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ORIGINAL ARTICLE

Outpatient Surgery as a Means of Cost Reduction in Total Hip Arthroplasty: A Case-Control Study

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Abstract *Background:* The current healthcare market coupled with expedited recovery and improvements in analgesia have led to the development of total hip arthroplasty being performed as an outpatient procedure in selected patients. *Questions/Purposes:* The purpose of this study is to compare outcomes and cost-effectiveness of traditional inpatient THA with outpatient hip replacement at the same facility. *Patients and Methods:* This observational, case-control study was conducted from 2008 to 2011. One hundred nineteen patients underwent outpatient THA through a direct anterior approach. These cases were all performed by a single surgeon. Outpatient cases were then compared to inpatient hospital controls performed by the same surgeon at the inpatient hospital facility. *Results:* Complications, length of stay, demographic data, and overall costs were compared between groups. There was no difference in complications or estimated blood loss between groups. Most notably, the average overall cost in the outpatient setting was significantly lower than inpatient, $24,529 versus $31,327 ($p$=0.0001). *Conclusions:* This study demonstrates that appropriately selected patients can undergo THA in an outpatient setting with no increase in complications and at a substantial savings to the healthcare system.

Keywords Hip arthroplasty · Outpatient · Cost · Outcome

Introduction

Advancements in analgesia, postoperative rehabilitation, and standardization of postoperative protocols combined with refined surgical techniques have led to shorter lengths of stay and early mobilization after total hip arthroplasty (THA) [1, 6, 8, 10, 11]. These improvements coupled with an increasing push from patients, as well as third-party payers, to expedite recovery and return to activities has led to the implementation of total hip replacement as an outpatient procedure in select patients [2, 4]. Proponents of outpatient hip arthroplasty cite advantages of decreased cost, shorter length of stay, and decreased complications as rationale for performing the procedure [3].

As the demand for THA grows [7], it is possible that outpatient hip arthroplasty will be performed in more patients over the next decade. Moreover, impending financial constraints in the healthcare industry will demand higher quality care at a fraction of the current [5]. Yet, there are also concerns with performing outpatient arthroplasty which include emergency room readmissions in patients who have difficulty once home in the immediate postoperative period and some patients requiring transfer to an inpatient facility when they are experiencing a delayed recovery after surgery [2].

With the use of our institution's advanced postoperative analgesia and early rehabilitative protocols, outpatient arthroplasty has become a suitable alternative to inpatient joint replacement when performed in the correct patient. We believe this procedure can be safe alternative and performed at a lower final cost when compared to arthroplasty performed as an inpatient.

The primary objective of this study is to analyze the final cost savings in dollars of outpatient hip arthroplasty versus traditional inpatient THA. An additional goal was to report and compare the complication rate, average length of stay, and transfusion rates between the two groups. Lastly, the study was designed to identify any demographic or patient variables which differed between patients receiving outpatient THA compared to controls undergoing traditional inpatient THA.

Methods

From 2008 to 2011, 119 patients underwent THA through a direct anterior approach at an outpatient surgery center

Level of Evidence: Therapeutic Study Level III

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owned by a parent inpatient hospital. These patients were compared to 78 control patients undergoing THA at the same parent inpatient hospital by date of surgery and side of surgery. Under IRB approval, a retrospective analysis was performed. Patient information including electronic and hard copy charts, perioperative records, final non-itemized bill, and demographic information was collected. Patient gender, age, body mass index, blood loss, transfusion data, complications, the final non-itemized bill, length of stay, and discharge information were collected and analyzed for a ninety day period following surgery. Blood loss was recorded directly from the intraoperative anesthesia record and cross-referenced with the operative note. Complications included deep or superficial infection, thromboembolic events, mortality, pneumonia, urinary tract infections, intraoperative fracture, renal failure, and any other medical conditions which resulted in transfer from the outpatient surgery center to an inpatient facility for monitoring.

All cases at the outpatient facility as well as the inpatient hospital were performed by a single surgeon (D.S). Each patient was seen by an anesthesiologist and primary care physician for preoperative risk stratification and medical optimization. Patients with coronary artery disease, valve dysfunction, a history of stents, or those deemed high risk was also screened by a cardiologist. Location of surgery was selected in a nonrandomized fashion, and selection criteria for outpatient surgery were broad. Ultimately, decision for outpatient arthroplasty was part of a shared decision-making process between the surgeon and patient after a full review of the patient's preoperative work-up and risk stratification. Patients with stable medical conditions such as cardiac or renal disease were permitted to undergo outpatient hip arthroplasty if their risk stratification was deemed acceptable by their cardiologist or primary care physician. The only contraindications to performing outpatient hip arthroplasy were a patient who fell into the "high- risk" category by the cardiologist during risk stratification or individuals with poorly controlled medical comorbidities. Surgery was performed on a standard operative table without special attachments, through a direct anterior, Smith-Peterson, approach. Tranexamic acid was not given to any patients in either group of this study. Operative rooms were equipped with laminar flow with all members of the surgical team wearing body exhaust suits. All 197 patients underwent hypotensive regional spinal anesthesia during the procedure.

A standardized pain protocol was administered to all inpatient and outpatient subjects and included a preoperative, one time administration of 1,000 mg acetaminophen, 75 mg pregabalin, and 400 mg celecoxib unless contraindicated. Postoperatively, patients were administered 15 or 30 mg of intravenous ketorolac, 75 mg pregabalin twice daily, and Tylenol 650 mg every 6 h. Additionally, patients were prescribed lortab 7.5-mg tablets or dilaudid 2-mg tablets for pain at discharge.

Postoperatively, patients in both groups received identical multimodal VTE prophylaxis; mobilization on the afternoon of postoperative day 0 by a physical therapist, intermittent pneumatic compression devices, and pharmacologic thromboprophylaxis with enoxaparin 40 mg daily for 10 days followed by aspirin 325 mg twice daily for four additional weeks. Institutional thresholds for transfusions occurred with hematocrit less than 25 mg/dl or any symptomatic patient. Patients were able to donate autologous blood preoperatively, and these patients were re-transfused during the case.

Each patient in both groups was seen by physical therapy preoperatively and counseled for education and on anterior hip precautions. Postoperative zero patients are mobilized once motor function has returned and are made full weight bearing as tolerated and ambulation with assistance. Criteria for discharge from physical therapy include independent transfers, ability to climb stairs, and walk one hundred feet. Patients are then examined on postoperative day two by a visiting nurse to inspect the wound and draw blood for measurement of hemoglobin and hematocrit. Patients who underwent outpatient were required to be discharged home or transferred from the hospital at 23 h postoperatively.

Indications for transfer to an inpatient facility from the outpatient surgery center were stringent and included any unstable patient, uncontrolled postoperative pain, postoperative nausea and vomiting, new onset cardiac arrhythmias, intraoperative complications precluding early discharge, and failure to clear physical therapy for discharge.

Cost was determined using the sum of final charges which were recorded by both the inpatient facility and outpatient surgery center. These bills were non-itemized and represented the final cost which was billed to the patient or third-party payer.

Univariate statistical analysis was performed by our institutions statistician using student's *t* test and chi-squared. A computerized software post hoc power analysis was also conducted (Minitab © v13.2). At beta=0.8, and using typical values reported in the literature for the studied variables, a difference in overall complication rates, cost, demographics, blood loss, and transfusions rates could be detected. However, the sample size was too small to detect a statistical difference in rates of infection, mortality, and venous thromboembolic events.

Results

A total of 197 cases, 119 outpatient and 78 inpatient, were reviewed and collected. Demographic information was collected (Table 1) and analyzed. Although not statistically significant, the age of the outpatient group was younger than inpatient (58.97 versus 61.51 years). BMI was significantly lower in the outpatient group (28.1 versus 33.16), $p=0.0047$. There was no difference with respect to complications, ($p=0.154$) or estimated blood loss ($p=0.224$) between groups. Outpatients had a much shorter average length of stay, 24.4 versus 73.84 h ($p=0.0001$) with four outpatients requiring transfer to the parent, inpatient facility. The average length of stay of the four admitted outpatients was 47.5 h. All patients undergoing outpatient THA were discharged home; whereas 18 of 78 patients undergoing inpatient THA were discharged to a rehabilitation facility or skilled nursing facility. There were no complications in the inpatient cohort.

Table 1 Demographics and univariate analysis

	Inpatient cohort	Outpatient cohort	*P* value
Number	78	119	
Sex			
Male	26	71	
Female	52	48	
Age (years)	61.5±13.2	59±5.8	0.07
BMI	33.2±6.7	28.1±3.5	*0.0001*
Estimated blood loss (ml)	352.9±153	328.6±125	0.224
Required transfusion	73	90	*0.009*
Discharge destination			*0.001*
Home	60	119	
Rehabilitation	18	0	
Length of stay (hours)	73.8±24.1	24.6±8.9	*0.001*
Final cost (USD)	$31327±9013	$24529±1759	*0.001*
Complications	0	4	0.154

Values in italic are statistically significant

There were no documented infections, mortalities, or thromboembolic events in either group. Most notably, the average final non-itemized bill charged to the patient or third-party payer in the outpatient setting was significantly lower than inpatient, $24,529 versus $31,327 ($p$=0.0001) (Table 1).

There were no readmissions in either cohort; however, the outpatient THA group had four complications requiring transfer to inpatient facility. The first patient had postoperative desaturations and a negative workup for pulmonary embolism. The patient's chest radiograph revealed atelectasis and responded well to supplemental oxygen. The patient was admitted for observation and monitoring and were discharged home at 23 h postoperatively. The second patient was transferred for intraoperative EKG changes from baseline for overnight monitoring on the telemetry flood and was discharged on postoperative day 3, at 72 h. Lastly, two patients in the outpatient group sustained non-displaced fractures of the calcar femorale noted intraoperatively. A cerclage wire was placed and the femoral prosthesis was reinserted. Both patients were made weight bearing as tolerated and transferred to the inpatient facility postoperatively. They were discharged home at 23 and 72 h, respectively. The average cost of the four patients who were transferred was $24,795.

Discussion

Innovative methods to safely decrease healthcare costs, such as outpatient THA, are growing in popularity. This study demonstrates that appropriately selected patients can undergo THA in an outpatient setting with no increase in complications and at a substantial savings to the healthcare system. Furthermore, outpatient THA may play an integral role in decreasing length of stay and healthcare costs in the future.

There are several important limitations to this study. First, there is a clear selection bias as patients chosen for outpatient THA have a lower BMI compared to controls. Also, patients selected for outpatient hip arthroplasty were younger and this approached significance. Secondly, the size of our cohort limits the ability of this study to comment with certainty on rare events such as mortality and pulmonary embolism. Lastly, the financial analysis only included the final non-itemized bill sent to the patient. Unfortunately, we were not able to study individual charges or actual costs associated with the various aspects of the procedure, nor did or bill include the cost of additional rehabilitation our outpatient therapy once the patient was discharged from either the inpatient or outpatient setting. While our costs reflect accurate final non-itemized bills, a more detailed prospective study reviewing all of the particular costs from the first office visit until one year follow-up with a formal cost analysis would help identify potential areas of cost savings and containment. Despite our limitations, the data has been collected in the most accurate and objective manner possible and does suggest notable differences between the cohorts. In the future, the limitations of this study could be resolved through a large, multicenter, prospective, randomized clinical trial for patients undergoing hip arthroplasty.

Body mass index was significantly lower in patients undergoing outpatient THA, p=0.0001. Age, approached significance, p=0.07, with outpatient THA performed in younger patients. While these differences in demographics reflect the inherent selection bias of the study, they also support the general trend of our country where physicians tend to select and perform outpatient procedures on younger, healthier patients [7]. Though there is an inherent bias, selecting younger patients with a lower BMI to undergo outpatient hip arthroplasty instead of inpatient, it still represents an opportunity to reduce overall cost to the healthcare system. The ideal patient for outpatient arthroplasty seems to be those who are the young and with the fewest number of risk factors for surgery. Patients ought to have little medical comorbidity, and if they do have a history of an underlying medical condition, it must be stable. Furthermore, patients should have a lower BMI, and we would caution against performing outpatient arthroplasty in elderly patients

As expected, length of stay was significantly shorter in the outpatient THA group. While this study does not include an itemized list of individual charges to the patients, review of the differences of gross final cost between the two groups support the hypothesis that a reduction in length of stay

would translate into a reduction in overall healthcare expenditure for THA.

We found no difference in rates of transfusion or blood loss between the two groups. Also, the transfusion rate at our institution was higher than previously described [9]. The transfusion data includes patients transfused with autologous and allogenic red blood cells, the majority of whom were re-transfused with autologous blood donated preoperatively.

There were no complications in the inpatient group and four complications in the outpatient group which resulted in transfer to the inpatient facility, although the difference was not significant. Furthermore, there were no thromboembolic events or infections in either cohort. While this may be attributed to aggressive mobilization and multimodal thromboembolic prophylaxis, it is also certain that our cohort is too small to comment on such complications with reliable certainty. A larger study would be necessary to address difference between these two groups.

Lastly, there was a significant difference in ultimate cost demonstrated between the two groups when comparing non-itemized final patient billing records, $24,529 versus $31,327, $p=0.0001$. Though the average cost of the four patients who required admission to the inpatient hospital was higher than the average of the remaining outpatients, $24,795 versus $24529, it was still significantly lower than the average cost of inpatient procedures, $31,327. While the use of itemized charges would have lent itself to an interesting evaluation and possible identification of particular areas of savings and cost containments, the final bills represent a general idea of potential savings if outpatient hip replacement is utilized in the correct patient.

As the population increases and ages, demand for THA will increase dramatically. Unfortunately, the current healthcare climate is one focused on cost containment and quality control. As such, orthopedists are faced with the challenge of meeting this demand and producing successful outcomes while reducing cost to the system. To ensure patient safety and limit readmissions from outpatient arthroplasty, we believe it is important to have strict guidelines in place for physical therapy clearance as well as physiologic parameters for discharge home or indications to transfer to an inpatient facility. Through selection of appropriate patients who are younger with a low BMI and little medical comorbidity, orthopedic surgeons can perform THA safely in the outpatient setting at a significant reduction in the final cost compared to inpatient hip replacement in similar patients.

Disclosures

Conflict of Interest: Michael Aynardi, MD, Zachary Post, MD, and Dean C. Sukin, MD have declared that they have no conflict of interest. Alvin Ong, MD reports personal fees from Stryker and Smith and Nephew, outside the work. Fabio Orozco, MD reports personal fees from Stryker, outside the work.

Human/Animal Rights: All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008 (5).

Informed Consent: Informed consent was waived from all patients for being included in the study.

Required Author Forms Disclosure forms provided by the authors are available with the online version of this article.

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