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Financial impact of total hip arthroplasty: a comparison of anterior versus posterior surgical approaches

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ABSTRACT

Background: Compared to the posterior approach, the anterior approach to total hip arthroplasty (THA) offers the potential for an accelerated recovery secondary to less dissection and therefore less pain in the immediate postoperative period. This offers potential financial benefit through a reduction in length of stay. This study retrospectively reviewed 98 anterior approach and 69 posterior approach THA cases (N = 167) to compare perioperative outcomes and cost-effectiveness.
Methods: Patients who underwent anterior approach THA were discharged sooner than those who underwent posterior approach THA.
Results: The anterior approach was also less expensive per patient than the posterior approach. Overall, differences in perioperative outcomes between these approaches to THA are less robust than previously reported. There is a significant difference in operative cost between these surgical approaches.
Conclusions: Although there are many sources for this difference in cost, the predominant contributor is surgeon implant preference.

Introduction

Traditionally, one of the most common surgical approaches to total hip arthroplasty (THA) has been the posterior approach (PA), in which the hip joint is accessed by splitting the gluteus maximus muscle [1,2]. However, in recent years, there has been increasing focus on minimally invasive surgical approaches to THA because of the potential to improve perioperative outcomes and hasten patient recovery [2-4]. The anterior, or Smith-Petersen, surgical approach has been shown to improve functional recovery in the early postoperative period [5-10]. Although the AA and PA have comparable long-term success rates, discrepancy is reported in the early postoperative period [2,4,6,11]. The anterior approach (AA) uses the intermuscular and internervous intervals between the sartorius and the tensor fascia lata muscles. This has been reported in previous work to cause less soft tissue damage, decrease postoperative pain, and decrease length of stay (LOS) in the hospital compared to cases using the PA [12-18]. In addition, patients who underwent AA THA were more likely to be discharged to home vs to rehabilitation when compared to patients receiving the PA [12-15]. These outcomes offer significant benefits for patients in the immediate postoperative period, as well as the potential to decrease hospital costs. Furthermore, the demand for THA is expected to rise over the next decade because of an aging and increasingly sedentary United States population [19,20]. Therefore, improvements in THA that can decrease length of recovery may significantly impact health care costs through a reduction in needed medical services.

The purpose of our study is to review the perioperative and financial results of THA performed through the AA vs PA to compare their perioperative outcomes and cost-effectiveness. Given the muscle-sparing nature of the AA and based on previous research, we hypothesized that patients who underwent AA THA would have a decreased length of hospital stay resulting in considerable cost reduction.

Material and methods

We obtained institutional review board approval at our institution to retrospectively evaluate 98 AA and 69 PA THA cases (N = 167) which took place between January and June of 2013. All AA THAs

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were performed by a single, experienced, fellowship-trained arthroplasty surgeon. A different surgeon with a similar background performed all PA THAs. Patient demographics included age, gender, American Society of Anesthesiologists score, body mass index, and surgical indication. Operative records were analyzed for perioperative outcomes including surgical time, blood loss, pain (visual analog scale pain score, 1- to 10-point scale), complications, discharge disposition (home or rehabilitation facility), and LOS. Complications were defined as undesired or unexpected results of the operation including, but not limited to, dislocation, infection, heterotopic ossification, and limb length discrepancy. All AA cases used the same implants: a Pinnacle uncemented acetabular component, a highly cross-linked polyethylene liner, a Trilock BPS uncemented femoral stem, and a Biolox Delta ceramic femoral head (all Depuy, Warsaw, IN). All PA cases used a Zimmer Trabecular metal cup, a highly cross-linked polyethylene liner, a metal stem, and a cobalt chromium head (all Zimmer, Warsaw, IN). All patients were treated at a single location in the same academic medical center.

The AA was performed with the patient in the supine position on a HANA (Mizuho OSI, Union City, CA) operative table. The incision started 2 cm distal to and 2 cm posterior to the anterior superior iliac spine and continued distally for 8-10 cm in alignment with the lateral edge of the patella. This approach, between the tensor fascia lata and the sartorius muscles, has been described previously in greater detail [10,11,14,21]. The PA was performed with the patient in the lateral decubitus position on a standard operating table and pegboard. A posterior oblique incision was made centered over the posterior tip of the greater trochanter. The gluteus maximus muscle fibers were split, and the piriformis and conjoined tendon were reflected. The PA is also well described in previous orthopaedic texts [14,21,22].

We conducted financial analyses based on data compiled from the institution's finance department. Cost was separated into direct and indirect categories. Direct costs included all expenses immediately associated with the surgical procedure, whereas indirect costs were facility, overhead, support, and administrative in nature. Relevant direct cost items included anesthesia, blood bank, imaging, laboratories, operating room (OR) supplies/implants, OR time, postanesthesia care unit and supplies, pharmacy, physical therapy/occupational therapy, radiation oncology, respiratory, and routine room and board (RMBD). Costs associated with the surgical approach but not grouped into another category were defined as others. These costs included vascular laboratory and noninvasive cardiology expenses, critical care support services, gastrointestinal services, and others. We calculated the total cost of the surgical procedure by approach and the median cost per approach. Because of differences in implant usage and physician preference regarding postoperative pain medication, the total procedural costs were corrected to exclude pharmaceutical and implant costs.

We performed a statistical analysis of the data by calculating the mean, median, standard deviation, and range for continuous variables and frequencies and percentages of categorical variables where appropriate. Median cost was determined where the assumption of normal distribution could not be made. Differences in the averages for continuous variables between anterior and PA patients were tested using Student's *t* tests when the assumption of normality was satisfied. Mann-Whitney tests were used when such an assumption could not be made. Pearson's chi-square and Fisher's exact tests were used to examine differences in categorical variables. A P value of <.05 was considered to be a significant difference.

Results

Financial and perioperative outcomes of 167 THAs performed within a 6-month period were reviewed. Ninety-eight THAs were performed via the AA and 69 via the PA. Patient demographic data illustrated that patients in the AA and PA groups were similar in terms of age, gender, body mass index, and American Society of Anesthesiologists score ($P > .05$), as differences were found not to be statistically significant (Table 1). In both groups, the predominant indication for surgery was degenerative osteoarthritis.

Data related to the procedure and hospitalization showed several differences between the 2 groups. Mean surgical time was almost 7 minutes longer in the AA group than in the PA group (94.8 vs 88.3 minutes, $P = .005$, Table 2). Mean length of hospital stay was shorter in the AA group than in the PA (LOS: 2.12 vs 2.4 days, $P = .0132$, Table 2). The majority of patients in both groups had an LOS of 2 days (Table 3). However, a larger proportion of the AA patients were discharged to home vs to a rehabilitation facility (87.8% vs 71%, $P = .012$, Table 2).

Perioperative outcomes indicate that the AA patients experienced greater blood loss (452.6 vs 267.5 mL, $P < .0001$) and a greater reduction in pain (visual analog scale score: 3.5 vs 2.14, $P = .0003$). There were fewer complications (2% vs 4%, $P = .64$) noted in the AA group, but the difference in incidence of complications was not found to be statistically significant ($P = .64$, Table 4).

Financial results illustrated that the direct cost of AA THA was $1002 more than the PA per patient ($13,342 vs $12,340; Table 5). However, when the direct cost was adjusted to account for prices of implants used and medications provided, the PA THA costs were $580 more than the AA per patient ($P = .001$, Table 5). Based on the categorical direct cost data, the greatest difference in cost between the 2 approaches was in OR supplies/implants ($1493, Table 6). Differences in OR time, imaging, radiation oncology, and other costs were also significant contributors to the resultant cost difference (Table 6). In general, the costs associated with OR supplies/implants (AA: $8801, PA: $7308), OR time (AA: $1569, PA: $1397), and routine RMBD (both $916) comprised the greatest portion of the total cost of the procedure for each patient (Table 6). It is important to note that 9 PA patients, compared to just 1 AA patient, used radiation oncology services for prophylaxis and/or treatment for heterotopic ossification, costing between $575 and $1079 (Table 6).

Discussion

In this study, we compare early perioperative and financial outcomes of AA vs PA THAs. The results indicate that the patients who underwent the AA had a shorter LOS in the hospital than the patients who underwent the PA. However, the resultant impact on cost was minimal. When comparing direct costs of the surgical procedure, the AA was more expensive than the PA primarily due to the greater cost of the implant used in AA patients, a cost largely

Table 1
Characteristics of study population.

Characteristics	Anterior (n = 98)	Posterior (n = 69)	*P* value
Age	61.13	62.9	.12
Gender			
Male	45 (46%)	34 (49%)	.79
Female	53 (54%)	35 (51%)	
BMI	30.38	30.72	.39
ASA	2.44	2.39	.28
Surgical indications			
Osteoarthritis	96 (98%)	62 (90%)	
Avascular necrosis	1 (1%)	4 (6%)	
Developmental dysplasia of hip	1 (1%)	1 (1%)	
Fracture	0	2 (3%)	

ASA, American Society of Anesthesiologists; BMI, body mass index.

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