Original Article

Risk Factors and Predictors of In-Hospital Mortality in Geriatric Patients with Hip Fractures: A Retrospective Study

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ABSTRACT

Background: Hip fractures are among the most frequent traumatic injuries in the elderly and cause significant morbidity and mortality. Elderly hip fractures are frequently admitted to the emergency department (ED). **Aim:** This study aimed to evaluate clinically geriatric patients admitted to an ED with hip fractures and to identify risk factors and predictors for in-hospital mortality. **Methods:** This retrospective study included patients aged ≥65 years diagnosed with hip fractures in the ED of a tertiary university hospital between January 1, 2017 and December 31, 2018. A multiple logistic regression model was used to identify risk factors for in-hospital mortality. **Results:** Three hundred and nineteen patients with hip fractures were analyzed, 204 (63.9%) of whom were women, with a mean age of 80.82 ± 7.41 years (65–102 years). In 247 (77.4%) patients, there was at least one comorbidity, most frequently hypertension (52%) or osteoporosis (51.1%). The median number of drugs used was 5 (range 0 to 9). Intensive care was required in 198 patients (62.1%). The in-hospital mortality rate was 8.5% (27 patients). According to the multiple logistic regression model, the factors predicting in-hospital mortality were pulse rate [odds ratio (OR), 1.039; 95% confidence interval (CI): 1.002–1.078], total leukocyte count (OR, 0.803; 95% CI: 0.652–0.989), serum calcium level (OR, 0.380; 95% Cl: 0.138–0.912), venous lactate level (OR, 2.459; 95% CI: 1.029–5.878), and length of hospital stay (OR, 1.205; 95% CI: 1.052–1.381). **Conclusion:** These data suggested that among geriatric hip fracture patients, increased pulse rate, elevated venous lactate level, low serum calcium level, total leukocyte count at the time of initial presentation to the ED, and prolonged duration of hospitalization were risk factors for in-hospital mortality.

KEYWORDS: *Geriatrics, hip fracture, mortality, risk factors*

INTRODUCTION

It is estimated that the number of adults aged 65 and over in the United States will exceed the number of children under 18 for the first time in history by 2034.[1] With advances and innovations in managing chronic diseases, the elderly population now participates in life more actively, which is reflected in an increase in the rate of trauma in the older population. Geriatric patients with trauma currently constitute 12% of all trauma patients, and this rate is predicted to increase to 40% by 2050.[2]

Falls and osteoporosis are common in older people, making hip fractures a significant health concern. Compared to the general population, mortality after hip fracture is significantly higher.[3] Globally, the annual incidence of hip fractures is expected to exceed 6 million by 2050.[4] Hip fractures are among the most frequent traumatic injuries in older adults.[5] As osteoporosis develops with advancing age, even minor trauma can cause hip fractures. The

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number of osteoporotic hip fractures is predicted to double to around 6.2 million by 2050.[6] The incidence of hip fractures has increased over the last 20 years in Türkiye, and there are expected to be 64,000 hip fracture cases per year by 2035.[7]

Almost all older people with hip fractures are admitted to hospital and undergo orthopedic surgery. Nearly 30% of these patients die within the first year.[4] Indeed, the 1-year mortality rate was 27.6% in a recent study in Türkiye.[8] A meta-analysis found that the risk of death was the highest in the first 3 months after a hip fracture, including a hospital stay, and that males had a higher risk than females.[9] Frost *et al*.[10] reported that the in-hospital mortality ranges from 4% to 12%.

Most older adults with hip fractures are admitted to emergency departments (EDs). Overcrowding in EDs affects the hospitalization of this patient group to the ward or intensive care unit; thus, the follow-up time in the ED may be prolonged.[11] Therefore, emergency physicians must know the risk factors for mortality in elderly patients with hip fractures. The main aims of this study are to analyze the clinical characteristics of geriatric patients with hip fractures admitted to the ED and to determine the risk factors for in-hospital mortality.

Materials and Methods

Study design

This retrospective study included patients aged ≥65 years diagnosed with hip fracture in the ED of a tertiary university hospital between January 1, 2017 and December 31, 2018. Erciyes University Clinical Research Ethics Committee approved this study with protocol number 2019-605. The medical dissertation "Analysis of Femur Fractures in Geriatric Patients" served as the basis for this study.

The patients' demographic, etiological, and clinical data were retrieved from archives and computer records and recorded on a data form. The data in this form included patient age, age group (65–74, 75–84, 85, and over), gender, vital signs in the ED, number of drugs used, comorbidities, laboratory test results in the ED, requirement for blood transfusion, trauma mechanism, requirement for operation, requirement for intensive care unit, length of hospital stay, and hospital outcomes. Patients with missing data were not included in the study.

The primary outcome of this study was in-hospital mortality. Three hundred and nineteen patients aged 65 years and older who were diagnosed with hip fractures in ED were included in the study [Figure 1].

Statistical analysis

The data obtained in this study were statistically analyzed using SPSS (v. 27). The normality of the continuous variables was evaluated using the Shapiro–Wilk test. Continuous variables with normal distribution were expressed as mean ± standard deviation values, and those not showing normal distribution as median and interquartile range (IQR) values. Categorical values were presented as frequencies (n) and percentages (%). Pearson Chi-square and Fisher's exact tests were used to compare categorical variables between groups. In addition, the independent samples *t*-test was used to compare groups of continuous variables with normal distribution, and the Mann–Whitney U test was used for data not showing normal distribution.

A binary logistic regression model was created for variables with a statistical *P* value below 0.15 for in-hospital mortality in univariate analyses. Univariate and multiple logistic regression analyses were performed to determine the predictors of in-hospital mortality. The odds ratios (ORs) were presented with 95% confidence intervals (CIs). Cutoff values were determined using receiver operating characteristic (ROC) analysis. Sensitivity, specificity, and positive and negative predictive values (PPV, NPV) for detecting in-hospital mortality were calculated with MedCalc. *P* values were accepted as statistically significant if less than 0.05.

Results

The evaluation, which included 319 patients, revealed several key findings. Most notably, 204 (63.9%) of the patients were female ($P < 0.001$), and the overall mean age was 80.82 ± 7.41 years. Most patients (93.7%, n: 299) presented to the ED after a fall. From the patients' histories, it was determined that 134 (42%) patients had a history of falls, and 50 patients (15.7%) had a history of hip operation. We found that 259 (81.2%) patients took at least one medication. The median (min-max) number of used drugs value was 5 (0–9), and patients mostly used antihypertensive drugs (n: 176, 55.2%). The number of medications used by the patients who fell was found to be statistically significant and higher than the number of drugs used by those with hip fractures due to nonfall mechanisms ($P < 0.001$). The demographic and clinical characteristics of patients concerned with in-hospital mortality are listed in Table 1. There were 247 patients (77.4%) with at least one comorbidity, primarily hypertension (52%) or osteoporosis (51.1%) [Table 2].

The diagnosis of hip fracture in the ED was made most often using direct radiography (96.2%, n: 307). Computed tomography imaging was performed in

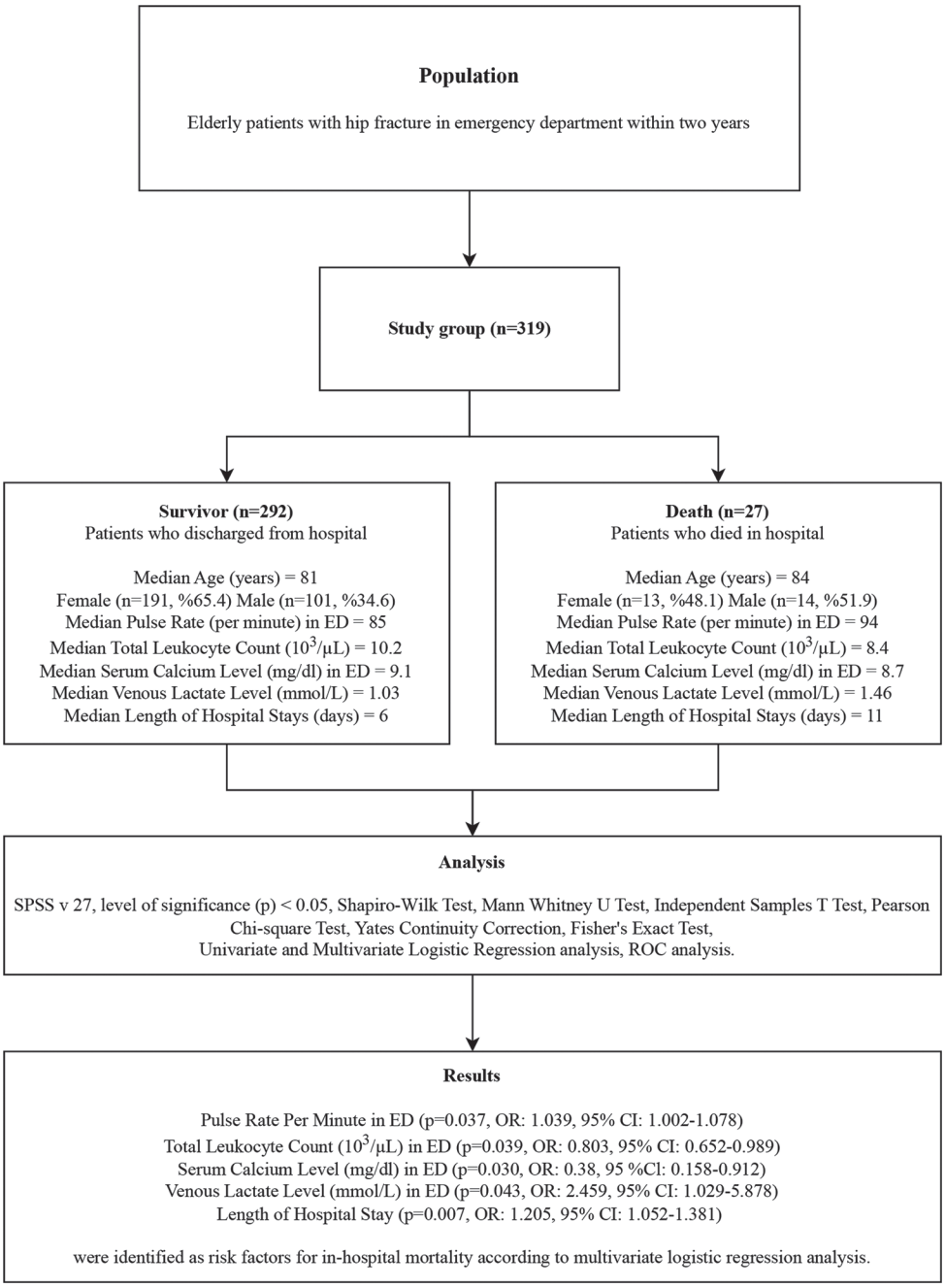

Figure 1: Diagram showing the study design and results

224 patients (70.2%). All the patients consulted orthopedics and 42.0% anesthesiology. Sixty-six patients (20.7%) had an additional injury to the hip fracture, the most frequent being another extremity injury (9.7%).

All the patients in this study were transferred from the ED to the ward or the intensive care unit after their clinical evaluation and stabilization in the ED, and 314 cases (98.4%) underwent surgery. Blood transfusion was required in 206 patients (64.6%), and transfusions were performed most often in the postoperative period (53.6%). One hundred ninety-eight (62.1%) patients required intensive care unit admission. The median (min-max) length of hospital stay was 6 (1–62) days. The in-hospital mortality rate was 8.5%. The comparison of laboratory results and vital signs of the patients at the time of ED admission concerning mortality is presented in Table 3.

A binary logistic regression model (accuracy, 94.6; Hosmer and Lemeshow Test; P = 0.865) showed that increased pulse rate in ED admission (OR, 1.039; 95% CI: 1.002–1.078), total leukocyte count (TLC) at ED

Table 1: Comparison of demographic and clinical characteristics of the patient groups according to mortality

Variable	Total (*n*: 319)	Death (*n*: 27)	Survivor (*n*: 292)	*P*
Age (years), Median (IQR)	82 (76-86)	84 (79-86)	81 (76-86)	0.078§
Age group (years)				
65-74	72 (22.6)	3 (11.1)	69 (23.6)	0.259*
75-84	139 (43.6)	12 (44.4)	127 (43.5)	
≥85	108 (33.9)	12 (44.4)	96 (32.9)	
Gender				
Female	204 (63.9)	13 (48.1)	191 (65.4)	0.115†
Male	115 (36.1)	14 (51.9)	101 (34.6)	
One or more comorbid condition	247 (77.4)	26 (96.3)	221 (75.7)	**0.027**†
History of previous falls	134 (42.0)	9 (33.3)	125 (42.8)	0.453†
Drug use	259 (81.2)	25 (92.6)	234 (80.1)	0.184†
Number of drugs used, Median (IQR)	5 (2-6)	5 (3-6)	4.5 (2-6)	0.518§
Additional injury outside the femur	66 (20.7)	6 (22.2)	60 (20.5)	1.000†
Transfusion requirement	206 (64.6)	16 (59.3)	190 (65.1)	0.694†
Preoperative transfusion requirement	12 (3.8)	3 (11.1)	9 (3.1)	0.071‡
Fall	299 (93.7)	23 (85.2)	276 (94.5)	0.077‡
Surgical operation	314 (98.4)	27 (100.0)	287 (98.3)	1.000‡
ICU requirement	198 (62.1)	27 (100.0)	171 (58.6)	**<0.001**†
Length of hospital stay (days), Median (IQR)	6 (4-8)	11 (8-26)	6 (4-8)	**<0.001**§

Values are number (%), unless otherwise specified. Bold values indicate statistically significant *P* (<0.05). ICU: intensive care unit; IQR: interquartile range. *Pearson Chi-square Test; †Continuity Correction; ‡Fisher's Exact Test; §Mann-Whitney *U*-Test

Table 2: Comparison of comorbid conditions of the patient groups according to mortality

Variable	Total (319)	Death (*n*: 27)	Survivor (*n*: 292)	*P*
Diabetes Mellitus	78 (24.5)	5 (18.5)	73 (25.0)	0.606*
Hypertension	166 (52.0)	17 (63.0)	149 (51.0)	0.324*
Chronic Kidney Disease	33 (10.3)	8 (29.6)	25 (8.6)	**0.003**†
Asthma-Bronchitis	36 (11.3)	1 (3.7)	35 (12.0)	0.337†
COPD	29 (9.1)	7 (25.9)	22 (7.5)	**0.006**†
Malignancy	25 (7.8)	1 (3.7)	24 (8.2)	0.708†
Osteoporosis	163 (51.1)	17 (63.0)	146 (50.0)	0.277*
Coronary Artery Disease	81 (25.4)	9 (33.3)	72 (24.7)	0.447*
Parkinson's Disease	13 (4.1)	0 (0)	13 (4.5)	0.612†
Alzheimer's Disease	44 (13.8)	4 (14.8)	40 (13.7)	0.776†
Depression	36 (11.3)	2 (7.4)	34 (11.6)	0.752†
Atrial Fibrillation	69 (21.6)	5 (18.5)	64 (21.9)	0.868*

Values are number (%), unless otherwise specified. Bold values indicate statistically significant *P* (<0.05). COPD: chronic obstructive pulmonary disease. *Continuity Correction; †Fisher's Exact Test

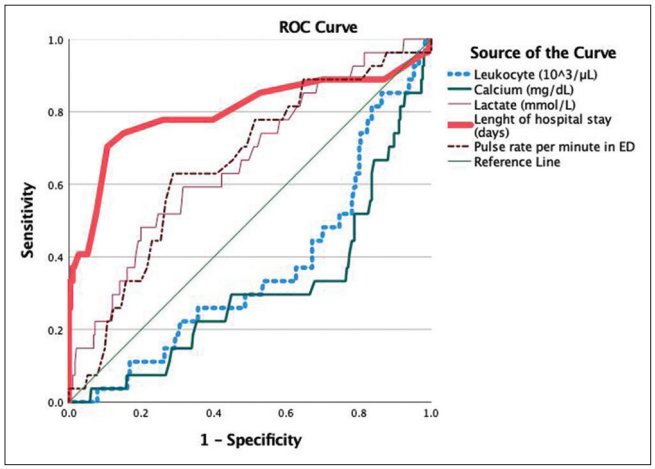

Figure 2: Graphics of receiver operating characteristic (ROC) analysis

admission (OR, 0.803; 95% CI: 0.652–0.989), serum calcium level at ED admission (OR, 0.380; 95% Cl: 0.138–0.912), venous lactate level (OR, 2.459; 95% CI: 1.029–5.878), and prolonged length of hospital stay (OR, 1.205; 95% CI: 1.052–1.381) were predictive of in-hospital mortality [Table 4]. The results of the ROC analysis performed to determine the cut-off values are shown in Table 5, and ROC curves in Figure 2.

Discussion

In this study, analyses of hip fractures in geriatric patients admitted to the ED revealed that specific biomarkers and clinical indicators can predict in-hospital mortality. Our findings underscore the crucial role of early intervention

Table 3: Comparison of laboratory findings and vital signs of patients in ED admission according to mortality

Variable	Death (*n*: 27)		Survivor (*n*: 292)		*P*
	Median (IQR)	Mean±SD	Median (IQR)	Mean±SD	
Laboratory findings in ED admission					
Hemoglobin (g/dL)	12 (10.9-13)	12.03±1.88	12.2 (11-13.4)	12.18±1.93	0.696†
Leukocyte (10^3/µL)	8.4 (7.7–11.5)	9.24±2.95	10.2 (8.4-12.8)	10.93±4.32	**0.019***
Platelet (10^3/µL)	203 (156-240)	212.19±74.38	232 (191-284)	247.6±84.64	**0.011***
Glucose (mg/dL)	124 (107-153)	131.5±32.5	130.5 (111-165.75)	151.95±68.23	0.319*
BUN (mg/dL)	29.6 (24.5–42.1)	32.54±13.22	22.1 (17.5-28)	24.47±10.7	**<0.001***
Creatinine (mg/dL)	1.23 (0.66-1.63)	1.44±1.05	0.91 (0.76-1.22)	1.08±0.7	0.052*
Sodium (mmol/L)	141 (138-142)	139.49±3.76	140 (138-142)	139.31±4.05	0.417*
Potassium (mmol/L)	4.55 (4.38-4.95)	4.64±0.66	4.52 (4.2-4.92)	4.56±0.57	0.465*
Calcium (mg/dL)	8.7 (8.3-9.2)	8.62±0.68	9.1 (8.7-9.4)	9.03±0.62	**<0.001***
AST (u/L)	26 (17.6–36.6)	28.44±13.47	20.3 (17-25)	23.12±14.80	**0.021***
ALT (u/L)	16 (11-25)	19.22±11.68	13 (10-17)	16.48±22.16	0.064*
INR	1.16 (1.05-1.21)	1.14±0.13	1.06 (0.99-1.14)	1.1±0.32	**0.009***
Lactate (mmol/L)	1.46 (0.98-2)	1.63±0.83	1.03 (0.8-1.5)	1.19±0.61	**0.005***
Vital signs in ED admission					
Fever (°C)	36.7 (36-37)	36.58±0.49	36.3 (36-36.8)	36.44±0.47	0.264*
Pulse rate (per minute)	94 (85-103)	93.34±17.12	85 (75-95)	85.85±15.59	**0.008***
Respiratory rate (per minute)	20 (18-22)	20±2.35	20 (18-22)	20.4±2.57	0.234*
Systolic blood pressure (mmHg)	159 (128-172)	153.96±23.31	145 (129.25-165)	148.24±24.68	0.159*
Diastolic blood pressure (mmHg)	80 (73-92)	82.07±12.31	80 (71-89)	79.86±13.46	0.504*

Bold values indicate statistically significant *P* (<0.05). ED: emergency department; BUN: blood urea nitrogen; AST: aspartate aminotransferase; ALT: alanine aminotransferase; INR: International normalized ratio. *Mann-Whitney *U*-Test; †Independent Samples *t*-test

Table 4: Logistic regression for in-hospital mortality

	Univariate		Multiple	
	OR (95% CI)	*P*	OR (95% CI)	*P*
Age	1.054 (0.996-1.115)	0.068	1.086 (0.99-1.192)	0.079
Gender Male	2.037 (0.922–4.499)	0.079	1.288 (0.353-4.701)	0.701
≥1 Comorbid condition	8.353 (1.113-62.66)	**0.039**	2.202 (0.164-29.488)	0.551
Chronic kidney disease	4.947 (1.788–11.308)	**0.001**	2.939 (0.559-15.465)	0.203
COPD	4.295 (1.638–11.266)	**0.003**	3.131 (0.618-15.856)	0.168
Leukocyte (10^3/µL)	0.872 (0.768–0.991)	**0.035**	0.803 (0.652-0.989)	**0.039**
Platelet (10^3/µL)	0.994 (0.988-1.00)	**0.036**	0.998 (0.991-1.005)	0.559
Aspartate aminotransferase (u/L)	1.015 (0.997–1.033)	0.113	1.017 (0.992-1.041)	0.179
Blood urea nitrogen (mg/dL)	1.050 (1.021–1.079)	**<0.001**	1.026 (0.974-1.081)	0.329
Calcium (mg/dL)	0.412 (0.238–0.712)	**0.002**	0.38 (0.158-0.912)	**0.030**
INR	1.279 (0.452–3.619)	0.643	0.996 (0.184-5.384)	0.996
Lactate (mmol/L)	2.263 (1.365–3.751)	**0.002**	2.459 (1.029-5.878)	**0.043**
Pulse rate per minute in ED	1.029 (1.004–1.053)	**0.02**	1.039 (1.002-1.078)	**0.037**
Preoperative transfusion requirement	3.931 (0.997–15.491)	0.05	4.206 (0.566-31.241)	0.160
ICU requirement	255075003.5 (0-0)	0.996	31691822.6 (0-0)	0.996
Length of hospital stay (days)	1.3 (1.171–1.443)	**<0.001**	1.205 (1.052-1.381)	**0.007**
Constant			0.000 (0.000–0.000)	0.994

Bold values indicate statistically significant *P* (<0.05). ED: emergency department; BUN: blood urea nitrogen; AST: aspartate aminotransferase; ALT: alanine aminotransferase; INR: International normalized ratio. *Mann-Whitney *U* Test; †Independent Samples *t*-test

and regular monitoring for pulse rate, TLC, serum calcium level, venous lactate level in ED admission, and length of hospital stay. These factors significantly affect mortality in elderly patients, emphasizing the responsibility and motivation for healthcare providers to act swiftly and vigilantly.

We found that admission serum lactate levels predicted in-hospital mortality in patients with hip fractures. Uzoigwe *et al*.[12] reported in a retrospective study that patients with elevated venous lactate levels following hip trauma were at an increased risk of death. Similarly, Venkatesan *et al*.[13] found in a prospective study that

Table 5: ROC curve results and sensitivity, specificity, and positive-negative predictive values

	AUC (95% CI)	*P*	Cut-off	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)	Accuracy (95% CI)
Pulse rate (per minute)	0.655 (0.550–0.761)	0.008	≥91	62.96 (42.37–80.6)	64.04 (58.25–69.55)	13.93 (10.45–18.34)	94.92 (91.9–96.86)	63.95 (58.41–69.22)
Length of hospital stay (days)	0.800 (0.683–0.917)	<0.001	≥8	77.78 (57.74–91.38)	73.97 (68.54–78.91)	21.65 (17.28–26.76)	97.30 (94.66–98.65)	74.29 (69.13–79.00)
Calcium (mg/dl)	0.692 (0.584–0.801)	0.001	≤8,73	66.67 (46.04–83.48)	76.37 (71.07–81.12)	20.69 (16.07–26.23)	96.12 (93.54–97.7)	75.55 (70.45–80.17)
Leukocyte (10^3/µL)	0.637 (0.53-0.743)	0.019	≤8,85	62.96 (42.37–80.60)	67.12 (61.41–72.48)	15.04 (11.27–19.80)	95.15 (92.25–96.99)	66.77 (61.31–71.92)
Lactate (mmol/L)	0.662 (0.554-0.770)	0.005	≥1,55	48.15 (28.67-68.05)	80.14 (75.09-84.56)	18.31 (12.46-26.09)	94.35 (92.04-96.02)	77.43 (72.44-81.9)

ROC: Receiver operating characteristic; AUC: Area under curve; CI: Confidence interval; PPV: Positive predictive value; NPV: Negative predictive value

high admission venous lactate levels were predictive of early mortality after hip fracture. They suggested that venous lactate could be a useful prognostic indicator or risk marker in patients with proximal femur fractures. In elderly patients with hip fractures, lactate levels could be a valuable risk stratifier, particularly in EDs. Identifying individuals at risk is crucial for preventing mortality.

The literature has consistently shown that hypocalcemia may increase mortality in elderly individuals. Hypocalcemia is common in older patients with hip fractures and is significantly associated with a higher total blood loss and a higher need for blood transfusion.[14] Li *et al*.[15] reported that preoperative serum calcium levels can serve as a potential prognostic indicator in older adults with hip fractures. Moreover, Morotti *et al*.[16] emphasized the effects that low calcium levels may be associated with coagulopathy that predisposes to increased bleeding in patients with intracranial hemorrhage. These mechanisms were reported to be more pronounced in elderly patients, thereby elevating mortality rates. The findings of our study suggest that serum calcium levels, as a clinical marker, play a significant role in the evaluation of geriatric patients in the ED and in formulating treatment strategies. Therefore, early intervention and regular monitoring for hypocalcemia may be critically important in reducing mortality rates following hip fractures in elderly patients.

TLC is a significant biomarker of the body's response to stress and infection. Niccolai *et al*.[17] reported that low TLC predicts mortality in elderly patients with proximal femur fractures, directly associated with worse outcomes—conversely, Dhingra *et al*.[18] found that increased TLC predicts 1-year mortality. Chen *et al*.[19] reported it as a predictor of 1-month mortality in elderly patients with femoral neck fractures. Our study highlights the significant role of TLC as a biomarker in the context of emergency medicine. The timely and accurate assessment of TLC can play a critical role in identifying high-risk patients. Early recognition of abnormal leukocyte levels can improve patient outcomes by enabling more aggressive monitoring and intervention strategies. Therefore, our study underscores the need to include TLC in the initial evaluation process of elderly patients with hip fractures.

In our study investigating factors influencing in-hospital mortality in elderly patients with hip fractures, we found that heart rates measured at the time of admission to the ED were statistically significantly higher in patients who subsequently died compared to those who were discharged. This finding aligns with existing literature, which identifies elevated heart rate as an indicator of underlying physiological stress or cardiovascular insufficiency. For instance, Palatini *et al*.[20] demonstrated

that high heart rates are associated with increased mortality risk in elderly patients. Similarly, Gabayan *et al*.[21] emphasized that elevated heart rate in emergency settings is linked to poor outcomes. As emergency medicine physicians, the timely and accurate assessment of vital signs, such as heart rate, is crucial for identifying high-risk patients. Early recognition of abnormal vital signs can lead to more aggressive monitoring and intervention strategies, potentially improving patient outcomes. Therefore, our study underscores the importance of emergency physicians considering vital signs, like heart rate, as critical components of the initial evaluation process for elderly patients with hip fractures.

We found that the length of hospital stay was an independent risk factor for in-hospital mortality. This finding aligns with existing literature, which shows that prolonged hospital stays often lead to increased morbidity and mortality in geriatric populations. A study by Tal *et al*.[22] found that prolonged hospitalization in elderly patients led to higher rates of complications such as infection and delirium, which can negatively affect outcomes. Similarly, the study by Morandi *et al*.[23] highlights that the length of hospital stays may reflect more severe disease or complications. Our study underscores the need for strategies to reduce the risks associated with prolonged hospitalization in elderly patients with hip fractures.

In the present study, we found that while there were more female patients, the mortality rate was higher among males. Consistent with our findings, other studies have also reported higher mortality rates in males with hip fractures compared to females.[9,24] The literature indicates that the female gender is a risk factor for hip fractures, with the female/male ratio in these fractures ranging from 1.5 to 4.5.[25] We believe that the high incidence of osteoporotic femur fractures in older females may be associated with osteoporosis in the postmenopausal period.

Furthermore, the mean age of the patients in our study was 80.82 years (range: 65–102 years). In a study conducted in Spain by Sanz-Reig *et al*.,[26] the mean age was 83.7 years, and in Turkiye, Ercin *et al*.[4] reported a mean age of 81 years. The mean age of the patients in our study was consistent with those in these studies. Our study found that age affected in-hospital mortality in univariate analyses. Similarly, numerous studies have found that advanced age affects mortality in elderly patients with hip fractures.[10,27]

The mortality rates are high for elderly patients with hip fractures during hospitalization and subsequent months and years. Sanz-Reig *et al*.[26] found an in-hospital mortality rate of 11.5% in a study examining in-hospital mortality after hip fractures in geriatrics, while Chatterton *et al*.[28] found 6.5%. Tarrant *et al*.[29] examined preventable mortality in elderly patients with hip fractures and reported an in-hospital mortality rate of 4.6%. Although the in-hospital mortality rate in the current study (8.5%) is close to that reported in other studies, it seems higher than the general average in the literature. This difference may be due to the higher transfer rate of patients with various complications to our regional hospital.

This study's retrospective design limited access to recorded information, archived files, and detailed history analyses. In addition, retrospective access to patient records and the study being conducted in a single center could have affected the study's statistical power. A more extended period of clinical follow-up would increase the validity of the data, and further prospective studies could be carried out to confirm the results.

Conclusion

Hip fractures are a significant cause of morbidity and mortality in elderly individuals. Osteoporosis develops with age, and even low-energy trauma can cause hip fractures. A substantial proportion of the elderly with hip fractures are present in ED. The time this group of patients spends in the ED may be prolonged due to overcrowding in ED and hospitals. Emergency physicians must be aware of risk factors to prevent mortality. In our study, TLC, lactate and calcium levels, increased heart rate, and prolonged hospital stay were found to be prognostic indicators in patients with hip fractures.

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Key Messages

Emergency physicians must know risk factors to prevent mortality for elderly hip fractures. In our study, total leukocyte count, lactate and calcium levels, increased heart rate, and prolonged hospital stay were prognostic indicators in patients with hip fractures.

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Conflicts of interest

There are no conflicts of interest.

References

1. Magidson PD, Carpenter CR. Trends in geriatric emergency medicine. Emerg Med Clin North Am 2021;39:243-55.
2. Konda SR, Lack WD, Seymour RB, Karunakar MA. Mechanism of injury differentiates risk factors for mortality in geriatric

trauma patients. J Orthop Trauma 2015;29:331-6.
3. Barcelo M, Torres OH, Mascaro J, Casademont J. Hip fracture and mortality: Study of specific causes of death and risk factors. Arch Osteoporos 2021;16:15.
4. Ercin E, Bilgili MG, Sari C, Basaran SH, Tanriverdi B, Edipoglu E, *et al*. Risk factors for mortality in geriatric hip fractures: A compressional study of different surgical procedures in 785 consecutive patients. Eur J Orthop Surg Traumatol 2017;27:101-6.
5. Abrahamsen B, van Staa T, Ariely R, Olson M, Cooper C. Excess mortality following hip fracture: A systematic epidemiological review. Osteoporos Int 2009;20:1633-50.
6. Bleibler F, Konnopka A, Benzinger P, Rapp K, Konig HH. The health burden and costs of incident fractures attributable to osteoporosis from 2010 to 2050 in Germany--A demographic simulation model. Osteoporos Int 2013;24:835-47.
7. Tuzun S, Eskiyurt N, Akarirmak U, Saridogan M, Senocak M, Johansson H, *et al*. Incidence of hip fracture and prevalence of osteoporosis in Turkey: The FRACTURK study. Osteoporos Int 2012;23:949-55.
8. Sofu H, Ucpunar H, Camurcu Y, Duman S, Konya MN, Gursu S, *et al*. Predictive factors for early hospital readmission and 1-year mortality in elder patients following surgical treatment of a hip fracture. Ulus Travma Acil Cerrahi Derg 2017;23:245-50.
9. Haentjens P, Magaziner J, Colon-Emeric CS, Vanderschueren D, Milisen K, Velkeniers B, *et al*. Meta-analysis: Excess mortality after hip fracture among older women and men. Ann Intern Med 2010;152:380-90.
10. Frost SA, Nguyen ND, Black DA, Eisman JA, Nguyen TV. Risk factors for in-hospital post-hip fracture mortality. Bone 2011;49:553-8.
11. Thiam CN, Khor HM, Pang GHM, Lim WC, Shanmugam T, Chandrasekaran CSK, *et al*. Hip fracture management in the emergency department and its impact on hospital outcomes: A retrospective cross-sectional analysis. Eur Geriatr Med 2022;13:1081-8.
12. Uzoigwe CE, Venkatesan M, Smith R, Burnand HGF, Young PS, Cheesman CL, *et al*. Serum lactate is a prognostic indicator in patients with hip fracture. HIP Int 2012;22:580-4.
13. Venkatesan M, Smith RP, Balasubramanian S, Khan A, Uzoigwe CE, Coats TJ, *et al*. Serum lactate as a marker of mortality in patients with hip fracture: A prospective study. Injury 2015;46:2201-5.
14. Wang Z, Chen X, Chen Y, Yang L, Wang H, Jiang W, *et al*. Low serum calcium is associated with perioperative blood loss and transfusion rate in elderly patients with hip fracture: A retrospective study. BMC Musculoskelet Disord 2021;22:1025.
15. Li DY, Zhang K, Wang H, Zhuang Y, Zhang BF, Zhang DL. Preoperative serum calcium level predicts postoperative mortality in older adult patients with hip fracture: A prospective cohort study of 2333 patients. J Am Med Dir Assoc 2024;25:655-60.
16. Morotti A, Charidimou A, Phuah CL, Jessel MJ, Schwab K, Ayres AM, *et al*. Association between serum calcium level and extent of bleeding in patients with intracerebral hemorrhage. JAMA Neurol 2016;73:1285-90.
17. Niccolai F, Parchi PD, Vigorito A, Pasqualetti G, Monzani F, Lisanti M. The correlation between preoperative levels of albumin and tlc and mortality in patients with femoral neck fracture. J Biol Regul Homeost Agents 2016;30 (4 Suppl 1):187-91.
18. Dhingra M, Goyal T, Yadav A, Choudhury AK. One-year mortality rates and factors affecting mortality after surgery for fracture neck of femur in the elderly. J Midlife Health 2021;12:276-80.
19. Chen X, Zhang J, Lin Y, Liu Z, Sun T, Wang X. Risk factors for postoperative mortality at 30 days in elderly Chinese patients with hip fractures. Osteoporos Int 2022;33:1109-16.
20. Palatini P, Casiglia E, Julius S, Pessina AC. High heart rate: A risk factor for cardiovascular death in elderly men. Arch Intern Med 1999;159:585-92.
21. Gabayan GZ, Gould MK, Weiss RE, Derose SF, Chiu VY, Sarkisian CA. Emergency department vital signs and outcomes after discharge. Acad Emerg Med 2017;24:846-54.
22. Tal S. Length of hospital stay among oldest-old patients in acute geriatric ward. Arch Gerontol Geriatr 2021;94:104352.
23. Morandi A, Bellelli G, Vasilevskis EE, Turco R, Guerini F, Torpilliesi T, *et al*. Predictors of rehospitalization among elderly patients admitted to a rehabilitation hospital: The role of polypharmacy, functional status, and length of stay. J Am Med Dir Assoc 2013;14:761-7.
24. Ekici C, Pazarci O, Kilinc S, Oztemur Z, Ozturk H, Tezeren G, *et al*. Effect on mortality of treatment method and surgery time for hip fracture patients aged over 65 years. Ulus Travma Acil Cerrahi Derg 2020;26:439-44.
25. Chang KP, Center JR, Nguyen TV, Eisman JA. Incidence of hip and other osteoporotic fractures in elderly men and women: Dubbo Osteoporosis Epidemiology Study. J Bone Miner Res 2004;19:532-6.
26. Sanz-Reig J, Salvador Marin J, Ferrandez Martinez J, Orozco Beltran D, Martinez Lopez JF, Quesada Rico JA. Prognostic factors and predictive model for in-hospital mortality following hip fractures in the elderly. Chin J Traumatol 2018;21:163-9.
27. Karaman O, Ozkazanli G, Orak MM, Mutlu S, Mutlu H, Caliskan G, *et al*. Factors affecting postoperative mortality in patients older than 65 years undergoing surgery for hip fracture. Ulus Travma Acil Cerrahi Derg 2015;21:44-50.
28. Chatterton BD, Moores TS, Ahmad S, Cattell A, Roberts PJ. Cause of death and factors associated with early in-hospital mortality after hip fracture. Bone Joint J 2015;97-B: 246-51.
29. Tarrant SM, Hardy BM, Byth PL, Brown TL, Attia J, Balogh ZJ. Preventable mortality in geriatric hip fracture inpatients. Bone Joint J 2014;96-B: 1178-84.