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Is prescribed lower extremity weight-bearing status after geriatric lower extremity trauma associated with increased mortality?

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ABSTRACT

Objectives: Evaluate whether mortality after discharge is elevated in geriatric fracture patients whose lower extremity weight-bearing is restricted.
Design: Retrospective cohort study
Setting: Urban Level 1 trauma center
Patients/participants: 1746 patients >65 years of age
Intervention: Post-operative lower extremity weight-bearing status
Main outcome measure: Mortality, as determined by the Social Security Death Index
Results: Univariate analysis demonstrated that patients who were weight-bearing as tolerated on bilateral lower extremities (BLE) had significantly higher 5-year mortality compared to patients with restricted weight-bearing on one lower extremity and restricted weight-bearing on BLE (30%, 21% and 22% respectively, $p < 0.001$). Cox regression analysis controlling for variables including age, Charlson Comorbidity Index, Injury Severity Scale, combined UE/LE injury, injury mechanism (high vs low), sex, BMI and GCS demonstrated that, in comparison to patients who were weight bearing as tolerated on BLE, restricted weight-bearing on one lower extremity had a hazard ratio (HR) of 0.97 (95% confidence interval 0.78 to 1.20, $p = 0.76$) and restricted weight-bearing in BLE had a HR of 0.91 (95% confidence interval 0.60 to 1.36, $p = 0.73$).
Conclusions: In geriatric patients, prescribed weight-bearing status did not have a statistically significant association with mortality after discharge, when controlling for age, sex, body mass index, medical comorbidities, Injury Severity Scale (ISS), mechanism of injury, nonoperative treatment and admission GCS. This remained true in when the analysis was restricted to operative injuries only.

Introduction

The geriatric population in the United States is growing rapidly. From 1980 to 1990 it increased by 21% [1,2] and by 2040 more than 20% of the population will be older than 65 [3–6]. The frequency of traumatic injury in geriatric patients, both low-energy and high-energy, is likewise expected to increase. It is clear that avoiding bedrest and encouraging early mobilization in hospitalized geriatric medical and critical care patients results in reduced decline in functional activities, reduction in new institutionalization, reduced incidence of medical complications such as pneumonia, blood clot and bedsores, and reduced mortality [7–12]. Furthermore, it is becoming well established that surgical treatment within 24–48 h of hip fracture leads to improved outcomes related to mobility, pain, independence, readmission and mortality at 6 months [13,14]. The survival benefit from early surgery is thought to be related to early mobilization in hip fracture patients. However, to our knowledge, the specific relationship between weight-bearing (rather than timing of surgery) and outcome in orthopaedic patients has not been studied. Despite this, many clinicians have extrapolated the data on timing of hip fracture management to advocate for minimizing weight-bearing restrictions after all fracture care in all older patients.

The aim of this study was to compare mortality after discharge between geriatric patients who were permitted to weight bear

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with that of patients whose weight-bearing was restricted, controlling for variables that are known to play a role in survival after traumatic injury in elderly patients including patient demographics and injury characteristics. We hypothesized that prescribed lower extremity weight-bearing status would be an independent predictor for long-term survival after traumatic injury.

Patients and methods

After receiving study approval from the Institutional Review Board, we reviewed the prospectively collected trauma database at our urban level I trauma center. We identified 2004 patients 65 years and older who were admitted with lower extremity orthopaedic injuries from 2004 through 2014.

From January 2004 through December 2014, 2029 patients ≥65 years of age were admitted to our center with lower extremity injuries. We excluded forty-one patients who did not have social security numbers included in their medical record, twenty patients who did not have weight-bearing status documented in the medical record, and 222 patients who died prior to discharge. This left a final cohort of 1746 patients. Nine-hundred seventy three patients were treated operatively for their orthopaedic injuries. A subgroup analysis was performed in this patient population. The Social Security Death Index (SSDI) was queried on December 31, 2015, so vital status was documented for any time prior to SSDI query.

The primary outcome measure was mortality. This was determined via query of the Social Security Death Index (SSDI). Social Security Numbers were used to search the database to determine the vital status of each patient. Postoperative weight-bearing status was determined from the electronic medical record based upon documentation in the operative note, physical therapy notes and discharge instructions. Demographic and clinical data were collected from the trauma database and from electronic medical records.

Baseline characteristics were summarized using means and standard deviations (SD) for continuous variables and proportions for categorical variables. A Students *t*-test was performed as appropriate to compare continuous variables and the χ^2 test was used to compare categorical variables between patients who were permitted to weight bear and those with restricted weight-bearing in one or both lower extremities. Significance was set at $p \leq 0.05$. Kaplan-Meier cumulative survival plots were also constructed to show risk of death for patients in the three subgroups defined by postoperative weight-bearing status.

Cox logistic regression analysis was conducted to control for hypothesis-driven variables related to outcomes of interest (mortality after discharge). The hypothesis-driven variables included in the model were age, sex, BMI, Charlson Comorbidity Index (CCI), Injury Severity Scale (ISS), combined upper/lower extremity injuries, injury mechanism (high versus low), Glascow Coma Scale at admission(GCS) presence of combined upper and lower extremity injury and operative treatment of injury.

Results

There were 1746 patients who met inclusion criteria. Baseline characteristics of the study population are shown in Table 1. Among all geriatric patients, those who were prescribed weight-bearing as tolerated on bilateral lower extremities, compared to those with restricted weight-bearing on one or both lower extremities were significantly older ($p < 0.001$), more female ($p = 0.001$), had a lower BMI ($p < 0.001$), had a higher Charlson Comorbidity Index (CCI) ($p < 0.001$), were more frequently injured via low-energy mechanism compared to high-energy mechanism ($p < 0.001$), had a lower Injury Severity Score (ISS) ($p < 0.001$), less frequently sustained isolated extremity injuries ($p < 0.001$), had a higher GCS ($p < 0.001$), had a shorter hospital length of stay ($p < 0.001$), more frequently had combined upper and lower extremity injuries ($p = 0.001$) and were more frequently treated nonoperatively ($p < 0.001$) (Table 1). Among patients who were treated operatively, those who were prescribed weight-bearing as tolerated on bilateral lower extremities, compared to those with restricted weight-bearing on one or both lower extremities were significantly older ($p < 0.001$), had a lower BMI ($p < 0.001$), had a higher CCI ($p < 0.001$), more frequently sustained low-energy injury mechanism ($p < 0.001$), were less frequently isolated extremity injuries ($p = 0.03$), had higher GCS ($p = 0.001$), had shorter hospital LOS ($p < 0.001$) and less frequently had combined upper and lower extremity injuries ($p = 0.01$). There was no

Table 1
Demographics and injury characteristics.

	All fractures				Operative fractures only			
	WBAT BLE (n = 673)	Restricted WB in one LE (n = 920)	Restricted WB BLE (n = 153)	p-value	WBAT BLE (n = 249)	Restricted WB in one LE (n = 592)	Restricted WB BLE (n = 132)	p-value
Age (years) mean (SD)	75.6 (9.9)	71.7 (8.6)	70.8 (7.9)	<0.001	73.8 (10.1)	70.4 (7.8)	70.2 (7.2)	<0.001
Female (%)	386 (57.4)	441 (47.9)	74 (48.4)	0.001	115 (46%)	235 (40%)	61 (46%)	0.135
BMI (kg/m2) mean (SD)	26.6 (6.5)	28.3 (7.4)	29.3 (6.3)	<0.001	26.7 (6.6)	27.9 (6.9)	29.1 (6.0)	<0.001
Charlson Comorbidity Index mean (SD)	4.0 (1.6)	3.6 (1.5)	3.2 (1.4)	<0.001	3.9 (1.8)	3.3 (1.3)	3.1 (1.4)	<0.001
High-energy mechanism (%)	400 (59.4)	677 (73.6)	142 (92.8)	<0.001	188 (76%)	553 (93%)	130 (98%)	<0.001
Injury Severity Score mean (SD)	16.1 (9.5)	14.5 (8.8)	19.0 (11.1)	<0.001	16.8 (9.5)	15.4 (9.2)	19.6 (11.6)	0.09
Isolated extremity injury (%)	240 (35.7)	391 (42.5)	37 (24.2)	<0.001	70 (28%)	198 (34%)	30 (23%)	0.03
GCS mean (SD)	14.5 (1.6)	14.6 (1.6)	13.9 (2.7)	<0.001	14.6 (1.5)	14.5 (1.8)	13.7 (2.9)	0.001
Combined UE and LE injuries (%)	549 (81.6)	781 (84.9)	111 (72.6)	0.001	184 (74%)	474 (80%)	92 (77%)	0.01
Nonoperative (%)	424 (63.0)	328 (35.7)	22 (13.7)	<0.001	na	na	na	na

WBAT = weight-bearing as tolerated.
BLE = bilateral lower extremities.
LE = lower extremity.
BMI = body mass index.
GCS = Glascow Coma Scale.