

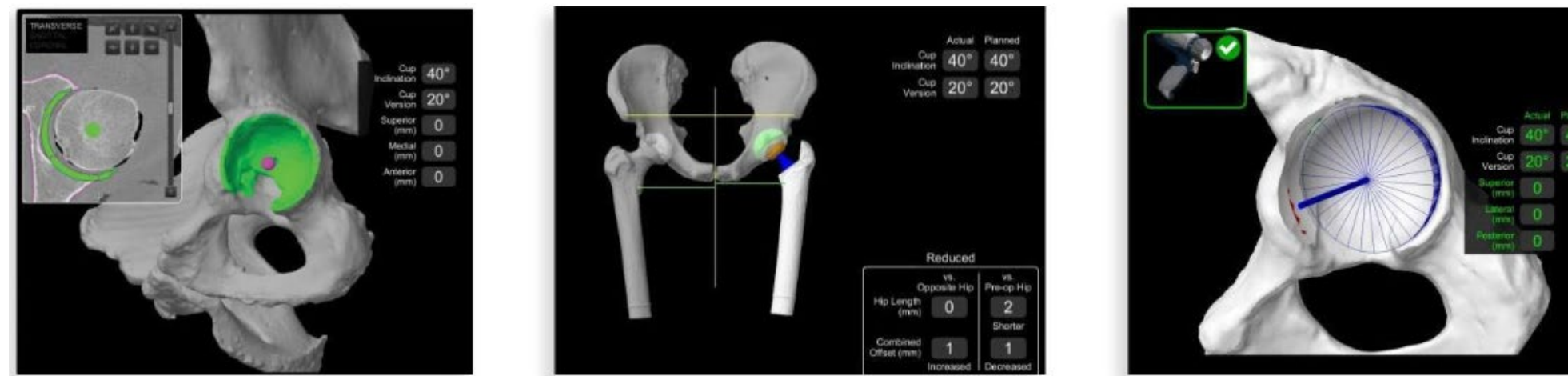
Does robotic-arm assisted total hip arthroplasty impact the surgical team's experience?

Christina O'Neill, BS¹, Kevin Barga, MS, RN¹, Andrea Coppolecchia, MPH¹

¹Stryker Orthopedics, Mahwah, NJ, USA

Introduction

The direct-anterior approach (DAA) has become increasingly adopted to minimize soft tissue damage, especially for outpatient total hip arthroplasties (THA)¹. This approach, however, often requires the use of fluoroscopy for visualization which may pose risks to surgeons and OR staff including radiation and unintended effects of protective lead gear.^{2,3} Utilization of CT-based robotic-arm assisted total hip arthroplasty (RA-THA) also continues to increase and offers potential benefits to patients such as reduced dislocations, decreased length of stay, and improved outcomes compared to manual THA.⁴ The use of RA-THA may help surgeons and staff using DAA in the OR by reducing, if not eliminating, fluoroscopy use.



Robotic system tools including functional hip positioning and virtual range of motion (VROM)

Methods

The purpose of this review is to evaluate the impact of a DAA with CT-based RA-THA on surgeon and OR staff, compared to a DAA with fluoroscopic-guided conventional total hip arthroplasty (C-THA). A review of available literature was performed to understand the impact of RA-THA using the DAA compared to fluoroscopy-guided C-THA using the DAA on surgeon and OR staff experience including ergonomics, fluoroscopy use, and efficiency.

Results

A retrospective study of 6,541 patients found RA-THA had a 4.0- to 5.0-fold shorter mean fluoroscopy time and a 6.5-fold smaller mean radiation dose compared with both computer navigation and C-THA (Figure 1).⁵ An earlier cadaver study reported two experienced surgeons eliminated fluoroscopy with RA-THA whereas C-THA required a mean of 21 ± 8.9 fluoroscopy shots, resulting in a mean 700 mrem of radiation exposure.⁶

In a comparison of surgeon health metrics, RA-THA was associated with reduced surgeon stress during acetabular preparation and lower heart rate during reaming, and surgeons reported less physical and mental demand than C-THA (Figure 2), in a cadaveric setting.⁷

A learning curve study showed RA-THA achieved similar operating times to C-THA after 15 cases and eliminated fluoroscopy after 17 cases.⁸ A workflow study demonstrated RA-THA using the DAA can be consistently completed under 60 minutes.⁹

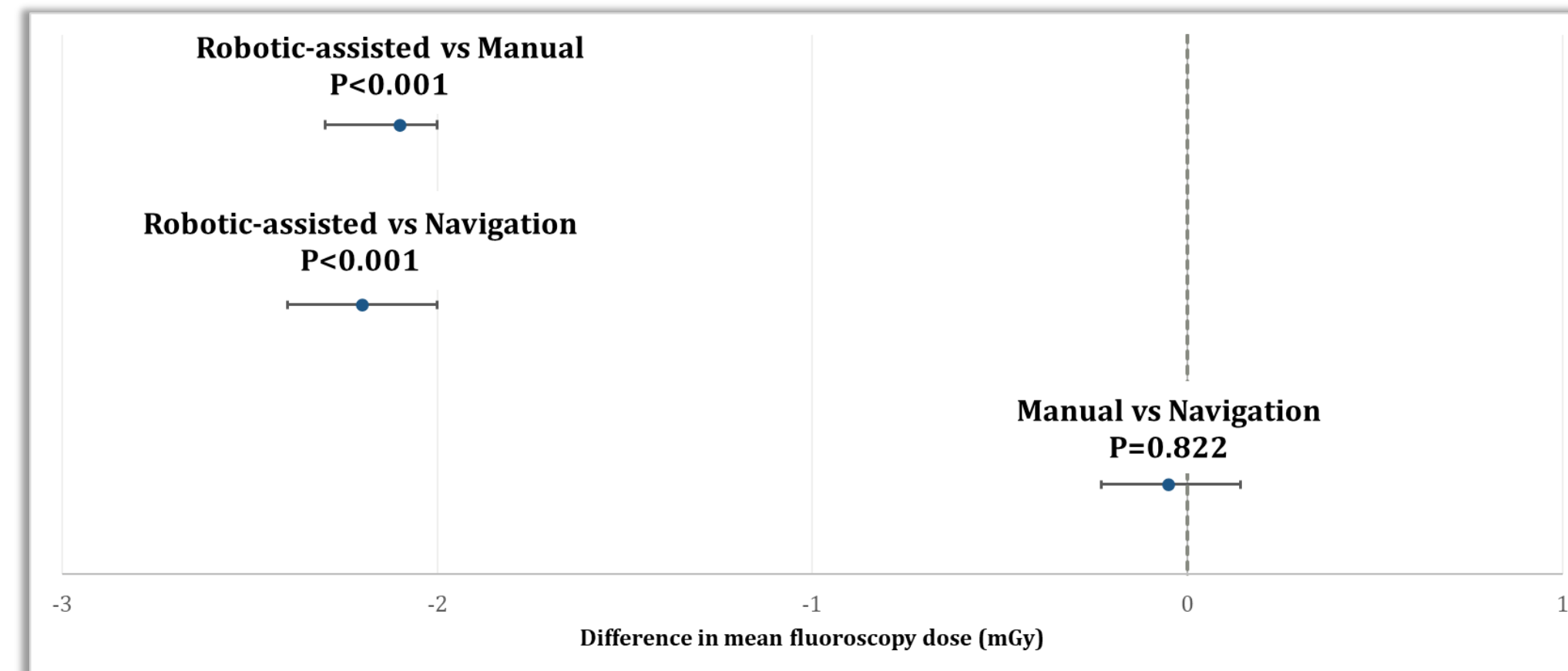


Figure 1: Difference in Fluoroscopy Dose by THA Technology Usage

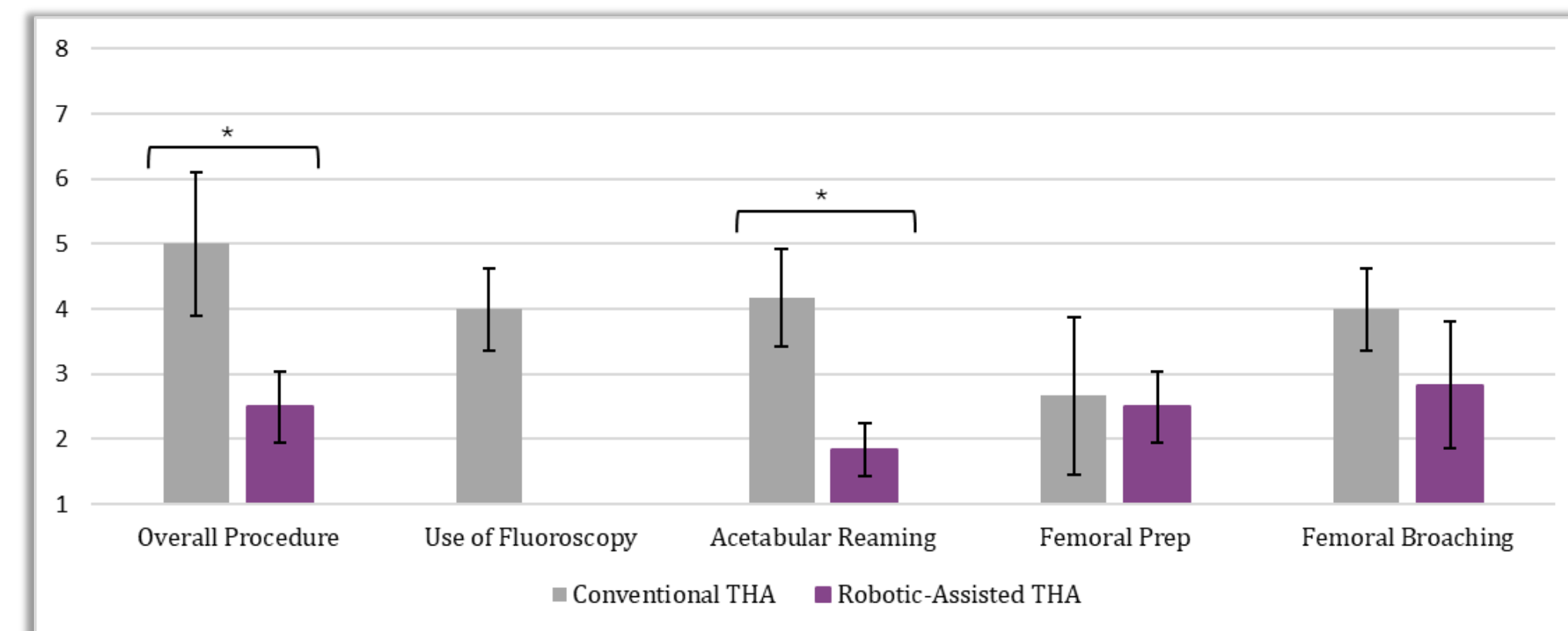


Figure 2: Surgeon-Reported Physical Demand by Surgical Step

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Conclusion

Studies have shown that CT-based RA-THA using the DAA reduced surgeon physical and mental demand, reduced or eliminated fluoroscopy use, and enabled workflow efficiency compared to fluoroscopy-guided C-THA using the DAA.