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Research Article

Does Discharge Disposition or Length of Stay for Patients Undergoing Staged Bilateral Total Joint Arthroplasty Change Between First and Second Procedures?

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Introduction

This study investigates whether ambulatory surgery rates, discharge disposition, or hospital length of stay (LOS) differ between the first and second surgeries for staged bilateral total joint arthroplasty (TJA). We hypothesize that patients have higher rates of ambulatory surgery and shorter LOS for the second surgery.

Methods

Data were retrospectively collected from staged bilateral total knee (TKA) or total hip arthroplasty (THA) patients within a 12-month period. Ambulatory surgery rates, discharge to home, and LOS after first (LOS_1) vs. second surgery (LOS_2) were compared. Multivariable regression analysis was performed to identify predictors of shorter LOS.

Results

Rates of ambulatory surgery were significantly higher after second surgery for TKA (28.7% vs. 20.2%, p<0.001) but not for THA (24.8% vs. 23.0%, p=0.405). Likelihood of discharge to home was not significantly different between first and second surgeries for TKA (p=0.225) or THA (p=0.248). LOS_2 was significantly shorter than LOS_1 for TKA (1.4 vs 1.6 days, p=0.005) but not for THA (1.4 vs 1.4 days, p=0.723). Undergoing TKA

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(OR=1.846, 95% CI=[1.142, 2.984]), former smoking (OR=1.686, 95% CI=[1.068, 2.660]), and younger age (OR=0.968, 95% CI=[0.939, 0.997]) were associated with LOS_2<LOS_1.

Conclusions

Our results show higher rates of ambulatory surgery and shorter LOS after second surgery vs. first for staged bilateral TKA but not THA. Factors associated with LOS_2<LOS_1 include undergoing TKA, former smoking, and younger age.

INTRODUCTION

Bilateral total hip arthroplasty (THA) and total knee arthroplasty (TKA) are commonly performed as staged procedures. While some literature on bilateral total joint arthroplasty (TJA) compares outcomes and expectations between the two stages (Gabr et al. 2011a; Poultsides et al. 2012; Scott et al. 2014), whether there is a difference in terms of ambulatory surgery rates, discharge disposition, or length of stay remains understudied. This is especially relevant in today's evolving healthcare landscape, with recent studies demonstrating a trend toward shorter inpatient length of stay (LOS) and more TJA being performed in the outpatient setting (Sarpong et al. 2019; Debbi et al. 2022; Haas et al. 2022). In particular, it is projected that over half of primary THA and TKA will be conducted in the outpatient setting by 2026 (DeCook 2019; McClatchy et al. 2021). Furthermore, the impact of the COVID-19 pandemic on TJA must also be acknowledged, with increased same-day discharges and decreased LOS reported following the pandemic (Piple et al. 2023).

Despite the recent shift towards outpatient TJA, patient perceptions and expectations have not been as quick to adapt. Multiple studies have found that patients still display hesitancy about outpatient TJA, expressing concerns about pain, mobility, and risk of falls, with one study reporting that roughly two-thirds (64.6%) would prefer to stay in the hospital following TJA (Pagani et al. 2022; Meneghini and Ziemba-Davis 2017; Adelani and Barrack 2019). These findings highlight the importance of preoperative education in managing patient expectations and, in the context of staged bilateral TJA, understanding whether patient expectations might change after they have experienced the first stage.

The purpose of this study is to determine whether ambulatory surgery rates, discharge disposition, or length of stay differ between first and second surgeries in staged bilateral TJA patients. Secondarily, we investigated whether there are any patient-specific factors that can predict shorter LOS in this context.

METHODS

Following Institutional Review Board approval, data were retrospectively collected from consecutive patients who underwent staged bilateral primary TKA or THA between March 2015 and August 2022 (Level of Evidence III). The surgeries were performed by four fellowship-trained arthroplasty surgeons at a single, tertiary academic medical center with a robust pre-operative education program in place with an emphasis on modern early mobility and recovery protocols. Inclusion criteria comprised patients 18 years of age or older who underwent both procedures within one year of each other. The cutoff of one year was chosed based on previous studies which use it as a threshold to define bilateral staged surgery (Bini et al. 2014; Sheth et al. 2016). Patients undergoing revision, conversion TKA/THA, or those with indication for fracture were excluded. All patients, including those undergoing ambulatory surgery, had access to the same preoperative and postoperative educational resources.

Demographic information and variables such as age, sex, smoking status, and a past medical history of diabetes mellitus were recorded for each patient. Comorbidities were collected to calculate the Charlson Comorbidity Index (CCI). Length of hospital stay (recorded in whole numbers reflecting the number of nights spent in the hospital) and whether the patient was discharged to home or subacute

Table 1. Demographics and Baseline Characteristics

Variable	Total (N=433)	TKA (N=272)	THA (N=161)
Age, years (range)	67 (60-74)	68 (63-75)	64 (56-72)
Charlson Comorbidity Index (CCI)	3 (2-4)	3 (2-4)	2 (1-3)
Diabetes mellitus, % (n)	17.6% (76)	21.7% (59)	10.6% (17)
Male sex, % (n)	34.9.0% (151)	29.4% (80)	44.1% (71)
Smoking Status			
Never, % (n)	63.1% (273)	65.1% (177)	59.6% (96)
Former, % (n)	31.4% (136)	29.4% (80)	34.8% (56)
Current, % (n)	5.5% (24)	5.5% (15)	5.6% (9)

rehabilitation (SAR) was collected for the first and second surgeries.

DISCHARGE DISPOSITION AND LOS

Ambulatory surgery (defined as same-day discharge) rates and discharge rates to home were compared between first and second surgery for TKA and THA cohorts. The LOS after first surgery (LOS_1) was compared to the LOS after second surgery (LOS_2) for the individual TKA and THA cohorts. Subgroup analyses were also performed for TJA cohorts before and after the start of the COVID-19 pandemic (defined as having both stages performed before/after March 2020).

FACTORS ASSOCIATED WITH LOS

The mean LOS (defined as mean of LOS_1 and LOS_2) was then computed for each patient and multiple linear regression analysis was performed to determine if any patient specific factors (age, smoking status, diabetes mellitus, CCI) were associated with shorter mean LOS. Patients were then sorted into groups depending on whether their second hospital stay was shorter than their first (LOS_2 < LOS_1), and multivariable logistic regression analysis was performed to identify factors associated with shorter LOS_2.

DATA ANALYSES

Statistical analysis was performed using SPSS (version 29.0.0.0, IBM). Discharge rates to home and ambulatory surgery rates were compared using McNemar's test for paired proportions. LOS_1 and LOS_2 were compared to each other using a paired-samples t-test. Multiple linear and logistic regression analyses were used to identify factors associated with mean LOS and LOS_2 < LOS_1, respectively. A cutoff of $p<0.05$ was considered statistically significant.

DEMOGRAPHICS

A total of 443 patients underwent staged bilateral TKA or THA by four surgeons between March 2015 and August 2022. Of these, 272 underwent TKA and 171 underwent THA. The demographic information for the total, TKA, and THA cohorts is listed in Table 1.

RESULTS

DISCHARGE DISPOSITION AND LOS

Rates of ambulatory surgery (same-day discharge) were significantly higher after second surgery for TKA (28.7% vs. 20.2%, $p<0.001$, 95% CI [4.71, 12.20]) but not for THA (24.8% vs. 23.0%, $p=0.405$, 95% CI [-2.52, 6.24]). Discharge rates to home were not significantly different between the first and second surgeries for TKA (86.8% vs 88.6%, $p=0.225$) or THA (91.3% vs 88.8%, $p=0.248$).

LOS_2 was significantly shorter than LOS_1 (1.39 vs 1.58 days) for the TKA cohort by paired-samples t-test ($p=0.005$) with a 95% confidence interval (CI) of [0.062, 0.336] for the mean difference, but not for those undergoing THA (1.41 vs 1.38 days, $p=0.723$, 95% CI [-0.142, 0.204]).

274 staged bilateral TJA were performed before March 2020, and 159 were performed after March 2020. In the pre-March 2020 group, there was no significant difference between first and second surgeries in terms of ambulatory surgery rates (6.6% vs. 4.0%, $p=0.092$), discharge rates to home (83.6% vs. 84.3%, $p= 0.832$), and LOS (1.92 vs. 1.82 days, $p=0.162$, 95% CI [-0.041, 0.246]). In the post-March 2020 group, there was no significant difference in discharge rates to home (96.9% vs 96.2%, $p=1.000$) and LOS (0.79 vs. 0.66 days, $p=0.102$, 95% CI [-0.027, 0.291]), but ambulatory surgery rates were significantly higher after second surgery (62.9% vs. 50.9%, $p<0.001$).

FACTORS ASSOCIATED WITH LOS

On multiple linear regression analysis, no patient-specific factors (age, diabetes mellitus, Charlson comorbidity index, smoking status) were predictive of mean LOS (Table 2). On multivariable logistic regression analysis, undergoing TKA (OR=1.846, 95% CI=[1.142, 2.984]), former smoking (OR=1.686, 95% CI=[1.068, 2.660]), and younger age (OR=0.968, 95% CI=[0.939, 0.997]) were associated with LOS_2 < LOS_1 (Table 3).

DISCUSSION

The aim of this study was to determine whether discharge disposition or hospital length of stay changes between the

Table 2. Factors Associated with Average LOS

Parameter	B	Standard Error	t-Ratio	p-Value
TKA	-0.019	0.059	-0.32	0.753
Current Smoker	0.011	0.162.	0.07	0.945
Former Smoker	0.090	0.105	0.86	0.392
DM	0.096	0.080	1.21	0.227
CCI	0.107	0.062	1.72	0.087
Age	0.009	0.008	1.10	0.271

Average LOS= (LOS_1+LOS_2)/2
CCI: Charlson comorbidity index; TKA: Total knee arthroplasty; DM: Diabetes mellitus

Table 3. Factors Associated with LOS_2 < LOS_1

			95% Confidence Interval for OR	
Parameter	p-Value	OR	Lower	Upper
TKA	0.012	1.846	1.142	2.984
Current Smoker	0.456	0.673	0.237	1.908
Former Smoker	0.025	1.686	1.068	2.660
DM	0.760	1.097	0.606	1.984
CCI	0.261	1.142	0.906	1.440
Age	0.034	0.968	0.939	0.997

CCI: Charlson comorbidity index; TKA: Total knee arthroplasty; DM: Diabetes mellitus; OR: Odds ratio

first and second surgeries for patients undergoing staged bilateral total joint arthroplasty. Our results demonstrated higher rates of ambulatory surgery and shorter LOS for the second surgery compared to the first surgery for patients undergoing primary TKA, but not for the THA cohort. Additionally, there were no differences in discharge disposition to home vs SAR between first and second surgery for any of the cohorts. Further analyses found that none of the patient-specific factors (diabetes mellitus, smoking, CCI, age) were associated with average LOS, but undergoing TKA, former smoking, and younger age were associated with LOS_2 < LOS_1.

LIMITATIONS

We would like to acknowledge some limitations of this study. Given its retrospective nature, this study is susceptible to inherent biases associated with data collection and analysis. Furthermore, this study was conducted at a single urban academic institution in the United States, which limits the generalizability of our findings to other healthcare settings and locations. Additionally, since our study only included a limited number of patient-specific factors (smoking status, diabetes mellitus, CCI, age), other factors (i.e. anesthesia type, race, insurance status) which could be associated with LOS were not assessed. Time of surgery (morning vs. afternoon) was also not included and can impact length of stay and same day discharge rates. Another limitation is that given the time period over which this study was conducted, both pre and post-COVID patients were included, resulting in a heterogenous patient population. Lastly, it is important to consider the difference between statistical significance and clinical significance. While statistically significant, the absolute difference in mean LOS_2 vs LOS_1 for TKA was 0.12 days, roughly 3 hours. We feel this overall trend, however, is still important to report, and provides surgeons with data which can be used to help set expectations for patients.

DISCHARGE DISPOSITION AND LOS

Our findings address some of the current research gap on potential differences in discharge disposition and length of stay between first and second procedures for staged bilateral TJA, which is not a well-studied topic. Some previous studies have explored this question to a limited extent. In a study published in 2013, Qutob et al found no difference in discharge rates to SAR for first vs second surgery (p=0.567), but mean LOS after second surgery (4.7 days ± 1.8) was significantly shorter than the mean LOS after first surgery (5.1 days ± 2.7) in a cohort of patients who underwent staged bilateral TKA (p<0.001) between the years 1998 and 2010 (Qutob et al. 2013). Similarly, Gabr et al found that LOS decreased from 6.16 to 4.73 days between the first and second surgery for patients who underwent staged TKA between 2005-2008 (p=0.05) (Gabr et al. 2011b). Tan et al analyzed a cohort of patients who underwent staged bilateral THA in China from 2013 to 2016 and found that the LOS after the second surgery was significantly shorter than the first surgery (5.8±3.2 vs. 6.4±3.4, p=.04) (Tan et al. 2019). Thus, our results are partially consistent with these previous finding because we found that LOS was shorter for

second surgery vs first for patients undergoing staged bilateral TKA but not THA, but none these prior studies were performed in an era where short-stay and same-day discharge TJA were common.

Interestingly, the mean LOS of our study was less than that of previous studies, which clearly relates to modern TJA practices including preoperative education, enhanced recovery after surgery (ERAS) protocols, multimodal pain regimens and widespread use of short-acting spinal anesthetic. As has been well-documented, COVID-19 has also resulted in a shift toward patients being discharged earlier to home after surgery to conserve inpatient resources (Ding, Ng, and Tan 2022; Peacock et al. 2022). When we performed subgroup analyses on pre and post-March 2020 cohorts, some of the differences in ambulatory surgery rates and LOS were no longer significant, which may be due to the decreased sample size of these subgroups relative to the overall TJA cohort.

The major clinical implication of our findings is that, even with robust preoperative education and using modern fast-track protocols, patients undergoing staged bilateral TKA may expect shorter hospital stays after their second surgery, although there may be a ceiling effect that has already been reached with staged bilateral THA. There are multiple possible explanations for this trend. Patients who have undergone the first stage may be more familiar with the postoperative recovery process and managing their rehabilitation through postoperative protocols such as early mobilization and pain control. In addition, by successfully replacing one affected joint during the first surgery, patients have a stable and functional leg on which they can bear weight and engage more easily in activities of daily living, further helping them through the recovery process for their second surgery.

FACTORS ASSOCIATED WITH LOS

Whether there are patient-specific factors that can be used to predict shorter hospital stays, in terms of either the average of LOS_1 and LOS_2, or having shorter LOS_2 than LOS_1, remains unclear. To our knowledge, no other studies have determined whether there are factors that can predict if patients will have shorter hospital stay after the second surgery compared to the first surgery. None of the patient-specific factors (smoking status, diabetes mellitus, CCI, age) included in our analysis were found to be associated with shorter mean LOS. This can be due to either insufficient power, or if there are other social or support factors that were not included in the analysis.

However, our study found that undergoing TKA, former smoking status, and younger age were all associated with LOS_2 < LOS_1. TKA as a predictor for LOS_2 < LOS_1 is not surprising given our finding that LOS_2 < LOS_1 for the TKA but not THA cohort. Younger age being a predictor for LOS_2 < LOS_1 is also not surprising, given that these patients may be more resilient and have a smoother recovery after first surgery and thus able to achieve shorter LOS after second surgery. Former smoking as a predictor for LOS_2 < LOS_1 is an unexpected result and may be due to an unaccounted confounding variable.

CONCLUSION

In conclusion, our study suggests that patients undergoing staged bilateral TKA can expect a shorter hospital LOS and higher rates of ambulatory surgery after their second surgery, a finding that our center plans to use when counseling patients undergoing their first TKA who are good candidates for ambulatory TKA but express apprehension and hesitancy about the prospect of a same-day discharge. We did not identify factors that might be used to predict which patients are more likely to have shorter average LOS. However, we did identify factors such as undergoing TKA, smoking status, and younger age as predictors for shorter LOS after second surgery. In the future, it may be useful to conduct multi-center studies to determine whether these results are generalizable to other health care settings. We hope that these findings can assist providers, patients, and healthcare institutions in discharge planning for patients undergoing staged bilateral TJA.

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