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Preoperative Pain Level and Patient Expectation Predict Hospital Length of Stay After Total Hip Arthroplasty

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ABSTRACT

The purpose of this study was to identify preoperative predictors of length of stay after primary total hip arthroplasty in a patient population reflecting current trends toward shorter hospitalization and using readily obtainable factors that do not require scoring systems. A retrospective review of 112 consecutive patients was performed. High preoperative pain level and patient expectation of discharge to extended care facilities (ECFs) were the only significant multivariable predictors of hospitalization extending beyond 2 days ($P = 0.001$ and $P < 0.001$ respectively). Patient expectation remained significant after adjusting for Medicare's 3-day requirement for discharge to ECFs ($P < 0.001$). The study was adequately powered to analyze the variables in the multivariable logistic regression model, which had a concordance index of 0.857.

Total hip arthroplasty (THA) is one of the most commonly performed and cost-effective orthopedic procedures [1,2]. By 2030, the number of primary THA in the United States is estimated to rise by 174% to 572,000 procedures [3]. This increased demand will undoubtedly place tremendous strain on existing hospital resources and calls for a greater understanding of the factors associated with hospital length of stay (LOS) to ensure efficient provision of health services.

In recent years, the LOS following THA in the U.S. has decreased substantially, in part due to refined surgical techniques including minimally invasive approaches [4] and implementation of postoperative clinical pathways emphasizing multimodal analgesia and rapid mobilization [5–7]. Medicare's prospective payment system is another incentive for shorter LOS. Medicare provides fixed payments to hospitals based on diagnosis related groups. The longer patients stay, the more money hospitals lose. In response to this financial incentive associated with shorter LOS, there has been an increased utilization of and tendency to discharge to extended care facilities (ECF), such as acute rehabilitation and skilled nursing facilities. Among Medicare beneficiaries, the mean hospital length of stay LOS after THA has decreased from 9.1 days to 3.1 days between 1991 and 2008 with a concomitant four-fold increase in the rate of discharge to ECF [8].

Previous studies have identified several factors that influence LOS after primary THA, including age [9–12], sex [9,10,12], comorbidities [12,13], body mass index [14], surgical approach [15], use of assistive devices [16], functional status [12], general health perception [10,13], and surgeon experience [10]. However, many of those studies had significantly long mean LOS [9,10], excluded patients with diagnoses other than primary osteoarthritis [16], focused only on select comorbidities [12], or required the use of time-consuming scoring systems [10,13]. Furthermore, previous studies often had postoperative rehabilitation protocols geared toward discharge to home [16], which has limited application to current practice where patients with slow postoperative recovery can be discharged to ECF. Most importantly, factors such as preoperative pain level, caregiver assistance, and patient expectation were often not investigated.

Predicting the LOS following THA is important for optimizing hospital resources and helping guide patient expectations. Building on previous studies, the purpose of this investigation was to identify preoperative predictors of LOS after primary THA in a patient population reflecting current trends toward shorter hospitalization and using readily obtainable factors that do not require scoring systems.

Materials and Methods

This study was approved by the institutional review board at our hospital. The primary outcome of the study was LOS, defined as the number of nights from admission to discharge. Because the standard target for discharge in our practice is postoperative day 2, prolonged

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hospitalization was defined as LOS >2. Our institution is a tertiary care teaching hospital performing about 600 THA annually with a large volume of revision and conversion procedures. All patients admitted the three senior authors between January 1, 2012 and December 31, 2012 with CPT code 27130 (THA) as the primary procedure were included in the study. The senior authors are full-time joint arthroplasty surgeons who followed the same postoperative clinical pathway described below. One hundred and twelve patients were identified and their medical records were retrospectively reviewed for factors including age, sex, pain level, body mass index (BMI), number of comorbidities, use of assistive devices, history of prior total hip or knee arthroplasty (TKA), history of prior ECF admission, patient expectation of discharge destination, and caregiver assistance at home. A comorbid condition was defined as any condition requiring active medical treatment. Because a majority of patients carried a diagnosis of arthritis and were receiving medications for joint pain at the time of surgery, arthritis was counted as a comorbid condition only if it involved joints other than the hip that was replaced. We intentionally chose to assess health status based on the number of active conditions in order to eliminate the use of scoring systems, which was one of the goals of this study. Caregiver assistance was classified as either adequate or inadequate depending on whether the caregiver was 1) able and 2) available to provide for patient needs (meals, hygiene, transfers, etc.). Pain level was assessed at the time of preoperative anesthesia evaluation and collected using the numeric rating scale for pain (NRS). NRS is an 11–point scale (0–10) for patient self-reporting of pain with "0" indicating no pain and "10" indicating the worst imaginable pain. Expectation of discharge destination was collected at the time of initial PT/OT session as described below.

While primary osteoarthritis was the predominant indication for THA, there were no exclusions based on operative diagnosis. Three surgeons performed the operations using either posterior or direct lateral approaches. A variety of cementless implants were used. All patients were admitted from home on the day of surgery. Following THA, patients were managed with a standardized clinical pathway with regards to pain control, mobilization, anticoagulation, and discharge criteria. Spinal anesthesia and single-shot fascia iliaca block were used unless contraindicated. Intravenous patient-controlled analgesia was provided immediately following surgery and transitioned into oral narcotics on the first postoperative day. Unless contraindicated, enoxaparin was used for DVT prophylaxis. Physical and occupational therapy (PT/OT) was initiated on the day of surgery and continued daily until discharge. The primary goals of the first PT/OT session were to assess patients' needs, review acute rehabilitation goals, assist with mobility as tolerated, and initiate preliminary discharge planning. As part of the preliminary discharge planning, the therapists inquired about patients' expectation of discharge destination, which was grouped into either home or ECF (acute rehabilitation and skilled nursing facilities). During the period the hip arthroplasties in this study were performed, patients were provided with informational packets in clinic describing the procedure, benefits, complications, and rehabilitation. They were also given the option of attending a total joint camp, but participation was low and did not exceed 20%. Preoperatively, patients were informed that their destination of discharge to home versus ECF depended on their progress with PT/OT postoperatively. They were also informed that the target day of discharge to home is the second postoperative day and to ECF the third postoperative day pending the discharge criteria met. Patients were cleared for discharge when they were medically stable, had adequate pain control, were able to void and tolerate oral diet, had no surgical concerns, and were functionally suitable for their discharge destination as determined by PT/OT.

Results for continuous variables were summarized using the mean and standard deviation for normally distributed variables and the 50th (25th, 75th) percentiles or range for non-normally distributed variables. Categorical variables were presented using counts and percentages (rounded to the nearest percent). Continuous variables were tested for normality using the Kolmogorov–Smirnov test. Variables determined to be normally distributed were compared using Student's t-test, while variables non-normally distributed were compared using the Kruskal–Wallis non-parametric test. The relationship between each categorical variable and LOS was assessed using the chi-square test, or Fisher's exact test was utilized in the presence of small cell counts (any expected cell count <5). All statistical tests were two-sided, and a P-value ≤ 0.05 was considered statistically significant. Following univariable analysis, statistically significant factors were subjected to a multivariable stepwise logistic regression analysis to determine the variables associated with LOS. Only variables with P-value ≤ 0.05 remained in the model. The linearity assumption between each continuous variable and the logit of the probability that LOS >2 was verified and transformations made if necessary. The concordance index (C-index) was used to determine how well the model discriminated between different responses. The conditional power of the study given the sample size and odds ratio of significant multivariable model covariates was reviewed for statistical adequacy. SAS version 9.2 was used for all analyses.

Results

One hundred twelve patients were included in this study. There were 58 males and 54 females with a median age of 61.0 years (range 25–85). The median BMI, pain level, and number of comorbidities were 28.6 (range 17.0–47.2), 4.5 (range 0–10), and 2 (range 0–7) respectively. All patients were admitted from home. 41 patients (37%) used assistive devices prior to surgery. Eight patients (7%) had prior THA in the contralateral side and 30 patients (27%) had prior TKA. One hundred four patients (93%) had adequate caregiver assistance at home. The demographic features of the study cohort are outlined in Table 1.

The mean LOS was 2.5 days (range 2–6). Ninety-two patients (82%) were discharged to home and 20 (18%) were discharged to acute rehabilitation centers or skilled nursing facilities. Factors that were not significantly correlated with prolonged LOS were sex ($P = 0.062$), BMI ($P = 0.439$), prior THA in the contralateral limb ($P = 0.326$), and use of assistive devices ($P = 0.090$). Univariable analyses revealed a significant independent association between LOS and number of comorbidities ($P = 0.003$), prior ECF admission ($P = 0.037$), caregiver assistance ($P < 0.001$), and a having a history of TKA ($P = 0.017$); however, these associations did not remain significant after multivariable analysis. Age was a borderline significant multivariable predictor ($P = 0.052$), while pain level ($P = 0.001$) and patient expectation of discharge destination ($P < 0.001$) were the only significant preoperative variables that remained in the final multivariable model. The C-index for the

Table 1
Demographic Features of the Study Group With Univariable Relationship of Each Preoperative Factor With Length Of Stay.

Feature	LOS ≤2	LOS >2	*P* Value
N	74	38	
Age	60 (54, 66)	66.5 (57, 77)	0.002
Male	43 (58%)	15 (40%)	0.062
Female	31 (42%)	23 (60%)	
BMI	28.6 (25.2, 32.2)	28.6 (19.1, 36.1)	0.439
Pain level	4 (1, 5)	6.5 (5, 8)	<0.001
Number of comorbidities	2 (1, 3)	3 (2, 4)	0.003
Use of assistive device	23 (31%)	18 (47%)	0.090
History of ECF admission	0 (0%)	3 (8%)	0.037
History of THA	22 (30%)	8 (21%)	0.326
History of TKA	2 (3%)	6 (16%)	0.018
Assistance at home			<0.001
Adequate	74 (100%)	30 (79%)	
Inadequate	0 (0%)	8 (21%)	
Expectation of discharge destination			<0.001
Home	73 (99%)	19 (50%)	
ECF	1 (1%)	19 (50%)	

Data are presented as *N* (%) or 50th (25th, 75th) percentiles.
ECF = extended care facility.