Original Article

The Effect of Comorbidities on Discharge Disposition and Readmission for Total Joint Arthroplasty Patients

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ABSTRACT

Background: As the annual demand and number of total joint arthroplasty cases increase, so do concerns of outcomes of patient with specific comorbidities relative to outcomes and costs of care.
Methods: The study cohort included 2009 primary total knee arthroplasty (TKA) patients and 905 total hip arthroplasty patients. Discharge disposition was classified as discharge to any facility or home. The comorbidities of the patients who were readmitted and those without a 90-day event were also evaluated.
Results: In the TKA population, age, female gender, nonsmoking status, venous thromboembolism (VTE) history, and diabetes were significantly associated with discharge to extended care facility (ECF) on univariate analysis, unlike body mass index. With multivariate analyses, female gender, age, VTE history, and diabetes were associated with ECF placement, but smoking was not. In the total hip arthroplasty population, age, female gender, and nonsmoking status were significantly associated with discharge to ECF on univariate analysis, whereas body mass index, diabetes, and VTE history were not. On multivariate analyses, female gender and age were associated with ECF, but smoking was not. The only significant finding for the readmission data was an increased rate of readmission for TKA patients of older age.
Conclusion: The potential of projecting patient discharge and readmission allows physicians to counsel patients and improve patient expectations.

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Total joint arthroplasty (TJA) is well accepted as a reliable and suitable surgical procedure to improve a patient's quality of life [1]. TJA greatly reduces direct costs attributed to osteoarthritis when compared with conservative management [2]. As the annual demand [3] and number of TJA cases increase, so do concerns regarding the associated costs. Discharge dispositions and readmission rates represent a significant measure of both medical and financial resources.

As reimbursement models move toward bundling payments, every aspect of cost is being scrutinized. Risk adjustment will become increasingly important for cost control and patient access.

It is imperative to determine which comorbidities create a higher risk for high cost discharge disposition such as extended care facility (ECF) or rehabilitation facility and/or adverse outcomes. As comorbidities in patients increase, so do postoperative complications [4].

Two of the largest costs associated with TJA are downstream and related to discharge to an ECF and/or readmission to a hospital. Furthermore, once at an ECF, Keswani et al [5] showed that patients are more likely to have severe adverse events after discharge. There is limited literature evaluating risk factors associated with these costs, discharge placement, and readmission. It is, however, important moving forward to identify the higher risk patients for these associated costs and managing patient expectations. Identifying key risk factors will help stratify patients, optimize them for surgery, and hopefully improve patient outcomes.

In 2012, a group of Michigan hospital systems as well as a major insurance company came together to form the Michigan Arthroplasty Registry Collaborative Quality Initiative (MARCQI). This initiative enabled hospitals to gather data for a quality-based total

Table 1
Demographics of the Patient Population.

Demographics	Total Hip Arthroplasty	Total Knee Arthroplasty
Patients	905	2009
Age, y (SD)	66.87 (10.06)	65.32 (11.27)
Sex, female:male	544:361	1347:662
Body mass index, kg/m^2 (SD)	30.25 (6.30)	32.93 (6.94)
Diabetes, yes:no	111:534	297:1166
Smoking status, yes:no	129:775	155:1848
History of DVT/PE, yes:no	50:851	104:1902
Length of stay, d (SD)	2.40 (1.03)	2.41 (1.52)
90-d readmissions	50 (5.52%)	111 (5.52%)

DVT/PE, deep venous thrombosis/pulmonary embolism; SD, standard deviation.

joint registry. This study used one of the participating hospital's data set to evaluate the comorbidities, associated discharge, and readmission status of their patients. Unlike other discharge and hospital data, this was not "administrative data." Specifically trained orthopedic nurse data abstractors collected all data prospectively. We focused on identifying comorbidities that were associated with increased level of discharge disposition and readmissions rate for primary total hip and knee patients. We hypothesized that higher body mass index (BMI), age, female sex, smoking, diabetes, and history of venous thromboembolism were associated with higher-level discharge disposition and higher readmission rates.

Materials and Methods

Using our hospitals' MARCQI joint registry database, we identified all patients who underwent elective primary TJA from May 2012 to October 2014. All cases were unilateral primary TJAs. Institutional review board's approval was obtained for the study. Trained MARCQI data collectors gathered the values prospectively.

All patients undergoing primary TJA within the quality database during the specified dates were included. Patients undergoing bilateral procedures were excluded as were patients having arthroplasty for fractures. All patients were admitted to the hospital on the day of surgery. Postoperatively, each patient underwent a standardized hospital pathway protocol for pain control, deep venous thrombosis (DVT) prophylaxis, physical therapy, and discharge planning. All patients were provided preoperative information about the hospital stay and expectations for discharge, encouraged to attend a preoperative total joint class, and were seen preoperatively for medical clearance and presurgical testing.

The data collected included gender, age, date of surgery, date of discharge, BMI, diagnosis of diabetes at the time of surgery, smoking status, history of DVT, history of pulmonary embolism (PE), and readmission to hospital within 90 days of discharge. Diabetes was defined categorically as yes or no. Patients in the yes category were diagnosed with either type 1 or type 2 diabetes vs

those that had neither. BMI was recorded at the time of surgery. Smoking status was classified as never or previous and/or current. History of a PE or DVT anytime before the procedure was noted. Discharge disposition was stratified by the level of service intensity, and defined as a facility (rehabilitation center, short-term nursing facility, ECF etc.) or home with or without home care and/or outpatient services. When evaluating readmission data, only patients who had an actual readmission event or no event were included. Patients who had an emergency department visit without admission were classed as no event.

Data were analyzed using both univariate and multivariate analyses. Chi-square analysis was used for frequencies, Student t test for continuous variables, and Fisher exact test was used for the univariate readmission analysis. Logistic regression models with odds ratio algorithms were used in assessing factors affecting discharge disposition and readmission. Data were analyzed using SPSS Version 22.0 (IBM Corporation, Armonk, NY) software. A P value <.05 was used to indicate statistical significance.

Results

There were a total of 2914 total joint procedures performed by 21 surgeons during this period (2009 total knee arthroplasties [TKAs] with an age range 33-95 years, 905 total hip arthroplasties [THAs] with an age range 24-95 years). Five surgeons contributed to more than 70% of the data. In the THA population, 361 patients were men, 544 patients were women. In the TKA population, 662 patients were men, 1347 patients were women.

In the total knee population, discharge disposition was found to be associated with several factors. For women undergoing TKA, 302 patients were discharged to ECF compared with 93 men ($P < .001$). The logistic regression showed that the women were 1.68 times more likely ($P = .002$) to go to an ECF. Three hundred seventy-five nonsmokers and 18 smokers went to ECF ($P = .009$). On the logistic regression model, smoking was ruled out as being associate with a discharge to ECF, $P = .634$. Patients with a history of DVT/PE went to an ECF 38.5% (40/104) of the time compared with 18.7% (355/1901) of patients with no history ($P < .001$), and patients with the positive history were 1.89 times more likely to go to an ECF than those with no history ($P = .023$). Patients with diabetes went to ECF 24.6% (73/297) of the time compared with 16.2% (189/1166) in those without diabetes ($P = .001$). Those with diabetes were 1.68 times more likely to go to ECF ($P = .002$). Patients going to ECF were typically older than those who did not (74.84 vs 64.93 years, $P < .001$). Every year of age had an odds ratio of 1.12 as seen on logistic regression. BMI was not associated with discharged disposition in the TKA population, $P = .616$ (Table 1).

In the total hip patients, discharge disposition was also found to be associated with multiple factors. Proportionally more women went to ECF (145/544 women vs 59/361 of men, $P < .001$) and the women had 1.491 times more likely ECF placement ($P = .035$) on logistic regression. Those who did not smoke had a higher

Table 2
Univariate Comparisons of Discharge Dispositions and Readmission Status Within Variables Within the THA Population.

Discharge Disposition, THA Variables	ECF	Home	P Value	Readmission, THA Variables	Readmission	No Event	P Value
Men	59 (16.3%)	302 (83.7%)	<.001	Men	24 (7.2%)	307 (92.7%)	.24
Women	145 (26.7%)	399 (73.3%)		Women	26 (5.3%)	469 (94.7%)	
Smoking	19 (14.7%)	110 (85.3%)	.023	Smoking	6 (5.0%)	113 (95%)	.83
Nonsmoking	184 (23.7%)	591 (76.3%)		Nonsmoking	44 (6.2%)	662 (93.8%)	
DVT/PE history	13 (26%)	37 (74%)	.559	DVT/PE history	3 (6.8%)	41 (93.2%)	.74
No history	191 (22.4%)	660 (77.6%)		No history	47 (6.0%)	732 (94%)	
Diabetic	28 (25.2%)	83 (74.8%)	.28	Diabetic	8 (8.2%)	90 (91.8%)	.51
Nondiabetic	110 (20.6%)	424 (79.4)		Nondiabetic	31 (6.8%)	458 (93.2%)	

DVT/PE, deep vein thrombosis/pulmonary embolism; ECF, extended care facility; THA, total hip arthroplasty.