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Does a Multidisciplinary Team Decrease Complications in Male Patients With Hip Fractures?

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Abstract

Background Men with hip fractures are more likely to experience postoperative complications than women. The Medical Orthopaedic Trauma Service program at New York Presbyterian Hospital utilizes a multidisciplinary team approach to care for patients with hip fractures. The service is comanaged by an attending hospitalist and orthopaedic surgeon, with daily walking rounds attended by the hospitalist, orthopaedic resident, physical therapist, social worker, and a dedicated Medical Orthopaedic Trauma Service physician assistant.

Questions/purposes We asked whether a multidisciplinary service for patients with hip fracture decreases (1) the incidence of inpatient complications in men, (2) the length of hospitalization, and (3) 90-day and 1-year mortality.

Patients and Methods We retrospectively reviewed the charts of 74 men who had surgery for a nonperiprosthetic femoral neck, intertrochanteric, or subtrochanteric fracture for two 7-month periods before and after implementation of the Medical Orthopaedic Trauma Service. Age, ethnicity, comorbidity status, time to surgery, and postoperative complication data were collected. Regression modeling was used to evaluate the likelihood of postoperative complications, length of hospitalization, and 90-day and 1-year mortality while controlling for age, Charlson Comorbidity Index score, fracture type, and time from admission to surgery.

Results We observed a decrease in the likelihood of experiencing at least one inpatient complication in male patients after implementation of the Medical Orthopaedic Trauma Service (odds ratio = 0.264). There was no difference in length of hospitalization, 90-day mortality, or 1-year mortality.

Conclusions Multidisciplinary collaboration for patients with hip fractures can decrease the likelihood of experiencing inpatient complications in male patients.

Each author certifies that he or she has no commercial associations (eg, consultancies, stock ownership, equity interest, patent/licensing arrangements, etc) that might pose a conflict of interest in connection with the submitted article.
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.
This work was performed at the Orthopaedic Trauma Service, New York Presbyterian Hospital/Weill Cornell Medical College.
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Level of Evidence Level III, therapeutic study. See Guidelines for Authors for a complete description of levels of evidence.

Introduction

Hip fractures create a substantial burden to both the individual and society. Current annual healthcare costs associated with hip fractures are between 10.3 billion USD and 15.2 billion USD [8], and the incidence of hip fractures is expected to rise substantially as an increasing proportion of the population ages [3]. Hip fractures are associated with mortality ranging from 12% to 37% 1 year after surgery [8, 15, 16] and substantial compromises to the patients' quality of life [17]. There is a disparity in outcomes between male and female patients, with the former having a greater mortality rate at 1 year and being more likely to experience a postoperative complication [1, 11, 14]. Additionally, men are less likely to comply with osteoporosis management recommendations after they are discharged [14]. These disparities in outcomes between genders represent a charge to improve care for male patients with hip fractures but also shed light on important areas for improvement in all patients with hip fractures.

Minimizing complications during inpatient care for hip fractures has been a topic of recent speculation. One approach to improving outcomes in patients with hip fractures has involved collaboration between orthopaedic surgeons and geriatricians [5, 6, 21]. This form of comanagement has decreased inpatient complications and length of stay [5, 6, 21]. In March 2008, we instituted the Medical Orthopaedic Trauma Service (MOTS) program in which elderly patients with hip fractures are admitted to a service comanaged by attending and resident physicians from the internal medicine and orthopaedic surgery departments. Daily walking rounds, led by the medical attending, serve as a form of communication between the medical and surgical staff, as well as nurses, social workers, and physical therapists. A coordinated plan to facilitate inpatient care, rehabilitation progress, and discharge planning is delivered to the patient each morning as a result of this multidisciplinary coordination. Previous studies have shown the benefits of collaboration between surgeons and geriatricians [5, 6, 21], and we believe our model of care will decrease the incidence and severity of inpatient complications after hip fractures. A multidisciplinary care model that involves physical therapists, social workers, and case managers (in addition to the orthopaedic surgeon and internist) has not yet been described in the scientific literature.

We investigated whether the MOTS multidisciplinary model of care for patients with hip fractures decreases (1) the incidence of inpatient complications in male patients with hip fractures, (2) the length of hospitalization, and (3) 90-day and 1-year mortality.

Patients and Methods

To preliminarily evaluate the impact of MOTS on the care for patients with hip fractures, we identified a patient population (men) at increased risk for complications after hip fractures [1, 11, 14]. From an institutional database, we identified 306 patients who had surgery for a nonperiprosthetic femoral neck, intertrochanteric, or subtrochanteric fracture from May to December 2007 and May to December 2008. These time periods were chosen to compare patient outcomes before and after initiation of the MOTS program in March 2008. We obtained prior approval from our Institutional Review Board. Seventy-four of the 306 patients (24%) were male: 40 in the pre-MOTS cohort and 34 in the post-MOTS cohort (Table 1). The average age was similar (t test, $p = 0.07$) in the pre-MOTS cohort (82.9 years) and the post-MOTS cohort (78.7 years). Thirty-six of the 40 pre-MOTS patients and 29 of the 34 post-MOTS patients were white. Times from admission to surgery were similar in the pre-MOTS and post-MOTS groups. The average Charlson Comorbidity Index was 2.5 in the post-MOTS group, which was higher (t test, $p = 0.029$) than that in the pre-MOTS group (1.7).

Before implementation of the MOTS program, patients with hip fractures were admitted to the orthopaedic surgery service, unless they were deemed acutely medically unstable by the emergency room physician. On the orthopaedic service, the orthopaedic house-staff physician primarily cares for patients, with a general medical consultant (resident and attending physicians) available for preoperative and postoperative consultation. Plans for rehabilitation therapy and discharge were discussed by the orthopaedic resident, physical therapists, and social workers on a patient-by-patient basis throughout the day. The MOTS program was implemented in March 2008 in an attempt to coordinate the care received by elderly patients with fragility fractures. Medically stable patients with hip fractures were admitted to the MOTS, which is comanaged by the internal medicine and orthopaedic surgery departments. A dedicated physician extender (nurse practitioner or physician assistant) was assigned to care for all MOTS patients. Preoperative and postoperative plans of care were coordinated through the physician extender after communicating with the orthopaedic and internal medicine residents and attending physicians. Daily inpatient walking rounds were led by the medical attending and included the orthopaedic resident, MOTS physician extender, physical therapist, social worker, and nursing staff. Medical and

Table 1. Demographic data, inpatient complications, and mortality data for male patients

Variable	Pre-MOTS	Post-MOTS	Statistical result
Number of patients	40	34	
Age (years)*	82.9 ± 8.2 (61–100)	78.7 ± 1.2 (55–97)	Independent-samples t test, p = 0.07
			Mean difference, 4.3 (95% CI: −3.4, 8.8)
Race	White: 36 (90%)	White: 29 (85.3%)	Pearson chi square test, p = 0.537
	Nonwhite: 4 (10%)	Nonwhite: 5 (14.7%)	
Fracture type	Femoral neck: 22 (55%)	Femoral neck: 17 (50%)	Pearson chi square test, p = 1.0
	Pertrochanteric: 18 (45%)	Pertrochanteric: 17 (50%)	
Charlson Comorbidity Index*	1.7 ± 1.7 (0–8)	2.5 ± 1.8 (0–7)	Independent-samples t test, p = 0.029
			Mean difference, −0.8 (95% CI: −1.6, 0.3)
Time from admission to surgery (days)*	1.8 ± 1.0 (0–6)	2.4 ± 2.3 (1–14)	Mann-Whitney U test, p = 0.163
Total length of stay (days)*	11.3 ± 9.7 (3–51)	11.9 ± 9.7 (4–53)	Mann-Whitney U test, p = 0.752
Inpatient complications (at least 1)	25 (62.5%)	16 (47.1%)	Pearson chi square test, p = 0.183 (95% CI: 0.211, 1.351)
MI or new arrhythmia	5 (12.5%)	3 (8.8%)	
DVT or PE	0 (0%)	0 (0%)	
Delirium	6 (15%)	4 (11.8%)	
Surgical site infection	0 (0%)	2 (5.8%)	
Decubitus ulcers	1 (2.5%)	2 (5.8%)	
Postoperative UTI	4 (10.0%)	6 (17.6%)	
Step-down or ICU transfer	10 (25.0%)	12 (35.3%)	
In-hospital mortality	1 (2.5%)	1 (2.9%)	
90-day mortality	5 (12.5%)	4 (11.8%)	Pearson chi square test, p = 0.923
1-year mortality	9 (22.5%)	9 (26.5%)	Pearson chi square test, p = 0.629

* Values are expressed as mean ± SD, with range in parentheses; all other values are expressed as number of patients, with percentage in parentheses; MOTS = Medical Orthopaedic Trauma Service; MI = myocardial infarction; DVT = deep venous thrombosis; PE = pulmonary embolism; UTI = urinary tract infection; ICU = intensive care unit; CI = confidence interval.

surgical plans and findings were discussed, as well as plans for rehabilitation progress and discharge. There was an afternoon debriefing involving the MOTS physician extender, medical attending, and orthopaedic resident.

We collected demographic data, including name, date of birth, social security number, gender, and race, from hospital registration data. Inpatient charts (admission notes, progress notes, operative dictations, consult notes, and discharge summaries) were reviewed to collect the date of admission, date and time of surgery, date of discharge, fracture type, surgeon, type of operative repair, and comorbid diagnoses. Patient comorbidity was quantified using the Charlson Comorbidity Index [2]. Incidences of postoperative complications (myocardial infarction, new arrhythmia, deep venous thrombosis, pulmonary embolism, pneumonia, delirium, surgical site infection, decubitus ulcers, postoperative urinary tract infections, transfer to step-down monitoring or intensive care unit, or in-hospital mortality) were recorded after detailed review of the inpatient chart. Myocardial infarction was defined by a postoperative increase in troponin or creatinine kinase levels, with or without ischemic changes on electrocardiograph. New arrhythmias were defined by a clinical diagnosis confirmed on electrocardiograph. Diagnoses for deep venous thrombosis and pulmonary embolism were based on sonograph (for the former only) or CT findings. Delirium was defined as a documented mental status change. Pneumonia was based on clinical diagnosis and confirmed on chest radiograph or CT scan. Surgical site infection was defined as a wound infection diagnosed clinically by the orthopaedic surgeon and treated with antibiotics or a formal incision and débridement. Decubitus ulcers were defined as pressure-induced areas of skin compromise or breakdown, as documented by the physician or nursing staff. Postoperative urinary tract infections were defined as new positive urinalysis or urine culture (when compared to the preoperative urinalysis and urine culture obtained for each patient). Transfer to step-down or intensive care settings and inpatient mortality were recorded using physician and nursing documentation. No further information was available after hospital discharge except whether or not the patient was readmitted to

the hospital within 1 year. Information regarding mortality after discharge was obtained through review of the Social Security Database [18]. Death within 90 days and 1 year of surgery was recorded. Aside from mortality, patient outcomes were not followed after discharge from the hospital.

Descriptive statistics were calculated for male patients in the pre-MOTS and post-MOTS cohorts. The distribution of age, Charlson Comorbidity Index, time between admission and surgery, total length of stay, incidence of postoperative complications, and mortality at 90 days and 1 year were evaluated, and the skewness and kurtosis for each parameter were calculated. The data for age, mortality at 1 year, incidence of postoperative complications, and Charlson Comorbidity Index were found to be normally distributed (skewness and kurtosis less than absolute value of 2). The mortality at 90 days, total length of stay, and time between admission and surgery were not normally distributed. Independent-samples t test (for continuous variables in a normal distribution), Mann-Whitney U test (for continuous variables not in a normal distribution), and chi square analysis (for categorical variables) were used to compare the age, Charlson Comorbidity Index, time between admission and surgery, total length of stay, incidence of postoperative complications, and mortality at 90 days and 1 year between the pre-MOTS and post-MOTS cohorts. Binary logistic regression modeling was used to determine differences in postoperative complications and mortality after implementation of the MOTS program, after controlling for potential confounders. Separate regression models were constructed for postoperative complications, 90-day mortality, and 1-year mortality. Linear regression modeling was used for length of hospitalization. Potential confounders (age, race, Charlson Comorbidity Index, type of fracture, and time from admission to surgery) were entered as covariates in each regression equation in a backward conditional manner. All statistical analyses were performed using SPSS® 16.0 (SPSS Inc, Chicago, IL).

Results

We observed a decrease (odds ratio = 0.264; exp[B] = 3.791; p = 0.041) in the incidence of a patient experiencing at least one inpatient complication after implementation of the MOTS program, after controlling for age, Charlson Comorbidity Index, race, fracture type, and time from admission to surgery (Table 2). A total of 27 complications occurred in 25 of the pre-MOTS patients, while 30 total complications occurred in 16 of the post-MOTS patients.

The total length of stay was similar in the two groups (Table 1).

We observed no difference between the pre-MOTS and post-MOTS groups for 90-day (five of 40 pre-MOTS, four of 34 post-MOTS) and 1-year mortality (nine of 40 pre-MOTS, nine of 34 post-MOTS) (Table 2).

Table 2. Outcome variables evaluated using binary logistic regression model

After initiation of MOTS program	Exp(B)	p Value	95% CI for exp(B)
Inpatient complications			
Step 1*	3.791	0.041	1.054, 13.634
Step 2†	3.773	0.039	1.073, 13.270
Step 3‡	3.901	0.033	1.120, 13.587
Step 4§	3.692	0.055	0.977, 9.881
90-day mortality*	1.854	0.524	0.277, 12.399
1-year mortality*	1.464	0.601	0.351, 6.111

Binary logistic regression model controlled for: *age, Charlson Comorbidity Index, race, fracture type, and time from admission to surgery; †Charlson Comorbidity Index, race, fracture type, and time from admission to surgery; ‡Charlson Comorbidity Index, fracture type, and time from admission to surgery; §Charlson Comorbidity Index, race, and time from admission to surgery; backward conditional method of regression modeling was used for inpatient complications; MOTS = Medical Orthopaedic Trauma Service; CI = confidence interval.

Discussion

The role of multidisciplinary collaboration in the care of patients with hip fractures is still being defined, but initial studies have shown substantial promise in decreasing inpatient complications and length of stay [5, 6, 21]. At our institution, patients with hip fractures are admitted to the MOTS team and receive coordinated care with input from an orthopaedic surgeon, hospitalist, physical therapist, social workers, and nurses. Because male patients are known to be at increased risk for complications after hip fractures, we chose to study this population initially to evaluate the impact of the MOTS model. We therefore asked whether MOTS decreased (1) the incidence of inpatient complications in male patients with hip fractures, (2) the length of hospitalization, and (3) 90-day and 1-year mortality.

Our study has several limitations. First and foremost, the study only included male patients, which allowed us to focus on a group known to be at increased risk for complications after hip fractures. However, we acknowledge further studies that include females are needed, and those investigations are currently underway. Secondly, the retrospective nature of the study involved several inherent limitations: the assessment of comorbidity and postoperative complications was dependent on the clinical evaluation and documentation provided by previous healthcare providers. However, this limitation is persistent across both

study cohorts (pre-MOTS and post-MOTS), which limits its likelihood of influencing the study results. Thirdly, the occurrence of some of the complications, including delirium and decubitus ulcers, was derived from review of clinical documentation. Because of the retrospective nature of the study, we were unable to use standardized measures to assess for delirium and to grade the severity of decubitus ulcers. Again, these limitations affected both cohorts and likely had minimal influence when comparing outcomes between the two groups. Furthermore, this study is limited by its inclusion of in-hospital outcomes only. The retrospective nature of its design did not allow for followup of outcomes after discharge, such as return to prehospital function, cognition, and residence, which are important after sustaining a hip fracture.

We found the likelihood of experiencing at least one inpatient complication was lower for MOTS patients after controlling for age, Charlson Comorbidity Index, race, fracture type, and time from admission to surgery. Recent studies have suggested comanagement of patients by geriatricians and orthopaedic surgeons results in shorter length of stay, lower readmission rates, and lower complication rates [5, 6, 21]. Similar models of comanaged care, including the geriatric fracture center described by Friedman et al. [5, 6] and the comprehensive geriatric intervention described by Vidán et al. [21], are focused on protocol-driven care and quality management. The outcomes in our analysis of inpatient complications in male patients before and after implementation of the MOTS program replicate results most recently described in the United States [5, 6], Australia [4], and Spain [21] but also the experiences described previously in the United Kingdom [7, 12] (Table 3). As suggested by Vidán et al. [21], it is likely the lower likelihood of experiencing at least one postoperative complication is due to early identification of high-risk patients through early and regular involvement of internists, as their more specialized training allows them to identify and properly treat medical problems. The role of hospitalists in perioperative management has increased steadily in the last decade [19], and incorporation of their efforts into multidisciplinary models such as MOTS may maximize the short- and long-term benefits to patients. The involvement of internists during hospitalization provides a timely opportunity to educate patients about the importance of adherence to osteoporosis management recommendations after discharge to prevent a second fragility fracture [4, 20]. Additionally, evaluation of collaborative management between hospitalists and orthopaedic surgeons for elective total joint arthroplasty has shown surgeon and nursing preference for a collaborative model [10], suggesting a higher level of comfort with the care given to postoperative patients.

We observed no difference in the length of hospitalization after the implementation of MOTS. Previous studies on comanaged models of care for patients with hip fractures report conflicting findings with regard to length of acute hospitalization. González-Montalvo et al. [9] and Friedman et al. [5] have both shown reductions in length of stay in separate studies, while Khan et al. [13] and Fisher et al. [4] have separately shown no difference in the length of stay with comanaged units. While length of hospitalization is certainly important to evaluate, the impact of comanagement may be most apparent in the quality of care given to patients. The patient who has suffered a fragility fracture often has multiple concomitant medical issues, and attention to these nonsurgical aspects of care is better suited to the care provided by a hospitalist and/or geriatrician. Although we did not show a difference in the length of stay for patients, it is our anecdotal experience that patients, ancillary staff, and physicians are more comfortable with the quality of care given to patients with hip fractures cared for with our MOTS model.

Table 3. Comparison of outcome data in previous studies of comanagement of hip fractures

Study	In-hospital complications		Length of stay (days)*		Mortality	
	Before comanagement	With comanagement	Before comanagement	With comanagement	Before comanagement	With comanagement
Gilchrist et al. [7] (1988)	NR	NR	52.1 ± 9.7	41.7 ± 3.7	18% (6 months)	14% (6 months)
Kennie et al. [12] (1988)	NR	NR	41	24	NR	NR
Khan et al. [13] (2002)	NR	NR	26.14	26.88	10.4% (2 years)	11.1% (2 years)
Vidán et al. [21] (2005)	61.7%	45.2%	18	16	NR	NR
Fisher et al. [4] (2006)	71.0%	49.5%	16.4 ± 17.6	15.9 ± 14.9	NR	NR
Friedman et al. [5] (2009)	46.3%	30.6%	8.3 ± 6.3	4.6 ± 3.3	NR	NR
González-Montalvo et al. [9] (2010)	NR	NR	18	12	NR	NR
Dy et al.	62.5%	47.1%	11.3 ± 9.7	11.9 ± 9.7	22.5% (1 year)	26.5% (1 year)

* Values are expressed as mean ± SD or median; NR = not reported.

We observed no difference in 90-day and 1-year mortality. It is distinctly possible the reduction in the likelihood of suffering an inpatient complication may have improved the quality of life and return to function after hospital discharge but may not have had such a drastic effect so as to prevent mortality. Because of the retrospective nature of the study and its limit to a review of inpatient documentation, we were unable to evaluate for the functional impact of the MOTS program at further postdischarge time points. Vidán et al. [21] have shown an improvement in recovery of previous activities and function at 3 months postdischarge with a comprehensive geriatric hip fracture intervention but were unable to show maintenance of this improvement at 6 and 12 months postdischarge When viewed in the context of similar studies that did not show a difference in within-year mortality [7, 12, 13], our findings further support the possibility that focused multidisciplinary models of care may improve short-term outcomes for patients with hip fractures but may not yield longer-term benefits.

Our data suggest a comanaged multidisciplinary team approach to hip fracture care can decrease inpatient complications in a high-risk population. These results corroborate those in the literature and provide further support for multidisciplinary team approaches to caring for elderly patients with fragility fractures. Further study of this model, including outcomes in female patients, is underway.

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