



A multidisciplinary approach to improve the quality of care for patients with fragility fractures



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ABSTRACT

Background: Fragility fractures have become a worldwide epidemic associated with significant morbidity and mortality. As the world population ages, the number of patients that experience these fractures is also expected to rise. A multidisciplinary team was assembled that was coordinated by the Acute Inpatient Medical Service and included orthopedic surgeons, geriatricians, anesthesiologists, cardiologists, nurses, trauma surgeons, emergency medicine physicians, physiatrists, and physical therapists. This team was formed with the expectation that geriatric fragility fracture complications, specifically hip fractures, could be reduced by identifying and implementing best practices using guidelines from the American Academy of Orthopedic Surgery and those from the International Geriatric Fracture Society. **Methods:** We implemented a clinical pathway with a standardized approach with reduction in care variation and followed that by instituting performance improvement measures. The difference in outcome measurements as reported by TQIP for the year prior to implementation and the year following creation of the fragility fracture program was evaluated.

Results: Benchmarking data demonstrated improved outcomes for patients with fragility fractures. Length of stay was significantly below national average, mortality remained below national average, and complication rates for UTIs and pressure ulcers were both reduced from 2014 to 2015 and below the national average.

Conclusion: The clinical pathway we adopted for the care of patients with fragility fractures has resulted in reduced lengths of stay, below average mortality, and improved discharge disposition.

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1. Introduction

Fragility fractures have become a worldwide epidemic associated with significant morbidity and mortality. As the world's population ages, the number of patients that experience these fractures is also expected to rise. Fragility fractures are those that result from a standing height fall or less, or a fracture presenting without external evidence of trauma. These low energy fractures occur primarily in the elderly and predict future fractures. According to the U.S. Census Bureau, by 2060, the number of Americans aged 65 and older is projected to more than double from 46 million in 2016 to 98 million in 2060.¹ As fracture incidence increases with age in both genders, and especially with older

women experiencing age-adjusted rates as high as 49%, this issue has the potential to become a tremendous burden on the health care system.² The creation of geriatric fracture programs to specifically address fragility has been studied and shown to be beneficial in returning patients to their activities of daily living and reducing future falls.^{3,4}

The Trauma Quality Improvement Program (TQIP) is a prospectively collected database of the American College of Surgeons (ACS). Data is collected from member institutions, and benchmarking data is then returned to the institutions for performance improvement purposes. The program uses risk-adjusted benchmarking to provide each participating hospital with accurate national comparisons. Using our TQIP benchmarking data, we identified an opportunity to improve our care of patients with isolated hip fractures.

At our ACS Level II trauma center we assembled a multidisciplinary team, coordinated by the Academic Inpatient Medical

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Service (AIMS) in order to develop optimal care pathways and to address any institutional barriers to providing care to elderly patients with an isolated hip fracture at our institution. This team included orthopedic surgeons, geriatricians, anesthesiologists, cardiologists, nurses, trauma surgeons, emergency medicine physicians, physiatrists, and physical therapists and was organized around the American Academy of Orthopaedic Surgeons (AAOS) and the International Geriatric Fracture Society (IGFS) CORE certification guidelines, which encourage interdisciplinary care programs.^{5,6} Our team focused on orthogeriatric treatment and examined all barriers to optimal care for these patients, with a specific eye toward increasing postoperative mobility, controlling postoperative pain, and increasing educational efforts around osteoporosis.⁷

Our multidisciplinary fragility fracture team was established in January 2015. This team, led by the AIMS physicians, streamlined the hospital course for patients with isolated hip fractures, beginning with their admission from the emergency department (ED). The fragility fracture program clearly delineates responsibilities among providers and depicts a clear work flow from admission to post-hospital transition. Using an electronic medical record (EMR) order set unique for fragility hip fractures, these patients were quickly and efficiently admitted to the hospital after diagnosis, decreasing their wait time in the ED. During this admission process, the admitting physician executed a cardiac risk assessment. This focused additional evaluation minimized unnecessary cardiology consults. Following this stratification, if patients were found to require specialized cardiology input and workup prior to operative intervention, further studies were ordered at the same time as the cardiology consult, namely electrocardiograms and echocardiograms. The ability for a cardiologist to review a patient's objective information at their initial consult expedited the preoperative risk assessment as they had all of the objective data present at the time of the cardiologist's initial visit.

In addition to ordering supplementary tests, the patient's coagulation status was assessed by both the ED physician and the admitting AIMS physician. If indicated, the patient's anticoagulation was reversed according to protocol, initiated by the ED care providers, thus expediting the transition to the operating room. Following resolution of these potential barriers, patients were admitted to a specific hospital ward, with a designated nursing staff, familiar with the fragility fracture program and their role in the protocol. Preoperative evaluation was executed by an anesthesiologist and all efforts were made to have femoral nerve blocks placed on all eligible patients. Starting in the post-anesthesia care unit (PACU), patients were given multi-modal anesthesia to maximize pain control while avoiding large doses of opiates.

These procedures had the cumulative effect of patients not only entering the hospital faster but also being preoperatively evaluated more thoroughly. Nutritionists were part of this whole-body assessment. A patient's nutrition was assessed by the admitting physician at the time of their initial encounter and nutrition consults were included in the admission order set for patients requiring a consult or further evaluation. The same is true of physical therapy and occupational therapy (PTOT). Given that patients were being operatively managed for their isolated hip fragility fracture, physical therapy was consulted on arrival to assess their risk of future falls and to work on rehabilitation and strength training postoperatively. The physical therapists were aware of those patients with fragility hip fractures prior to their operative intervention, which allowed the physical therapists to see these patients in an expedited manner postoperatively. Goals included weight-bearing on postoperative day one and mobilizing with the nursing staff as well as the PTOT team. In addition, if laboratory results showed evidence of osteoporosis, osteoporosis

education was instituted by the clinical coordinator postoperatively and follow up was arranged with the patient's primary care physician. These practices were instituted based upon the AAOS and IGFS guidelines for physical therapy, nutrition, and interdisciplinary care.^{5,6}

2. Methods

Our hospital is an academic medical center, verified by the American College of Surgeons (ACS) as a level II trauma center. Our institution participates in the American College of Surgeons' Trauma Quality Improvement Program (TQIP). Our TQIP database is a prospectively collected registry of all trauma patients. We queried our TQIP database for patients admitted to our facility with an isolated hip fracture from a low velocity mechanism between January 1, 2014 and December 31, 2015.

We stratified patients into two groups: those from 2014 who presented before implementation of our fragility fracture program and those who were injured and admitted after the fragility fracture program was in place in 2015. We compared demographic information, comorbidities, complications and outcomes measures. Demographics included age, gender, race/ethnic background, mechanism of injury (MOI) and Injury Severity Score (ISS). Comorbidities were compared with Fisher's exact test. Complications were calculated as a proportion of the annual sample; outcome measures included mortality, hospital length of stay (HLOS), ICU length of stay (ICULOS), discharge destination, and time to operative intervention. Categorical data were compared using Fisher's exact test with 95% confidence intervals (95% CI). Continuous data were compared using student's *t*-test with standard deviations (SD). Injury Severity Score, HLOS and ICU LOS were compared using Mann Whitney *U* test \pm SD.

3. Results

Four hundred thirty-seven patients with fragility hip fractures were studied from 2014 to 2015. The two groups were not significantly different with respect to age, gender, or race. Mechanism of injury was also not statistically significant between the two groups. Co-morbidities were similar in the patient populations except for an increase in patients with CHF in 2015 ($p=0.02$) (Table 1). The average age was similar at 81.1 years old in 2014 and 82.7 years old in 2015 ($p=0.99$). The national average for patients with isolated hip fractures in 2016 is 82 years old (Table 2).⁸

The median length of stay was four days for both groups (2014 and 2015), two days less than the national average of six days (Table 2). Median length of stay, in-hospital mortality, UTI, and pressure ulcers were all lower in our institution as compared to the national TQIP average. Complication rates were low, and the differences were statistically insignificant. Our rates of UTI and pressure ulcers were below the national average for 2014 and 2015. DVT rates fell below the national average in 2015, after institution of our fragility fracture program, with only one case in 2015. Pneumonias were the only tracked complication noted to increase in 2015 to 2.5%, above the national average of 1.2% and larger than the previous year (1%).

Most notably, our discharges to home and acute inpatient rehabilitation ("desirable discharges") increased significantly compared to discharges to skilled nursing facilities (SNFs), hospice, and death in 2015 as compared to 2014 ($p=0.007$).

4. Discussion

Several models of a geriatric fracture program have been developed in recent years with variable degrees of integration, but

Table 1
Demographics.

	2014	2015	p-Value
Sex			
Female (%)	68.4% (134/196)	68.8% (165/240)	1.00
Ethnicity:			
Asian	1.0% (2/196)	0.8% (2/240)	1.00
Black	6.6% (13/196)	5.0% (12/240)	0.54
Hispanic	3.0% (6/196)	2.9% (7/240)	1.00
White	88.3% (173/196)	90.0% (216/240)	0.64
Comorbidities:			
Hypertension	77.0% (151/196)	69.2% (166/240)	0.09
Psychiatric Illness	26.0% (51/196)	28.3% (68/240)	0.67
Dementia	29.0% (57/196)	22.9% (55/240)	0.12
Coronary Artery Disease	24.0% (47/196)	22.5% (54/240)	0.64
Acquired Coagulopathy	17.9% (35/196)	22.1% (53/240)	0.28
History of Cardiac Surgery	16.8% (33/196)	12.9% (31/240)	0.28
Chronic Obstructive Pulmonary Disease	15.3% (30/196)	13.8% (33/240)	0.68
Congestive Heart Failure	29.6% (28/196)	23.8% (57/240)	0.02
Diabetes	17.3% (34/196)	16.3% (39/240)	0.79

Bold values indicates the statistically significant values less than 0.05.

all have been associated with improved outcome measures.^{9,10} Patients aged 70 years or older with a hip fracture admitted to a comprehensive geriatric care ward demonstrated improved mobility at 4 months compared with those that were not, reinforcing the results that suggest that orthogeriatric care is the preferred method of care.¹¹ Wide application of similar models could substantially improve the quality of care for frail elders with hip fracture, thus the impetus to implement our own program. This positive effect was observed even within the first year after establishment of a fragility fracture program, significantly so in the improvement of patients' discharge disposition.

These positive results were guided by the AAO and IGFS guidelines. Results were so much improved, in fact, that our institution received IGFS CORE certification, an outcomes-focused program that is the first to independently verify geriatric fracture programs in the world. IGFS CORE certification focuses, among other things, on standardized order sets and osteoporosis education of the type that were implemented at our hospital.

Comprehensive geriatric assessments (CGA) are the cornerstone of a successful fragility fracture program. Preoperatively, the CGA includes surgical risk reduction by appropriate management of comorbid conditions. Post operatively, the CGA should focus on early mobilization and prevention of common medical

complications. Also of importance, at discharge, each patient should have a tailored program to promote recovery and prevent future falls.¹² The reduction of falls is an integral part of fracture prevention in the elderly. Falls, which occur equally inside and outside of the home, are the proximate cause of most fractures in multi-national cohorts of women.¹³ Surprisingly, elderly patients that sustain fall related injuries are at risk for high mortality when compared to those injured in high energy mechanisms such as motor vehicle collisions; falls therefore may be a marker for general physiologic decline of patients.¹⁴

Mortality in these patients is high in the first year after fracture, and remains higher than the background population during the following five years.¹⁵ Therefore, a post fall assessment was undertaken by PTOT, as falls are a marker of underlying disorders or general physiologic deterioration that may be identified. This deterioration could, in turn reduce disability and costs if preemptively addressed.¹⁶

The anesthesia team in the geriatric fracture center model is extremely important to the success of the program. Our anesthesiologists are paramount in evaluating the patient before the operating room, ensuring they were optimized for surgery. The assessments and interventions that occur in the hours immediately prior to surgery and are designed to optimize the patient for

Table 2
Improvement in outcome measures.

	2014	2015	p-value	TQIP National Average ^a
Number of patients	196	240		
Mean age of patients	81.1 years	82.7 years	0.99	82 years
Median length of stay	4 days	4 days		6 days
30 day readmission rate	6.1% (12/196)	9.2% (22/240)	0.28	
In-hospital mortality	1.5% (3/196)	1.7% (4/240)	1.0	3.3%
Percent with co-managed care	100% (196/196)	100% (240/240)	1.0	
UTI	2.0% (4/196)	1.2% (3/240)	0.71	2.7%
Pressure Ulcers	0.5% (1/196)	0% (0/240)	0.45	0.6%
Wound infection	0% (0/196)	0% (0/240)	1.0	0%
DVT	0.5% (1/196)	0.4% (1/240)	1.0	0.5%
Pneumonia	1.0% (2/196)	2.5% (6/240)	0.30	1.2%
Discharge disposition:				
Home & acute rehab	21.9% (43/196)	33.8% (81/240)	0.0076	40.2%
Skilled nursing facility, hospice, death	78.1% (153/196)	66.3% (159/240)	0.0076	59.9%

TQIP = Trauma Quality Improvement Program, UTI = Urinary Tract Infection, DVT = Deep Vein Thrombosis.

Bold values indicates the statistically significant values less than 0.05.

^a Committee on Trauma, American College of Surgeons. Trauma Quality Improvement Program (TQIP). Chicago, IL, 2016.

safe anesthesia can be time consuming. Peri-operatively, the anesthesia team plays an integral role in making appropriate decisions regarding the type of anesthesia used and post-operative pain control methods. The utilization of neuroaxial anesthesia for primary joint arthroplasty has shown superior perioperative outcomes and decreased HLOS.¹⁷ Given this, our orthopedists and anesthesiologists worked closely together to try to maximize the number of femoral blocks used on patients with fragility hip fractures.

An additional goal of fragility fracture programs is to address the important issues related to pain control in the elderly. The management of postoperative pain in this population is a difficult task, as they may have co-morbid conditions requiring medication use which may contribute to polypharmacy and increased drug–drug interactions, diminished functional status, decreased physiologic reserve, and concomitant age-related pharmacokinetic changes. They are also at higher risk for cognitive impairment, which may lead to problems in pain assessments.

Osteoporosis currently affects 8 million women and 2 million men in the United States. With the rapidly aging US population, education and treatment is an integral part of any successful fragility fracture program. There are 75 million Americans entering the stage in their lives where they are at most risk for osteoporosis. By 2025 annual fractures and their associated costs are projected to rise by almost 50%.¹⁸ The most rapid increase is estimated for people aged 65–74, with an increase of greater than 87%; men currently account for 29% of fractures. An increase of nearly 175% is projected for Hispanics and other subpopulations. Therefore osteoporosis prevention, treatment, and close attention are warranted for men and diverse ethnic groups.¹⁹ The role of the orthopedic surgeon in the osteoporosis disease management is centrally important.²⁰ Orthopedic surgeons can facilitate osteoporosis treatment by coordinating care with primary care providers and families of patients with fragility fractures. Other important steps include managing the current fracture to maintain mobility, evaluating reversible risk factors for osteoporosis, and developing an appropriate follow up plan (both for the acute fracture healing and for the long term management of osteoporosis). By following these steps, orthopedic surgeons can ensure that patients with fragility fractures receive appropriate osteoporotic treatment, thereby reducing the risk of subsequent fractures.²¹

Nutrition plays an important role in patients with fragility fractures. In a recent study, individuals with an acute hip fracture admitted to an orthogeriatric program demonstrated a prevalence of malnutrition of 48%.²² This is of particular importance to patients with a fragility fracture as a recent meta-analysis demonstrated that frailty and pre-frailty were significantly associated with a higher risk of future falls. This risk increases significantly with chronological age.²² When identified in a comprehensive geriatric assessment, frailty was associated with and predicted significantly an increased risk of falls, fractures, death, and overnight hospitalizations.²³ To combat this problem, appropriate nutritional assessments should be undertaken. Routine nutritional assessment should replace nutrition risk screening in hip fracture patients.²⁴ However, isolated nutritional interventions have not consistently shown significant impact on long term outcomes after hip fracture, although improvements in body weight, biochemical indices, complication rates, and mortality have been reported.²⁵ Also of importance, multidisciplinary nutritional care has been demonstrated to reduce nutritional deterioration over admission and increase the rate of discharge back to the community setting.²⁶

Fragility fracture programs endorse early mobility, which is borne out in the literature as essential to the recovery process and aids in early transition to rehabilitation services.²⁷ Six months of extended rehabilitation that includes progressive resistance

training can improve physical function and quality of life and reduce disability in frail, elderly patients that have sustained a hip fracture.²⁸ These rehabilitation programs can also have a significant impact on various functional abilities such as knee extension strength, balance, fast gait speed, and timed “up and go” tests as shown in recent studies.²⁹ Ideally, this should be accomplished at an acute inpatient rehabilitation facility as patients that are newly admitted to skilled nursing facility experience more problems than those discharged to an inpatient rehabilitation facility.³⁰

A patient’s discharge disposition is inextricably linked to their overall health status. Preoperative predictors for a “desirable discharge” include age, cognitive ability, and number of comorbidities. Following an admission for a hip fracture, patients discharged to SNFs are more likely to be older with decreased cognitive abilities while those discharged home were younger with fewer comorbidities and greater mobility.³¹ Despite increased comorbidities in our patients in 2015 with higher rates of CHF, our rates of “desirable discharges” increased with fewer patients going to SNFs, hospice care, or dying (Table 2).

As with all investigations, our study has its limitations. The populations were not matched exactly, as the number of congestive heart failure patients increased significantly in 2015. Despite this difference, with more complex and ill patients presenting in 2015, complication and readmission rates did not increase significantly. Also, our study is a retrospective review of a single institution’s outcomes after the implementation of a fragility fracture program and may not be broadly applicable. However, this study demonstrates that outcome measures may be improved with a multidisciplinary fragility fracture program as seen by TQIP as well as comparison to the national averages. Given the international importance of this problem, it is important for those of us that care for the elderly to consider implementing this type of performance improvement process.

Conflict of interest

The authors have none to declare.

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