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Variation in Treatment Patterns Correlate With Resource Utilization in the 30-Day Episode of Care of Displaced Femoral Neck Fractures

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ABSTRACT

Background: We evaluated which treatment decisions in the management of displaced femoral neck fractures (FNFs) may associate with measures of resource utilization relevant to a value-based episode-of-care model.

Methods: A total of 1139 FNFs treated with hip arthroplasty at 7 hospitals were retrospectively reviewed. Treatment choices were procedure (hemiarthroplasty vs total hip arthroplasty [THA]), surgeon training status, admitting service, and time to surgery. Dependent variables were length of stay, discharge disposition, 30-day readmission, and in-hospital mortality. Variation across hospitals was evaluated with analysis of variance and chi-square tests. Treatment choices were evaluated for the dependent variables of interest with univariable and multivariable regression.

Results: There was significant variation between hospitals regarding proportion of cases treated with THA (range = 3.0%-73.2%, $P < .001$), proportion treated by arthroplasty fellowship−trained surgeons (range = 0%-74.9%, $P < .001$), proportion admitted to the orthopedic service (range = 2.8%-91.3%, $P < .001$), mean time to surgery (range = 0.9-2.1 days, $P < .001$), and proportion of discharge home (range = 63.9%-97.8%, $P < .001$). Multivariable analysis adjusting for age, gender, and Charlson Comorbidity Index demonstrated correlations between (1) decreased length of stay and admission to orthopedics (B = −1.256, $P < .001$); (2) lower 30-day readmission and THA (odds ratio [OR] = .376, $P = .004$), and (3) decreased discharge to a care facility and admission to orthopedics (OR = 0.402, $P = <.001$), THA (OR = 0.435, $P = .002$), and treatment by an arthroplasty fellowship−trained surgeon (OR = 0.572, $P = .016$). None of the treatment variables tested associated with in-hospital mortality.

Conclusion: We observed significant variation in the treatment of displaced FNF patients across 7 hospitals and identified treatment choices that associated with resource utilization within the episode of care. Future, prospective study is necessary to understand whether care pathways that adapt some combination of these characteristics may result in more value-based care.

Geriatric hip fractures result in significant mortality, morbidity, and costs [1]. Their prevalence is steadily rising and increases the already significant burden on society [1]. Also, 3%-15% of hip arthroplasty procedures are performed for nonelective diagnoses such as femoral neck fractures (FNFs) [2]. Compared with total hip arthroplasty (THA) for osteoarthritis, hip arthroplasty for FNF is associated with greater rates of complications, longer length of stay (LOS), a greater likelihood of discharge to postacute inpatient rehabilitation, and higher rates of unplanned readmission [3]. This implies greater resource utilization, and therefore less optimal care for patients with a fracture.

As we enter an era of value-based healthcare, new reimbursement models have been designed to hold organizations accountable not only for the acute-care costs that occur during the initial hospitalization but also for the costs of postacute rehabilitation, early complications, and readmissions that occur during a

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predefined episode of care [4,5]. Thus, there is a new emphasis on optimizing long-term clinical outcomes not only for patients but also for this defined episode of care. Fortunately, these goals often align [6,7].

Variability in treatment patterns for hip fractures, including timing of surgery and choice of surgical procedure, has been shown to affect perioperative complications, readmission rates, mortality, and long-term functional outcomes [8–16]. However, to our knowledge, other potentially important variables have not yet been evaluated. Furthermore, variability in treatment patterns within the context of value-based models has not yet been explored.

We sought to understand how displaced FNF care might vary across hospitals within a single healthcare system that serves a densely populated metropolitan urban and suburban area of the United States. Differences in practice patterns between hospitals also provide an opportunity to explore whether treatment decisions made in the preoperative, perioperative, and acute postoperative periods may associate with markers of resource utilization and quality relevant to the bundle of care. As a result, we study LOS, early readmission, discharge disposition, and mortality in this report.

Methods

Patient Population

After obtaining institutional review board approval, we retrospectively collected 2013-2016 data from an administrative database within our health system. Parameters queried were FNFs treated under diagnosis-related group 469 and 470. Due to limitations of integration of electronic medical record platforms across the larger healthcare system, complete data were available from 7 hospitals (n = 1193 FNFs).

Study Variables

Baseline data collected included patient age, gender, Charlson Comorbidity Index (CCI), hospital, admitting attending, admit date, operating attending, fellowship training status of the operating attending, principal procedure with date, discharge disposition, discharge date, LOS, 30-day readmission, and mortality. Principal procedure type was either THA or hemiarthroplasty (HA). The fellowship training status of each operating surgeon was categorically defined as arthroplasty fellowship trained (AFT), or non–arthroplasty fellowship trained (non-AFT). Any case where operating attending was not recorded, thus precluding determination of fellowship training status, was excluded (n = 54). This yielded a total population of 1139 FNF patients for study.

Patients were considered to be admitted to the orthopedic service if the admitting attending was an orthopedic surgeon and considered to be admitted to another service if the admitting attending was not an orthopedic surgeon. Time to surgery (in days) was calculated from admission date to primary procedure date, and time after surgery (in days) was calculated from primary procedure date to discharge date. Discharge disposition after the index procedure stay was classified into 2 categories: home or nonhome. The latter group included inpatient care facilities such as a skilled nursing facility, an acute inpatient rehabilitation facility (rehab), a long-term care facility, or a hospice facility. Readmissions included any medical or surgical complication requiring admission to the hospital within 30 days of the index procedure. Patients who died during their initial inpatient stay (n = 23) were not included in the analysis of discharge disposition or 30-day readmission.

Table 1
Descriptive Statistics in the Total Population.

Variable	Mean or Number	SD or Percent
Demographics		
Total number	1139	
Age	81.8	9.9
Female	809	71.0
CCI	4.9	2.1
Treatment variables		
THA	226	19.8
AFT	338	29.7
Admitted to orthopedics	501	44.0
Time to surgery (d)	1.5	1.5
Outcomes		
Length of stay (d)	6.6	4.1
30-d Readmission[a]	130	11.4
Discharge nonhome[a]	979	86.0
Mortality	23	2.0

SD, standard deviation; CCI, Charlson Comorbidity Index; THA, total hip arthroplasty; AFT, arthroplasty fellowship trained.
[a] Percentage excludes patients who died in-hospital.

Statistical Analysis

Descriptive statistics were calculated for the total baseline population, and by hospital. Chi-square test for independence was used to observe for variance in categorical variables between hospitals. Levene's test for equality of variances and Welch's analysis of variance were used to observe for variance in continuous variables between hospitals.

Univariable logistic regression was performed for 30-day readmission, discharge disposition, and mortality. Covariates analyzed were age, gender, CCI, choice of procedure (THA vs HA), admitting service (orthopedics vs other), fellowship training status of the treating surgeon (AFT vs non-AFT), time to surgery (in days), and discharge disposition (for 30-day readmission).

Linear regression was performed for LOS, using the same variables as in logistic regression, except for time to surgery. Time to surgery is part of LOS and therefore was not run in the regression as an independent predictor of LOS. Time to surgery was instead analyzed for the dependent variable of time after surgery. The final multivariable model was constructed for overall LOS because it more completely accounts for resource utilization within the episode of care.

Table 2
Variation Across Hospitals.

Variable	Mean or Percent	Range[a] (Lower)	Range[a] (Upper)	*P*
Cases	1139	74	389	
Demographics				
Age	81.8	79.7	83.8	.005
Female	71.0	64.5%	81.1%	.083
CCI	4.9	3.9	5.6	.000
Treatment variables				
THA	19.8%	3.0%	73.2%	.000
AFT	29.7%	0.0%	74.9%	.000
Admitted to orthopedics	44.0%	2.8%	91.3%	.000
Time to surgery (d)	1.5	0.9	2.1	.000
Dependent variables				
Length of stay	6.6	5.8	6.9	.553
30-d Readmission[b]	11.6%	7.2%	14.3%	.425
Discharge nonhome[b]	87.7%	63.9%	97.8%	.000
Mortality	2.0%	0.0%	4.1%	.438

CCI, Charlson Comorbidity Index; THA, total hip arthroplasty; AFT, arthroplasty fellowship trained.
[a] Range is reported as a number, mean, or percent at a given hospital by each category.
[b] Percentage excludes patients who died in-hospital.