Preoperative Predictors of Length of Hospital Stay and Discharge Disposition Following Primary Total Knee Arthroplasty at a Military Medical Center

CPT David A. Crawford, MC USA; CPT William Scully, MC USA; LTC Lee McFadden, MC USA; LTC Mark Manoso, MC USA

INTRODUCTION

Total knee arthroplasty (TKA) is one of the most common orthopedic procedures performed each year, with over 450,000 primary total knee replacements performed in the United States in 2003. It is projected that this number will increase 673% by 2030 with over 4.14 million primary TKAs performed every year.1 Increased length of hospital stay (LOHS) can result in higher hospital costs and decreased bed availability. The LOHS for patients undergoing primary TKA is determined both by their medical condition and by clearing physical therapy discharge goals. In our institution, patients who do not meet the required physical therapy goals either stay in the hospital longer or are discharged to a skilled nursing facility (SNF). Arranging rehabilitation placement requires insurance approval, patient selection of facility, and bed availability at the desired location. It has been our experience that patients being discharged to a rehabilitation facility are hospitalized at least an extra day to make aforementioned arrangements.

Previous studies performed in Europe have examined preoperative predictors for LOHS after TKAs. Age, gender, American Society of Anesthesiologists (ASA) class, surgeon training, preoperative hemoglobin, preoperative knee score, and day of the week the surgery was performed were found to be significant predictors of increased LOHS.2-4

The goal of this study was to determine if age, gender, ASA class, body mass index (BMI), year of surgery, and day of week of surgery influenced LOHS after primary TKA. We also evaluated how the establishment of a “pathway” program affected LOHS. A second goal was to determine if these variables could predict the discharge disposition to either home or SNF at our military medical center.

PATIENTS AND METHODS

All patients included in the study had surgery performed at Madigan Army Medical Center. This is an Army tertiary referral hospital that covers the Western Regional Medical Command. Our current tracking program for all patients undergoing surgery was instituted in April 2002. We retrospectively searched all surgeries from April 2002 to December 2008 for the CPT code 27447 for primary TKA. Exclusion criteria were bilateral TKA, unicompartmental knee arthroplasty, or revision knee arthroplasty. Preoperative data collected included age at time of surgery, BMI, gender, and ASA score. Surgical data included year of the surgery, day of the week of the surgery, and surgeon performing the surgery.

Outcome variables assessed were LOHS and discharge disposition to either home or a SNF. Length of stay was defined as the number of hospital days of admission beginning on postoperative day 1. Determination of discharge disposition was based on documentation in the disposition section of our standard electronic discharge sheet.

Eight different surgeons performed the primary TKAs over the 7-year study period. Two of the surgeons were total joint fellowship trained, 2 were fellowship trained in orthopedic oncology, and the remainder were general orthopedic surgeons. The total joint- and oncology-trained surgeons performed the vast majority of the surgeries (97.8%), and so statistical analysis of surgeon training was not included in the study. A variety of implants were used by each surgeon and were not included in the data collection.

STATISTICAL ANALYSIS

SPSS was used to perform all statistical analysis. Linear regression analysis was used to compare all variables to length of stay, and logarithmic regression analysis was used to compare the variables to discharge disposition. Unpaired t-test and
analysis of variance were used to compare each variable or groups of variables to the dependent outcomes.

RESULTS

During the study period, 413 patients were documented as undergoing primary TKA based on the CPT code 27447. Thirty patients were excluded for having undergone a bilateral procedure, revision TKA, unicompartmental arthroplasty, or other procedures. This left 383 patients for analysis.

The mean preoperative factors for all patients were age 63.97 (±9.90), ASA class 2.32 (±0.55), and BMI 33.04 (±6.54). Two hundred and fourteen patients were female and 168 patients were male. Forty-five percent of the surgeries were performed on Monday, 48% were performed on Tuesday, and the remainder were performed on Thursday or Friday. There was no statistical difference in LOHS between patients who had their surgery on Monday and those who had their surgery on Tuesday. Patients who had surgery on either Monday or Tuesday had a significantly shorter LOHS (4.27 ± 2.26) than those who had surgery on either Thursday or Friday (5.44 ± 1.7; /7 = 0.01). The mean LOHS for all patients was 4.35 (±2.24) days. Three hundred and twenty-eight patients were discharged to home, and 55 patients were discharged to a SNF.

Factors found to be statistically significant for LOHS were age, ASA class, BMI, and year of admission (Table I). Figure 1 compares age to LOHS, and Figure 2 compares year of admission to LOHS.

Factors found to be statistically significant for LOHS were age, ASA class, BMI. Patients with a higher BMI were found to have a significantly shorter LOHS. We then compared age and BMI in our cohort. We found that the mean age of patients with BMI <25 was 66 ± 10.6 and BMI >35 was 62.6 ± 9.6 (p = 0.073). The mean BMI for patients of age <60 was 33.7 ± 6.09 and >80 was 30.19 ±6.61 (/; = 0.017).

Excluding year of admission, multivariate linear regression age, ASA class, and BMI remained significant variables. Year of admission was excluded as these are values not relevant to predicting patients undergoing surgery in years after 2008. BMI was analyzed based on the group range noted in Table I. The percent increase in hospital stay for each increasing decade of life above the age of 60 years was 8 to 18%. The percent increase in LOHS stay based on ASA score was from 25 to 31.3% with ASA class above 2.

After instituting our “pathway” program in 2006, there was a significant decrease in LOHS from 4.79 to 3.71 days (p = 0.013). Comparing patient demographics before and after instituting our “pathway” program, there was no significant difference in age or BMI. However, patients who had surgery after 2006 had a significantly higher ASA class (p = 0.001).

Factors significant for a discharge to a SNF were age and ASA class. These factors remained significant after logistic regression analysis. Patients who were discharged to a SNF had statistically significant longer hospital stay (Table II). The odds ratio of being discharged to a SNF was from 1.6 to 6.8 for every decade of life above the age of 60 years and from 3.9 to 4.4 for ASA class above 2 (Table III).

DISCUSSION

Numerous patient and institutional factors dictate LOHS following surgery. The focus of this study was on specific quantifiable variables in patients undergoing primary TKA, with the hope to identify those patients at risk for longer hospital stays.
and those who may require placement in a SNF. We recognize that patient factors such as age and ASA class are not modifiable and their impact on LOHS and discharge disposition may be intuitive. However, scientifically demonstrating the relationship of these factors to outcome variables gives providers evidence-based medicine to counsel their patients on expectations and plan for their postoperative course.

One would expect older patients to require longer hospital stays, and this is in fact what we and others have found. Smith et al have reported that LOHS increases from 10 to 27% every advancing decade of life. We found an increase of 8 to 18% for every increasing decade of life above the age of 60 years. The largest difference was seen in those patients above the age of 80. With increasing age there is often a concomitant rise in the patient’s medical comorbidities. We chose ASA class to reflect the overall health of the patient. In 1963, the American Society of Anesthesiologists adopted a 5-category physical status classification system for assessing a patient before surgery. A 6th category was later added. The higher the ASA class the more severe was the systemic disease. Our results showed that LOHS increases as the ASA class increased above 2. These results may be intuitive as older patients with more medical problems are at greater risk for perioperative complications, requiring more postoperative care. Tamdee et al found that patients with an ASA class above 3 had a relative risk of 19.9 for 24-hour perioperative cardiac arrest in noncardiac surgery. Higher ASA class has also been associated with increased risk of surgical site infection.

It is unclear why in our study patients with ASA class 1 actually had an increased LOHS compared to ASA class 2. Many of these patients were active duty soldiers who were not stationed locally and thus may have remained an inpatient for housing reasons rather than for medical condition or therapy needs delaying discharge. When Husted et al evaluated ASA class as a risk factor for LOHS following TKA, they found patients with an ASA class of 1 had a 60% probability of staying less than 3 days and patients with an ASA class of 2 had a 20% probability of staying less than 3 days compared to patients with an ASA class of 3.

Analysis of BMI as a factor yielded unexpected results. Patients with higher BMI had a shorter hospitalization, which was statistically significant. Further analysis demonstrated that in our cohort older patients tended to have a lower BMI and that age may be a confounding factor for BMI analysis.

As at most joint replacement hospitals, the majority of our surgeries were performed on either Monday or Tuesday. Patients who had their surgery on Thursday or Friday had significantly longer LOHS than those who had surgery earlier in the week. We have limited physical therapy and social work coverage over the weekend, which likely contributes to this finding.

We found no difference in length of stay or discharge disposition based on gender, which is in contrast to Husted et al, who found that women had almost a 40% greater probability of staying more than 3 days compared to men.

At our institution, physical therapy determines the functional requirements for discharge and often recommends disposition placement. It has been our experience that failure to meet physical therapy goals is the most common reason patients are discharged to a SNF, although patients may also require SNF placement for medical issues as well. Our results showed that patients with increased age and ASA class were statistically more likely to be discharged to a SNF. Patients discharged to SNF also had statistically significant longer hospital stays. This may be a result of active postoperative medical issues or awaiting clearance of physical therapy. It has been our experience that the approval process and arrangements to
Preoperative Predictors of Length of Hospital Stay and Discharge Disposition
discharge to a SNF can take anywhere from 1 to 3 days. This increased LOHS incurs more cost to the hospital. Wasielewski et al found that the mean hospital cost for patients discharged to a rehab facility was $20,415 compared to $15,946 for patients discharged to home. A confounding factor for SNF placement is insurance approval and may create a selection bias for the older patient with more medical comorbidities as the younger healthier patient who cannot clear physical therapy requirements early in the postoperative period may not be approved for SNF transfer. This creates a longer inpatient LOHS for these patients, and we feel this may be a contributing factor to why patients with an ASA class 1 had longer LOHS than those with an ASA class 2. That being said, early recognition of the patients who will need SNF placement would help minimize excessive LOHS awaiting logistical arrangements.

In 2006, we instituted a structured preoperative and postoperative pathway for patients undergoing total joint replacement. Fast-track or “pathway” programs have been developed to improve clinical efficiency, cost-effectiveness, and quality of care. This included dedicated nursing, facilities, and ancillary staff for specific surgical procedures. Husted et al found that their LOHS decreased from 8 to 3.8 days following TKA after the implementation of their fast track program. Healy et al found that patients enrolled in their clinical pathway had a decrease in hospital stay from 6.79 to 4.16 days and that hospital cost was reduced by 19%. Healy et al also found a significant decrease in the percentage of patients enrolled in the pathway who were discharged to a SNF (1%) compared to the control group (39%). We did not see a decline in patients discharged to a SNF after implementing our “pathway” program.

Some factors that have been shown by others to have a significant impact on LOHS following primary TKA were not examined in this study. Patients with lower preoperative function based on the American Knee Society Score have statistically significant longer hospital stays. Smith et al found that for every increase in unit for the walking-aid score the LOHS increased by 1 to 4% and that for every increasing unit in the stair score the LOHS increased by 3 to 9%. Hemoglobin level of ≤12 g/dL has also been found to be associated with longer LOHS. As one would expect, social support plays a role in LOHS. Husted et al found that patients who live alone have a greater probability of staying more than 3 days.

Our study findings and previous studies in the literature clearly document that length of stay is influenced by many pre-and perioperative factors. Older patients with higher ASA class should be counseled that they will likely have longer LOHS and have an increased probability of discharge to a SNF. “Pathway” programs should be instituted to streamline the process of having a joint replacement and should decrease LOHS.

REFERENCES