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Original Article

The Association Between Hospital Length of Stay and 90-Day Readmission Risk for Femoral Neck Fracture Patients: Within a Total Joint Arthroplasty Bundled Payment Initiative

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ABSTRACT

Background: Hip arthroplasty is increasingly performed as a treatment for femoral neck fractures (FNFs). However, these cases have higher complication rates than elective total hip arthroplasties (THAs). The Center for Medicare and Medicaid Services has created the Comprehensive Care for Joint Replacement model to increase the value of patient care. This model risk stratifies FNF patients in an attempt to appropriately allocate resources, but the formula has not been disclosed. The goal of this study was to ascertain if patients with FNFs have different readmission rates compared to patients undergoing elective THA so that the resource utilization can be assessed.

Methods: We analyzed all patients undergoing THA at our institution during a 21-month period. Patients classified by a diagnosis-related group of 469 or 470 were included. Multivariate and survival analyses were performed to determine risk of 90-day readmission.

Results: Patients admitted for FNFs were older, had higher body mass indices, longer lengths of stay, and were more likely to be discharged to inpatient facilities than patients who underwent elective THA. Increased American Society of Anesthesiologists scores and FNF were also independent risk factors for 90-day readmission, and these patient were more likely to be readmitted during the latter 60 days following admission.

Conclusion: Results suggest that patients who undergo an arthroplasty following urgent or emergent FNFs have inferior outcomes to those receiving an arthroplasty for a diagnosis of arthritis. Fracture patients should either be risk stratified to allow appropriate resource allocation or be excluded from alternative payment initiatives such as Comprehensive Care for Joint Replacement.

With over 300,000 patients treated annually, hip arthroplasties are among the most common and highly successful procedures performed in the United States [1,2]. This number is also expected to grow, as citizens above the age of 65 years are expected to reach 20% of the American population by 2050 [3]. The Centers for Medicare and Medicaid Services is attempting to create innovative plans to increase the health care value delivered to these patients [4,5]. One prime example of this innovation is the Comprehensive Care for Joint Replacement (CJR) model, which is aimed at increasing the value of care by holding health care providers, including physicians and institutions, accountable for complications and readmissions associated with total hip and knee arthroplasties [6].

In 2014, joint arthroplasties performed on Medicare patients accrued a cost of over $7 billion in hospitalizations alone [7]. With the number of total hip arthroplasties (THAs) expected to increase by roughly 170% to 572,000 procedures annually by 2030, better care delivery pathways that will increase the quality of care and decrease the cost are needed [8]. One of the key aspects of the CJR is the role of bundled payments and the target price initiative. Hospitals and providers will be reimbursed a single amount for all care delivered to patients from the index procedure until 90 days

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following admission [6]. One issue raised with the proposed plan is the variety of preoperative diagnoses associated with THA [9]. Although most hip arthroplasties performed are elective in nature and associated with osteoarthritis, avascular necrosis, and rheumatoid arthritis, between 3% and 15% are due to other nonelective diagnoses such as femoral neck fractures [2,10,11]. Femoral neck fracture are fundamentally urgent or emergent diagnosis, and patients with femoral neck fractures treated with total or partial hip arthroplasty have worse outcomes and accrue higher costs compared to patients treated for primary osteoarthritis [12–15]. Poor outcomes such as increased readmission rates are associated with higher costs and are an indicator for reduced health care value [16]. Hence, more resources are needed to care for these patients appropriately. We hypothesize that patients undergoing either total or partial hip arthroplasty for femoral neck fractures will have higher rates of 90-day readmission compared to patients undergoing elective THA for diagnoses other than a femoral neck fracture.

Methods

Prior interval review board approval was obtained for this study. We analyzed all Medicare patients admitted for a diagnosis-related group of 469 and 470, to a single specialty, high volume, urban, teaching, orthopedic hospital during a 21-month period. In addition, we analyzed Medicare claims data to identify patients readmitted within 90-days of their respective index admission. To only analyze hip arthroplasty data, patients who underwent total ankle arthroplasties, total knee arthroplasties, partial hip arthroplasty for nonfemoral neck fractures, and total hip conversions were excluded from analysis.

Patients who were noted to have a surgical diagnosis of a femoral neck fracture were grouped for comparison against patients with other surgical diagnoses who underwent an elective THA. Length of stay (LOS) for femoral neck fracture patients was determined from both the time of admission and time of index surgery. Time from index surgery was used for multivariate analysis. Patients were grouped into one of 2 groups of patients in regard to readmission: patients readmitted within 90 days and patients not readmitted within 90 days of discharge. Readmission type (medical vs surgical) was also ascertained. The Medicare claims data that we received was used to group readmission cases into medical, not related to index surgical procedure, and surgical, related to the index surgical procedure. This grouping was based on CJR guidelines stating that the following outcomes are considered complications of surgery, "acute myocardial infarction, pneumonia, or sepsis/septicemia within 7 days of admission; surgical site bleeding, pulmonary embolism or death within 30 days of admission; or mechanical complications, periprosthetic joint infection, or wound infection within 90 days of admission" [6]. In situations where the Medicare readmission diagnosis or description was not adequately specific to correctly group the diagnosis, health record review was used if the readmission occurred at a hospital affiliated with the primary institution. Only the initial medical and/or surgical readmission records were used for analysis.

The Kolmogorov-Smirnov test and the Shapiro-Wilk test were used to ascertain the normality of the analyzed groups. The demographic variables consisting of age, sex, race, ethnicity, body mass index (BMI), American Society of Anesthesiologists (ASA) score, and discharge location were examined. Significance testing for categorical variables was performed utilizing the Fischer's exact test and Chi-square test of independence in addition to the nonparametric test of the Mann-Whitney U test for continuous variables. Multivariate analysis was performed to determine how covariates affect the dependent variable, defined as 90-day readmission. Variables with a univariate *P*-value greater than .20 were included in the model. Kaplan-Meier survival analysis was performed to determine the relationship between femoral neck fracture and 90-day readmission.

Results

Our analysis included 751 patients: 58 (7.7%) underwent partial hip arthroplasty and 693 (92.3%) underwent THA (Table 1). Six hundred sixty-one (46.8%) of patients from the initial diagnosis-related group group were excluded, although all patients undergoing THA or hemiarthroplasty (HA) for FNF were included. Patients who had a mean age of 72.3 years (interquartile range [IQR] = 67.0-78.0 years) were mostly female (n = 460, 61.3%), white (n = 646, 86.0%), and non-Hispanic (n = 717, 95.5%). Patients included in analysis were on average overweight (BMI 27.0, IQR = 22.4-30.8 kg/m^2) and had a mean hospital LOS of 3.0 (IQR = 2.2-3.5) days. Most patients had mild systemic disease as indicated by an ASA score of 2 (n = 424, 56.5%).

Eighty-three cases (11.1%) were found to have a surgical diagnosis of a femoral neck fracture. Patients with femoral neck

Table 1
Comparison of Patients Who Underwent Total or Partial Hip Arthroplasty With or Without a Diagnosis of Femoral Neck Fracture.

Patient Characteristics	Femoral Neck Fractures[a]	No. Femoral Neck Fracture[a]	*P* Value
Sex[b]			.01
Male	21 (25.3%)	265 (39.7%)	
Female	62 (74.7%)	398 (59.6%)	
Race			.2
White	77 (92.8%)	569 (85.2%)	
Black	1 (1.2%)	37 (5.5%)	
Asian/Pacific islander	0 (0.0%)	10 (1.5%)	
Native American	0 (0.0)	0 (0.0%)	
Other	3 (3.6%)	41 (6.1%)	
Ethnicity			.154
Hispanic	0 (0%)	21 (3.1%)	
Non-Hispanic	81 (97.6%)	636 (95.2%)	
Age[c]	83.0 (76.5-87.0)	71.0 (67.0-76.0)	<.001
Marital status			.071
Married	37 (44.6%)	385 (57.6%)	
Not married	42 (50.6%)	277 (41.5%)	
Smoking status[b]			.021
Current smoker	3 (3.6%)	35 (5.2%)	
Former smoker	28 (33.5%)	320 (47.9%)	
Never smoker	52 (62.7%)	308 (46.1%)	
BMI[c]	22.1 (20.3-26.0)	27.5 (24.1-31.2)	<.001
ASA score[c]			<.001
I	2 (2.4%)	15 (2.2%)	
II	26 (31.3%)	398 (59.6%)	
III	44 (53.0%)	240 (35.9%)	
IV	8 (9.6%)	10 (1.5%)	
Total LOS[c]	5.5 (2.3-7.7)	2.9 (2.6-3.2)	<.001
Postoperative LOS	5.0 (2.1-8.0)	3.1 (1.8-4.5)	<.001
Type of procedure[b]			<.001
Hemiarthroplasty	58 (69.9%)	0 (0.0%)	
THA	25 (30.1%)	668 (100%)	
Discharge location[c]			<.001
Rehab facility	28 (33.7%)	35 (5.2%)	
Skilled nursing facility	46 (55.4%)	124 (18.6%)	
Home health care Svc	9 (10.8%)	469 (70.2%)	
Home/self care	0 (0%)	40 (6.0%)	
Readmissions[c]			
Readmitted 0-90 d	16 (19.3%)	30 (4.5%)	<.001
Between 0-30 d	9 (10.8%)	25 (3.7%)	.077
Between 30-90 d	7 (8.4%)	5 (7.5%)	.517

BMI, body mass index; ASA, American Society of Anesthesiology; LOS, length of stay; THA, total hip arthroplasty; Svc, service.

[a] Continuous variables reported as medians with interquartile ranges.

[b] Significant *P* value <.05.

[c] Significant *P* value <.01.