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Total Hip Arthroplasty in Patients Younger than 35 Is Effective Regardless of Surgical Approach

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Abstract

INTRODUCTION: Surgical indications for total hip arthroplasty (THA) are expanding to include increasingly younger patients, yet limited outcomes research has focused on this population. This study compares outcomes between the anterior and posterior approach, as well as between conventional and technology-assisted THA in patients younger than 35-years old.

METHODS: A retrospective analysis of 139 primary THAs in 125 patients younger than 35-years old was conducted. Patients were divided into two cohorts: (1) anterior-THA and (2) posterior-THA. A posterior-THA sub-group analysis was performed to compare: (1) technology-assisted THA (tech-THA) versus (2) conventional-THA (con-THA). Demographics, perioperative data, radiographic and clinical outcomes were analyzed using Chi squared and unpaired student t-tests for categorical and continuous variables, respectively.

RESULTS: Of the 139 cases performed, 40 were anterior-THA and 99 were posterior-THA. The anterior-THA cohort had shorter mean surgical time (95.0±25.7 vs. 118.3±43.3 minutes; $p<0.01$), shorter hospital LOS (1.9±1.4 vs. 2.7±1.2 days; $p<0.01$), and lower estimated blood loss (EBL) (343.4±164.1 vs. 438.0±272.8 mL; $p<0.01$) compared to the posterior-THA cohort. There were no statistically significant differences in acetabular component positioning, postoperative limb length discrepancy, clinical outcomes or postoperative complications between cohorts. In the sub-group analysis, cup

placement within Lewinnek's Safe Zone was achieved in 78% and 49% of the tech-THA and con-THA groups, respectively (p<0.01). Need for revision THA was significantly higher among the con-THA group (9.4% vs. 0%; p<0.01).

CONCLUSION: There is no significant difference in outcomes between anterior and posterior THA among patients under 35-years of age, however, the anterior approach may promote earlier hospital discharge. Technological-assistance can improve component positioning and reduce the rate of early revision and late wear in patients younger than 35 undergoing posterior-THA.

1 Introduction

Advancements in prosthetic design, materials, and surgical technique have improved total hip arthroplasty (THA) longevity, while the more recent advent of robotics and computer-navigation has enhanced capabilities of accurate component placement. Accordingly, the indications for THA have expanded to include younger patients of greater physical demand with expectations of earlier functional recovery.[1–4] Previous studies have demonstrated improvements in implant survivorship and clinical outcomes of THA in patients under 30 years-of-age since 1998, however, much of this success has been attributed to breakthrough treatment for juvenile rheumatoid arthritis and the increased utilization of cementless implants.[5–7]

The anterior approach to THA has become popular in the last decade due to purported advantages of a more rapid recovery and less postoperative pain.[8–10] Robotic-assisted platforms and computer navigation software have also gained popularity in an effort to improve component alignment and more accurately restore native joint kinematics.[11] To date, there has been limited research to specifically evaluate THA outcomes in the young adult population with respect to surgical approach or the use of this modern technology. The purpose of this study was to compare the outcomes between: (1) the anterior and posterior approach and (2) the use of conventional instrumentation versus technological-assistance for THA performed in patients under the age of 35. The authors hypothesized no significant difference in outcomes at final follow-up for either analysis.

2 Methods & Materials

2.1 Data Collection

A retrospective, multi-surgeon cohort study including 125 patients under 35 years-old who underwent primary THA (139 hips) between January 2013 and April 2018 was conducted. Patients were divided into two cohorts: (1) anterior-THA and (2) posterior-THA. A sub-group analysis of the posterior-THA cohort was performed to compare: (1) technology-assisted THA (tech-THA) (use of robotic-assistance or computer navigation) and (2) conventional THA (con-THA). Patient demographics, perioperative details, and postoperative outcomes were studied.

2.2 Radiographic Analysis

Radiographic analysis included measurements of acetabular component anteversion and inclination, as well as postoperative leg length discrepancy (LLD). Cup orientation was deemed appropriate within the traditional Lewinnek "safe zone" parameters of 15° +/- 10° of anteversion and 40° +/- 10° of inclination;[12] LLD was determined by the distance from the inter-teardrop line to the most prominent point on the lesser trochanter.[13]

2.3 Statistical Analysis

Unpaired student t-tests and Chi squared analysis were performed using SPSS v23 (International Business Machines, Armonk NY) statistics software for continuous and categorical variables, respectively. All tests performed were 2-sided where a p-value <0.05 was deemed statistically significant.

3 Results

3.1 Patient and Surgical Characteristics

Of the 125 patients, 38 patients (40 hips) were in the anterior-THA cohort, and 87 patients (99 hips) were in the posterior-THA cohort. Thirty-four of 40 anterior-THA cases used fluoroscopy. There were no significant differences between the groups with respect to patient demographics including age, gender, BMI, ASA, indication for surgery, or prior hip surgery. Osteonecrosis and developmental dysplasia of the hip (DDH) combined comprised greater than 70% of indications for both groups. Mean surgical time (95.0±25.7 vs. 118.3±43.3 minutes; $p<0.01$) and mean hospital length of stay (LOS) (1.9±1.4 vs. 2.7±1.2 days; $p<0.01$) was significantly shorter in the anterior group. Mean estimated blood loss (EBL) was higher for anterior-THA (343.4±164.1 mL) compared to posterior-THA (438.0±272.8 mL) ($p<0.01$) (Table 1).

There were no significant differences between anterior-THA and posterior-THA with respect to cup placement within Lewinnek's Safe Zone (anterior: 79.5% vs. posterior: 62.6%; $p=0.11$) (Table 1) and postoperative radiographic LLD (anterior: 4.9±4.7mm vs. posterior: 7.2±7.9mm; $p=0.09$) (Figure 1).

3.2 Postoperative Outcomes

There were no significant differences among groups with respect to dislocation (anterior: 0% vs. posterior: 3%, $p=0.27$), need for revision THA (anterior: 5.3% vs. posterior: 5.9% $p=0.96$),

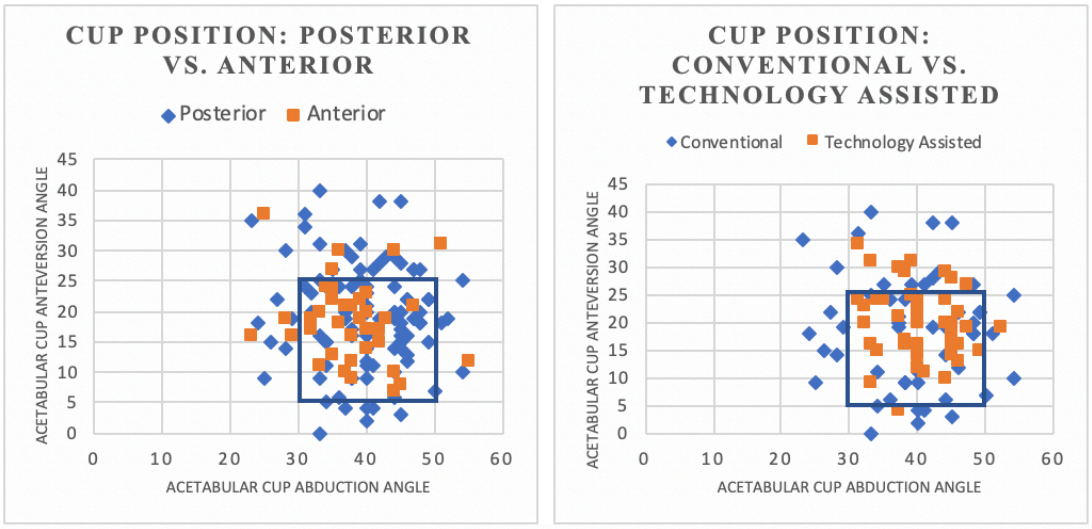
postoperative complications (e.g. deep vein thrombosis, pulmonary embolism, infection, instability, aseptic loosening, and periprosthetic facture [anterior: 7.5% vs. posterior 9.4%, p=0.83]), and 90-day readmissions (anterior: 0% vs. posterior: 3.5%, p=0.28).

3.3 Sub-Group Analysis

In the posterior-THA sub-group analysis, technology was used in 46 (46.4%) THAs compared to 56 (53.6%) THAs that were done conventionally. There were no significant differences in patient demographics with the exception of length of follow-up (tech-THA: 16.1±12.4 vs. con-THA: 22.9±18.7; p<0.05). No significant differences in overall postoperative complications (tech-THA: 6.5% vs. con-THA: 11.3%, p=0.41) or 90-day readmissions (tech-THA: 0% vs. con-THA: 5.7%, p=0.10) were observed. Cup placement within Lewinnek's Safe Zone was achieved in 78% of the tech-THA group compared to only 49% of the con-THA group (p<0.01) (Figure 1). The need for revision was significantly greater following con-THA (9.4%) compared to tech-THA (0%) (p<0.05). Of five revisions in the con-THA group, two were due to instability (Table 1).

Table 1. Surgical Characteristics	**Anterior n = 38 patients 40 hips (%)**	**Posterior n = 87 patients 99 hips (%)**	***p*-value**
Anesthesia Method			0.24
Spinal	25 (62.5)	51 (51.5)	
General	15 (37.5)	48 (48.5)	
Surgical time (minutes) (mean±SD [range])	95.0±25.7 [58-160]	118.3±43.3 [48-266]	**<0.01***
EBL (mL) (mean±SD [range])	343.4±164.1	438.0±272.8	**<0.05***
Hospital LOS (days) (mean±SD [range])	1.9±1.4 [0-8]	2.7±1.2 [0-6]	**<0.01***
LLD (mm) (mean±SD [range])	4.9±4.7 [0.1-21.1]	7.2±7.9 [0.8-63]	0.09
Cup Positioned within Lewinnek Safe Zone			0.11
Yes	31 (79.5)	62 (62.6)	
No	8 (20.5)	37 (37.4)	
Discharge Disposition			0.33
Home w/ health services	40 (100)	92 (92.9)	
Acute rehab	0 (0)	2 (2.0)	
Skilled nursing facility	0 (0)	5 (5.1)	
Sub-Analysis of Posterior THA	**Technology Assistance 46 hips (%)**	**Conventional 53 hips (%)**	***p*-value**
Cup Positioned within Lewinnek Safe Zone			**<0.01***
Yes	36	26	
No	10	27	
Dislocation	1 (2.2)	2 (3.8)	0.64
Revision THA	0	5 (9.4)	**<0.05***
Instability	-	2	
Infection	-	1	
Femoral stem subsidence	-	1	
Periprosthetic fracture		1	
Any postoperative surgical complication	3 (6.5)	6 (11.3)	0.41
90-day readmission	0	3 (5.7)	0.10

Figure 1. Acetabular Cup Positioning Scatterplots



4 Discussion

The presented data reveals that the anterior approach may help reduce hospital LOS in THA patients under the age of 35. A prospective randomized study by Christensen et al. similarly found shorter LOS following anterior compared to posterior-THA in patients of all ages (1.4 days vs. 2.0 days p=0.01).[9] While these findings have been supported elsewhere in the literature,[14,15] younger patients may have shorter LOS after THA in general.[16,17] There has been no evidence to suggest long-term clinical benefits of anterior compared to posterior-THA regardless of age,[9,18,19,20,21] which is also consistent with our study, as there was no difference between groups with respect to postoperative complications.

Sub-group analysis findings demonstrate that tech-THA may help improve outcomes in younger THA recipients as seen by the lower rates of revision in this group. Moreover, patients in the tech-THA cohort had acetabular cups positioned within Lewinnek's safe zone more often than patients in the con-THA cohort. This is in accordance with the study by Domb et al. that found that 100% of cups placed in robotic-assisted THAs were within Lewinnek's safe zone, compared to 80% in the conventional THA cohort (p=0.001).[22] Considering instability was the leading cause for revision in the conventional group, it is possible that the higher rate of sub-optimal cup placement (50.9%) played a role in this finding.

5 Conclusion

There is no significant difference in outcomes between anterior and posterior THA among patients under 35-years old, however, the anterior approach may promote earlier hospital discharge. Technological-assistance can improve component positioning and reduce the rate of early revision and late wear in patients younger than 35 undergoing posterior-THA. Continued study of this young patient population is warranted.

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