

PERSPECTIVES
SPECIALTY UPDATES

What's New in Adult Reconstructive Knee Surgery

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This annual review highlights the most noteworthy and impactful studies in adult reconstructive knee surgery published over the past year. Emphasis was placed on studies with higher levels of evidence, including randomized trials and large cohort studies, as well as on award-winning research. Although studies across a range of evidence levels were considered, priority was given to those with the greatest potential to influence clinical practice.

Treatment of Mild to Moderate Knee Osteoarthritis

Bio logic strategies to treat and to prevent the progression of knee osteoarthritis continue to gain traction. Several recent studies have noted that higher platelet doses appear to be a key determinant of the clinical success of platelet-rich plasma (PRP) injections for knee osteoarthritis. Although the use of PRP remains controversial without substantial evidence of prevention of osteoarthritis progression, a systematic review of 29 randomized controlled trials (RCTs) showed significant improvements ($p < 0.01$) in clinical outcomes with a higher mean platelet dose ($5,500 \pm 474 \times 10^6$) than those with a lower dose ($2,302 \pm 437 \times 10^6$)¹.

Corticosteroid injections remain a cornerstone of conservative management for knee osteoarthritis, but their use in patients with type-2 diabetes is often limited by concerns regarding hyperglycemia. In a post hoc analysis of a Phase-2 randomized trial involving 33 patients with knee osteoarthritis and type-2 diabetes, extended-release triamcinolone acetonide was associated with significantly less disruption of glycemic control compared with immediate-release triamcinolone acetonide, offering a potentially safer alternative for this high-risk population².

Arthroscopic debridement for knee osteoarthritis remains controversial. A systematic review reported good to excellent patient-reported outcome measures (PROMs) in patients with Kellgren-Lawrence grade-1 or 2 disease, with lower conversion rates to arthroplasty (0% to 4.5%) compared with the conversion rates of patients with Kellgren-Lawrence grade-3 disease (7.6% to 50%)³. However, the only RCT found

no benefit of debridement over optimized nonoperative care⁴. These findings indicate that, although arthroscopic debridement may offer short-term symptom relief in select patients with mild to moderate knee osteoarthritis unresponsive to conservative treatment, its overall short-term and long-term effectiveness remains uncertain.

Unicompartmental Knee Arthroplasty (UKA)

Indications and Outcomes

Modern indications for UKA are broader than the historical Kozinn and Scott criteria. Current absolute contraindications include uncontrolled inflammatory arthritis, a body mass index (BMI) of $>35 \text{ kg/m}^2$, flexion contracture of $>10^\circ$, coronal deformity of $>10^\circ$, and lateral facet patellofemoral arthritis⁵. UKA accounts for approximately 10% of all knee arthroplasties worldwide, although regional variation is substantial. In the United States, utilization increased by $>590\%$ between 2012 and 2022⁶.

The impact of obesity on UKA outcomes remains under debate, but recent evidence is reassuring. In a large, single-institution series of 4,973 medial UKAs performed with cement, the implant survivorship was 95.7% at 5 years and 92.8% at 10 years. Higher BMI modestly increased revision risk at thresholds of 30 kg/m^2 and 35 kg/m^2 ; however, BMI of $>40 \text{ kg/m}^2$ was not associated with a significant difference in implant survivorship compared with BMI of $\leq 40 \text{ kg/m}^2$. Arthritis progression was the most common cause of revision, whereas infection rates remained consistently low across BMI categories. Improvements in PROMs were similar across all BMI groups ($\leq 30 \text{ kg/m}^2$ and $>30 \text{ kg/m}^2$, $\leq 35 \text{ kg/m}^2$ and $>35 \text{ kg/m}^2$, and $\leq 40 \text{ kg/m}^2$ and $>40 \text{ kg/m}^2$), with patients with BMI of $>30 \text{ kg/m}^2$ reporting greater gains in the Knee Injury and Osteoarthritis Outcome Score, Joint Replacement (KOOS JR) ($p = 0.034$)⁷.

Lateral UKA

Although medial UKA remains the most common UKA, lateral UKA is being performed with increasing frequency. A 2025

Disclosure: The Disclosure of Potential Conflicts of Interest forms are provided with the online version of the article (<http://links.lww.com/JBJS/I974>).

multicenter matched analysis of 124 lateral UKAs and 124 medial UKAs reported no significant differences in reoperation rates, PROMs, or functional performance at 2 years⁸. These early results support lateral UKA as a safe and effective option for isolated lateral disease, although longer follow-up is required.

Technology-Assisted UKA

Robotic-assisted UKA improves the accuracy of component positioning, typically achieving alignment within 1° of the preoperative plan, and facilitates consistent ligament balancing. Recent studies have confirmed that robotics enhances radiographic accuracy and reduces outliers, although these technical advantages have not consistently translated into superior patient-reported outcomes⁹. Importantly, robotics does not increase overall complication rates, although device-specific issues may occur¹⁰. With broader adoption, robotic assistance may help to mitigate the surgeon volume effects observed in registry data.

UKA Revision

UKA continues to demonstrate higher revision rates than total knee arthroplasty (TKA). A systematic review of 56 studies comprising nearly 30,000 UKAs (mean follow-up, 13 years) reported an overall revision rate of 8.8%, with a mean time to revision of 6.5 years¹¹. Conversion of UKA to TKA yields favorable outcomes. In a high-volume institutional series of 439 conversions, the 10-year survivorship of aseptic conversion TKA (95.6%) was equivalent to that of primary TKA (95.8%) and superior to that of first-time revision TKA (84.2%). The leading causes of UKA failure included osteoarthritis progression (31%), tibial loosening or subsidence (27%), polyethylene wear or osteolysis (23%), and femoral loosening (9%)¹². Collectively, these findings support UKA as a safe treatment option for which TKA is a reliable salvage when necessary.

Primary TKA

Antibiotic Prophylaxis and Infection Prevention

The prevention of surgical site infections and periprosthetic joint infections (PJIs) remains an important frontier in total hip arthroplasty (THA) and TKA. A national database analysis of 528,250 primary TKAs found that cefazolin prophylaxis, either alone or with another antibiotic, was associated with a significantly lower 90-day PJI rate (0.7%) compared with non-cefazolin regimens (1.0%). After adjustment, cefazolin-only (odds ratio [OR], 0.68) and combination

therapy (OR, 0.74) both reduced infection risk, supporting cefazolin as the preferred prophylactic agent when not contraindicated¹³. The safety of cefazolin use in patients with

penicillin allergy has traditionally been called into question due to concerns about cross-reactivity. A large retrospective study of 49,842 patients undergoing primary THA or TKA found that cefazolin use in those with a reported penicillin allergy was associated with a very low rate of mild allergic reactions (0.1%), comparable with or lower than rates with alternative antibiotics. No differences were observed in superficial or deep infection or *Clostridium difficile* rates¹⁴. A retrospective study of 8,456 patients undergoing THA or TKA found that cefazolin administration in those with documented penicillin anaphylaxis was not associated with increased risk of anaphylaxis or clinical compromise. Among 214 such patients who received cefazolin, only 1 had an event requiring epinephrine or rapid response, which was not significantly different.

In contrast, vancomycin use was linked to markedly higher odds of such events. These findings support cefazolin's safety in patients who have an anaphylactic allergy to penicillin and its role in reducing reliance on less effective second-line antibiotics¹⁵.

In an RCT, 1,022 patients were randomized to receive 2 g of intrawound vancomycin powder compared with no vancomycin prior to arthrotomy closure. There was no significant difference ($p = 0.264$) in the rate of PJI in the vancomycin group (0.2% [n 1]) compared with the control group (0.58% [n 3]), but vancomycin was associated with a higher rate of wound complications (13.2% [n 67]) compared with the control group (7.56% [n 39]) ($p < 0.05$)¹⁶. Another prospective study similarly found no difference in 90-day PJI rates but also noted no difference in wound complications with the use of intrawound vancomycin¹⁷.

The use of intraosseous vancomycin continues to gain traction. In a retrospective review of 1,923 primary TKAs, intraosseous vancomycin (used in 1,359 cases) demonstrated significantly lower PJI rates at 90 days (0.5% compared with 1.6%), 1 year (0.7% compared with 1.8%), and 2 years (0.9% compared with 2.4%) compared with intravenous vancomycin (used in 564 cases). No significant differences were observed in thromboembolic events, wound complications, or incidence of acute kidney injury¹⁸.

The adoption of extended oral antibiotics for infection prevention is becoming widespread, with a national database of >1.35 million TKAs between 2010 and 2022 showing a 321% increase in extended oral antibiotic use after primary TKA and a 368% increase after revision TKA. Utilization rates were

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similar in high-risk and general patients¹⁹. Prescription of extended oral antibiotics increased from 0.9% to 8%, with similar growth in standard-risk and high-risk patients. Trends were not explained by patient comorbidities, suggesting shifts in prescribing practices²⁰. There are conflicting reports on the efficacy of extended oral antibiotics in reducing the incidence of PJI. In 1 retrospective study of 4,576 patients undergoing primary THA or TKA, a 10-day course of extended oral antibiotics demonstrated no significant difference in PJI rates at 90 days (1.0% compared with 0.8%) or 1 year (1.0% compared with 1.0%) compared with controls. In high-risk patients, PJI rates did not reach significance (0.8% compared with 2.3%). No increase in *C. difficile* infection or antibiotic resistance was observed²¹. A retrospective study of nearly 3,000 cases showed that a 7-day postoperative course of oral cefdinir significantly lowered ($p = 0.04$) 3-month PJI rates after primary TJA from 0.74% to 0.23%, a 3.85-fold risk reduction²². A recent meta-analysis of approximately 19,000 patients across 18 studies revealed that patients receiving extended oral antibiotics were 35% less likely to develop PJI compared with controls. Specifically, the benefit was seen for primary THA and aseptic revision TKA, but not for primary TKA²³.

Blood Loss Control and Thromboprophylaxis

A meta-analysis of 14 studies found that intravenous iron significantly decreased transfusion requirements and improved hemoglobin levels at 2 to 6 weeks postoperatively without increasing adverse events. These findings suggest that perioperative intravenous iron supplementation is a safe and valuable blood management tool to enhance recovery after TKA²⁴.

There has been a continued trend toward the adoption of aspirin for venous thromboembolism (VTE) prophylaxis following TKA over the past decade^{25,26}. In a large national database study of 126,692 patients undergoing TKA between 2012 and 2022, the use of low-dose aspirin (81 mg) increased from 7.7% to 55.3%, whereas the use of other prophylactic agents declined²⁷. Low-dose aspirin was more commonly prescribed in low-risk patients but increased across all risk groups. Propensity-matched analysis showed that aspirin use was associated with lower odds of deep vein thrombosis, pulmonary embolism, bleeding, infection, and hospitalization compared with other agents, regardless of VTE risk profile. Even in patients with a history of VTE, aspirin was found to be as effective as enoxaparin in preventing pulmonary embolism and deep vein thrombosis after THA and TKA²⁸. In terms of the risk profile, 1 database study found morbid obesity (BMI of ≥ 40 kg/m²) to be associated with a greater incidence of pulmonary embolism (OR, 2.74) in patients who underwent aspirin monotherapy following primary TKA²⁹. No differences in VTE rates were found when BMI was stratified to 40 to 44.9 kg/m², 45 to 49.9 kg/m², and ≥ 50 kg/m² in a separate retrospective study³⁰. When compared with oral anticoagulants, aspirin was associated with significantly lower odds of thrombotic and bleeding complications compared with apixaban for VTE prophylaxis^{31,32}. These findings are further supported by a meta-analysis of 11 RCTs (4,717 patients), which demonstrated the safety and effectiveness of aspirin compared with oral anticoagulants³³. The formulation of the

aspirin may play a role in its efficacy. One retrospective study found that VTE incidence was lower with chewable aspirin compared with enteric-coated aspirin, with similar gastrointestinal complication rates³⁴. The safety and efficacy of aspirin have also been demonstrated in the revision setting³⁵.

Perioperative Care and Pain Management

The winners of the American Association of Hip and Knee Surgeons (AAHKS) Clinical Research Award, Ng et al.³⁶, randomized 46 patients who underwent primary TKA to receive 75 mg of either intraosseous or intravenous diclofenac. The intraosseous route, compared with intravenous diclofenac, yielded significantly lower pain scores throughout the first postoperative day, reduced opioid consumption through postoperative day 3, and improved early walking, sleep, quality-of-recovery scores, and patient satisfaction. A double-blinded RCT of 100 patients undergoing primary TKA evaluated the timing of an adductor canal block (30 minutes preoperatively compared with in the post-anesthesia care unit postoperatively). All patients received periarticular local infiltration analgesia. The preoperative adductor canal block group demonstrated significantly lower opioid consumption (first 24 hours and total), lower stress responses, and a lower incidence of chronic pain at 3 months³⁷.

The winners of the James A. Rand Young Investigator's Award, Hannon et al.³⁸, randomized 404 patients who underwent primary TKA across 11 centers to receive 4, 8, or 16-mg intravenous dexamethasone intraoperatively. The 16-mg dose resulted in lower opioid use, reduced pain at rest, and fewer vomiting episodes on postoperative day 1. Blood glucose was highest in the 16-mg group on postoperative day 1, but there were no differences in complications, length of stay, or outcomes beyond 24 hours. In an RCT of 150 patients undergoing TKA, two 5-mg perioperative doses of dexamethasone or a single preoperative 10-mg dose significantly lowered the incidence and severity of postoperative nausea or vomiting and reduced opioid consumption compared with placebo. The split-dose regimen demonstrated superior benefit over the single dose, with no difference in adverse outcomes³⁹. In patients with well-controlled type-2 diabetes (hemoglobin A1c, $\leq 7.0\%$), intravenous dexamethasone provided meaningful analgesic benefit while only transiently increasing blood glucose, with no long-term glycemic impact noted⁴⁰. Similarly, in patients without diabetes, dexamethasone had a transient effect on postoperative blood glucose⁴¹.

Sleep disturbance is a common symptom after TKA. In a systematic review, melatonin and cyclooxygenase-2 inhibitors appear to provide clinical benefits, but the evidence remains too limited to make a strong recommendation for their routine use⁴². A recent systematic review and meta-analysis demonstrated that early manipulation under anesthesia (MUA) after TKA (within 3 months) results in nearly double the flexion gain and lower complication and revision rates compared with delayed MUA, despite similar final flexion⁴³.

Alignment Technique

There is ongoing debate between the various alignment philosophies in TKA. In a series of 65 patients who

underwent simultaneous bilateral TKA, patients who underwent calipered kinematic knee alignment demonstrated faster recovery, greater flexion, and higher patient satisfaction compared with mechanical alignment at 2 years, with no differences in pain scores or revision rates⁴⁴. Kinematic alignment achieved a tibial joint line angle closer to parallel during a single-leg stance than mechanical alignment, especially in patients with apex-distal joint line obliquity, while better preserving the native joint line orientation, which may better restore native knee kinematics⁴⁵. In another study of simultaneous bilateral TKA, anatomical alignment (distal femoral resection 2° valgus to the mechanical axis, tibial resection 2° or 3° varus) and mechanical alignment achieved similar outcomes at a mean of 4.9 years, although patients slightly preferred the anatomical side and reported marginally higher satisfaction scores⁴⁶. The winners of the John N. Insall award, Young et al.⁴⁷, demonstrated that functional alignment using robotic-assisted TKA required fewer soft-tissue releases than mechanical alignment but yielded similar 2-year outcomes overall. More patients with functional alignment recommended the procedure, and better PROMs were demonstrated in a subset of patients with preoperative CPAK (Coronal Plane Alignment of the Knee) Type-I alignment. The winners of the Mark Coventry Award, Kraus et al.⁴⁸, demonstrated that matching postoperative TKA alignment to a patient's native CPAK class did not influence PROMs at a 2-year follow-up, suggesting that outcomes depend on multiple surgical and biomechanical factors beyond coronal alignment alone.

Implant Design

Although the use of highly cross-linked polyethylene (HXLPE) has improved survivorship and longevity of THA implants, the long-term outcomes after TKA remain unclear. A double-blinded RCT of 96 TKAs with cementless cruciate-retaining implants found no clinically relevant differences in femoral component migration or PROMs at 5 years between HXLPE inserts and conventional polyethylene (PE) inserts⁴⁹. In another RCT of 518 TKAs with a mean 11-year follow-up, there was no difference in overall survivorship, reoperation risk, radiographic results, or clinical outcomes between HXLPE and conventional PE inserts. No wear-related failures occurred in the HXLPE group; however, 1 case of osteolysis was observed in the ultra-high molecular weight PE group, suggesting that HXLPE may offer long-term protection against wear-related complications⁵⁰.

Modern cementless implants continue to show promising longevity. A systematic review and meta-analysis evaluated the outcomes of contemporary cementless TKA compared with TKA performed with cement, focusing on modern implant designs published since 2010. Across 68 studies (23 RCTs, 45 observational studies), cementless implants demonstrated superior survivorship in patients <60 years of age throughout a 14-year follow-up. Cementless components demonstrated greater early migration that stabilized by 10 years, suggesting durable long-term fixation⁵¹. A large institutional registry study compared the outcomes after 3,763 contemporary TKAs performed with cement and cementless TKAs that occurred between 2016 and 2023. At a mean 3-year follow-up, the overall revision rate was low and

similar between groups (1.8% for the cementless TKA group compared with 1.6% for the TKA performed with cement group). Infections were the most common reason for revision, whereas aseptic loosening was infrequent but more common in cobalt-chromium cementless tibial implants, all of which failed within the first postoperative year. Titanium cementless implants demonstrated equivalent survivorship to cemented fixation (97%)⁵². A large national database study compared intermediate-term outcomes between cementless TKAs and TKAs performed with cement in >11,000 matched patients treated between 2015 and 2022. Across all time points (1, 2, and 5 years), the rates of aseptic loosening and all-cause revision were nearly identical between fixation methods. At 5 years, aseptic loosening occurred in 0.9% of cementless TKAs compared with 1.2% of TKAs performed with cement, and all-cause revision rates were 3.7% for the cementless TKA group and 3.8% for the group that underwent TKA performed with cement. The cementless TKA cohort demonstrated excellent 5-year survivorship (99.1% for aseptic loosening and 96.3% for all-cause revision)⁵³. The rates of aseptic loosening were similar across age groups, including patients who were >80 years of age⁵⁴.

Technology-Assisted TKA

The efficacy of robotic-assisted TKA continues to garner great interest. In an RCT comparing manual TKA with robotic-assisted TKA, robotic assistance yielded a clinically meaningful greater improvement in pain and higher likelihood of meeting daytime pain relief expectations compared with manual TKA, but showed no advantage in function, health-related quality of life, satisfaction, or return to activities at 12 months⁵⁵. A registry study of a single health-care system compared 874 manual TKAs and 439 robotic-assisted TKAs. Similar short-term complication rates, revision-free survival (99% at 1 and 2 years), and proportions of patients achieving clinically meaningful improvement or worsening in physical function at 1 year were seen in both groups⁵⁶.

Clinical Outcomes and Other Considerations

The winners of the Chitranjan S. Ranawat Award, Ayers et al.⁵⁷, identified independent predictors of pain and function 5 years after TKA in a multicenter cohort of 3,688 patients. Key factors associated with worse KOOS pain included younger age, race (non-White), insurance status (Medicare), comorbidity burden (Charlson Comorbidity Index ≥ 2), back pain, the number of painful joints, contralateral knee pain, mental health, and baseline pain scores. Predictors of poorer KOOS activities of daily living function were similar, with additional influences from BMI (>35 kg/m²) and ipsilateral hip pain. Addressing modifiable risk factors through preoperative optimization may improve satisfaction, recovery, and shared decision-making in patients undergoing TKA. In a cohort of patients with BMI of 40 to 47 kg/m², a remote dietitian and mobile app program were viewed favorably by patients and showed promise in achieving weight loss, but the difference was not significant compared with controls⁵⁸. In a systematic review and meta-analysis of patients who underwent TKA that

compared 62,818 patients who underwent a prior bariatric surgery and 2,813,729 patients who did not, the bariatric group had lower risks of VTE, stroke, and periprosthetic fracture⁵⁹. A large retrospective cohort study of 10,389 patients, with a mean follow-up of 8.6 years, compared outcomes across BMI groups, focusing on super-obese patients (BMI of ≥ 50 kg/m²). Super-obese patients had a markedly higher risk of revision within the first postoperative year (adjusted hazard ratio [HR], 3.7 compared with overweight), which plateaued thereafter. These patients had worse preoperative function but still achieved meaningful improvements in pain, function, and satisfaction, with incremental functional gains associated with higher BMI. These findings suggest that, although BMI of ≥ 50 kg/m² confers increased early revision risk, long-term outcomes and patient-reported benefits remain favorable⁶⁰. A systematic review of 10 studies (42,533 TKAs), including 3 RCTs, evaluated the role of stemmed versus standard keeled tibial components in obese patients undergoing TKA. Some studies suggested reduced aseptic loosening and mechanical failure with stems, whereas others found no difference. Patient-reported outcomes were similar across groups, and overall evidence certainty was graded as very low. The inconsistent results in the current literature do not support the routine use of stemmed tibial components based on obesity alone, highlighting the need for further high-quality research⁶¹.

The winners of the CCJR (Current Concepts in Joint Replacement) Gerard A. Engh Excellence in Knee Research Award, Franco et al.⁶², identified a multiprong strategy to meet upcoming U.S. Centers for Medicare and Medicaid Services (CMS) mandates for PROM reporting in TKA. By combining electronic medical record integration, in-clinic tablet collection, and patient engagement tools, the health system successfully achieved CMS minimum requirements for both reporting (79% at 1 year) and clinical outcomes (mean KOOS JR improvement of 22.9 points), providing a model for compliance and optimization ahead of the 2028 reimbursement timeline.

Revision TKA

Etiology of Failure and Causes of Re-Revision

A systematic review of 39,723 revision TKAs revealed that infection (27.5%), instability (13.6%), aseptic loosening (12.8%), arthrofibrosis (9.4%), and periprosthetic fracture (7.6%) were the leading causes of failure, with an overall re-revision rate of 13.5%⁶³. Flexion instability is a challenging but increasingly recognized indication for revision TKA. In a cohort of 170 revisions for isolated flexion instability, all PROMs improved significantly at a mean of 3.2 years, with 70% of patients reaching the minimal clinically important difference (MCID), 55% achieving substantial clinical benefit (SCB), and 49% achieving a patient acceptable symptom state (PASS). The survivorship free of re-revision was 90.6% at 11.7 years, with only 1.2% of patients undergoing revision for recurrent instability⁶⁴.

Technology-Assisted Revisions

Technology-assisted revision TKA has gained traction and shown encouraging early results. A systematic review of 795

cases across 20 studies found that robotic-assisted and navigation-assisted revision TKA significantly reduced radiographic outliers compared with conventional techniques. Specifically, robotic-assisted revision decreased hip-knee-ankle axis outliers (13% compared with 26%), improved coronal alignment of both femoral and tibial components, and restored the joint line more reliably (79.5% compared with 58.3% within 4 mm). Operative time was increased by 15 to 24 minutes, but complication rates were not higher than those with conventional revision TKA⁶⁵.

Bone Loss Management

Bone loss remains a central challenge in revision TKA. A large, registry-based cohort of 2,882 aseptic revisions evaluated the addition of metaphyseal cones or sleeves to stemmed components. At 8 years, there was no significant reduction in aseptic re-revision compared with use of stems alone (HR, 0.76 [95% confidence interval, 0.42 to 1.37]). These findings suggest that, although cones and sleeves are valuable for fixation in cases of severe bone loss, their routine use does not independently reduce the risk of re-revision⁶⁶.

Extensor Mechanism Reconstruction

Extensor mechanism failure, although rare (occurring at a rate of 0.1% to 2.5%), remains one of the most devastating complications following TKA. A systematic review and meta-analysis of 774 cases reported failure rates of 34% after quadriceps tendon repair and 63% after patellar tendon repair. Reconstructions with allografts or synthetic mesh demonstrated similar failure rates (approximately 32%), whereas autograft reconstructions were associated with lower failure rates and reduced extensor lag, although available data remain limited⁶⁷.

Complications

Patients with obesity remain at increased risk for wound complications following revision TKA. In a retrospective series of 214 obese patients (BMI of >35 kg/m²), closed-incision negative-pressure wound therapy, compared with standard dressings, significantly reduced infection-related revision (0.8% compared with 8.3%), all-cause revision (3.1% compared with 13.1%), complications (3.8% compared with 11.9%), and readmissions (10.8% compared with 21.7%)⁶⁸. In contrast, an institutional series of 2,836 aseptic revisions found that BMI of >40 kg/m² was associated with higher risks of reoperation for PJI and for any cause on univariate analysis, but these effects disappeared after adjustment for confounders⁶⁹. These findings suggest that the surgical indication may be more prognostic than BMI alone.

PJI

Infection prevention continues to be a research priority in aseptic revision TKA. The winners of the AAHKS Best Podium Presentation Research Award, McNamara et al.⁷⁰, conducted a multicenter study of 719 aseptic revision TKAs. Intraosseous vancomycin infusion significantly lowered PJI incidence

compared with intravenous administration: 0.3% compared with 2.1% at 30 days, 0.9% compared with 3.1% at 90 days, and 1.6% compared with 4.9% at 1 year (all $p < 0.05$). A large, single-center study of 218 revisions for PJI (including 90 highly complex “salvage” cases [41.3%]) compared 36 one-stage revisions (16.5%) and 182 two-stage revisions (83.5%) performed according to Philadelphia Consensus guidelines. The overall infection eradication was 67.4%, with no significant differences between the 1-stage and 2-stage groups⁷¹. A Phase-II multicenter randomized trial assessed the safety of intra-articular antibiotic irrigation in rapid 2-stage exchange arthroplasty for PJI. Thirty-seven patients received intra-articular antibiotic irrigation with daily tobramycin and hourly vancomycin via an intramedullary device, whereas 39 patients underwent standard spacer-based exchange. Both groups took systemic antibiotics for 12 weeks. No antibiotic-related adverse events occurred, although 2 serious events were linked to local irrigation. Systemic vancomycin and tobramycin levels were often detectable but consistently below toxicity thresholds. Blood transfusion requirements and mortality rates were similar between groups. The study concluded that intra-articular antibiotic irrigation is safe, with minimal systemic exposure, warranting further investigation into its efficacy for infection eradication⁷².

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, 11 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 Orthopaedics

Bensa A, Previtali D, Sangiorgio A, Boffa A, Salerno M, Filardo G. PRP injections for the treatment of knee osteoarthritis: the improvement is clinically significant and influenced by platelet concentration: a meta-analysis of randomized controlled trials. *Am J Sports Med*. 2025 Mar;53(3):745-54. This meta-analysis evaluated 18 RCTs (1,995 patients), comparing PRP with placebo for knee osteoarthritis and focusing on clinically meaningful outcomes using MCID thresholds. PRP demonstrated superior improvements in pain (visual analog scale [VAS]) and function (Western Ontario and McMaster Universities Osteoarthritis Index [WOMAC]) across all follow-up intervals, with pain relief exceeding the MCID at 3 and 6 months, and functional improvement surpassing the MCID at every time point up to 12 months. Subgroup analysis revealed that high-platelet PRP ($>1,000,000/\mu\text{L}$) provided more durable benefits, including clinically important pain relief at 3, 6, and 12 months, whereas low-platelet PRP failed to achieve sustained improvements over placebo. These findings suggest that platelet concentration significantly influences PRP efficacy, with high-platelet formulations offering more reliable and longer-lasting outcomes.

Bradbury TL, McConnell MJ, Whitacre D, Naylor BH, Gibson BT, DeCook CA. A remote physical therapy program demonstrates similar outcomes compared to in-person, supervised physical therapy after same-day discharge total knee arthroplasty: a randomized clinical trial. *J Arthroplasty*. 2024 Nov;39(11):2725-2730.e4. This randomized trial of patients who underwent same-day-discharge TKA and an electronic remote perioperative management program examined patients who postoperatively underwent either remote physical therapy or outpatient physical therapy. Among the 171 patients who completed the study, those in both groups had equivalent outcomes in terms of pain scores, functional measures, range of motion, patient-reported outcomes, and satisfaction at up to 1 year. Patients undergoing remote physical therapy avoided travel, incurred no physical therapy costs, and saved a mean of 133 minutes compared with patients undergoing outpatient physical therapy, who attended nearly 12 sessions. Remote physical therapy is a viable, lower-burden alternative for postoperative rehabilitation compared with in-person outpatient physical therapy, although further work is needed to identify predictors of crossover from remote to outpatient physical therapy. These results will offer certain patients a different option following knee arthroplasty.

French JMR, Woods A, Sayers A, Deere K, Whitehouse MR. Day-case knee and hip replacement. *Bone Joint J*. 2024 Dec 1;106-B(12):1385-92. Outpatient joint arthroplasty continues to gain wider adoption. This systematic review synthesized evidence from 38 studies (83,888 procedures) to compare outcomes of same-day-discharge knee and hip replacement and those of inpatient knee and hip replacement. Patients selected for same-day discharge were generally younger, were more often male, and had lower BMIs and American Society of Anesthesiologists classifications, reflecting a selection bias toward lower-risk profiles. Same-day-discharge arthroplasty was associated with significantly lower odds of readmission, emergency department visits, and complications, and the rates of reoperation and mortality were similar to those for inpatient procedures. Approximately 85% of patients scheduled for same-day-discharge surgery were successfully discharged the same day, with success rates highest for unicompartmental knee replacement, followed by total knee and total hip replacement. Patient-reported outcomes and cost-effectiveness were equivalent or favored same-day-discharge approaches. In conclusion, within the limitations of mostly observational studies and inherent selection bias, the evolution of knee arthroplasty continues to shift toward earlier recovery and return to home, as same-day hip and knee replacements appear to provide outcomes that are at least equivalent and, in some respects, superior to inpatient surgery.

CRISTAL Economic Analysis Study Group. Cost-effectiveness of enoxaparin versus aspirin in the prevention of venous thromboembolism after total hip or knee arthroplasty: an analysis from the CRISTAL cluster-randomized trial. *Bone Joint J*. 2024 Jun 1;106-B(6):589-95. This economic analysis, using data from the CRISTAL randomized trial in Australia, compared the cost-effectiveness of enoxaparin versus aspirin for VTE prevention after THA or TKA. Enoxaparin reduced symptomatic VTE within 90 days (risk difference, 1.97%; $p = 0.007$) but added a mean cost of AUD\$83 per case. The quality-adjusted life years (QALYs) gained were minimal (0.002), with an incremental cost-effectiveness ratio (ICER) of AUD\$50,567 per QALY, below the willingness-to-pay threshold of AUD\$70,000. Sensitivity analyses suggested greater confidence in cost-effectiveness when higher VTE treatment costs and longer follow-up were considered. The investigators concluded that, although enoxaparin lowered VTE rates compared with aspirin, the economic benefit was minimal. Although many contemporary studies have supported the efficacy and safety of low-dose aspirin after TKA, this study showed that

enoxaparin may be considered cost-effective primarily when the burden of VTE or its long-term consequences is high.

Kim YH, Park JW, Jang YS, Kim EJ. No discernible difference in revision rate or survivorship between posterior cruciate-retaining and posterior cruciate-substituting TKA. *J Bone Joint Surg Am.* 2024 Nov 6; 106(21):1978-85. This prospective randomized study followed 300 patients who underwent simultaneous bilateral TKA with 1 knee implanted with a NexGen CR-Flex (Zimmer) and the other knee implanted with a NexGen LPS-Flex (Zimmer) prosthesis, with a mean follow-up of 18 years. Outcomes at nearly 2 decades demonstrated no significant differences between cruciate-retaining and posterior-stabilized designs in Knee Society scores, WOMAC scores, University of California Los Angeles (UCLA) activity scores, range of motion, radiographic or computed tomographic findings, or revision rates (6.0% compared with 6.3%). Importantly, no osteolysis was observed in either group, and survivorship at 19.5 years was excellent and nearly identical (94% in the cruciate-retaining group compared with 93.7% in the posterior-stabilized group). Although conforming bearings are gaining popularity in knee arthroplasty, many registries still show a high percentage of the use of posterior-stabilized and cruciate-retaining bearings. This study shows that both these designs provide durable long-term results, and neither demonstrated a clinical advantage over the other.

Makkar JKD, Warriar G, Ghai B, Chhabra M, Sarkar PKD, Goni VG, Kaur Khurana BJ. Effect of radiofrequency ablation of genicular nerves on the isokinetic muscle strength of knee joint in patients with osteoarthritis knee: a randomized double-blind sham controlled clinical trial. *Pain Med.* 2024 Aug 5;pnae077. The use of a nerve block to treat moderate osteoarthritis continues to show promise. This RCT investigated the impact of genicular nerve radiofrequency ablation (RFA) on muscle strength in patients with moderate to severe knee osteoarthritis and chronic pain. Fifty-four patients were randomized to either RFA or a sham procedure. RFA of the genicular nerves provided superior pain relief, improved function, and increased knee muscle strength at 3 months compared with sham treatment, supporting its role as an effective adjunct for managing chronic pain and dysfunction in knees with osteoarthritis.

Pan F, Wang Y, Lim YZ, Urquhart DM, Estee MM, Wluka AE, Wolfe R, Cicuttini FM. Metformin for knee osteoarthritis in patients with overweight or obesity: a randomized clinical trial. *JAMA.* 2025 May 27; 333(20):1804-12. This randomized, double-blinded, placebo-controlled clinical trial investigated whether metformin improves symptoms in patients who were overweight or obese and had knee osteoarthritis. A total of 107 participants were randomized to receive either oral metformin (2,000 mg/day) or placebo for 6 months, with 82% completing follow-up. At 6 months, patients in the metformin group experienced a significantly greater reduction in knee pain on the VAS compared with placebo (mean difference, -11.4 mm [95% confidence interval, -20.1 to -2.6]; p 0.01), representing a moderate effect size. Although diarrhea and abdominal discomfort were more common with metformin, no serious adverse events were reported. Obesity remains a challenging epidemic facing patients, many of whom have debilitating knee osteoarthritis. The results of this study suggest that metformin may provide clinically meaningful pain relief in patients with knee osteoarthritis and overweight or obesity, although confirmation in larger, adequately powered trials is warranted.

Pardo-Pol A, Fontanellas-Fes A, Pérez-Prieto D, Sorli L, Hinarejos P, Monllau JC. The use of erythromycin and colistin cement in total knee arthroplasty does not reduce the incidence of infection: a randomized study in 2,893 knees with a 9-year average follow-up. *J Arthroplasty.* 2024 Sep;39(9):2280-4. This large, prospective randomized study with nearly 2,900 TKAs performed with cement and a mean follow-up of 8.7

years evaluated the efficacy of erythromycin-loaded and colistin-loaded bone cement in reducing PJI compared with plain cement in primary TKA. Both groups received the same systemic antibiotic prophylaxis. Deep infection rates were similar (p 0.58) at 1.8% overall, and there were no differences in revisions for aseptic loosening or antibiotic resistance patterns. These results suggest that antibiotic-loaded cement did not reduce the risk of PJI in primary TKA, and its routine use in the general population is not supported.

Porto JR, Lavu MS, Hecht CJ 2nd, Kamath AF. Is your surgical helmet system compromising the sterile field? A systematic review of contamination risks and preventive measures in total joint arthroplasty. *Clin Orthop Relat Res.* 2025 Jun 1;483(6):972-90. Surgical helmet systems remain widely used in total joint arthroplasty to protect surgical personnel, but concerns persist about their potential to increase sterile field contamination and infection risk. This comprehensive systematic review found that these helmets frequently harbor microbes and that improper use, such as activating the fan before full gowning, can contaminate gowns and gloves. Evidence suggests that the exhaust may increase operating room air contamination, although mitigation strategies such as sealing gown-glove interfaces and using a toga system help to reduce this. Crucially, current clinical data do not demonstrate a clear increase in PJI risk from helmet use. Given their protective benefits for staff and lack of definitive harm to patients, the authors concluded that surgical helmets can be safely used if strict protocols for donning, fan activation, gown sealing, and helmet sterilization are followed. This study highlights the need for surgeons to balance infection risk reduction with personal protective equipment benefits.

Ross M, Zhou Y, English M, Sharplin P, Hirner M. The effect of intra-articular autologous protein solution on knee osteoarthritis symptoms. *Bone Joint J.* 2024 Sep 1;106-B(9):907-15. This double-blinded RCT evaluated the efficacy of an autologous protein solution injection compared with saline solution in patients with moderate knee osteoarthritis. Forty patients were randomized and were followed for 12 months. The primary outcome, the WOMAC total score at 1 year, showed no significant difference between groups. Similarly, sub-scores of the WOMAC and the KOOS were not different across time points. Strikingly, VAS pain scores at rest (p 0.026) and during activity (p 0.008) were significantly worse in the autologous protein solution group compared with saline solution at 12 months. No adverse events were reported in either group. These results indicate that autologous protein solution did not improve pain or function and was associated with worse pain outcomes at 1 year, challenging its role as a biologic treatment option for knee osteoarthritis.

Yoshioka T, Arai N, Sugaya H, Taniguchi Y, Kanamori A, Gosho M, Okuno K, Kikuchi N, Hyodo K, Aoto K, Yamazaki M. The effectiveness of leukocyte-poor platelet-rich plasma injections for symptomatic mild to moderate osteoarthritis of the knee with joint effusion or bone marrow lesions in a Japanese population: a randomized, double-blind, placebo-controlled clinical trial. *Am J Sports Med.* 2024 Aug;52(10): 2493-502. This RCT evaluated the efficacy of leukocyte-poor PRP (LP-PRP) injections in Japanese patients with mild to moderate knee osteoarthritis. Thirty patients were randomized to receive 3 weekly intra-articular LP-PRP injections or saline solution placebo and were followed for 24 weeks. The PRP group showed significantly greater improvements in WOMAC scores (median, 75.9% compared with 27.7%; p 0.032) and higher rates of clinically meaningful VAS pain improvement (73.3% compared with 28.6%; p 0.027). Magnetic resonance imaging analysis also demonstrated significantly greater improvements in bone marrow lesions in the PRP group (p 0.017). No differences were observed in joint effusion or other secondary end points. Overall, LP-PRP provided clinically important improvements in function and pain relief compared with placebo, supporting its efficacy in this population.