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In-Hospital Morbidity and Postoperative Revisions After Direct Anterior vs Posterior Total Hip Arthroplasty

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ABSTRACT

Background: The direct anterior approach (DAA) offers the potential for less soft tissue insult, improved early recovery, and reduced dislocation rates. However, complications are associated with the DAA, particularly during the learning curve. We compare the DAA learning curve experience with the posterior approach regarding in-hospital complications and revision rate.

Methods: We evaluated systemic and local in-hospital complications associated with primary unilateral cementless THAs from January 1, 2010 to December 31, 2012 in 4249 patients through a posterior approach and 289 patients through a DAA. All procedures were performed consecutively by high-volume surgeons who use a single approach in a nonselective manner. The DAA was performed by surgeon transitioning from the posterior approach, thus incorporating the learning curve. Demographics were comparable. Revision procedures were captured through a minimum 4-year follow-up. Analyses compared complication and revision rates.

Results: The DAA group demonstrated shorter length of stay, procedure time, lower blood transfusion rate, and increased discharge to home rate. Local and major systemic in-hospital complications were rare and comparable between groups. The minor systemic complication rate was significantly greater for the posterior group (10.9% posterior vs 6.2% DAA, $P < .05$). Revision rate was significantly greater for the posterior group (2.7% posterior vs 0.7% DAA, $P < .032$). The incidence of revision for dislocation was 1.5% for the posterior approach vs 0.4% for the DAA.

Conclusion: There was an increased rate of in-hospital minor systemic complications and overall revision, predominantly due to instability, after THA by the posterior approach, in comparison with the DAA.

Although the posterior approach is the most commonly used approach for total hip arthroplasty (THA) in the United States, the direct anterior approach (DAA) has become popular as a true internervous and intermuscular approach because of the potential for less soft tissue insult, faster functional recovery, and reduced dislocation rates [1]. However, concerns with the DAA include increased operating time [2], greater blood loss [2], and a technical learning curve with a difficult exposure accompanied by potential complications such as femoral fracture [3], femoral loosening [4], and wound healing issues [5]. This study compares the direct anterior and posterior approaches with THA over a period which includes the learning curve for the DAA to examine in-hospital complications and revision rates at 4-6 years.

Several studies have reported on complication rates following the DAA. Spaans et al [2] observed 20% complications in 46 THAs performed through a DAA including early revisions for acetabular and femoral loosening. Barnett et al reported an overall medical and surgical complication rate of 3.9% at 90 days in 5090 consecutive primary THA procedures using the DAA, including 41 intraoperative femur fractures, 7 postoperative femur fractures, 20 infections, 12 dislocations, 8 hematomas, 3 cases of cellulitis, 2 sciatic nerve palsies, 1 peroneal nerve palsy, and an intrapelvic bleed [6]. Masonis et al [7] demonstrated significant reductions in operative and fluoroscopy times after their first 100 cases and no femur fractures after their first 62 cases. Meneghini et al [4] reported a greater risk of early femoral loosening with the DAA and a greater risk of acetabular loosening with the posterior

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Table 1
Patient Demographics.

	Posterior THA (n = 4249)	DAA THA (n = 289)	*P* Value
Age, mean ± SD	64.7 ± 11.2	65.1 ± 9.8	.581
BMI, mean ± SD	28.1 ± 5.7	28.4 ± 5.5	.387
Female, N (%)	2349 (55.3%)	167 (57.8%)	.408
Male, N (%)	1900 (44.7%)	122 (42.2%)	
Right hip, N (%)	2378 (56.0%)	169 (58.5%)	.426
Left hip, N (%)	1871 (44.0%)	120 (41.5%)	

BMI, body mass index; DAA, direct anterior approach; SD, standard deviation; THA, total hip arthroplasty.

approach. In that series, there were more revisions for instability after THA by the posterior approach [4].

Complications associated with the DAA are most prevalent during the learning curve for the DAA [2,7,8], and Parvizi et al [9] reported that most complications of lower-extremity total joint replacement occurred within the time-frame of the typical hospital stay. The present study was designed to compare the learning curve for the DAA with the posterior approach for THA with regards to (1) in-hospital complications and (2) revision rate and indications for revision at 4-6 years after primary THA.

Materials and Methods

This study was approved by the institutional review board. We performed a review of an institutional hip arthroplasty patient database based on hospital discharge data to identify admissions at a single high-volume orthopedic hospital (Hospital for Special Surgery, New York, NY) with an International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) procedure code for primary THA (81.51) [10] from January 1, 2010 through December 31, 2012. Two groups of patients undergoing unilateral primary THA were delineated on the surgical approach used, DAA (n = 289) vs posterior (n = 4249), based on the operating surgeon.

All procedures were performed consecutively by high-volume fellowship-trained arthroplasty surgeons who exclusively use a single approach (either posterior or the DAA) to THA in a nonselective manner. Starting in 2010, the DAA was used in a nonselective manner by a single surgeon at our institution in practice at the time for 21 years (M.M.A.), who transitioned from the posterior approach after learning the DAA through attending courses, surgeon visitations, and self-teaching. Excluded cases included those performed by surgeons who use both the DAA and posterior approach in a selective manner, those performed by surgeons who routinely perform cemented THA, and those performed by a surgeon who used a recalled implant during the study period resulting in a high volume of revisions. This methodology provided patient groups with similar demographics (Table 1).

DAA THA was performed in the supine position without use of a specialized table. A capsulectomy was performed for every case. A hook femoral elevator was used. Femoral releases included the piriformis and conjoint tendon only as needed to facilitate femoral elevation. Acetabular screws were not routinely used. All DAA cases used the Biomet Microplasty femoral stem and G7 acetabular component (Biomet, Warsaw, IN). Final acetabular component sizing and position as well as femoral component sizing, offset, and leg length were clinically evaluated and confirmed fluoroscopically. Fluoroscopic determination of leg length discrepancy was measured by referencing the ischium and lesser trochanter bilaterally. Posterior THA was performed in the lateral position. The hip capsule and the external rotators were repaired using nonabsorbable suture passed through the bone of the greater trochanter. All patients were maintained on a uniform institutional perioperative protocol. Pain management was consistent between groups. Physical therapy was uniform with the exception of posterior hip precautions following posterior THA. Inpatient hospitalists making the assessment for need for blood transfusion were consistent in both groups. Tranexamic acid was not used during the study period. Prophylaxis for venous thromboembolism consisted predominantly of aspirin with the exception of high-risk patients who were given Coumadin. Patients were evaluated in the office routinely in the first 5 years after surgery per the protocol of the operating surgeon.

Administrative data collected for this study consisted of ICD-9-CM diagnosis and procedure codes, patient demographics, hospital length of stay (LOS), blood transfusions, and revision surgery status. Patient demographics included age, sex, body mass index (BMI), and THA laterality. Patient overall health status was evaluated using the American Society of Anesthesiologists score. Presence or absence of specific comorbidities was also assessed including hypertension, diabetes mellitus, obesity, hypercholesterolemia, pulmonary disease, renal disease, coronary artery disease, and congestive heart failure (Appendix 1).

The primary outcome was in-hospital complications, identified using ICD-9-CM diagnosis and procedure codes [10] and classified as local, minor systemic, or major systemic. All coding for both groups was completed by the Health Information Management department at our institution. Local (orthopedic) complications included peripheral nerve and vascular injuries, hemorrhage, hematoma, or seroma complicating the procedure, accidental puncture or laceration during the procedure, and disruption and nonhealing of the surgical wound; they were identified using codes for complications of surgical and medical care (956.XX, 997.XX-998.XX). The list of specific local complications and ICD-9-CM codes are provided (Appendix 1).

An additional 19 acute systemic complications were identified using ICD-9-CM codes [10] (Appendix 1) and classified as minor or major. Minor complications included those that necessitated additional observation or required medical treatment: (1) hypotension, (2) syncope and collapse, (3) tachycardia, (4) delirium, (5) urinary tract infection, (6) urinary retention, (7) superficial incisional surgical site infections and cellulitis, (8) paralytic ileus, and (9) pleural effusion. Complications were considered major if they required complex surgical or medical intervention or if they were deemed life-threatening or resulted in functional impairment; they included (1) central nervous system infarction (ischemic stroke), (2) pulmonary compromise, (3) sepsis, (4) shock/cardiorespiratory arrest, (5) acute myocardial infarction, (6) major cardiac (except myocardial infarction), (7) pneumonia, (8) pulmonary embolism, (9) deep vein thrombosis, and (10) deep periprosthetic infection.

Revision surgeries were captured as a secondary outcome through December 2016 for a minimum interval of 4 years (range 4-6 years) from the time of primary THA. Revisions were identified by database

Table 2
Patient Comorbidities.

	Posterior THA (n = 4249)		DAA THA (n = 289)		*P* Value
	N	%	N	%	
ASA 1-2	3516	82.8	240	83	.904
ASA 3-4	732	17.2	49	17.0	
Diabetes	331	7.8	28	9.7	.247
Hypercholesteremia	1515	35.7	94	32.5	.281
Obesity	457	10.8	29	10	.701
Hypertension	1892	44.5	119	41.2	.267
CAD	354	8.3	20	6.9	.399
Pulmonary disease	383	9.0	33	11.3	.170
Renal disease	75	1.8	3	1	.484
CHF	28	0.7	2	0.7	.717

ASA, American Society of Anesthesiologists; CAD, coronary artery disease; CHF, congestive heart failure; DAA, direct anterior approach; THA, total hip arthroplasty.