Adoption of Robotic-Assisted Total Knee Arthroplasty in Canada (2019–2023) Was Associated with a Twofold Increase in Major Surgical Complications

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INTRODUCTION: Robotic-assisted total knee arthroplasty (rTKA) has been increasingly adopted despite ongoing debate about its clinical advantages over conventional TKA (cTKA). This study aimed to evaluate whether rTKA is associated with reduced complication rates when implemented within a publicly funded healthcare system.

METHODS: We conducted a population-based cohort study of all adults undergoing primary TKA for osteoarthritis in Ontario, Canada between 2019 and 2023. Cases were identified as either rTKA or cTKA, and outcomes were compared using 4:1 propensity-score matching. The primary outcome was a composite of major surgical complications within one year postoperatively (defined as revision arthroplasty, deep surgical site infection, and/or fracture requiring surgery). Hazard ratios (HRs) were estimated using Cox proportional hazards regression.

RESULTS: Among 74,359 TKAs performed across 62 hospitals by 345 surgeons, 1,613 were rTKAs and 72,746 were cTKAs. Robotic adoption increased from 1.7% of cases in 2019 to 5.8% in 2023 ($p < 0.001$). Compared to matched cTKA patients (n = 6,218), those undergoing rTKA had a significantly higher rate of major complications within one year (2.0% vs. 1.2%, $p < 0.001$; HR 1.98, 95% CI 1.3–3.0). Median operative time was longer for rTKA (101 minutes [IQR: 89–116]) compared to cTKA (89 minutes [IQR: 75–106], $p < 0.001$). Findings were consistent in sensitivity analyses excluding the first 10 robotic cases per surgeon to account for early learning curves.

DISCUSSION AND CONCLUSION: In this population-level study, the introduction of rTKA in Canada was associated with a twofold increase in major surgical complications and longer operative times compared to cTKA. These findings suggest that real-world learning curves may be steeper than previously reported, particularly when robotics are introduced across diverse practice settings. Additionally, elevated complication rates may reflect risks intrinsic to current generation robotic platforms, beyond the learning phase. The results underscore the need for cautious implementation of rTKA, support for structured training programs, and further evaluation of clinical outcomes to justify widespread adoption (including assessments of pain, function, and differences among robotic platforms).