate pain control.

We need to take into account that the actual intake of medications may not have been completely ascertained.

Sattler LN, Hing WA, Rathbone EN, Vertullo CJ. Which patient factors best predict discharge destination after primary total knee arthroplasty? The ARISE Trial. *J Arthroplasty.* 2020 Oct;35(10):2852-7.

Increasing age, preoperative affirmative beliefs about inpatient rehabilitation, and level of support after discharge predict discharge disposition after primary TKA. In this prospective cohort trial, 100 patients underwent the Arthroplasty Rehabilitation Initial Screening Evaluation (ARISE) to investigate factors predictive of discharge disposition.

We believe that social factors such as patient support systems and beliefs should be identified in order to intervene early and increase the chances of home discharge after primary TKA.

Torle J, Thillemann JK, Petersen ET, Madsen F, Soballe K, Stilling M. Less polyethylene wear in monobloc compared to modular ultra-high-molecular-weight-polyethylene inlays in hybrid total knee arthroplasty: a 5-year randomized radiostereometry study. *Knee.* 2021 Mar;29:486-99.

This is a patient-blinded RCT in which 50 patients undergoing TKA were randomized to receive either a cementless high-porosity Trabecular Metal (Zimmer) tibial component with a monobloc ultrahigh molecular-weight polyethylene (UHMWPE) inlay or a cementless low-porosity screw-augmented titanium fiber-mesh tibial component with a modular UHMWPE inlay. Although the wear of the monobloc polyethylene inlay wear was nearly 40% of that of the modular polyethylene inlay wear, the difference did not have a clinical impact on osteolysis and rate of revision at 5 years.

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This study was likely underpowered (n = 50) to detect differences in revision risk. A larger study is warranted.

Tsuda K, Shibuya T, Okamoto N, Shiigi E, Shirakawa N, Hosaka K, Akagi R, Ohdera T. Can accuracy with the iASSIST navigation be confirmed by assessment? A multi-center prospective randomized controlled trial with independent three-dimensional image assessment. *Knee*. 2021 Jun;30:344-52.

In this multicenter, prospective RCT, 83 patients undergoing TKA were randomized to the use of either a conventional system (n = 41) or the iASSIST navigation system (n = 42). Although the iASSIST group showed significantly better femoral alignment in the sagittal plane (within 3° of the neutral), there were no differences from the clinical standpoint at the 6-month follow-up. iASSIST increased the accuracy of femoral resection with no impact on clinical outcomes.

Overall, the iASSIST TKA navigation system does not appear to provide short-term clinical benefits. Long-term clinical outcomes remain uncertain.