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Hip Fracture in the Elderly Patients: A Sentinel Event

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Abstract

Importance: Hip fracture in the elderly patients is associated with increased morbidity and mortality. There is great need for advance care planning should a patient fail to rehabilitate or experience an adverse event during or after recovery. This study was performed to evaluate for palliative care consultation and changes in code status and/or advance directives in elderly patients with hip fracture. **Methods:** We performed a retrospective review of 186 consecutive patients aged 65 years and older with a hip fracture due to a low-energy fall who underwent surgery at a large academic institution between August 1, 2013, and September 1, 2014. Risk factors assessed were patient demographics, home status, mobility, code status, comorbidities, medications, and hospitalizations prior to injury. Outcomes of interest included palliative care consultation, complications, mortality, and most recent code status, mobility, and home. **Results:** About 186 patients with hip fractures were included. Three patients died, and 12 (6.5%) sustained major complications during admission. Nearly one-third (51 patients) died upon final follow-up approximately 1.5 years after surgery. Of the patients who died, palliative care consulted on 6 (11.8%) during initial admission. Eleven (21.6%) were full code at death. Three patients underwent cardiopulmonary resuscitation (CPR) and 1 underwent massive transfusion and extracorporeal membrane oxygenation prior to changing their code status to do not attempt resuscitation. **Conclusion:** Hip fracture in elderly patients is an important opportunity to reassess the patient's personal health-care priorities. Advance directives, goals of care, and code status documentation should be updated in all elderly patients with hip fracture, should the patient's health decompensate.

Keywords

hip fracture, elderly patients, code status, advance directives, palliative care, mortality, advance care planning

Introduction

Hip fracture in elderly patients is a common yet sentinel event in patients' health due to the frequent decline in the patient's overall health and increased risk of morbidity and mortality.[1-3] Because of the high incidence and poor prognosis of elderly patients with hip fracture, hospital admission provides a unique opportunity to evaluate and update patients' preferred code status and advance directives.[4] Neuman and colleagues postulate that "providers of orthopaedic care therefore may serve as important points of contact with the healthcare system for patients near the end of life, and may engage with patients in decisions regarding healthcare services, such as surgery, with implications for the duration and quality of life. For these reasons, acute orthopaedic care offers distinct opportunities to improve the overall experiences of dying patients and their families in ways that may extend beyond the care they deliver for a specific, presenting injury."[4(p898)] While the idea of discussing death and dying may be disconcerting to both the patient and the provider in the perioperative period, there is an alternative perspective to be considered. Similar to preparing a will while in good health, admission for hip fracture represents an opportunity for elderly patients and their families to have informed discussions and document updated preferences in an acute, nonemergent setting before the patient is gravely ill or imminently dying.

In addition, palliative care has transformed to meet the holistic needs of the patients undergoing curative therapies, such as hip fracture fixation.[5-7] The evolution of palliative care is reflected in the American Society of Clinical Oncology definition and supported by the World Health Organization, "Palliative care is frequently misconstrued as synonymous with end-of-life care. Palliative care is focused on the relief of suffering, in all of its dimensions, throughout the course of a patient's illness."[7,8(p880)]

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Attempts have been made in various fields, most notably oncology,[9,10] intensive care,[11-13] and chronic illness,[14,15] to increase access to palliative care consultation. These studies have demonstrated an association between palliative care and improved patient satisfaction, diminished use of health-care resources, and, in some cases, a decrease in mortality.[16-20] This is a unique reversal of trends, as health-care utilization and costs are frequently increased in elderly patients' last few years of life.[21-23] In addition, enhanced longevity and a large aging population have increased the incidence of hip fracture and, consequently, its burden on health care.[1,3,24,25]

While palliative care consultation for this vulnerable patient population appears worthwhile, the question remains: Should palliative care consultation be reserved for the sickest or used for all elderly patients with hip fracture? Several attempts have been made to identify elderly patients at risk of having a hip fracture and those likely to have poor outcomes after hip fracture.[1,26-28] This has resulted in the identification of some risk factors, such as dementia and end-stage renal disease[4]; however, current screening criteria are not yet concise and accurate enough to identify the most at-risk patients.[28]

In brief, admission for hip fracture is a unique opportunity to have informed discussions and to update and document the preferences of high-risk, vulnerable elderly patients before it is too late.[29] The objective of this study was to perform a multidimensional assessment of current practices regarding palliative care consultation and advance care planning in relation to patient risk factors in order to identify opportunities for improvement. First, we wanted to identify whether any preoperative risk factors were predictive of postoperative complications and mortality. Second, we wanted to determine if the patients who died during follow-up were appropriately identified during admission by evaluating for a relationship between palliative care consultation and patients' survival at last follow-up. Finally, we wanted to assess for evidence of advance care planning by examining changes in code status and determining whether patients' code status during follow-up was consistent with their outcome.

Methods

We performed a retrospective chart review of all patients aged 65 and older admitted within the Duke University health system (Duke University Hospital or Duke Regional Hospital) between August 1, 2013, and September 1, 2014, for an acute hip fracture from a ground-level fall. Patients were identified by searching the hospital DEDUCE database for patients aged 65 and older with Current Procedural Terminology (CPT) codes for arthroplasty or internal fixation of a hip (27125, 27236, 27245, 27235, and 27244) and an associated International Classification of Disease (ICD)-9 code indicating hip fracture during the aforementioned time period. Patients with pathologic fractures due to malignancy or high-energy trauma were excluded. Up to 1.5 years of postoperative data were gathered on all patients.

Gathered data included patient age, race, gender, home status, functional status, number and type of comorbidities, number and type of preoperative risk factors, number of medications, and number of hospitalizations in the year prior to hip fracture. Outcomes of interest were patient mortality, length of stay, palliative care consultation while admitted, readmission after the index operation, code status at last follow-up, and functional status 6 months after surgery. Home status was documented prior to surgery and at last follow-up to assess for functional independence after postoperative rehabilitation. Ambulatory status was collected from orthopedic surgery notes. No patients were contacted for this study. Follow-up was determined as any appointment or hospitalization within the Duke Health system.

Code status was defined as "full code" or "do not attempt resuscitation" (DNAR). Functional status was defined as ambulating without an assistive device, ambulating with an assistive device (cane or walker), or nonambulatory. Home status was defined as either living in a home or living in a long-term care facility (ie, nursing homes, skilled nursing facilities, and assisted living centers).

Complications were aggregated and compared using the following definitions, as established in the literature.[27]

Major complications were defined as cardiac arrest, stroke, pulmonary embolism, pulmonary edema, acute renal failure, deep vein thrombosis, osteomyelitis, sepsis, unplanned intubation, hardware failure, ICU admission, or coma.

Minor complications included urinary tract infection, pneumonia, wound complications (seroma, dehiscence, or infection), decubitus ulcer formation, transfusion of blood products, postoperative delirium, postoperative fall, or postoperative abdominal ileus.

Statistical Analysis

We used independent *t* tests and Z-scores to compare gender differences in perioperative risk factors, chi-square to compare pre and postinjury home and mobility, and odds ratio to compare the relationships between code status, advance directives, and death. Risk ratios and number needed to treat (NNT) were calculated to determine risk of death in patients seen by palliative care as a proxy for evaluating whether the highest risk patients were appropriately identified. A decision tree was created to model key predictors of death within 1.5 years of injury, using a 50/50 split of the data set for training and testing. Model accuracy was determined using the area under the curve (AUC). Data collection and analysis of population statistics was completed using Excel software; remaining analysis was done using the R statistical software program, including the rpart and pROC packages.[30-32]

Results

Demographics

One hundred ninety-six patients underwent surgical fixation for a proximal femur fracture between August 2013 and September

Table 1. The Most Common Active Cancers Were Skin Cancers.[a]

Preoperative Risk Factors	Men	Women	Total	Z Score	*P* Value	*t* Test	*P* Value
Mean age	79.3	81.8	81.1			1.86	
Mean total comorbidities	4.21	3.48	3.68			−2.56	.011
Heart disease	73.1%	48.5%	55.4%	−3.03	.002		
Lung disease	34.6%	26.9%	29.0%	−1.05			
GI disease	48.1%	41.0%	43.0%	−0.87			
Renal disease	38.5%	26.1%	29.6%	−1.66			
Diabetes mellitus	32.7%	25.4%	27.4%	−1.00			
Cancer (active)	11.5%	8.2%	12.9%	−0.71			
Cancer (remission)	28.9%	16.4%	19.9%	−1.91			
Atherosclerotic disease	57.7%	37.3%	43.0%	−2.52	.012		
Neurologic disease	65.4%	53.0%	56.5%	−1.53			
Psychiatric illness	32.7%	35.1%	34.4%	0.31			
Chronic pain diagnosis	38.5%	54.5%	50.0%	1.96			
Prior diagnosis of osteoporosis	9.6%	38.8%	30.6%	3.88	.0001		
Mean total medications	9.5	10.6	10.3			1.31	
Mean prescription medications	6.9	6.8	6.8			−0.19	
Mean over-the-counter medications	2.6	3.9	3.5			3.09	.002
Mean preoperative albumin	3.33	3.36	3.35			0.22	
Mean number of admissions in past year	0.92	0.68	0.75			−1.17	
Mean body mass index (BMI)	25.1	24.1	24.4			−1.18	
Perioperative risk factors							
Mean length of stay, days	9.1	6.3	7.1			−3.79	.0002
In-hospital complications							
No complications	19.2%	40.3%	34.4%	2.71	.007		
Minor complications	44.2%	47.8%	46.8%	0.43			
Major complications	15.4%	3.0%	6.5%	−3.09	.002		
Major and minor complications	19.2%	7.5%	10.8%	−2.33	.020		
Death	1.9%	1.5%	1.6%	−0.21			

[a]All patients with known metastatic disease were excluded. The most frequent psychiatric illnesses were anxiety and depression. Chronic pain was primarily due to osteoarthritis and degenerative disc disease, and was not included if managed without medication or intervention. Significance was reported only when $P < .05$.

2014 at our institution. Seven patients were excluded for pathologic fracture and 3 patients were excluded for a traumatic fracture due to a motor vehicle accident, leaving a total of 186 patients for inclusion. Mean age was 81.1 years (range 65-100; Table 1). Most (82.3%) patients underwent surgical fixation within 48 hours, those who did not have a significantly delayed presentation and/or required further medical optimization.

On average, patients had 3.68 comorbidities (women 3.48, men 4.21, $t = 2.56$, $P < .05$) and took 10.3 medications (approximately 6.8 prescription and 3.5 over-the-counter medications; Table 1). Men had higher rates of heart disease ($Z = 3.03$, $P < .01$) and atherosclerotic disease ($Z = 2.52$, $P < .05$). Women had higher rates of a preinjury diagnosis of osteoporosis ($Z = 3.88$, $P = .0001$) and took more over-the-counter medications ($t = 3.09$, $P < .01$).

Prognostic Risk Factors

Prediction of death at 1.5 years by decision tree analysis resulted in 3 key variables: Body mass index (BMI), preoperative risk factors, and number of admissions in the prior year (Figure 1). The BMI had the greatest predictive value; having BMI >24 lowered the risk of death in 45% of patients from the baseline prevalence of 27% to 7%. In contrast, patients with a BMI <24 and one or more preoperative risk factors (40% of patients) had a >50% risk of death. The addition of 2 or more hospital admissions in the previous year increased the risk to 86% (8% of patients). The AUC was 0.65, indicating that this method may be useful, but clinical gestalt should prevail in clinical practice.

Changes in Mobility and Home

Nearly 94% of patients were ambulatory prior to hip fracture; 51.1% (95 patients) walked without an assistive device and 42.5% (79 patients) required a cane or walker to ambulate (Table 2). Only 31.2% (58) of previously ambulatory patients regained the same degree of mobility or better within 6 months of surgery. In contrast, nearly 50% of patients who were ambulatory prior to hip fracture had a significant decline in mobility at 6 months follow-up; 52 (28.0%) now required a walking aid and 40 were nonambulatory (21.5%). Three patients who were nonambulatory prior to hip fracture were able to walk with an assistive device after surgery. Twenty-eight patients were deceased, lost to care, or had outside follow-up at 6 months. Preinjury mobility was strongly predictive of mobility at 6 months after surgery ($\chi^2 = 23.03$, $P < .001$).

Home status prior to hip fracture was also predictive of home status at 1.5 years after surgery ($\chi^2 = 40.78$,

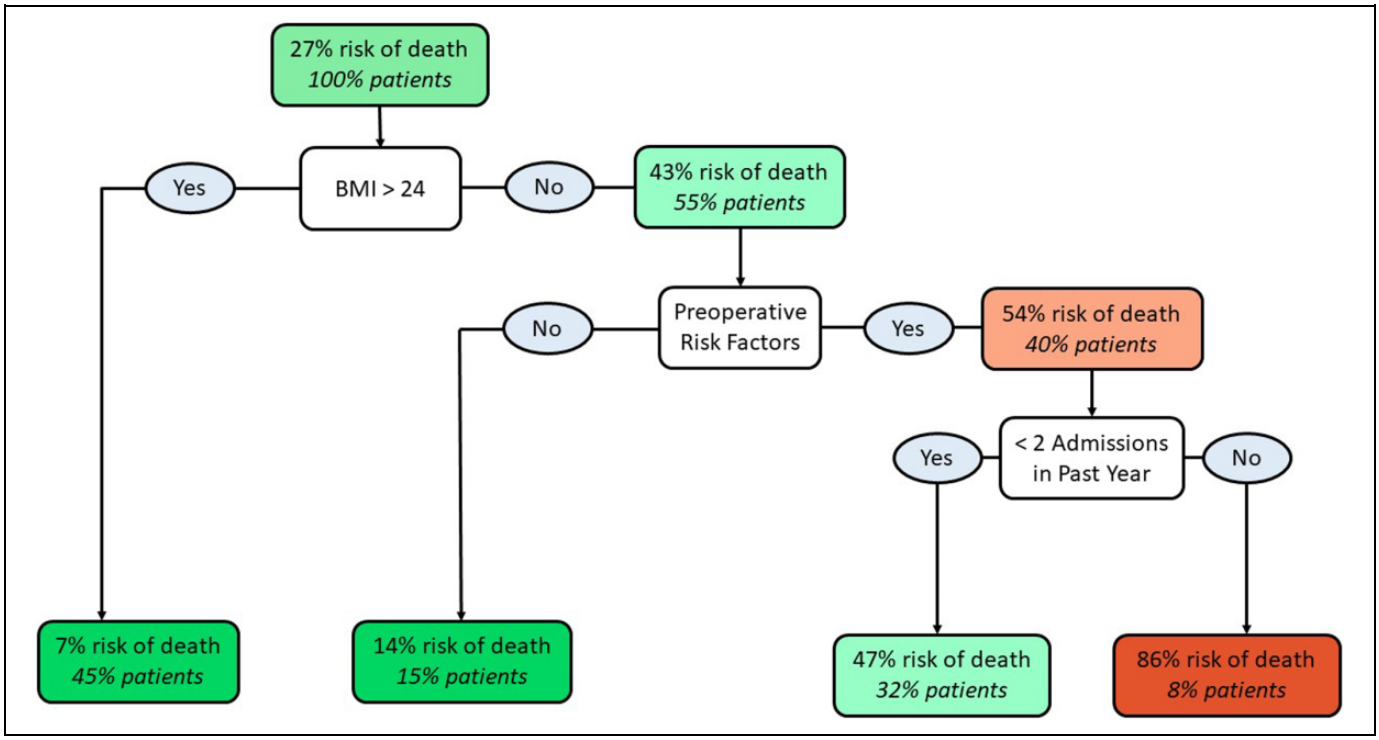

Figure 1. Decision tree analysis of patient factors with increased risk of postoperative mortality was performed. Body mass index (BMI) of 24 or less, 2 or more hospital admissions in the past year and certain preoperative risk factors were all found to have poor prognosis with increased risk of death. Preoperative risk factors included preoperative albumin <3.5, admission from a long-term care facility, history of pulmonary embolism (PE) or deep venous thrombosis (DVT), and/or taking home anticoagulation medications. The percentage of patients in this study in each category is represented in the decision tree analysis below the risk of death for each given risk factor.

Table 2. Mobility Was Assessed Prior to Hip Fracture and at 6 Months After Surgery.[a]

Postoperative Mobility at 6 Months					
Prehip Fracture Mobility	Walking Without an Aid	Walking With an Aid	Nonambulatory	Unknown	Died
Walking without an aid before injury	19 (10.2%)	52 (28.0%)	11 (5.9%)	5 (2.7)	8 (4.3%)
Walking with an aid before injury	4 (2.2%)	35 (18.8%)	29 (15.6%)	7 (3.8%)	4 (2.2%)
Nonambulatory before injury	0 (0%)	3 (1.6%)	5 (2.7%)	3 (1.6)	1 (0.5%)
Sum	23 (12.4%)	90 (48.4%)	45 (24.2%)	15 (8.1%)	13 (7.0%)

[a]Nearly 60% of patients who were ambulatory (with or without an assistive device) were ambulatory within 6 months of surgery, though 1/2 of these patients had a new requirement for a cane or walker. One of every 5 patients who was ambulatory (with or without a cane/walker) prior to hip fracture were nonambulatory 6 months after surgery. Of the patients who were nonambulatory prior to hip fracture, 3 became ambulatory after surgery. There were 41 patients without 6 months of follow-up. Of these patients, 19 were ambulating with an aid and 7 were nonambulatory at last follow-up and were included in the corresponding columns in this table. The remaining 15 patients were lost to care or had outside follow-up.

$P < .00001$). Nearly two-thirds of patients (123/186) were able to return to the same type of living situation after surgery (ie, home vs long-term care facility; Table 3). Over 25% (47) of patients who were admitted from their home, however, were living in a long-term care facility at last follow-up. Nine patients had an unknown living situation, and 3 patients were deceased prior to discharge.

Morbidity (Complications)

During admission for hip fracture, 3 (1.6%) patients died, 12 (6.5%) patients developed a major complication, 87 (46.8%) patients experienced minor complications, and 20 (10.8%) patients had both major and minor complications. Sixty-four (34.4%) patients had no in-hospital complications. The most common minor complications were need for transfusion (39, 44.8%) and postoperative delirium (28, 32.2%) or both (13, 14.9%). Of the 32 patients who experienced 1 or more major complications, 29 had an acute kidney injury, congestive heart failure decompensation, myocardial infarction, atrial fibrillation with rapid ventricular response, or a combination thereof.

Mortality, Code Status, and Advance Directives

Fifty (26.8%) of patients had advance directives documented prior to admission. An additional 13 patients had an advance

Table 3. Of the Patients Admitted from Home, 43% Returned to Living at Home.[a]

	Living Situation at Last Follow-up			
	Home	LTCF	Unknown	Died Prior to Discharge
Living at home prior to injury	80 (43.0%)	47 (25.3%)	9 (4.8%)	1 (0.5%)
Living in an LTCF prior to injury	4 (2.2%)	43 (23.1%)	0 (0%)	2 (1.1%)

Abbreviation: LTCF, long-term care facility.
[a]One-fourth of patients who lived at home prior to injury were still living in an LTCF at last follow-up (up to 1.5 years after surgery). Four patients who were living in an LTCF prior to hip fracture were able to return to living at home after surgery. Three patients died during the index admission for hip fracture. Nine patients were lost to care or had outside follow-up.

directive added to their chart during follow-up. Of the 63 patients with an advance directive, one-third (20/63) died at last follow-up. Thus, one-third of the living patients (43/135) had an advance directive.

Fifty-one (27.4%) patients died at last follow-up. Of those who died, 11 (21.6%) were full code, 1 had no documented code status, and 39 (76.5%) were DNAR at last follow-up (Figure 2). Three patients underwent attempted cardiopulmonary resuscitation and 1 patient underwent massive transfusion and extracorporeal membrane oxygenation prior to their code statuses being changed to DNAR. Among the 135 living patients (72.6%), 60.7% (82) were full code, 38.5% (52) were DNAR, and 1 had no documented code status (Figure 2).

The DNAR code status at last follow-up was associated with death (odds ratio [OR], 5.13; 95% confidence interval [CI], 2.46-10.68; $P < .0001$). There was no correlation between having an advance directive in the chart and death during follow-up.

Palliative Care Consultation and Postoperative Mortality

Six (11.8%) of the patients who died and 3 (2.2%) of the living patients had received a palliative care consultation during the index admission for hip fracture. An additional 3 patients rapidly decompensated in the postoperative period and were transitioned directly to comfort-based care without palliative care consultation. Of patients who received palliative care consults, 1 died during admission, 1 died within 30 days of surgery, 1 died between 30 and 60 days, and 3 died between 60 days and 1 year. Risk ratios of 9.53 (3.01, 30.18) and 2.42 (1.34, 4.37) at 60 days and 1.5 years, respectively, indicated that palliative care was consulted in patients with an increased risk of death, with an NNT of 3 for both time periods.

Discussion

Many patients and providers are uncomfortable with, and therefore avoid, discussing code status and advance directives. However, this leaves elderly patients vulnerable to potentially unwanted invasive procedures in an emergency. It is reasonable to consider incorporating palliative care approaches in the care of all patients with geriatric hip fracture—as has been done in other patient populations with increased mortality rates.[29] This is particularly important, as screening measures for the highest risk patients remains limited. Hip fracture in an elderly patient is an opportunity for patients, their families, and physicians to have an informed discussion regarding the patient's preferred code status and advance directives.

Risk Factors and Complications

The high incidence of delirium and transfusion for postoperative anemia may have been due to referral of higher risk patients, as this study was performed at a major tertiary care center. Our findings were otherwise consistent with other studies.[27]

Risk factors for increased mortality found in other studies include increased patient age,[27] male gender,[27] cardiac disease,[33] chronic obstructive pulmonary disease,[33] chronic kidney disease,[34] and end-stage renal disease.[35-37] The American Society of Anesthesiologists (ASA) Physical Status classification in patients with nondisplaced femoral fractures,[38] admission source,[33] and limited mobility[33] have also been associated with increased mortality. BMI, admissions in the year prior to surgery, and number of home medications were all poor prognostic factors in this study.

Historically, 30-day mortality has been used as a measure of surgical success and safety. However, elderly patients with hip fracture have an elevated risk of morbidity and mortality within the 1 to 2 years of injury. Hip fracture fixation is important, as it offers pain relief and avoidance of bed sores even in patients who are demented, nonambulatory, or have a relatively short life expectancy.[1] Therefore, long-term, patient-centered metrics of surgical success such as medical complications, readmission, mortality, mobility, and change in home status (home or long-term care facility) are critical.[39]

Many previously ambulatory elderly patients fail to regain mobility within a year of hip fracture fixation.[40] However, evidence suggests that patients can rehabilitate, even in the setting of dementia.[41] In this study, 93.5% (174/186) of patients were ambulatory prior to hip fracture, whereas 63.2% (110/174) of surviving patients were ambulatory 6 months after surgery. We were unable to assess mobility at 1 year, as orthopedic follow-up typically ended once the patient successfully healed from surgery.

Code Status, Advance Directives, and Palliative Care Consultation

While a plethora of studies demonstrate palliative care improves quality of life and relieve suffering in patients with cancer[9,10,42] and chronic illness,[14,15,43] there is very little palliative care data on elderly patients with hip fracture. Given the high morbidity and mortality, it is reasonable to incorporate palliative care in the care of the patient with geriatric hip fracture. One suggested screening method to increase palliative care consultation is "Would it be surprising if this patient died

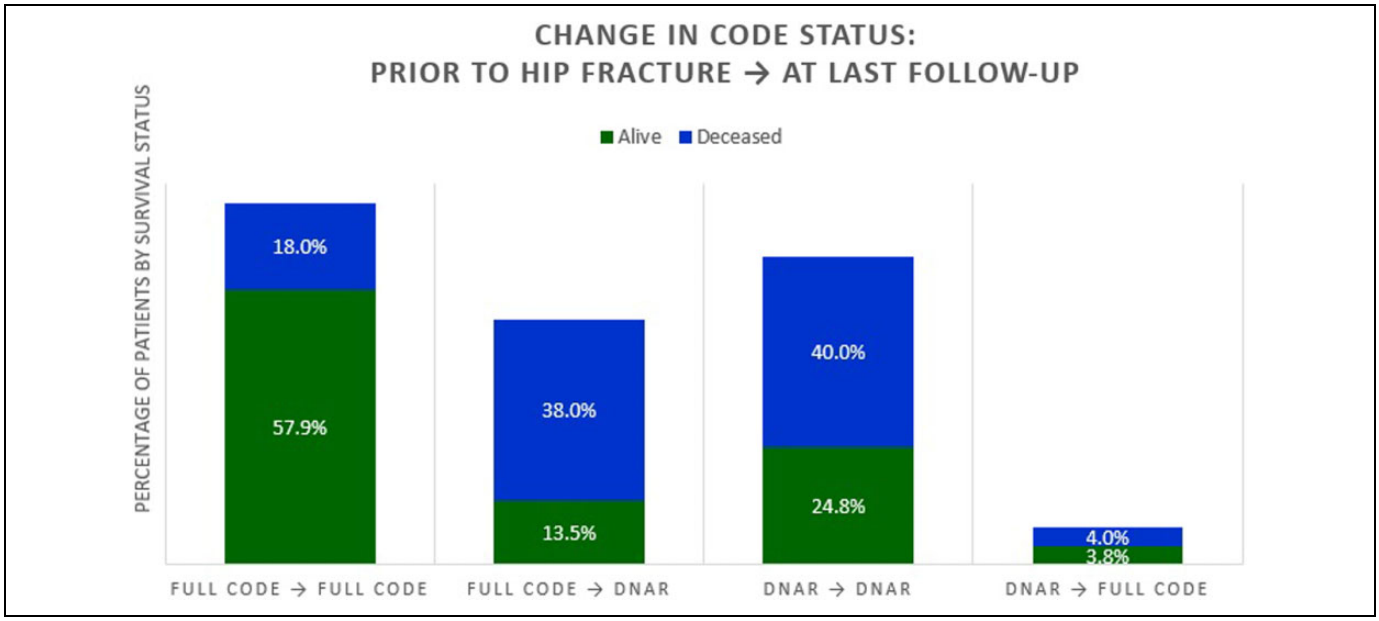

Figure 2. Among patients who died, 38% were full code prior to hip fracture and became DNAR prior to death, leading to a combined 78% of patients who died with a DNAR code status. Eighteen patients died without changing their code status from full code to DNAR. In this study, all patients who were transitioned to comfort measures were considered DNAR regardless of whether their code status was changed to DNAR. Among patients who survived at least 1.5 years after surgery, 82.7% did not change their code status. DNAR indicates do not attempt resuscitation.

within 1 year?"[44] Despite low overall palliative care referrals in our sample, the risk ratios for patient death, particularly at 60 days, indicate that referrals are being made for patients who are likely to die. The NNT of 3 compares favorably with other interventions in hip fracture and indicates that this population may benefit from more liberal use of palliative care services.[45]

It is unknown whether use of our decision tree model would improve accuracy of referral for palliative care. At this stage, the variables of BMI >24 and a lack of preoperative risk factors may decrease the need for a palliative care consult, while a low BMI, presence of preoperative risk factors, and multiple recent hospitalizations may indicate benefit from palliative care consultation and assessment of the patient's health-care goals and preferences. Given the small sample size and the AUC, this model is only an initial hypothesis for further testing.

Much debate exists regarding the options for code status in the operative patient and the length of the perioperative period.[46-51] For example, a patient with a "DNAR" code status may choose to reverse their code status to "full code" for surgery. However, if the patient is unable to tolerate extubation after surgery, a plan should be in place for the duration of ventilator support, in the event that the patient does not improve. It is therefore critical to have advance directives and discuss patients' exact wishes in the context of the perioperative period in order to avoid ethical dilemmas in decision-making and the implementation of code orders.[52]

The Future of Palliative Care Principles in Orthopedics

Because surgeons must discuss the risks and benefits of surgery, there is a unique role for surgeons in ensuring the discussion of code status, advance directives, and goals of care in patients, particularly those who are poor operative candidates or have a poor long-term prognosis.[9,53] While palliative care is not a routine aspect of most residency training programs, studies demonstrate increased comfort in discussing end-of-life issues in general surgery and internal medicine residents after palliative care training.[54,55] Resources are also available for self-taught learning or teaching others.[56-59] In settings with access to a palliative care team, perhaps referrals would increase if providers understood the role of palliative care in quality of life and relief of suffering. Wentlandt et al found that one-third of oncologists would increase referrals if palliative care was renamed "supportive care."[60] In elderly patients with hip fracture, palliative care can address acute symptoms (eg, delirium) and alleviate mental–emotional suffering (eg, fear of permanent loss of independence and/or mobility).

Conclusion

Hip fracture in the elderly patients is often a sentinel event for further morbidity, mortality, and reduced quality of life—yet it is difficult to identify the highest risk patients for a poor prognosis. Palliative care approaches, such as acute symptom management, relief of mental-emotional suffering, and discussions regarding code status, and advance directives, are important components of the care of patients with geriatric hip fracture. Due to the high risk of short- and long-term complications after hip fracture, these patients would benefit from preventative interventions during admission to assist with symptom

management, relief of suffering and decision-making in case of poor rehabilitation, or a future decline in health.

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Declaration of Conflicting Interests

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