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Perioperative Predictors of Length of Stay After Total Hip Arthroplasty

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ABSTRACT

Background: Few studies had examined whether specific patient variables or performance on functional testing can predict length of stay (LOS) after total hip arthroplasty (THA). Such tools would enable providers to minimize prolonged LOS by planning appropriate discharge dispositions preoperatively.
Methods: We prospectively recruited 120 patients undergoing a THA through an anterior (n = 40), posterior (n = 40), or lateral (n = 40) approach. Patients performed a timed up-and-go (TUG) test preoperatively to determine if it was predictive of hospital LOS after THA. Other variables of interest included patient age, body mass index, age-adjusted Charlson Comorbidity Index, mean procedure time, and time spent in the postanesthetic care unit. A logistic regression analysis was performed to determine which variables predicted LOS greater than 48 hours, which is our institution's target time to discharge.
Results: The TUG test was predictive of LOS beyond 48 hours. For every 5-second interval increase in TUG time, patients were twice as likely to stay in hospital beyond 48 hours (odds ratio [OR] = 2.02, 95% confidence interval [CI] = 1.02-4.01, $P = .043$). Patient age (OR = 0.97, 95% CI = 0.90-1.05, $P = .46$), body mass index (OR = 1.01, 95% CI = 0.86-1.18, $P = .90$), Charlson Comorbidity Index (OR = 1.29, 95% CI = 0.68-2.44, $P = .44$), mean procedure time (OR = 1.05, 95% CI = 0.97-1.14, $P = .27$), and mean time in the postanesthetic care unit (OR = 1.00, 95% CI = 0.99-1.00, $P = .94$) were not predictive of increased LOS.
Conclusion: The TUG test was predictive of hospital LOS after THA. It is a simple functional test that can be used to assist with discharge planning preoperatively to minimize extended hospital stays.

Total hip arthroplasty (THA) remains the most effective treatment modality for hip arthritis and is often regarded as one of the most important surgical advances in orthopedic surgery [1]. The rising disease and financial burden of hip osteoarthritis have increased pressures to reduce hospital length of stay (LOS) after elective surgery such as THA [2]. An area of interest is the impact of preoperative functional testing on hospital metrics such as hospital LOS.

It is well established that patient factors such as obesity and comorbidities such as heart, lung, and liver disease predict increased LOS after THA [3-6]. Few studies have examined the predictive value of functional testing or clinical outcome scores on LOS after THA. Adding a simple functional assessment tool predictive of LOS would enable providers to minimize prolonged hospital stays by planning alternative discharge dispositions preoperatively for patients who may have reduced baseline mobility.

The purpose of our study was to examine the impact of patient variables and performance on a simple functional walking test on perioperative outcomes after THA. We hypothesized that that specific patient factors (ie, increased number of comorbidities) and worse functional performance preoperatively would correlate with prolonged LOS in hospital.

Materials and Methods

Institutional review board ethics approval was attained for study completion. Patients were recruited consecutively from the clinics of 1 of the 3 fellowship trained arthroplasty surgeons at our institution. Informed consent for THA was attained for those patients whose hip arthropathy was deemed most appropriately treated with surgical intervention.

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Patients were included if they consented for THA performed through either an anterior, posterior, or lateral approach, were older than 19 years, and did not meet any of the exclusion criteria. Exclusion criteria included body mass index (BMI) was >40 kg/m^2, prior hip surgery, cemented THA, bilateral THA, use of implants other than those standardized for the study, non-English–speaking patients, cases performed by trainees (residents or fellows), or preoperative diagnosis other than osteoarthritis or avascular necrosis.

At the time of enrollment, patient age, gender, and BMI were collected. Comorbid conditions acquired through history taking or electronic medical records were used to calculate the Charlson Comorbidity Index (CCI) [7]. The primary diagnosis causing arthropathy of the hip joint (ie, osteoarthritis, avascular necrosis) was determined based on patient history and radiographic images. Surgical approach and operative side were also recorded.

Each patient also completed a timed up-and-go (TUG) test preoperatively as a preoperative measure of function. The test begins with the patient sitting in a chair with armrests. On the word "go", the patient walks to a 3-meter mark, turns, returns to the chair, and sits down [7]. The time from the word "go" to the instant the patient's buttock contacts the chair is recorded to the nearest tenth of a second. The patient performs the test in their normal footwear and is allowed to use an assisted device (ie, cane). The patients performed the test 3 consecutive times, and the average time was calculated for analysis.

Each surgical approach was performed as outlined in a recent report by the authors [8]. The anterior approach was performed with the use of a specialized operating room table (Hana fracture table; Mizuho OSI, Union City, CA). A general anesthetic was used for all patients in the anterior approach cohort. The use of a general vs spinal anesthetic for the posterior and lateral approach cohorts was at the discretion of the anesthesiologist and patient. All patients received a periarticular anesthetic injection before wound closure. The injection cocktail was either ropivicaine (0.35%) with morphine (10 mg) and ketorolac (30 mg) or plain ropivicaine if there were contraindications to nonsteroidal anti-inflammatories.

Each patient received standardized implants: a hydroxyapatite-coated, cementless femoral stem (Corail stem; DePuy Orthopaedics Inc, Warsaw, IN), a cementless acetabular cup (Pinnacle Sector II acetabular cup; DePuy Orthopaedics Inc), a highly cross-linked polyethylene liner (AltrX polyethylene liner; DePuy Orthopaedics Inc), and a cobalt chrome femoral head (Articul/eze cobalt chrome; DePuy Orthopaedics Inc). Cancellous screws (DePuy Orthopaedics Inc) were inserted to augment acetabular fixation at the surgeon's discretion.

Postoperatively, all patients were admitted to an orthopedic ward. Each patient received 24 hours of postoperative antibiotics, as well as prophylaxis against deep vein thrombosis. Analgesia was managed by our institution's acute pain service. All patients were permitted to weightbear as tolerated with the use of a gait aid as needed. All patients received standardized physiotherapy in accordance with our institution's hip arthroplasty discharge pathway. Hospital LOS was acquired from the electronic record.

Demographics were summarized with descriptive statistics including frequencies, means, and standard deviations. Categorical demographics were tested using cross tabulation with Pearson chi-square, and scale variables were tested for significance using parametric (*t* test, analysis of variance) or nonparametric (Kruskal-Wallis) depending on the distribution of the variable. Post hoc testing was performed using the Scheffé test when appropriate. Logistic regression was performed to establish preoperative and perioperative characteristics that substantially predicted patient LOS after THA. The target LOS at our institution is 48 hours; therefore, we divided hospital stay into 2 categories: <48 hours or >48 hours.

Preoperative variables that were deemed clinically important were introduced into the regression model (age, BMI, age-adjusted CCI, procedure time, and preoperative TUG time). Odds ratios (ORs) were reported for significant variables. Statistical significance was set at $P < .05$. SPSS, version 23 (SPSS Inc, Chicago, IL), was used for all analyses.

Results

One hundred eighty patients were approached for study participation. After exclusion, 120 patients were enrolled in the study and had completed preoperative data (Fig. 1). There were no significant demographic differences across the cohort (Table 1). The mean procedure time was 59.9 ± 13.1 minutes. The mean LOS was 54.3 ± 26.4 hours for the entire cohort. Post hoc testing revealed a significantly shorter LOS for the anterior approach cohort ($P < .001$ for both pairwise comparisons, Table 1). For every 5-second interval increase in TUG time, patients were twice as likely to stay in hospital beyond 48 hours (OR = 2.02, 95% confidence interval [CI] 1.02-4.01, $P = .043$). Patient age (OR = 0.97, 95% CI = 0.90-1.05, $P = .46$), BMI (OR = 1.01, 95% CI = 0.86-1.18, $P = .90$), CCI (OR = 1.29, 95% CI = 0.68-2.44, $P = .44$), and mean procedure time (OR = 1.05, 95% CI = 0.97-1.14, $P = .27$) were not predictive of increased LOS. The mean preoperative TUG times for patients discharged before 48 hours were significantly less than those discharged after 48 hours (Table 2).

Discussion

The purpose of our study was to determine whether patient factors and a simple preoperative functional assessment tool predict perioperative outcomes after THA. The TUG test is a simple, time-efficient functional assessment tool that correlated with LOS after THA. Other patient variables examined did not predict increased LOS in hospital.

For a functional assessment tool to truly be predictive of an outcome variable such as LOS, it is important to control for other variables. The same surgeon performed each procedure and surgical approach, thus optimizing the internal validity of our study. We included the 3 most commonly performed surgical approaches for THA to ensure that the TUG was still predictive of LOS regardless of approach. We standardized the implants used in the study to mitigate implant selection as a confounder. The postoperative protocol was similar for each patient with respect to acute pain service assessments and periarticular injections to ensure that all patients had optimal postoperative analgesia. All patients were

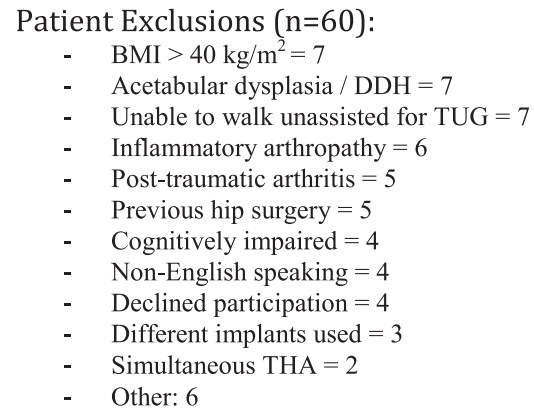

Fig. 1. Patient exclusions during recruitment. BMI, body mass index; DDH, developmental dysplasia of the hip; THA, total hip arthroplasty; TUG, timed up-and-go.