Computer-Assisted Fluoroscopic Navigation Is Cost Effective Compared To Robotic-Assisted And Manual Surgery In Total Hip Arthroplasty

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Jenna Bernstein, MD[1], Jean-Baptiste Trouiller, PharmD[2], Mina Kabiri, PhD[3], William Hamilton, MD[4]

[1]Connecticut Orthopaedics, Hamden, CT, USA, [2]Johnson & Johnson MedTech, Paris, France, [3]Johnson & Johnson MedTech, Raynham, MA, USA, [4]Anderson Orthopedic Clinic, Arlington, VA, USA.

Background

- Total hip arthroplasty (THA) is among the most common surgeries performed worldwide for hip osteoarthritis.
- Besides the conventional manual technique (mTHA), enabling technologies such as computer-assisted fluoroscopic navigation (cTHA) and robotic-assisted solutions (rTHA) are available for primary THA. Such enabling technologies aim to optimize implant positioning and alignment, since accurate reconstruction of the hip's biomechanics is critical in restoring patients' functional outcomes and quality of life (QoL).[1]
- Each approach can influence patients' QoL and costs and, while previous studies have shown the cost-effectiveness of rTHA compared to mTHA,[2,3] no study has assessed the cost-effectiveness or cost-utility of cTHA compared to rTHA and mTHA.
- **The objective of this study was to analyze the cost-utility of cTHA compared to rTHA and mTHA among patients undergoing primary THA from the US healthcare system perspective.**

Methods

A Markov state-transition model was developed to estimate and compare costs and utilities of cTHA vs. mTHA, and cTHA vs. rTHA over a 1-year time horizon using a cycle length of 3 months. The model population consisted of patients undergoing primary THA, treated with one of the three interventions. The mean age of the patient cohort was set at 66 years. The health states were defined according to the occurrence of complications leading to readmissions with or without revision, which impact both costs and patients' QoL (Figure 1). QoL were measured through utility values, presented in quality-adjusted life years (QALYs) and collected from the literature. Cost components included length of stay (LOS), operating room time and readmissions/revisions.

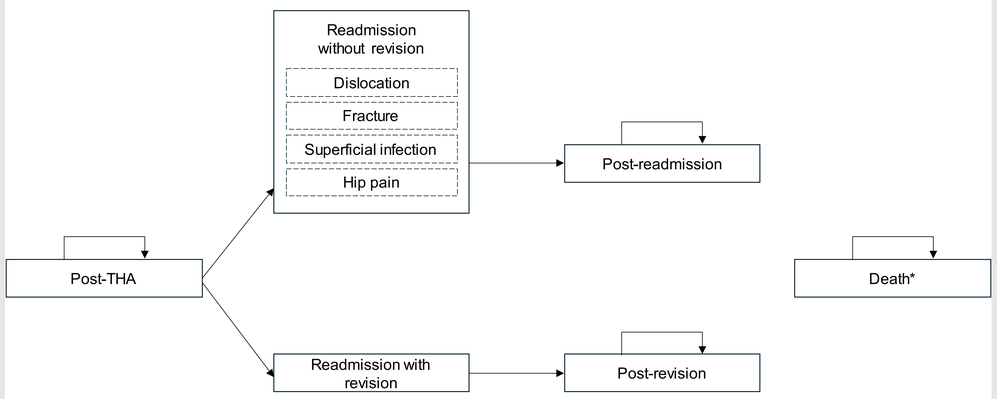

Figure 1: Model structure showing possible health states after a total hip arthroplasty (THA. *All health states can lead to death, which is an absorbing state.

Results

- cTHA was associated with **estimated savings of $1,595 and $949 per patient** compared to rTHA and mTHA, respectively, and a **slight QALY gain of approximately 0.001** compared to both rTHA and mTHA (Table 1).
- Compared to rTHA, per-patient cost saving using cTHA was largely attributed to savings in OR time (47%). Compared to mTHA, per-patient cost saving using cTHA was most strongly attributed to differences in LOS.
- Deterministic sensitivity analysis showed that model cost results were the most sensitive to changes in LOS and 3-month readmission/revision rates.
- Probabilistic sensitivity analysis indicated that **cTHA was cost saving in 100% of the 1,000 simulations** compared to both rTHA and mTHA, indicating the robustness of the results to changes in input parameters (Figure 2).

	Group		
Per-Patient Outcomes	**cTHA**	**rTHA**	**mTHA**
Total Costs ($)	11,061	12,657	12,011
LOS	4,960	5,411	5,765
OR Time	5,617	6,362	5,511
Readmissions and Revisions	484	884	735
Cost Difference ($)	-	1,595	949
QALYs	0.9201	0.9188	0.9192
QALY Difference	-	-0.0013	-0.0009
ICER ($/QALY)	-	Dominant	Dominant

Abbreviations: cTHA, computer-assisted fluoroscopic total hip arthroplasty; ICER, incremental cost-effectiveness ratio; LOS, length of stay; mTHA, manual total hip arthroplasty; OR, operating room; QALY, quality-adjusted life years; rTHA, robotic-assisted total hip arthroplasty.

Table 1: Per-patient cost and quality of life outcomes.

Conclusions

Using computer-assisted fluoroscopic navigation in primary THA showed cost savings in addition to a slight improvement in QoL compared to robotic-assisted and manual THA, indicating that cTHA was the '**dominant**' strategy. The results of this study suggest **computer-assisted fluoroscopic navigation as the preferred strategy for primary THA,** mainly due to its impact on downstream cost savings incurred by reductions in LOS and readmissions.

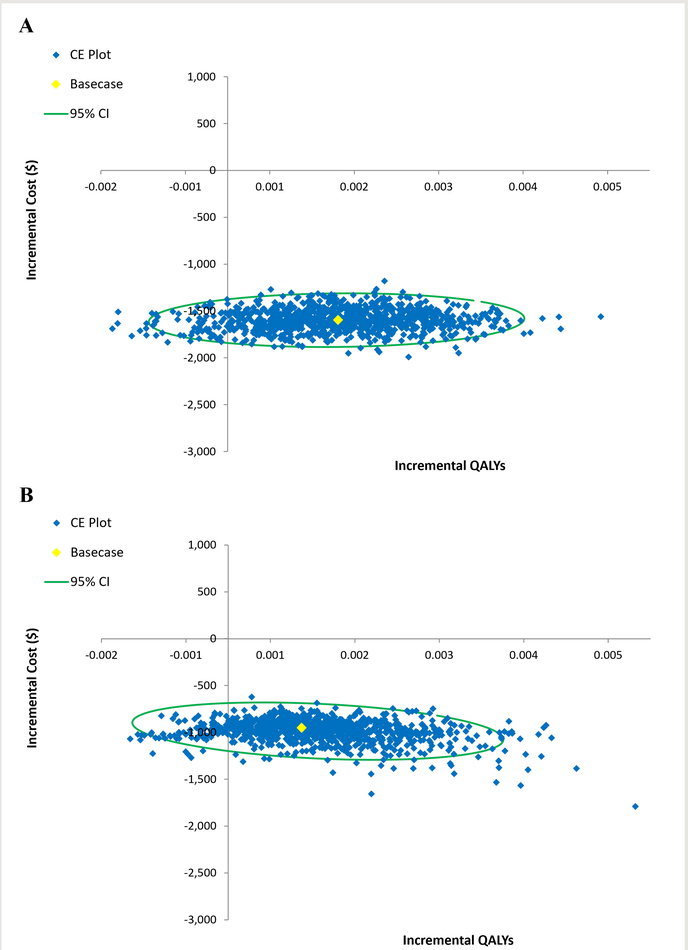

Figure 2: Probabilistic sensitivity analyses for (A) computer-assisted fluoroscopic vs robotic-assisted total hip arthroplasty and (B) computer-assisted fluoroscopic vs manual total hip arthroplasty. Abbreviations: CE, cost-effectiveness; CI, confidence interval; QALY, quality-adjusted life years.

References:

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