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Readmission Within 30 Days of Discharge After Hip Fracture Care

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Abstract

The Affordable Care Act currently requires hospitals to report 30-day readmission rates for certain medical conditions. It has been suggested that surveillance will expand to include hip and knee surgery-related readmissions in the future. To ensure quality of care and avoid penalties, readmissions related to hip fractures require further investigation. The goal of this study was to evaluate factors associated with 30-day hospital readmission after hip fracture at a level I trauma center. This retrospective cohort study included 1486 patients who were 65 years or older and had a surgical procedure performed to treat a femoral neck, intertrochanteric, and/or subtrochanteric hip fracture during an 8-year period. Analysis of these patients showed a 30-day readmission rate of 9.35% (n=139). Patients in the readmission group had a significantly higher rate of pre-existing diabetes and pulmonary disease and a longer initial hospital length of stay. Readmissions were primarily the result of medical complications, with only one-fourth occurring secondary to orthopedic surgical failure. Pre-existing pulmonary disease (odds ratio [OR], 1.885; 95% confidence interval [CI], 1.305–2.724), initial hospitalization of 8 days or longer (OR, 1.853; 95% CI, 1.223–2.807), and discharge to a skilled nursing facility (OR, 1.586; 95% CI, 1.043–2.413) were determined to be predictors of readmission. Accordingly, patient management should be consistently geared toward optimizing chronic disease states while concomitantly working to minimize the duration of initial hospitalization and decrease readmission rates.

The goal of treatment in elderly patients with hip fracture is to return them to their preinjury level of function. Often these patients are frail, with diminished physiologic reserves as a result of multiple pre-existing medical problems that complicate recovery and lead to hospital readmission.¹ Pre-existing comorbidities often include cardiovascular and pulmonary disease, diabetes, dementia, and osteoporosis that increase the risk of morbidity and prolong recuperation after surgical intervention.^{1,2}

The aim of the Affordable Care Act of 2010 was to improve the quality and affordability of health care through various mechanisms. A strategy implemented in this legislation was the

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creation of financial penalties for health care facilities in an effort to improve the delivery of health care. Initial areas of focus included outcomes associated with the management of myocardial infarction, heart failure, and pneumonia. Measures that influence reimbursement of health care facilities include not only initial outcomes but also readmission rates. Since 2012, hospitals have been required to report readmission of Medicare patients within 30 days of discharge for myocardial infarction, heart failure, or pneumonia. Penalties range from 1% to 2% of all Medicare payments.³ It has been suggested that surveillance will expand to include hip and knee surgery-related readmissions.⁴ To help provide quality care and prevent penalties, readmission related to hip fractures requires further investigation. The goal of this study was to assess the incidence and cause of 30-day readmission in patients with a primary admission diagnosis of hip fracture at a level I trauma center in rural Appalachia. The study findings provide novel data on patients from rural Appalachia who require hospital readmission after initial repair of a hip fracture. This study also provides insight into risk factors and/or patient-specific conditions that may place members of the rural geriatric community at higher risk for hospital re-admission after initial management of hip fracture.

Materials and Methods

After approval by the institutional review board was obtained, a retrospective review was conducted of patients admitted to a tertiary care level I trauma center between January 2005 and December 2012. The study institution is a large facility that serves approximately one-third of West Virginia as a tertiary care facility and level I trauma center. The patient base is primarily rural and is spread over a large geographic area.

Patients included in this analysis were identified through the trauma registry at the institution. Those included were 65 years or older and were admitted to the study facility with a diagnosis of femoral neck, intertrochanteric, or subtrochanteric fracture. Patients who died during the initial hospitalization, were transferred to another facility, or did not undergo surgery were excluded. A total of 1482 patients met the inclusion criteria and were divided into 2 groups for comparison, depending on whether they were readmitted within 30 days of discharge. Variables collected for both groups included demographic data; admission and readmission diagnosis based on *International Classification of Diseases, Ninth Revision*, codes; comorbidities; discharge location; hospital length of stay; type of hip fracture; and operative procedure. Additional analyses were performed on the subset of patients who were readmitted to determine whether readmission was the result of either a surgical or a medical complication. Comparative analyses were completed to establish the most common reasons for readmission. Surgical and medical causes were categorized into subsets as shown in Table 1.

Descriptive analysis was conducted for each variable. Chi-square or Fisher's exact test for categorical variables and Student's *t* test for continuous variables were conducted to determine statistically significant differences between groups. Basic descriptive statistics, such as mean and standard deviation for continuous variables and proportions and frequencies for categorical variables, were used to analyze patient characteristics. Logistic regression was used to determine predictors of readmission. All comparisons were

performed at a level of significance of 0.05. Analysis was done with SAS version 9.3 software (SAS Institute, Cary, North Carolina).

Results

During the study period, 1482 patients who met the inclusion criteria were admitted. The mean age of the study population was 82 years (range, 65–103 years), with a mean Injury Severity Score of 9. Approximately 76% of the study population was female. Injuries primarily occurred at the patient's home (71.86%; $n=1065$), with approximately one-third of injured patients presenting to the study institution after transfer from an outlying facility (32.18%; $n=477$).

More than 1000 (68.62%; $n=1017$) of the patients were discharged to a skilled nursing facility after initial admission. Table 2 compares demographic and other factors between readmitted and non-readmitted groups. Approximately 10% (9.35%; $n=139$) were readmitted within 30 days of discharge. There was a statistically significant difference ($P=.0154$) between readmitted and non-readmitted patients regarding placement after discharge.

The incidence of selected pre-existing medical conditions was significantly higher in the readmitted subset of study patients. Pulmonary disease (38.13% vs 23.75%; $P<.0002$) and a surgical history (20.86% vs 12.43%; $P=.0052$) were more common in readmitted patients compared with the non-readmitted group (Table 2). Diabetes was also more common in the readmitted group; however, this difference fell slightly short of statistical significance (34.53% vs 26.81%; $P=.052$). Initial hospital length of stay was also longer in patients who required readmission. These patients averaged 1 additional day of hospitalization compared with the non-readmitted group (7.98 ± 4.24 days [range, 2–28 days] vs 6.99 ± 4.03 days [range, 1–47 days]; $P=.006$).

Patients were 2.4 times more likely to be readmitted because of medical vs surgical complications (70.50% [$n=98$] vs 28.50% [$n=41$]; $P<.001$). Non-orthopedic infection (31.63%; $n=31$) and cardiovascular (20.41%; $n=20$) and gastrointestinal (14.29%; $n=14$) complications were the most common medical complications resulting in readmission (Table 3). Additional review of the 31 patients readmitted for non-orthopedic infection showed that pneumonia (51.61%; $n=16$), urinary tract infection (41.94%; $n=13$), and *Clostridium difficile* enteritis (16.13%; $n=5$) were the most frequently occurring infections in this study subset (Table 4). Surgical complications requiring readmission were most commonly caused by surgical site infection (39.02%; $n=16$), new fracture (29.27%; $n=12$), and failure of surgically implanted hardware (19.51%; $n=8$) (Table 3). Fractures leading to readmission included periprosthetic fractures and ipsilateral and contralateral unrelated fractures. Readmission rates were twice as high for women in the group of readmitted patients because of surgical vs medical complications (87.80% vs 68.37%; $P=.0171$).

Regression analysis showed that transferring a patient to a skilled nursing facility was an independent risk factor for readmission. Those discharged to a skilled nursing facility were 1.5 times more likely to require readmission (95% confidence interval [CI], 1.043–2.143; $P=.031$) within 30 days of initial hospital discharge. Corresponding with the high incidence

of pulmonary disease in the readmission study group, pre-existing pulmonary disease almost doubled the risk of readmission in surgical patients (odds ratio [OR], 1.885; 95% CI, 1.305–2.724; $P=.0007$). The third predictor of readmission was hospital length of stay. Patients whose initial hospitalization was 8 days or longer were 1.885 times more likely to require readmission (95% CI, 1.305–2.724; $P=.0036$) (Table 5).

Discussion

With the increase in the American population older than 65 years, it is expected that the number of hospital admissions for hip fracture will also rise. Hip fracture has been identified as the second leading cause of hospitalization in geriatric patients.⁵ Recent discussion suggested that the Affordable Care Act will be expanded to include quality and affordability measures for hip and knee replacement surgery. As a result, it is anticipated that expansion of this legislation will include enforcement of penalties on health care facilities for readmission of hip- and knee-related surgery.⁴

Previous studies showed disparity in 28- to 30-day readmission rates of 4% to 18%.^{4,6,7} This wide range could be explained by different database sources used to recruit patients (eg, Medicare or institutional database) and geographic settings (urban, suburban, rural). The hospital readmission rate for patients in this study was 9.35%, which appears to be conservative compared with the national average of 14.5% reported by the Dartmouth Atlas researchers in 2009.⁸ The average admission rate in the current study may underestimate the true readmission rate because patients readmitted to other facilities were not included in the current analysis.

Data from the current study showed that readmission after hip fracture was largely the result of medical complications. The most common cause of readmission was nonsurgical site infection. These findings are comparable to the studies of Hahnel et al⁹ and Boockvar et al¹⁰ that showed that 81.0% and 89.0% of readmissions, respectively, were the result of nonsurgical complications. They also reported that infection was the most frequent cause of readmission, with rates of 21.0% and 26.2%, respectively. In the current study, infection primarily included pneumonia, urinary tract infection, and *C difficile* enteritis. After infection, the 2 most common causes for readmission were cardiovascular and gastrointestinal complications.

Clinical status and management of patients with hip fracture are affected by many factors that could affect and potentially predispose patients to complications and potential readmission. These factors include, but are not limited to, prolonged hospitalization with recumbency; exposure to pathogens; invasive vascular devices; the use of tubes, drains, and catheters; metabolic stressors; intravenous fluid administration; and exposure to pharmacologic agents in excess of the patient's usual medications. Comorbidities may also play an important role in the manifestation of complications after hospitalization. In the current study, pre-existing diabetes and pulmonary disease were more common in patients who required readmission. Patients who required readmission were also more likely to have a prior history of surgery. The risk of infection in these patients could have been influenced by pre-existing comorbidities such as diabetes, which is known to predispose patients to

infection, especially when it is poorly controlled. In addition, the high rate of pre-existing pulmonary disease in patients who were readmitted is likely indicative of a patient population with a higher propensity to pneumonia during post-hospitalization care. Accordingly, based on regression analysis, patients with pre-existing pulmonary disease were twice as likely to be readmitted after surgical hip repair compared with those without baseline pulmonary disease. However, neither diabetes nor surgical history was a predictor of readmission. Although these factors did not have predictive value for readmission, these data likely support the idea that patients with diabetes and a history of surgery represent a patient population with poorer baseline health that results in an increased likelihood of post-hospitalization complications.

Approximately one-fourth of readmissions were caused by orthopedic complications. Readmission in this group was primarily the result of surgical site infection, new fracture (eg, periprosthetic and contralateral), and failure of the implant. As previously discussed, more than one-third of the study patients who were readmitted had pre-existing diabetes, likely increasing their risk of infectious complications. In addition, a significantly higher number of female patients were readmitted because of surgical complications compared with the group of patients readmitted for medical complications. This finding may be related to the higher propensity of elderly women to have osteopenia or osteoporosis. Although a conclusive association between pre-existing bone density and fracture or malfunction of implanted orthopedic hardware cannot be concluded from the current study, this idea presents an interesting theory for analysis in future investigations.

Elderly patients are often frail and frequently have multiple medical problems that make it difficult for them to withstand the physiologic stress associated with injuries such as hip fracture.^{1,2} In this setting, chronic disease may be exacerbated, further complicating patient care. Studies in this patient population have found that readmission is commonly the result of pre-existing pulmonary or neurologic disease or diabetes.^{6,7} The current study had similar findings in that patients with pre-existing pulmonary disease were almost twice as likely to be readmitted within 30 days of hospitalization because of hip fracture. Typically, frail patients with multiple baseline comorbidities require longer and more extensive care after an injury such as a hip fracture. This study also found that patients with initial hospital length of stay of 8 days or longer had a two-fold increase in the risk of readmission. These findings are similar to those reported by Dailey et al,⁴ who found an association between readmission rates and initial hospital length of stay in patients undergoing orthopedic surgery.

Data from the current study suggest that discharge disposition is also associated with the risk of readmission. Contrasting evidence is found in the current literature on discharge disposition as a risk factor for readmission. Boockvar et al¹⁰ conducted a prospective multisite cohort study and found no significant relationship between initial discharge location and readmission. However, Dailey et al⁴ reported that patients who were discharged to a skilled nursing facility had a two-fold increase in risk of readmission compared with patients who were discharged to home, were discharged to inpatient rehabilitation, or were discharged with orders for home medical therapy. The current study showed a statistically significant difference in readmission rates for patients who were discharged to a skilled nursing facility vs other discharge dispositions. Patients who were discharged to a skilled

nursing facility were approximately 1.5 times more likely to require readmission than patients who were discharged to a lower-acuity setting. Approximately one-fourth of these readmissions were caused by infection. This finding is not unique to the current study. Infectious complications in patients admitted to any health care facility are common, with urinary tract infection cited as the most frequent infection in patients in skilled nursing facilities. Therefore, appropriate infection control practices and proper staff training are of utmost importance.^{11,12}

These data present an avenue for institutions to engage in quality improvement efforts to optimize the clinical status of patients with pre-existing diseases that are shown to increase the risk of readmission. Previous findings by Dy et al¹³ showed that collaboration and monitoring of patients with practitioners specializing in geriatric care may prevent readmission in select populations of geriatric patients receiving surgical care for hip fracture. Similarly, Hahnel et al⁹ proposed that one-third of readmissions after hip fracture may have been avoided with the help of a dedicated “orthogeriatric” practitioner. Further efforts could be geared toward optimizing the dose, frequency, and duration of perioperative antimicrobial therapy in addition to prompt removal of catheters and intravascular devices when clinically indicated.

Although the current study showed important findings and risk factors associated with readmission after hospitalization for hip fracture, this study is not without limitations. The retrospective nature of the study design inherently introduced the potential for selection bias. In addition, the primary outcome of the authors’ study on readmission rates may have been slightly underestimated because some patients could have been readmitted to another facility and therefore not captured in this analysis. In addition, the current study could not always identify a single primary diagnosis or complication for readmission. For example, patients who were readmitted because of infectious complications may have had concomitant cardiovascular dysfunction that was related to the infection and was not an exacerbation of baseline cardiovascular disease. Accordingly, some patients had multiple complications documented on readmission. Finally, the inclusion of documented complications in patients who were readmitted was based purely on information retrieved from the medical record and was not verified with predefined clinical parameters.

Conclusion

Despite the innate limitations of this retrospective study, the study has strong statistical findings, suggesting that the data can be extrapolated to aid in identifying patients who may be at increased risk for readmission within 30 days of an initial hospital stay for hip fracture. The findings of this study in a rural area reflect previous data compiled from patients managed in urban centers. Regardless of a patient’s baseline geographic location, management should be consistently geared toward optimizing chronic disease while working concomitantly to minimize the duration of hospitalization before discharge. With changes in policies affecting hospital reimbursement and in an effort to achieve optimal outcomes, future studies should focus on identifying modifiable risk factors and developing management strategies to prevent readmission in these high-risk patients.

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Table 1**Surgical and Medical Complications**

Subset	Complications
Surgical	
Site infection	
Fracture	Femoral neck; intertrochanteric; subtrochanteric
Hardware failure	
Dislocation of hip implant	
Seroma/hematoma	
Pain management	
Medical	
Cardiovascular	Peripheral vascular disease; acute exacerbation of heart failure Subendocardial myocardial infarction; coronary atherosclerosis; atrial fibrillation
Gastrointestinal	Intestinal impaction; duodenal ulcer with hemorrhage; cirrhosis; gastrointestinal bleeding; constipation; calculus of gallbladder; noninfectious diarrhea; intestinal obstruction
Pulmonary	Obstructive chronic bronchitis with acute exacerbation Bronchus/lung cancer; pneumonitis
Renal	Complications caused by a renal dialysis device; acute renal failure
Endocrine	Hypothyroidism
Neurologic/psychiatric	Transient cerebral ischemia; altered mental status; cerebral artery occlusion/cerebral infarction; dementia
Hematologic	Pancytopenia; pulmonary embolism; acute post-hemorrhagic anemia; atheroembolism
Electrolyte, glucose, and fluid disorders	Severe hypoglycemia; hypercalcemia Dehydration
Musculoskeletal, not related to surgical site	Nontraumatic hematoma of soft tissue; closed intertrochanteric fracture
Infection	Pneumonia; urinary tract infection; <i>Clostridium difficile</i> enteritis; osteomyelitis; infection secondary to hematoma; diverticulitis
Sepsis	
Rehabilitation	

Table 2

Univariate Analysis of Non-readmitted Versus Readmitted Patients After Surgical Repair

Variable	Non-readmitted Patients (n=1343)	Readmitted Patients (n=139)	P
Age, mean±SD (range), y	81.81±7.77 (65–103)	81.83±8.31 (65–102)	.9764
Sex, male, No.	323 (24.05%)	36 (25.90%)	.6282
Place of injury, No.			
Home	961 (71.56%)	104 (74.82%)	.9426
Public facility	82 (6.11%)	8 (5.76%)	
Residential institution	193 (14.37%)	19 (13.67%)	
Street	12 (0.89%)	1 (0.72%)	
Others	95 (7.07%)	7 (5.04%)	
Injury Severity Score, mean±SD (range)	8.98±0.23 (4–9)	8.96±0.42 (4–9)	.4984
Entry system, No.			
Facility transfer	450 (33.51%)	27 (19.42%)	.0020 ^a
Prehospital with trauma team activation	2 (0.15%)	0	
Prehospital without trauma team activation	891 (66.34%)	112 (80.58%)	
Discharged to, No.			
Nonskilled nursing facility	434 (32.32%)	31 (22.30%)	.0154 ^a
Skilled nursing facility	909 (67.68%)	108 (77.70%)	
Comorbidity, No.			
Cardiovascular disease	1154 (85.93%)	127 (91.37%)	.0746
Pulmonary disease	319 (23.75%)	53 (38.13%)	.0002 ^a
Neurologic disease	404 (30.08%)	45 (32.37%)	.5756
Gastrointestinal disease	39 (2.90%)	5 (3.60%)	.598
Psychiatric disease	396 (29.49%)	49 (35.25%)	.158
Renal disease	16 (1.19%)	1 (0.72%)	>.9999
Diabetes	360 (26.81%)	48 (34.53%)	.0522
Autoimmune disease	44 (3.28%)	4 (2.88%)	>.999
Hematologic disease	292 (21.74%)	35 (25.18%)	.3522
Cancer	26 (1.94%)	1 (0.72%)	.5058
History of surgery	167 (12.43%)	29 (20.86%)	.0052 ^a
Hospital stay, mean±SD (range), d	6.99±4.03 (1–47)	7.98±4.24 (2–28)	.0060 ^a
Intensive care unit stay, mean±SD (range), d	3.73±4.07 (1–19)	5.20±3.56 (2–9)	.4396
Type of procedure, No.			
Replacement	503 (37.45%)	58 (41.73%)	.3228
Fixation	844 (62.84%)	83 (59.71%)	.4676

^a Statistically significant at $P=.05$.

Table 3

Medical and Surgical Complications Precipitating Readmission

Complication	No.	%
Medical		
Infection	31	31.63
Cardiovascular	20	20.41
Gastrointestinal	14	14.29
Neurologic/psychiatric	8	8.16
Hematologic	7	7.14
Pulmonary	5	5.1
Electrolyte, glucose, and fluid	5	5.1
Musculoskeletal, not related to surgical site	4	4.08
Renal	3	3.06
Sepsis	2	2.04
Endocrine	1	1.02
Rehabilitation	1	1.02
Surgical		
Surgical site infection	16	39.02
Fracture	12	29.27
Hardware failure	8	9.51
Dislocation of hip implant	4	9.76
Seroma/hematoma	2	4.88
Pain	1	2.44

Table 4

Nonsurgical Infections

Medical Complication	No.	%
Pneumonia	16	51.61
Urinary tract infection	13	41.94
<i>Clostridium difficile</i> colitis	5	16.13
Diverticulitis	1	3.23
Osteomyelitis	1	3.23

Table 5

Predictors of Readmission

Effect	Odds Ratio Estimate			<i>P</i>
	Point Estimate	95% Wald	Confidence Limit	
Pulmonary disease	1.885	1.305	2.724	.0007
Hospital length of stay 8 d	1.853	1.223	2.807	.0036
Discharge to skilled nursing facility	1.586	1.043	2.413	.031