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No Difference in Dislocation Seen in Anterior Vs Posterior Approach Total Hip Arthroplasty

Joseph D. Maratt, MD [a, *], Joel J. Gagnier, ND, MSc, PhD [a], Paul D. Butler, MD [b], Brian R. Hallstrom, MD [a, c], Andrew G. Urquhart, MD [a], Karl C. Roberts, MD [d]

[a] Department of Orthopaedic Surgery, University of Michigan, Ann Arbor, Michigan
[b] Grand Rapids Orthopaedic Surgery Residency Program, Grand Rapids, Michigan
[c] Michigan Arthroplasty Registry Collaborative Quality Initiative, Ann Arbor, Michigan
[d] Department of Surgery, Michigan State University, Grand Rapids, Michigan

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ABSTRACT

Background: The direct anterior approach (DAA) for total hip arthroplasty (THA) has rapidly become popular, but there is little consensus regarding the risks and benefits of this approach in comparison with a modern posterior approach (PA).
Methods: A total of 2147 patients who underwent DAA THA were propensity score matched with patients undergoing PA THA on the basis of age, gender, body mass index, and American Society of Anesthesia classification using data from a state joint replacement registry. Mean age of the matched cohort was 64.8 years, mean body mass index was 29.1 kg/m^2, and 53% were female. Multilevel logistic regression models using generalized estimating equations to control for grouping at the hospital level were used to identify differences in various outcomes.
Results: There was no difference in the dislocation rate between patients undergoing DAA (0.84%) and PA (0.79%) THA. Trends indicating a slightly longer length of stay with the PA and a slightly greater risk of fracture, increased blood loss, and hematoma with the DAA are consistent with previous studies.
Conclusion: On the basis of short-term outcome and complication data, neither approach has a compelling advantage over each other, including no difference in the dislocation risk.

Total hip arthroplasty (THA) is generally considered one of the most successful surgical interventions to improve health-related quality of life not only in orthopedics but in all of medicine [1]. Most patients experience a significant increase in function and mobility, with a decrease in pain, after undergoing THA. However, a minority of patients experience complications secondary to the procedure, with dislocation occurring in 1%-3% [2,3]. In the American Joint Replacement Registry 2014 Annual Report, dislocation was the most frequently reported reason for early revision [4]. Since the inception of THA, efforts have been made to improve the procedure, enhance recovery, and limit complications such as instability, abductor weakness, infection, implant failure, intraoperative fracture, soft tissue injury, and implant wear.

The posterior approach (PA) is the most commonly used approach for THA in the United States. The direct anterior approach (DAA) has rapidly become popular because of perceived improvements in early functional recovery and reduced dislocation rates, with some surgeons advocating for no hip precautions following the procedure [5]. Possible benefits include less soft tissue trauma and a more rapid recovery while maintaining a lower risk of dislocation associated with anteriorly based approaches [6-8]. As

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* Reprint requests: Joseph D. Maratt, MD, Department of Orthopaedic Surgery, University of Michigan, A. Alfred Taubman Health Care Center, 1500 East Medical Center Drive, Room 2912, Ann Arbor, MI 48109-5328.

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most studies show little difference in functional recovery beyond 6 weeks between the 2 approaches, dislocation risk remains one of the main reasons for advocating the anterior approach. However, there is concern over a high prevalence of numbness from injury to the lateral femoral cutaneous nerve, in addition to a potentially overall higher risk of complications during a surgeon's "learning curve" [9-12]. Modern PAs with repair of the capsule have demonstrated comparable dislocation rates to DAA THA [13-15], and the short-term functional benefit of the DAA may not be as significant as once thought when patients are risk matched within a cohort and undergo contemporary perioperative protocols [16]. Much of the comparative literature is limited to smaller numbers of patients, single-surgeon series, and experienced surgeons beyond their learning curve at high-volume centers; thus, the literature may not reflect the actual results seen in the spectrum of clinical settings.

The Michigan Arthroplasty Registry Collaborative Quality Initiative (MARCQI) is a statewide joint arthroplasty registry with abstracted and validated data capturing greater than 90% of primary total hip and knee arthroplasties done in the state with 98.5% completeness of data [17].

Our goal was to compare short-term outcomes and complications between the direct anterior and PAs for THA in the state of Michigan by using data from the MARCQI joint registry. The primary outcome of interest was dislocation. Secondary outcomes of interest included other parameters thought to be affected by surgical approach, including fracture, blood loss, transfusion, hematoma formation, length of stay, and readmission.

Methods

A retrospective analysis of MARCQI data was performed. MARCQI is a Blue Cross Blue Shield of Michigan and Blue Care Network supported collaborative enrolling its first patients in 2012. Participation in MARCQI is a requirement of the Blue Distinction Center of Excellence for Knee and Hip Surgery. All the 59 hospitals in the state of Michigan performing greater than 200 hip or knee arthroplasty procedures annually are now recruited and participating in the collaborative.

MARCQI collects level I, II, and III data using a combination of manual abstraction from the medical record, administrative data uploads, and device information uploads with rigorous auditing and data validation. Data elements include demographic data, including name and Social Security number, details of the operative intervention, implants used, 90-day adverse events, comorbidities, venous thromboembolism prophylaxis, and perioperative laboratory data. Completeness of level I and II data is 98.5% [17].

The registry was queried for all patients undergoing unilateral primary THA utilizing a DAA or PA between February 2012 and September 2014. During the study period, 42 participating hospitals submitted 15,424 primary THAs to the registry. The numbers of DAA and PA surgeries performed were 2156 (14.0%) and 8956 (58.0%), respectively. An anterolateral approach was used in 3918 (25.4%) cases. Other approaches were used in 283 (1.8%) cases, and the approach was unknown or missing in 139 (0.9%) cases. Information retrieved for each case included demographic data, operative variables, and 90-day adverse event data.

Patients who underwent DAA THA were propensity score matched with patients undergoing PA THA on the basis of age, gender, body mass index and American Society of Anesthesia classification favoring exact matches and without replacement. Cases with missing match parameters were excluded (9 [0.42%] DAA, 45 [0.50%] PA) from matching. From the cases eligible for propensity score matched (11,112), 2147 matched pairs were identified. Mean age of the matched cohort was 64.8 years, mean body mass index was 29.1 kg/m^2, and 53% were female. A comparison of the match parameters was performed to confirm that the groups were comparable (Table 1).

Table 1
Propensity Score Matched PA and DAA Cohort Baseline Comparisons.

	PA		DAA		
	Mean	Standard Deviation	Mean	Standard Deviation	95% CI[a]
Age	64.84	12.08	64.36	10.93	−0.21 to 1.17
Height	169.79	10.30	169.61	10.13	−0.03 to 2.24
Weight	84.85	18.36	83.75	19.53	−0.43 to 0.80
BMI	29.30[b]	5.01	28.97[b]	5.51	0.01-0.64
	n	%	n	%	
Female	1117	52.0	1169	54.0	
ASA I	74	3.4	71	3.3	
ASA II	1322	61.6	1269	59.1	
ASA III	721	33.6	770	35.9	
ASA IV	30	1.4	37	1.7	

PA, posterior approach; DAA, direct anterior approach; CI, confidence interval; BMI, body mass index; ASA, American Society of Anesthesia.
[a] 95% Confidence interval of the difference.
[b] Statistical significance was reached at the 0.05 level.

Multilevel logistic regression models using generalized estimating equations to control for grouping at the hospital level were used to identify differences in various outcomes for the predictor variable of DAA vs PA. We selected generalized estimating equation correlation structures by testing each and selecting the structure with the smaller Quasi Akaike Information Criterion value separately for all models. Incidence risk ratios and 95% confidence intervals were calculated for each outcome variable of interest: dislocation, fracture recognized intraoperatively, fracture recognized postoperatively, hematoma, length of stay, duration of surgery, change in hemoglobin level, transfusion, and readmission.

Our study was powered ($1 - b > 0.80$) to detect a difference of 1% with a baseline risk of 0.8%. The threshold for statistical significance was $\alpha < 0.05$. SPSS (v22.0.0.0, IBM, Armonk, NY) and Stata (v14.0, StataCorp, College Station, TX) software packages were used in the analysis.

Results

There was no difference in the rate of dislocation based on approach (0.84% DAA vs 0.79% PA, incidence rate ratio = 1.06, $P = .88$). There was an increase in procedure duration with the DAA (100.94 ± 38.00 min DAA vs 76.35 ± 27.72 min PA, incidence rate ratio = 1.32, $P < .05$). There were no statistically significant differences in fracture rate, blood loss, transfusion, hematoma, length of stay, or readmission (Table 2). There were trends toward a longer length of stay in the PA group and greater risk of fracture, increased blood loss, and hematoma in the DAA group (Table 2).

Discussion

Our results demonstrate no significant differences in dislocation rates or early outcomes between the anterior and posterior surgical approaches when performing primary THA.

Surgeon preference, training, experience, perceived risks and benefits of each approach, patient preference, and the influence of direct-to-consumer marketing all play a role in selection of approach for THA. Analysis of data from the MARCQI joint registry representing greater than 90% of all primary THAs done in Michigan with more than 22,907 THA cases recorded since 2012