Robotic-Assisted Total Knee Arthroplasty Is Associated with Decreased Manipulation under Anesthesia Compared to Manual Approach

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INTRODUCTION: Arthrofibrosis and stiffness are one of the leading complications following total knee arthroplasty (TKA). When those challenging complications persist, manipulation under anesthesia (MUA) is commonly performed. Imprecise implant size, positioning, alignment, and ligament balance can potentially lead to stiffness after TKA, as can poor pain management and patient comorbidities. To address the shortcomings of conventional measured resection and gap balancing, computer-assisted navigation (CN) and subsequently robotic-arm assistance (RA) were developed to optimize surgical planning and execution. The purpose of this study was to investigate MUAs associated with adoption of CN- and RA-TKA and compare them to the manually instrumented approaches.

METHODS: A retrospective chart review of 21,893 TKAs performed by fellowship-trained orthopaedic surgeons at the same institution between April 2008 and December 2022 was performed. Included cases were stratified into three groups, according to the utilization or absence of technology (RA-, CN-, and manual TKA). Patients undergoing MUA after TKA for stiffness were identified through medical records chart review. Manipulation absolute and relative frequencies between RA-, CN-, and manual TKAs were then analyzed. Chi-squared tests and a logistic regression model were used to determine if adoption of technology impacted MUA rates.

RESULTS: A total of 21,893 primary TKAs were eligible for analysis: 17,661 (81%) manual, 1,065 (5%) RA-TKA, and 3,167 (14%) CN-TKA. In total, 765 (3.5%) MUAs took place over the study period. There were 29 MUAs (2.7%) out of the 1,065 RA-TKAs, 89 MUAs (2.8%) out of the 3,167 CN-TKAs, and 647 MUAs (3.7%) out of the 17,661 manual TKAs (Table 1). Significant differences were identified between the groups (P= 0.02). The majority of MUAs (N =746, 97.5%) occurred within 120 days following TKA.

DISCUSSION AND CONCLUSION: The findings of this study demonstrate that the adoption of technology in TKA leads to a significant decrease in the incidence of MUA compared to manual TKA. These results highlight the potential benefits of incorporating technological advancements into TKA, offering improved outcomes, and reducing the need for additional interventions such as MUA.

Table 1. Manipulation under anesthesia (MUA) rates between robotic-assisted (RA), computer-navigated (CN) and manually instrumented total knee arthroplasties.

Outcomes	RA-TKA	CN-TKA	Manual TKA
MUA	29	89	647
No MUA	1,036	3,078	17,014
Total	1,065	3,167	17,661
% MUA rate	2.7%*	2.8%*	3.7%*

*Indicates a significant difference in MUA rate between the groups (p = 0.02)