Comparative Analysis of Perioperative and Early Postoperative Outcomes in Robotic-Assisted Versus Manual Revision Total Knee Arthroplasty

Alexander Burbelo[1], Christopher Potts[1], William Stone[1], Andrew Murphy[1], Austin Doyle[1], Christopher Schmidt[1], Amit Singla[1], Matthew Bullock[1], Alexander Caughran[1]
[1]Marshall University Joan C. Edwards School of Medicine, Huntington, WV
burbelo@marshall.edu

Disclosures: Alexander Burbelo (N), Christopher Potts (N), William Stone (N), Andrew Murphy (N), Austin Doyle (N), Christopher Schmidt (N), Amit Singla (N), Matthew Bullock (Smith & Nephew), Alexander Caughran (N)

INTRODUCTION: Revision total knee arthroplasty (rTKA) is technically challenging with high complication rates. Meta-analytic data in primary TKA indicate that robotic assistance improves anatomical and mechanical alignment without compromising clinical outcomes (Alrajeb et al., 2024), suggesting these benefits may extend to rTKA. Recent reports suggest that robot-assisted rTKA can enhance implant placement accuracy and soft tissue balancing, offering a promising alternative in these complex cases (Nham et al., 2023). Robotic-assisted rTKA (rarTKA) using the off-label image-based Stryker Mako platform has the potential to improve surgical planning and implant positioning (MacAskill et al., 2024). This study compared perioperative characteristics and early outcomes between rarTKA and manual rTKA.
METHODS: We retrospectively reviewed 148 rTKA procedures from July 2018–March 2025 at a single academic institution as approved by our institutional review board: 83 manual and 65 rarTKA. Data included demographics, ASA class (American Society of Anesthesiologists Physical Status Classification System), operative laterality, time from primary procedure, preoperative pain score, and revision indication. Outcomes were operative time, length of stay (LOS), 30- and 90-day readmissions, and 2-week range of motion (ROM) measured by goniometer. Welch's t-tests and Fisher's exact tests compared groups; multivariable linear regression identified predictors of LOS and ROM, and logistic regression assessed readmissions, adjusting for age, sex, BMI, ASA, and surgical approach. P<0.05 was considered significant.
RESULTS: Groups were similar in demographics and revision indications, with instability most common. The manual group had 38.6% males, compared to 52.3% in the rarTKA group. Operative time was longer for rarTKA (178.2 ± 36 vs 145.2 ± 57 min; p<0.001). LOS was shorter for rarTKA (35.5 ± 28.8 vs 48.6 ± 66.6 hrs) but not significant (p=0.109). Thirty-day readmissions occurred in 12.3% (rarTKA) vs 19.3% (manual; p=0.272) and 90-day readmissions in 10.8% vs 21.7% (p=0.121). Two-week ROM was similar (104.8° ± 15.0° vs 104.2° ± 15.1°; p=0.810). Higher ASA and older age predicted longer LOS; no significant predictors were found for ROM or readmissions.
DISCUSSION: Short-term outcomes between rarTKA and manual rTKA were comparable. While rarTKA required longer operative times, trends toward shorter LOS and fewer readmissions may reflect perioperative advanatges. Similar perioperative patterns—longer operative time with comparable early outcomes and, in some series, shorter LOS—have been reported in primary TKA (Hamilton et al., 2021). The lack of statistical significance for these findings likely reflects sample size and follow-up duration, supporting the need for larger, prospective trials to determine whether these patterns persist.
SIGNIFICANCE/CLINICAL RELEVANCE: These findings suggest that robotic-assisted rTKA is a promising potential option for complex revision cases, demonstrating early outcomes comparable to manual techniques. While no significant differences were observed, the results support further investigation to clarify its role and potential advantages in practice.

R**EFERENCES**:

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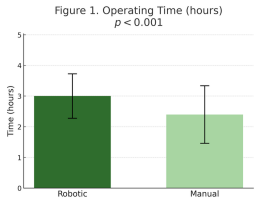

Figure 1. Mean operative time was significantly longer in the robotic-assisted group compared with the manual group (p < 0.001). Error bars denote variability.

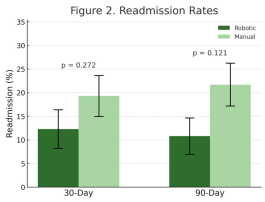

Figure 2. Thirty-day and ninety-day readmission rates were not significantly different between robotic-assisted and manual rTKA. Error bars denote variability.

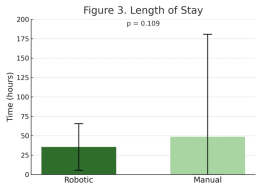

Figure 3. Length of hospital stay trended shorter for robotic-assisted rTKA but did not reach statistical significance (p = 0.109). Error bars denote variability.