The Journal of Arthroplasty 31 (2016) 1155–1162

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Health Policy & Economics

Discharge Destination After Total Joint Arthroplasty: An Analysis of Postdischarge Outcomes, Placement Risk Factors, and Recent Trends

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ARTICLE INFO

Article history:
Received 25 September 2015
Received in revised form
24 November 2015
Accepted 30 November 2015
Available online 20 January 2016

Keywords:
discharge destination
discharge disposition
skilled nursing facility
inpatient rehab facility
readmission
complication

ABSTRACT

Background: This study aimed to compare risk of postdischarge adverse events in elective total joint arthroplasty (TJA) patients by discharge destination, identify risk factors for inpatient discharge placement and postdischarge adverse events, and stratify TJA patients based on these risk factors to identify the most appropriate discharge destination.

Methods: Patients who underwent elective primary total hip or knee arthroplasty from 2011 to 2013 were identified in the National Surgical Quality Improvement Program database. Bivariate and multivariate analyses were assessed using perioperative variables.

Results: A total of 106,360 TJA patients were analyzed. The most common discharge destinations included home (70%), skilled nursing facility (SNF) (19%), and inpatient rehabilitation facility (IRF; 11%). Bivariate analysis revealed that rates of postdischarge adverse events were higher in SNF and IRF patients (all $P \leq .001$). In multivariate analysis controlling for patient characteristics, comorbidities, and incidence of complication predischarge, SNF and IRF patients were more likely to have postdischarge severe adverse events (SNF: odds ratio [OR]: 1.46, $P \leq .001$; IRF: OR: 1.59, $P \leq .001$) and unplanned readmission (SNF: OR: 1.42, $P \leq .001$; IRF: OR: 1.38, $P \leq .001$). After stratifying patients by strongest independent risk factors (OR: $\geq$1.15, $P \leq .05$) for adverse outcomes after discharge, we found that home discharge is the optimal strategy for minimizing rate of severe 30-day adverse events after discharge ($P \leq .05$ for 5 out of 6 risk levels) and unplanned 30-day readmissions ($P \leq .05$ for 6 out of 7 risk levels). Multivariate analysis revealed incidence of severe adverse events predischarge, female gender, functional status, body mass index >40, smoking, diabetes, pulmonary disease, hypertension, and American Society of Anesthesiologists class 3/4 as independent predictors of nonhome discharge (all $P \leq .001$).

Conclusion: SNF or IRF discharge increases the risk of postdischarge adverse events compared to home. Modifiable risk factors for nonhome discharge and postdischarge adverse events should be addressed preoperatively to improve patient outcomes across discharge settings.

Given the increasing prevalence of primary total joint arthroplasty (TJA) procedures in the United States and the relative clinical homogeneity of these procedures, TJA presents a large opportunity for cost savings and has therefore become a very popular target for fixed-cost, pay-for-performance programs such as bundled payments [1,2]. In these models in which the care team is held accountable for patient outcomes and cost of care over a predefined postsurgical period, increased emphasis is placed on expeditious discharge of patients to the most appropriate care setting, thus minimizing the use of non–value-added care in the post–acute care setting. Several studies have indicated that as much as 77%-87% of TJA patients receive some kind of post–acute care with 44%-65% of those patients discharged to a nonhome rehab facility—usually, an inpatient rehab (IRF) or skilled nursing facility (SNF) [3-5]. Multiple TJA bundled payment demonstrations have shown that as much as 40% of primary TJA episode costs are incurred

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to http://dx.doi.org/10.1016/j.arth.2015.11.044.

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http://dx.doi.org/10.1016/j.arth.2015.11.044
0883-5403/

during the post–acute period, largely driven by nonhome discharge destination [4,5]. To improve the value (clinical and functional outcomes divided by cost) of TJA to patients and society, it is critical that we understand the risk-adjusted effect of discharge destination on patient outcomes and identify patient risk factors for discharge placement [6].

To our knowledge, a large, nationally representative sample of TJA patients that controls for a broad set of patient demographic, preoperative, intraoperative, and postoperative variables has not been used to address the aforementioned issues. The aim of this study was to compare adverse events after discharge by discharge destination and identify patient risk factors for inpatient discharge placement and adverse events after discharge. A secondary focus was to stratify patients based on these risk factors to identify the most appropriate discharge destination for each group.

Methods

The American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database was used to identify patients who underwent total knee arthroplasty (TKA) or total hip arthroplasty (THA) from 2011 to 2013. The TKA cohort was identified using the common procedural terminology code corresponding to primary TKA (27447). The THA cohort was similarly identified using the common procedural terminology code (27130). Patients with incomplete data or who underwent nonelective TJA were removed from the analysis.

The ACS-NSQIP is a national surgical database that prospectively collects patient data from over 370 participating institutions. All data are validated with strict adherence to guidelines including routine audits to ensure high-quality data. Data from medical records, operative reports, and patient interviews are collected up to 30 days postoperatively by trained clinical reviewers. In addition, NSQIP provides patient demographics such as age, sex, race, smoking status, and functional status among others, as well as patient medical comorbidities including, diabetes, cardiac, pulmonary, renal, cancer, and American Society of Anesthesiologists (ASA) class. Perioperative and intraoperative variables including days from admission to operation, operative time, type of anesthesia, days from operation to discharge, and discharge destination are included as well.

Adverse events within 30 days of operation are tracked by NSQIP and were classified into the following categories for analysis: severe predischarge, severe postdischarge, minor predischarge, minor postdischarge, infectious complication, and readmission [7]. Severe adverse events included death, myocardial infarction, cerebrovascular accident, renal failure, pulmonary embolism, venous thromboembolism, sepsis, septic shock, unplanned intubation, peripheral nerve injury, deep wound infection, organ/space infection, and return to operating room. Minor adverse events included superficial wound infection, urinary tract infection, and pneumonia. Infectious complications including deep wound infection, superficial wound infection, organ/space infection, sepsis, or septic shock were also compiled for separate analysis.

Based on the discharge destination field, all TKA and THA patients were categorized into IRF, SNF, home (which could be either home health or home self-managed), death, and other discharge destination for analysis. Although ACS-NSQIP data collection goes back to 2007, discharge destination data are only available starting 2011; therefore, only 2011 to 2013 data were analyzed.

Statistical analysis was conducted using SAS (version 9.3) with a 2-tailed alpha of 0.05. Bivariate analysis was conducted to compare demographics, comorbidities, intraoperative variable, predischarge outcomes, and 30-day outcomes between the IRF, SNF, and home discharge destination cohorts. Categorical analysis was conducted with chi-square and Fisher's exact tests where appropriate. Continuous variables were analyzed using the Student t test or Mann-Whitney U test after testing for normality and equal variance. Multivariate logistic regression models only included predictors which yielded a P value of $\leq$.20 from bivariate analysis. Severe or minor adverse events' predischarge predictors were included in the multivariate logistic regression model regardless of the P value from bivariate analysis. All variables were assessed for confounding and interaction where appropriate. Final models were assessed for goodness of fit using the Hosmer-Lemeshow test.

Results

A total of 64,763 TKA and 41,597 THA patients were included for analysis. The most common discharge destinations were home (70%), SNF (19%), and IRF (11%). Bivariate analysis revealed that nonhome discharge destination (IRF or SNF) patients tended to be older, female, functionally dependent, and morbidly obese (body mass index [BMI], >40) as compared to patients discharged home (all $P < .001$; Table 1). Nonhome TJA patients had increased rates of diabetes, pulmonary disease, cardiac disease, hypertension, renal disease, steroids for chronic condition at time surgery, bleeding-causing disorders, ASA class 3 or 4, as well as longer operative times and days from admission to operation (all $P < .001$).

Bivariate analysis of predischarge outcomes in patients discharged to nonhome vs home destinations revealed that rates of severe adverse events (nonhome: 1.9%, home: 0.8%) and minor adverse events (nonhome: 1.1%, home: 0.4%) were greater for nonhome vs home (all $P < .001$; Table 1). Length of stay (LOS) tended to be longer in nonhome patients (nonhome: 3.8 days, home: 3.1 days, $P < .001$).

Between IRF and SNF TJA cohorts, rates of severe adverse events before discharge (IRF: 2.2%, SNF: 1.7%) and minor adverse events (IRF: 1.4%, SNF: 1.0%), as well as total LOS (IRF: 3.9 days, SNF: 3.7 days), were greater in IRF patients (all $P < .003$).

Bivariate analysis of postdischarge outcomes revealed that postdischarge severe adverse events (nonhome: 3.0%, home: 1.7%), minor adverse events (nonhome: 1.9%, home: 1.1%), unplanned readmission (nonhome: 5.0%, home: 2.8%), and infectious complications (nonhome: 1.3%, home: 0.9%) were significantly higher in patients discharged to SNF or IRF compared to home (all $P < .001$; Table 2). Across all TJA patients, differences in rates of severe adverse events after discharge for nonhome vs home patients were driven primarily by increased rates of organ/space infection, wound dehiscence, unplanned intubation, thrombolic event, cardiac arrest, sepsis, unplanned reoperation, and death in nonhome patients (all $P \leq .02$). Between only the IRF and SNF cohorts, rate of thrombolic events (IRF: 1.5%, SNF: 1.1%, $P = .001$) was higher for IRF patients. However, there was no significant difference in overall rates of severe adverse events, minor adverse events, or unplanned readmissions for IRF vs SNF patients.

In multivariate analysis controlling for patient demographics, comorbidities, and severe adverse events before discharge, the strongest independent predictors for nonhome discharge destination were renal disease (odds ratio [OR]: 2.24), prior dependent functional status (OR: 2.04), BMI >40 (OR: 1.50), severe adverse events before discharge (OR: 1.40), ASA class 3/4 (OR: 1.40), pulmonary disease (OR: 1.39), bleeding-causing disorders (OR: 1.35), diabetes (OR: 1.28), steroids for chronic conditions within 30 days of surgery (OR: 1.21), hypertension (OR: 1.20), and history of smoking (OR: 1.18; all $P < .001$; Table 3). Within the nonhome discharge cohort, significant predictors for IRF discharge destination as opposed to SNF included bleeding-causing disorders (OR: 1.17), history of cardiac disease (OR: 1.10), history of smoking