Are There Identifiable Risk Factors and Causes Associated with Unplanned Readmissions Following Total Knee Arthroplasty?

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Introduction

Prevention of unplanned hospital readmissions has become a major focus in cost containment efforts by healthcare payers, policy makers, and providers. Under the Patient Protection and Affordable Care Act (PPACA) of 2009, the Center for Medicare & Medicaid Services (CMS) has begun instituting reimbursement penalties for 30-day readmissions associated with certain conditions.[1] In August 2013, CMS announced an expansion of this policy to elective total knee arthroplasty (TKA) for fiscal year 2015.[2] Since private insurers often emulate Medicare's payment methods, we can expect many insurers to follow suit.[3] Therefore, if this proposal is successfully implemented, hospitals will have a strong financial incentive to decrease such readmissions.

While unplanned readmission rates have received increasing attention recently, there are a relatively limited number of studies focusing on readmissions after primary TKA. Recent work has suggested an association with black race, increased length of stay (LOS), decreased age, and male gender.[4] Overall, however, current literature on the subject is mixed and inconclusive. A better understanding of the factors associated with such readmissions will be essential in efforts to identify and prevent potential future readmissions. The purpose of this study is to identify the risk factors and causes for unplanned readmissions following TKA.

Methods

A retrospective review of 3,218 primary TKAs performed over two years from July 1, 2009, to June 30, 2011, at a large urban academic hospital network was conducted using clinical and administrative data. We used a sample of convenience composed of patients admitted to the institution under review. Patients who had undergone primary TKA during the study period were identified using the corresponding ICD-9 procedure code (81.54). Unplanned 30-day readmissions were identified using ICD-9 codes and patient-specific identifiers. Planned readmissions, most commonly for in-house acute inpatient rehabilitation or skilled nursing facility, and revision TKA procedures were excluded.

Patients with unplanned readmissions were compared to non-readmitted patients on the basis of age, gender, race, body mass index (BMI), LOS, Medical Severity Diagnosis-Related Group (MS-DRG) weighting, and whether the TKA was the second episode of a staged bilateral procedure. We conducted a medical record review of all readmitted patients to determine the most common readmitting diagnoses after TKA.

Categorical data (gender, race, and number of staged bilateral procedures) were compared using the chi-square test. The Mann-Whitney U-test was used to analyze differences between continuous non-parametric variables (age, BMI, and LOS). Statistical significance was defined by p-values < 0.05. Odds ratios (OR), 95% confidence intervals (CI), and p-values were calculated using bivariate and multivariate logistic regression.

Results

We identified 3,218 patients who had a TKA during the observation period. The average age at time of surgery was 63 years and the average BMI was 32.8 kg/m^2. Sixty-six percent of patients were female. The 30-day readmission rate at our institution was 5.53%, comprised of 178 readmissions among 165 patients. Readmission was associated with increased LOS ($p < 0.001$). Age, BMI, gender, race, and staged bilateral procedures were not associated with readmissions (Table 1). Average MS-DRG weight among readmitted patients was 2.57 versus 2.48 among non-readmitted subjects ($p = 0.074$).

Similar associations were demonstrated by bivariate logistic regression (Table 2); LOS is significantly associated with a 10% increased odds of readmission. This association is unchanged after adjusting for gender and race in multivariate regression.

The most common diagnoses associated with readmissions were post-operative infection (22.5%), hematoma (10.1%), pulmonary embolus (7.9%), deep venous thrombosis (5.6%), and uncontrolled pain (5.6%). Surgical causes constituted 53.9% while medical causes constituted 46.1% of all readmissions (Table 3).

Table 1. Patient Characteristics

	All Patients (N = 3,218)		Readmitted (N = 165)		Not Readmitted (N = 3,053)		
	N or mean	% or SD	N or mean	% or SD	N or mean	% or SD	p-Value
Age (y)	63.0	10.9	63.9	12.6	62.9	10.8	0.100
Gender							
Female	2125	66.0%	112	67.9%	2013	65.9%	0.608
Male	1093	34.0%	53	32.1%	1040	34.1%	-
Race							
White	2152	66.9%	100	60.6%	2049	67.1%	0.084
Black	908	28.2%	55	33.3%	851	27.9%	0.129
Native American	3	0.1%	0	0.0%	3	0.1%	0.687
Asian	48	1.5%	2	1.2%	46	1.5%	0.761
Other	63	2.0%	4	2.4%	58	1.9%	0.633
Unkown	50	1.6%	4	2.4%	46	1.5%	0.353
BMI	32.8	7.6	33.4	8.2	32.7	7.6	0.329
LOS (days)	3.8	2.1	4.70	4.12	3.75	1.95	<0.001
Staged bilateral procedures	69	2.1%	5	3.0%	64	2.1%	0.420

Table 2. Bivariate logistic regression (readmitted vs non-readmitted patients)

		OR	95% CI	p-Value
Age		1.01	0.99 − 1.02	0.30
	≤ 55	1.0	-	-
	56-65	0.97	0.63 − 1.49	0.88
	66-75	1.26	0.82 − 1.94	0.3
	≥ 76	1.44	0.87 − 2.39	0.16
Gender				
	Female	1.0	–	–
	Male	0.94	0.68 − 1.31	0.73
Race				
	White	1.0	–	–
	Black	1.28	0.92 − 1.80	0.15
	Other	1.11	0.47 − 2.57	0.82
LOS		1.1	1.06 − 1.16	< 0.001
BMI		1.01	0.99 − 1.03	0.24
	< 25	1.0	–	–
	25 − < 30	0.7	0.41 − 1.21	0.2
	30 − < 35	1.08	0.64 − 1.81	0.78
	≥ 35	1.00	0.61 − 1.65	0.99
Staged bilateral procedures*		–	–	–

*The event rate was too low for logistic analysis

Table 3. Most common causes of readmission

Readmitting Diagnosis	Count	% of Readmissions
Deep Wound Infection	21	11.8%
Superficial Cellulitis	19	10.7%
Hematoma	18	10.1%
Pulmonary embolus	14	7.9%
DVT	10	5.6%
Pain control	10	5.6%
Altered mental status	9	5.1%
Dehiscence	6	3.4%
Chest pain (MI work up)	5	2.8%
Swelling	5	2.8%

*Total: Surgical causes = 53.9%; Medical causes = 46.1%

Discussion

Patients with increased LOS were more likely to be readmitted in this population, which is consistent with previous literature.[5-7] Prior literature has suggested that extended LOS is associated with increased levels of comorbidity and complications, which likely explains the elevated rate of readmission as well as the relatively high MS-DRG weights among these patients.[8-10]

Race may be correlated with socioeconomic status in the study population, so the trend towards decreased readmissions among white patients likely represents the impact of numerous socioeconomic factors. Prior literature has shown black race associated with higher rates of readmission following TKA than white race.[9]

The most common causes of readmission in our study parallel previous findings, where infection remains one of the major causes of readmission.[4,8,10-13] Likewise, these studies demonstrate that despite many readmissions for medical reasons, most patients are readmitted for post-surgical issues. These complications differ in treatment costs; surgical infections tend to be relatively more expensive to treat because they frequently necessitate multiple subsequent procedures, extended courses of intravenous antibiotics, prolonged rehabilitation, and frequent follow-up.[14]

In order to improve care and prevent financial losses, providers should strive to reduce unplanned readmissions. One method to consider is the consolidation of care at large healthcare centers. Bozic, et al identified a volume-outcomes relationship associated with TKA.[15] That is, increased surgeon and hospital volumes were associated with a reduction in readmissions. Furthermore, multiple studies of TKA patients, as well as other surgical patients, have shown that implementation of standardized care pathways contributed to reduced LOS[15-17] and improved short-term outcomes,[18-20] illustrating the benefit of process standardization. Mixed findings exist for an association between readmission and discharge disposition;[21,22] however, Riggs, et al demonstrated that identifying patients who may benefit from inpatient rehabilitation before discharge may be a crucial step in preventing hospital readmissions.[21] Interdisciplinary home care programs provide a non-medical intervention aimed at reducing readmissions and costs for outpatients by providing informal care from providers and friends, and has demonstrated lower readmissions rates than traditional inpatient alternatives.[23-27]

Limitations of this study include using a single institution's data and no analysis of discharge disposition for our patient population.

Conclusion

With CMS likely to institute reimbursement penalties for unplanned TKA readmissions and with private insurers prone to emulate Medicare's payment schemes, U.S. hospitals will likely be motivated to initiate programs to minimize such occurrences. It is critical for healthcare institutions to perform analyses like those presented here in order to identify the specific risk factors for unplanned TKA readmissions in their patient populations. Our results suggest that targeting patients with extended LOS, low socioeconomic status, and elevated infection risk is a good starting point. Certain interventions, such as standardized protocols, discharge coordinators, and home care programs have proven effective in prior literature and may merit widespread implementation.

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