The Learning Curve of Robotic-Arm Assisted Total Joint Arthroplasties: A Systematic Review

Hailey Huddleston, Neil V Shah, Eric Howard Tischler, Steven Burekhovich, MATTHEW SUNK CHUNG, Jared Newman, Sukhpreet S Ahluwalia, Samuel Gedailovich, Akhilesh Sastry[1], Harleen Kaur[2], Qais Naziri[3]
[1]Sports Medicine Atlantic Orthopaedics, [2]SUNY Downstate Medical Center, [3]SUNY DOWNSTATE MEDICAL CENTER

INTRODUCTION:
Previous studies have analyzed the learning curve associated with different approaches to arthroplasty. However, no study has comprehensively reviewed the literature pertaining to the learning curve of robotic-arm assisted total joint arthroplasty. The goal of this study was to systematically review the literature related to the learning curve of total knee (TKA) and hip (THA) arthroplasty so that orthopaedic surgeons may better approximate the number of cases necessary to achieve proficiency in robotic-arm assisted arthroplasty.

METHODS: A literature search was performed for studies that evaluated the learning curves of robotic-arm assisted arthroplasties between the database inception through 2018. Selected studies included patient and cadaver studies in the English language that met the following criteria: 1) robotic-arm use (ROBODOC, MAKO, CASPAR); 2) surgical cases comparison over a time period; and 3) presence of at least one outcome measurement. Outcome measurements included number and type of complications, mean procedure time, alignment error, and alignment measurements. A total of 7 studies were included (Figure 1).

RESULTS: Seven studies examined the learning curve associated with robotic-arm assisted total joint arthroplasties. One investigation found the learning curve of THA to be 35 cases based on operation time and acetabular component mispositioning. In contrast, TKA generally had a shorter learning curve of 3 to 36 cases based on operation time. No study found a statistically significant difference in complications or alignment between early and late cases of TKA or THA.

DISCUSSION AND CONCLUSION: Robotic-arm assisted arthroplasty has been shown to produce similar or improved results compared to traditional manual arthroplasty. Few studies have evaluated the learning curve through a multitude of outcome measurements, and there is a lack of consensus on how to properly evaluate the learning curve. The results of this review suggest that there is a relatively short learning curve for robotic-arm assisted TKA and THA.

Figure 1. PRISMA flowchart of study selection