Robotic assistance in low-volume total knee arthroplasty surgeons yields outcomes comparable to those of high-volume surgeons using conventional techniques.

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INTRODUCTION:

Robotic-assisted total knee arthroplasty (R-TKA) usage has grown. Prior studies have reported mixed findings on R-TKA utility compared to conventional total knee arthroplasty (C-TKA). Separately, higher surgical volume has been correlated with improved outcomes. Given these considerations, R-TKA may be of greater utility for low-volume surgeons and elevate their outcomes, while high-volume surgeons may not see this same effect due to their already improved outcomes. Therefore, the current study aimed to investigate the interplay of robotic-assistance and surgeon volume on total knee arthroplasty outcomes.

METHODS:

Patients undergoing R-TKAs and C-TKAs performed by low-volume and high-volume surgeons were identified from the PearlDiver M170Ortho dataset. The annual case volume cutoffs for high-volume and low-volume surgeons were determined through the American Joint Replacement Registry 2023 Annual Report corresponding to the 75th (69 TKAs) and 25th (7 TKAs) percentiles of TKA surgeons. Three matched comparisons were performed: conventional low-volume TKA (C-LV-TKA) versus robotic low-volume TKA (R-LV-TKA), conventional high-volume TKA (C-HV-TKA) versus robotic high-volume TKA (R-HV-TKA), and C-HV-TKA versus R-LV-TKA. Matching for each comparison was 4:1 based on age, sex, and Elixhauser Comorbidity Index (ECI). Aggregated 90-day adverse events (AEs), 5-year implant-related events, and reoperation rates were assessed.

RESULTS:

First, among high-volume surgeons, C-HV-TKAs were 19,732 and R-HV-TKAs were 4,939 after matching. R-HV-TKAs had lower odds of 90-day any (OR 0.79, p<0.001) and minor (OR 0.74, p<0.001) AEs. At 5 years, R-HV-TKAs had lower odds of prosthetic joint infection (OR 0.56, p<0.001) and lower reoperation rates (2.2% vs. 3.3%, p=0.02).

Next, between low-volume surgeons, C-LV-TKAs were 8,923 and R-LV-TKAs were 2,235 after matching. R-LV-TKAs had lower odds of 90-day any (OR 0.63, p<0.001), severe (OR 0.71, p=0.002), and minor (OR 0.66, p<0.001) AEs. At 5 years, no differences existed in 5-year implant-related events or reoperations.

Last, comparing conventional high-volume and robotic low-volume, C-HV-TKAs were 8,923 and R-LV-TKAs were 2,235 after matching. No differences existed in aggregated 90-day AEs (any, severe, or minor), 5-year implant-related events, or reoperation rates.

DISCUSSION AND CONCLUSION: Consistent with some existing literature, robotics appears to offer some, but inconsistent, advantages for TKA at differing surgeon case volume levels. The novel finding was that robotics usage by low-volume surgeons elevated outcomes to become comparable to high-volume non-robotic surgeons, suggesting that lower-volume surgeons can close outcomes gaps with higher-volume surgeons through robotics.

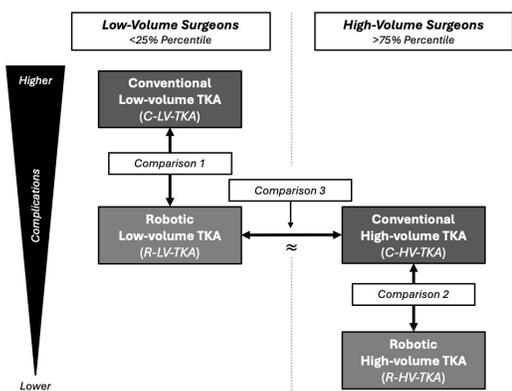**Figure 1:** Graphical representation of the matched comparisons performed and the relative complication levels based on platform and surgeon volume.