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CLINICAL RESEARCH

Medicine versus Orthopaedic Service for Hospital Management of Hip Fractures

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Abstract

Background Hospital care of patients with hip fractures often is managed primarily by either a medicine or orthopaedic service, depending on the institution. Whether complication rates, length of stay, or time to surgery differs on different services is unknown.

Questions/purposes We therefore determined whether (1) perioperative complication rates, and (2) length of stay and time to surgery for patients undergoing surgical management of hip fractures differed by the specialty of the primary service.

Patients and Methods We performed a retrospective cohort study at a university-based academic hospital of patients undergoing surgery for hip fracture admitted to medicine and orthopaedic services during 2006. Of the 98 patients included in the analysis, 34% were managed by a medicine service and 66% by orthopaedics. Using multivariable regression models to adjust for patient characteristics and comorbidities, we determined whether service designation predicted the likelihood of severe or intermediate perioperative complications, length of stay, or time to surgery.

Results The rate of severe or intermediate complications for patients undergoing surgical management of hip fractures was 30%. Patients with medicine or orthopaedic services did not differ in the rate of severe or intermediate complications or length of stay in adjusted analysis. However, time to surgery was longer in patients managed by the medical service in adjusted analysis.

Conclusions In our patient cohort, the likelihood of perioperative complications occurring among patients with hip fractures did not differ by service designation in adjusted analysis.

Level of Evidence Level II, prognostic study. See Guidelines for Authors for a complete description of levels of evidence.

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Each author certifies that his or her institution approved the human protocol for this investigation and that all investigations were conducted in conformity with ethical principles of research.
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Introduction

Although in-hospital mortality rates for hip fracture have declined by a third within the last 15 years [1, 4], hip fracture remains the most common injury requiring

hospitalization among persons 65 years and older [2]. Posthospital institutionalization rates are high with 41% of patients discharged to nursing homes [11]; life expectancy is estimated to be reduced by 25% after hip fracture with an average of 24% of patients older than 50 years with hip fractures dying during the year after the fracture [6, 11]. Hip fracture management is also costly with annual hospital costs reaching nearly $9.2 billion and annual overall costs exceeding $20 billion per year in the United States [3, 6]. Thus, surgical and hospital care of patients with hip fractures should focus on reducing morbidity and mortality in a cost-effective manner.

Huddleston et al. reported that a multidisciplinary approach with hospitalist-orthopaedic comanagement for elective hip and knee arthroplasty hospital care reduces overall medical complication rates compared with traditional care [8]. The same group also found the establishment of a hospitalist care model involving comanagement by a teaching orthopaedic surgery service and hospitalist service for elderly patients with hip fractures was associated with decreased time to surgery and length of stay without differences in 30-day readmission or 1-year mortality rates [5, 9]. Vidan et al. reported a daily multidisciplinary geriatric intervention (consisting of daily geriatrician, rehabilitation specialist, and social work involvement) reduced mortality and major medical complications in patients hospitalized for hip fracture [12]. Although these nontraditional approaches to hospital hip fracture management reportedly reduce postoperative complications, they require establishment of new multidisciplinary services and resource allocation that may not be available to all institutions.

At our institution, patients with hip fractures historically have been admitted to the orthopaedic surgery service with medicine consultation when deemed necessary. A few years ago these admission strategies were questioned because patients seemed to be more medically complex as the prevalence of chronic disease has been increasing [7]. Therefore in 2005, the Departments of Medicine and Orthopaedics instituted guidelines directing patients with hip fractures deemed to have active medical issues to be admitted to the medicine service with the orthopaedic service providing consultation for surgical services. The new guidelines were disseminated passively; therefore, interpretation and adherence to these guidelines were highly variable, depending on the individual emergency medicine, internal medicine, and orthopaedic staff, resulting in patients with a range of medical complexities on both services.

We therefore asked whether (1) perioperative complication rates differed by primary service after adjustment for patient characteristics and comorbidities; and (2) length of stay or time to surgery differed by primary service.

Patients and Methods

We retrospectively reviewed the charts of all 151 patients undergoing surgery in 2006 for fractures of the femoral head/neck, intertrochanteric, or subtrochanteric regions at the Penn State Milton S. Hershey Medical Center. We excluded patients managed nonoperatively. Patients admitted to services other than orthopaedic surgery, internal medicine, or family medicine also were excluded; this resulted in 32 being excluded, most of whom were admitted to trauma surgery. Additionally, we excluded patients younger than 50 years ($n = 10$), those with other major concomitant trauma ($n = 2$), suspected pathologic fractures ($n = 4$), bilateral hip fractures ($n = 0$), or previous fracture or surgery at the current fracture site ($n = 1$). An additional four patients met multiple exclusion criteria. The remaining 98 patients were included in the analysis, of whom 65 were admitted to orthopaedic surgery and 33 were admitted to medicine. There were nine patients initially admitted to the orthopaedic surgery service who were transferred to the medicine service during the hospitalization; because we were interested in the affect of the admitting service, these patients were analyzed as orthopaedic surgery patients. Of the 65 orthopaedic surgery patients, 53 received a medicine consultation. Four patients died between 2 and 11 days postoperatively. The study was approved by the Penn State College of Medicine's Institutional Review Board.

All patient data were obtained from the medical records. Data for demographics (gender, age, race/ethnicity, marital status), preadmission residence (private residence versus assisted living/nursing home), and functional status (ambulatory without aids versus cane/walker/wheelchair-dependent) were collected. The admission history, progress notes, consultant notes, and discharge summary were used to determine medical history of previously diagnosed dementia, chronic obstructive pulmonary disease (COPD)/chronic lung disease, congestive heart failure, coronary artery disease/myocardial infarction, diabetes, stroke/transient ischemic attack, end-stage renal disease/renal transplant, thromboembolic disease (deep vein thrombosis or pulmonary embolism), peripheral vascular disease, current smoking, and current alcohol use. We acknowledge that medical records are not always complete, and that the medical comorbidities of interest may have been present but not documented. We presumed these medical comorbidities were absent if they were not specifically documented in the aforementioned areas of the medical record. Type of hip fracture (femoral neck, intertrochanteric, or subtrochanteric) and the type of surgical procedure (arthroplasty, internal fixation by percutaneous pinning with cannulated screws, internal fixation with dynamic hip screw, or internal fixation with intramedullary nail) also

was noted. The sample was entirely of the White race, which is reflective of the central Pennsylvania population; the majority of the study population were residents of Dauphin, Lebanon, Lancaster, Cumberland, and Schuylkill counties, where the population is 91% White [10]. The orthopaedic and medicine patients differed in several baseline characteristics (Table 1). The patients on the medicine service were more likely to need ambulatory aids, have dementia, COPD/chronic lung disease, congestive heart failure, coronary artery disease, end-stage renal disease, and peripheral arterial disease than patients on the orthopaedic service. All patients received antibiotic prophylaxis before surgery.

Complications after surgery were divided into three major categories: severe, intermediate, and minor [5]. Our main outcome variable was the occurrence of any severe or intermediate complication during the hospitalization. Severe medical complications were in-hospital death; respiratory failure (from any cause necessitating mechanical ventilation for longer than 24 hours postoperatively or need for reintubation); acute myocardial infarction (new Q wave, elevated troponin I level, increase of the CK-MB level); renal failure (new need for dialysis); cardiac arrest; or pulmonary embolus (high-probability ventilation-perfusion scan, positive spiral CT scan, or positive pulmonary angiogram). Intermediate medical complications were pneumonia (infiltrate seen on chest radiograph and symptoms consistent with pneumonia); congestive heart failure; deep venous thrombosis; stroke or transient ischemic attack; delirium; ileus; or gastrointestinal bleeding. Minor complications were urinary tract infections, postoperative fever (temperature greater than 38°C on two occasions in a 24-hour period excluding the first 24 hours postoperatively); electrolyte abnormalities (any potassium or sodium level outside the normal institutional normal range); other infections; arrhythmia; pressure sores; or anemia requiring transfusion.

Secondary outcomes evaluated were length of hospital stay and time from presentation to surgery. The four patients who died were excluded from the length-of-stay analysis.

Patient characteristics and complication rates were compared by service designation (medicine vs. orthopaedics)

Table 1. Baseline characteristics of patients undergoing surgery for hip fracture surgery stratified by service (n = 98)

Characteristic	Orthopaedic service (n = 65; %)	Medicine service (n = 33; %)	p Value
Female	51 (78%)	21 (64%)	0.11
Age, mean (SD)	78 (11)	82 (10)	0.08
Married	28 (43%)	13 (39%)	0.73
Preadmission residence			
Private home	47 (72%)	23 (71%)	0.96
Assisted living/nursing home	18 (28%)	9 (28%)	
Preadmission functional status			
Ambulatory without aids	37 (57%)	11 (33%)	0.03
Cane/walker/wheelchair	28 (43%)	22 (67%)	
Dementia	12 (18%)	14 (42%)	0.01
Chronic obstructive pulmonary disease/chronic lung disease	12 (18%)	13 (40%)	0.02
Congestive heart failure	5 (8%)	13 (39%)	0.0001
Coronary artery disease	9 (14%)	13 (39%)	0.004
Diabetes	14 (22%)	11 (33%)	0.21
Stroke/transient ischemic attack	10 (15%)	8 (24%)	0.28
End-stage renal disease/renal transplantation	1 (2%)	9 (27%)	< 0.0001
Thromboembolic disease	3 (5%)	4 (12%)	0.17
Peripheral arterial disease	3 (5%)	7 (21%)	0.01
Current smoker	8 (12%)	3 (9%)	0.63
Current alcohol use	2 (3%)	1 (3%)	0.99
Type of hip fracture			
Femoral neck	33 (51%)	11 (33%)	0.10
Intertrochanteric or subtrochanteric	32 (49%)	22 (67%)	
Surgical procedure			
Arthroplasty	18 (28%)	5 (15%)	0.17
Internal fixation	47 (72%)	28 (85%)	

using chi square tests and t-tests, where appropriate. To determine the association between service designation and the main outcome variable (any severe or intermediate complication) while controlling for potential confounding variables, we used a multivariable logistic regression model. Patient characteristics and comorbidities were considered potential confounding variables and were included in the multivariable model if they had at least a mild bivariate association with the outcome variable, which we defined as a p value less than 0.2 using a chi square test. Using these criteria, the multivariable model testing the association of service designation with any severe or intermediate complications was adjusted for gender, congestive heart failure, coronary artery disease, and thromboembolic disease.

We took a similar approach to test our secondary outcome variables, which were length of stay and time from presentation to surgery. These outcomes were modeled using linear regression with covariates selected from patient characteristics and comorbidities with at least a mild bivariate association with the outcome. The length of stay regression model was adjusted for dementia, congestive heart failure, coronary artery disease, end-stage renal disease, thromboembolic disease, and type of hip fracture. Finally, the time to surgery regression model was adjusted for gender, congestive heart failure, coronary artery disease, end-stage renal disease, and peripheral vascular disease.

As stated previously, we determined whether patient comorbidities were present based on medical chart review. Medical comorbidities were assumed to be absent if they were not documented in the hospital record. As medical records are not always complete, there may be instances when we assumed a comorbidity to be absent when it actually was just not documented. We assume that the quality of the medical documentation was equal by the medical and orthopaedic providers, so our method of using imputed values for missing values would not affect the main results through differential misclassification. All analyses were two-tailed. All data were analyzed using SAS for Windows 9.1 (SAS Institute Inc, Cary, NC). Our sample size allowed 80% power to detect a 30% difference in complication rates between services at an alpha value of 0.05.

Results

There was no difference in the likelihood of severe or intermediate complications by service designation after adjusting for patient characteristics and comorbidities. There were a total of seven severe, 26 intermediate, and 67 minor complications occurring among the 98 patients studied (Table 2). In the adjusted analysis, patients with the medicine service did not differ (odds ratio [OR], 1.17; 95% confidence interval [CI], 0.35–3.89; $p = 0.80$) from patients with the orthopaedic service regarding likelihood of a severe or intermediate complication (Table 3). The presence of coronary artery disease was the only predictor of severe or intermediate complications (adjusted OR, 13.47; 95% CI, 3.61–50.28; $p = 0.0001$).

The median length of stay was similar ($p = 0.42$) on the two services in the adjusted analysis. Patients on the orthopaedic surgery service had a shorter ($p = 0.04$) median time to surgery (Table 4); the median time to surgery on the orthopaedic service was 12.0 hours versus 18.5 hours in the adjusted analysis.

Discussion

Hip fracture is a common injury in older persons that can lead to increased morbidity and mortality. Hospital management of patients with hip fractures should address effective and efficient care to reduce perioperative complications. However, it is not known whether primary assignment to an orthopaedic team versus a medical team affects likelihood of perioperative complications or lengths of stay for patients undergoing surgery for hip fractures. We therefore determined whether the primary service (orthopaedic surgery versus medicine) caring for the patient predicted (1) perioperative complication rates; or (2) length of stay and time to surgery.

We acknowledge several limitations in this study. First, we attempted to compare the outcomes of two groups of patients that were inherently different. Patients were more likely to be triaged to the medicine service if they had more baseline comorbidities. We attempted to control for those differences in our logistic regression analysis, but it is possible risk adjustment was not fully robust. One way to address the covariate imbalance would have been to perform a propensity score analysis, but our limited sample size hindered our ability to draw adequate matches. Additional study with larger samples would be informative. Second, this was a retrospective cohort study using patient chart review, so the data were limited to the quality of chart documentation. Specifically, medical comorbidities were determined by chart abstraction; we assumed that patients did not have a specific comorbidity if it was not explicitly documented, but there likely was missing information. However, we assumed this would not bias our results as we presumed the quality of chart documentation was similar by primary service. Third, this analysis was limited to the experience of one academic institution and therefore may not be generalizable beyond our hospital. Finally, it is possible small differences in perioperative complications

Table 2. Perioperative complications by orthopaedic versus medicine service (n = 98)

Complication	Orthopaedic service (n = 65; %)	Medicine service (n = 33; %)	p Value*
Any severe or intermediate complication	15 (23%)	14 (42%)	0.05
Any severe complication	1 (2%)	6 (18%)	0.003
In-hospital death	0 (0%)	4 (12%)	
Respiratory failure	0 (0%)	4 (12%)	
Acute myocardial infarction	1 (2%)	1 (3%)	
Renal failure requiring dialysis	0 (0%)	1 (3%)	
Cardiac arrest	0 (0%)	4 (12%)	
Pulmonary embolism	0 (0%)	1 (3%)	
Any intermediate complication	14 (22%)	12 (36%)	0.13
Pneumonia	0 (0%)	1 (3%)	
Congestive heart failure	1 (2%)	0 (0%)	
Deep venous thrombosis	2 (3%)	1 (3%)	
Stroke/transient ischemic attack	0 (0%)	0 (0%)	
Delirium	7 (11%)	5 (15%)	
Ileus	0 (0%)	0 (0%)	
Gastrointestinal bleeding	0 (0%)	0 (0%)	
Arrhythmia	2 (3%)	3 (9%)	
Pressure sore	6 (9%)	6 (18%)	
Any minor complication	41 (63%)	26 (79%)	0.11
Urinary tract infection	9 (14%)	4 (12%)	
Fever	9 (14%)	7 (21%)	
Electrolyte abnormalities	26 (40%)	22 (67%)	
Other infection	1 (2%)	3 (9%)	
Anemia requiring transfusion	24 (37%)	17 (52%)	

*Chi square tests.

Table 3. Likelihood of severe and intermediate perioperative complications* (n = 97)

Characteristic	Adjusted odds ratio	95% confidence interval	p Value
Admitting Service			
Orthopaedic surgery	Reference	Reference	0.80
Medicine	1.17	0.35–3.89	
Gender			
Male	Reference	Reference	0.27
Female	0.52	0.16–1.66	
Congestive heart failure	0.68	0.14–3.33	0.63
Coronary artery disease	13.47	3.61–50.28	0.0001
Thromboembolic disease	6.69	0.90–49.81	0.06

*Only covariates associated with likelihood of severe/intermediate postoperative complications ($p < 0.2$) in bivariate analysis were included in this model.

by the specialty of the primary service do exist and our sample size was not large enough to detect them.

Based on our adjusted analyses we observed no difference in the likelihood of severe or intermediate perioperative complications when comparing surgical patients with hip fractures assigned to orthopaedic versus medicine services. Although multidisciplinary approaches to hospital management of surgical patients with hip fractures have resulted in reduced complication rates as reported in other studies [5, 9, 12], our study suggests simply shifting the primary management from the surgical team to the medical team (or vice versa) does not.

Table 4. Secondary outcomes by orthopaedic versus medicine service (n = 98)

Outcome	Orthopaedic surgery (n = 65)	Medicine (n = 33)	p Value*
Length of stay (days); median (interquartile range)	4 (3–7)	6 (4–10)	0.50*
Time to surgery (hours); median (interquartile range)	12.0 (8.0–23.0)	18.5 (14.0–33.0)	0.04*

*Significance testing using linear regression models on log-transformed data adjusting for covariates associated ($p < 0.2$) with length of stay (dementia, congestive heart failure, coronary artery disease, end-stage renal disease, thromboembolic disease, and type of hip fracture) and time to surgery (gender, congestive heart failure, coronary artery disease, stroke, end-stage renal disease, and peripheral vascular disease) were included in these models.

We also compared the effect of the primary service on the secondary outcomes of length of stay and time to surgery. In adjusted analyses, there was no difference between services for length of stay, but patients on the medicine service had a longer time until surgery. Longer time to surgery on the medicine service may be explained by inadequate adjustment for case mix; these patients may have required more preoperative evaluation or stabilization before surgery. Delays also may have resulted from extra time needed to coordinate the medicine service with the orthopaedic surgical team. Decreased time to surgery and decreased length of stay were observed by Phy et al. [9], who studied the effect of a hospitalist care model consisting of a teaching orthopaedic surgery service with comanagement by a hospitalist service. Like with the primary outcome of perioperative complications, comprehensive multidisciplinary models may be needed to generate improvement in length of stay and time to surgery.

We found no difference in the severe and intermediate complication rates of surgical patients with hip fractures assigned to medical or orthopaedic services. Additional study with larger samples to determine effects of service designation are needed. Previous reports have suggested improved outcomes in patients with hip fractures with establishment of novel multidisciplinary care teams [5, 9, 12]; it may be that dedicated services such as those are required to see improved outcomes and simply shifting patients to traditional medical services is not sufficient. However, establishment of these multidisciplinary care teams specifically for surgical patients with hip fractures requires cost and resource allocation that is not widely available, especially at smaller hospitals that have lower surgical volume. Whether lower-volume institutions would see the same benefits as larger institutions is also unknown. Because such specialized programs are not attainable for many institutions, additional study of the effect of primary service designation in traditional service models would be important. For the present, hospital admission strategies for surgical patients with hip fractures will be determined largely by the resources and experience of individual hospitals.

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