

Improved functional outcomes with robotic compared with manual total hip arthroplasty

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Introduction

Functional outcome following total hip arthroplasty (THA) is affected by accurate component positioning and restoration of hip biomechanics. Robotic-assisted THA (rTHA) has been shown to improve accuracy of component positioning, but its impact on functional outcomes has not been demonstrated. The purpose of this study was to compare: 1) operative time; 2) estimated blood loss; 3) postoperative complications; and 4) patient-reported outcome measures (PROMs) between patients who either underwent rTHA or manual THA (mTHA).

Materials and methods

In this retrospective cohort study, a single-center database was used to identify all patients who underwent primary THA since introduction of rTHA at a large academic medical center. Surgical factors including operative time and estimated blood loss as well as postoperative complications were recorded. Validated PROMs following rTHA (n = 100) were compared with consecutive mTHA cases (n= 100) performed by the same fellowship-trained surgeon at a minimum one-year follow-up (24 ± 6 months). PROMs included the Short-Form 12 Health Survey (SF-12), UCLA activity score (UCLA), Western Ontario and McMaster (WOMAC) Osteoarthritis Index, and modified Harris Hip Score (mHHS). A categorical analysis was performed to determine differences in proportions of patients with mHHS scores of 90 to 100, 80 to 89, 70 to 79, and < 70 points between the two groups. Chi-square and two-tailed t-tests were used to compare categorical and continuous data between cohorts.

Table 1. Patient-reported outcomes (PROMs) comparing rTHA and mTHA patient groups

	Group (rTHA n=100, mTHA n=100)	Preoperative	Postoperative	PROMs (Postoperative – Preoperative)	p-value
mHHS (Mean and Standard Deviation)	rTHA	49.6 (16.3)	92.1 (10.5)	43.0 (18.8)	< 0.001
	mTHA	49.2 (14.8)	86.1 (16.2)	37.4 (18.3)	< 0.001
	p-value	0.865	0.002	0.035	
SF12-MCS (Mean and Standard Deviation)	rTHA	54.1 (10.4)	54.6 (9.1)	0.4 (9.7)	0.629
	mTHA	53.1 (9.6)	53.0 (10.2)	0.5 (11.5)	0.970
	p-value	0.459	0.245	0.962	
SF12-PCS (Mean and Standard Deviation)	rTHA	33.5 (9.6)	46.0 (10.5)	12.5 (11.8)	< 0.001
	mTHA	30.3 (8.0)	44.4 (11.0)	14.0 (11.9)	< 0.001
	p-value	0.010	0.282	0.404	
WOMAC (Mean and Standard Deviation)	rTHA	45.6 (18.9)	16.0 (14.9)	-29.6 (21.4)	< 0.001
	mTHA	47.1 (14.7)	17.3 (15.5)	-28.5 (18.3)	< 0.001
	p-value	0.536	0.538	0.618	
UCLA (Mean and Standard Deviation)	rTHA	5.1 (1.9)	6.3 (1.8)	1.2 (1.7)	< 0.001
	mTHA	4.8 (1.8)	5.8 (1.7)	1.0 (1.9)	< 0.001
	p-value	0.227	0.033	0.429	
Categorical Analysis of Modified Harris Hip Score					
90-100	75.0% (75)		61.0% (61)		0.034
80-89	13.0% (13)		15.0% (15)		0.684
70-79	6.0% (6)		5.0% (5)		0.756
< 70	6.0% (6)		19.0% (19)		0.005

Results

Mean operative time was nine minutes longer for the rTHA group compared with the mTHA group (131 ± 23 min vs. 122 ± 29 min, respectively, p = 0.012). Estimated intraoperative blood loss was reduced for the rTHA group when compared to the mTHA group (374 ± 133 mL vs. 423 ± 186 mL, p = 0.035), and there was no difference in overall complication rates between the two groups (p = 0.101). Robotic-assisted THA demonstrated higher mean postoperative mHHS (92.1 ± 10.5 vs. 86.1 ± 16.2, p = 0.002) and mean UCLA scores (6.3 ± 1.8 vs. 5.8 ± 1.7, p = 0.033) compared with mTHA. The difference between pre- and postoperative mHHS scores was statistically significant when comparing rTHA with mTHA (43.0 ± 18.8 vs. 37.4 ± 18.3, p = 0.035). There were no significant differences in SF-12 or WOMAC scores. There was a significantly higher proportion of patients with mHHS scores between 90 to 100 points (75% vs. 61%, p = 0.034) and a lower percentage with scores < 70 points (6% vs. 19%, p = 0.005) in the rTHA cohort compared with the mTHA cohort.

Discussion

The rTHA cohort demonstrated significantly higher mean postoperative UCLA scores, higher mean postoperative mHHS scores, and a greater percentage of patients with mHHS of 90 to 100 points compared with mTHA at a minimum one-year follow-up. To the author’s knowledge, this is the first study to demonstrate that robotic-assisted THA leads to improved patient-reported outcomes. The observed improvement in functional outcomes following rTHA is encouraging and warrants additional multi-center studies to determine if these advantages are maintained at longer follow-up intervals.

Reference:

Bukowski B.R, Chughtai M, Anderson P et al. Improved functional outcomes with robotic compared with manual total hip arthroplasty. Surg Technol Int. 2016 Oct.

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