

Technology-Assisted Total Hip Arthroplasty: A Contemporary Analysis of Regional Trends, National Trends, and 90-day Outcomes in a Nationwide Cohort

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INTRODUCTION:

Technology-assisted total hip arthroplasty (THA), including computer-navigated and robotic-assisted techniques, has emerged as a strategy to improve component alignment and potentially enhance postoperative outcomes. While prior studies have documented increasing adoption, there is a paucity of literature assessing contemporary trends and associated complication rates.

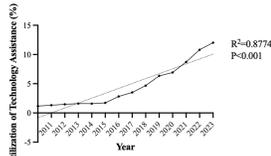
METHODS: A retrospective cohort study was conducted using a large national database to identify patients who underwent primary elective THA between 2010 and 2023. Patients were stratified into conventional versus technology-assisted THA groups, with the latter defined by the use of computer navigation or robotic assistance. Annual utilization trends were evaluated using linear regression, and 90-day postoperative complications were compared using multivariate logistic regression after adjusting for demographic, clinical, and regional factors.

RESULTS:

Among 1,062,597 patients undergoing primary elective THA, 4% received technology-assisted procedures (Table 1). Utilization of technology-assisted THA increased from 1.2% in 2010 to 12% in 2023, representing a 927% relative increase (Figure 1). Regional variation was observed, with the highest utilization in the Northeast and lowest in the Midwest (Figure 2). Overall, patients undergoing technology-assisted THA had lower odds of 90-day complications compared to conventional THA (5.36% vs. 6.26%, $P < 0.001$; adjusted OR: 0.77, 95% CI: 0.75–0.80). Specifically, technology-assisted THA was associated with reduced odds of dislocation (OR: 0.64, 95% CI: 0.60–0.69) and periprosthetic joint infection, but increased odds of wound dehiscence (OR: 1.15, 95% CI: 1.07–1.23) (Table 2).

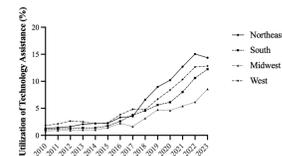
DISCUSSION AND CONCLUSION: Technology-assisted THA utilization has increased significantly across the United States, with evidence of improved short-term outcomes, particularly reduced dislocation rates. These findings contribute to the growing body of literature supporting the potential clinical benefits of technology in THA, though continued investigation is warranted to assess long-term outcomes.

Figure 1: Trends in Technology-Assisted THA from 2010 to 2023



THA: Total hip arthroplasty

Figure 2: Trends in Technology-Assisted THA from 2010 to 2023 by Region



THA: Total hip arthroplasty

Table 1: Patient demographics and characteristics

	Conventional THA		Technology-Assisted THA		P-value
	N	%	N	%	
Total	1,017,887	95.79	44,710	4.21	-
Age (SD)	65.01	10.22	65.00	10.54	0.74
CCI (SD)	1.50	1.95	1.52	1.93	<0.001
CCI (SD)	4.05	3.23	4.43	3.61	<0.001
Length-of-Stay (SD)	3.01	2.3	2.12	1.75	<0.001
Sex	-	-	-	-	0.45
Male	441,896	43.41	18,491	42.29	-
Female	575,991	56.59	26,219	58.40	-
Payment	-	-	-	-	-
Cash	1,397	0.16	122	0.27	<0.001
Commercial	648,245	63.69	32,773	73.31	<0.001
Government	14,231	1.40	492	1.11	0.03
Medicaid	30,380	2.98	15,553	34.64	<0.001
Medicare	313,303	30.88	14,250	31.76	<0.001
Uninsured	8,111	0.80	864	1.93	<0.001
Unspecified	210,722	20.70	11,319	24.87	<0.001

THA: Total hip arthroplasty; SD: standard deviation; CCI: Charlson Comorbidity Index; ECI: Elixhauser Comorbidity Index

Table 2: Ninety-day complications by method of THA

	Conventional THA		Technology-Assisted THA		P-value	Adjusted Odds Ratio (95% CI)	P-value	
	N	%	N	%				
Total	1,017,887	6.26	44,710	5.36	<0.001	0.77 (0.75-0.80)	<0.001	
Acute Myocardial Infarction	5,537	0.55%	141	0.30%	0.69	0.91	0.61-1.05	0.13
Pulmonary Embolism	7,261	0.72%	281	0.63%	0.68	0.67	0.61-0.74	<0.001
Pneumonia	11,023	1.08%	437	0.97%	0.68	0.57	0.50-0.65	<0.001
Sepsis	5,387	0.53%	291	0.65%	0.68	1.06	0.93-1.20	0.07
Wound Dehiscence	7,382	0.73%	433	0.97%	1.15	1.07-1.23	<0.001	
Dislocation	4,544	0.45%	179	0.40%	0.64	0.63	0.58-0.69	<0.001
Periprosthetic Joint Infection	17,396	1.71%	544	1.23%	0.64	0.63	0.58-0.67	<0.001
Periprosthetic Fracture	7,294	0.72%	333	0.75%	0.53	0.58	0.48-0.65	0.001
Delirium	13,049	1.28%	498	1.12%	0.68	0.64	0.58-0.69	<0.001
All Cause Complications	43,746	4.30%	2,384	5.35%	0.68	0.71	0.75-0.80	<0.001

THA: Total hip arthroplasty