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Prognostic Factors for 30-day Mortality after Hip Fracture in the Elderly

Yaşlılarda Kalça Kırığı Sonrası 30 Günlük Mortalitede Prognostik Faktörler

Büşra Akpınar[1], Mürsel Karadavut[1], Eyüp Şenocak[2], İbrahim Dağ[2], Ömer Karaşahin[3], Pınar Tosun Taşar[1]

[1]Atatürk University Faculty of Medicine, Department of Internal Medicine, Division of Geriatrics, Erzurum, Türkiye
[2]Atatürk University Faculty of Medicine, Department of Orthopedic Surgery, Erzurum, Türkiye
[3]Erzurum Training and Research Hospital, Clinic of Infectious Diseases and Clinical Microbiology, Erzurum, Türkiye

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Abstract

Objective: In older adults, hip fractures lead to disability, diminished life quality, and increased socioeconomic burden and risk of death. This study aimed to evaluate the prognostic determinants of survival within a geriatric cohort following hip fracture.

Methods: We conducted a retrospective chart review of individuals aged 60 and above admitted with hip fractures to a tertiary academic orthopedic department from January 2013 through January 2024. Our analysis integrated baseline demographic and clinical profiles, fracture etiology, and anatomical site. Furthermore, we assessed surgical variables (timing and specific techniques employed), postoperative adverse events, total hospitalization duration, and mortality status at one month post-injury.

Results: A total of 250 older adults (median age: 80 years, range: 60-110, 62.4% women) constituted the study sample. The 30-day mortality rate was 6.8% (n=17). Patients in the non-surviving group were notably older (p=0.021) and more likely to have dementia (p=0.014) than those who survived. Femoral neck fractures were associated with improved survival (p=0.004), whereas pertrochanteric fractures were associated with increased mortality (p<0.001). Admission laboratory data showed that non-survivors had depressed lymphocyte counts and elevated serum creatinine and blood urea nitrogen concentrations. Subsequent multivariate logistic regression identified pre-existing dementia (odds ratio=4.12) and pertrochanteric fracture location (odds ratio=15.87) as independent predictors of early mortality.

Conclusion: Early mortality following a hip fracture among geriatric patients was strongly predicted by the presence of comorbid dementia, pertrochanteric fracture, and admission lymphopenia. Recognizing these baseline clinical vulnerabilities is critical for implementing vigilant, targeted perioperative care protocols.

Keywords: Elderly, hip fracture, mortality, prognostic factors, risk factors

Address for Correspondence/Yazışma Adresi: Mürsel Karadavut, MD, Atatürk University Faculty of Medicine, Department of Internal Medicine, Division of Geriatrics, Erzurum, Türkiye
E-mail: mursel_karadavut@hotmail.com
ORCID ID: orcid.org/0000-0002-0099-6317

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Öz

Amaç: Kalça kırıkları yaşlılarda ciddi sakatlığa yol açmakta, yaşam kalitesinde düşüşe sebep olmakta, mortalite riskini ve sosyoekonomik yükü artırmaktadır. Çalışmamızda kalça kırığı olan geriatrik hastalarda mortalite ile ilişkili faktörleri belirlemeyi amaçladık.

Yöntem: Ocak 2013 ile Ocak 2024 tarihleri arasında 3. basamak bir üniversite hastanesi olan hastanemizin ortopedi kliniğinde kalça kırığı nedeniyle yatan geriatrik hastaların verileri geriye dönük olarak incelendi. Demografik ve klinik verilerin yanı sıra kalça kırığının yeri ve nedeni, preoperatif bekleme süresi, operasyon türü, postoperatif komplikasyonlar, hastanede kalış süresi ve 30 günlük sağ kalım bilgileri kaydedildi.

Bulgular: Çalışmaya 60 yaş ve üzeri 250 hasta dahil edildi. Ortanca yaş 80 (60-110) yıldı ve 156'sı (%62,4) kadındı. On yedi hastanın (%6,8) travma sonrası kalça kırığı nedeniyle 30 gün içinde öldüğü görüldü. Otuz gün içerisinde mortalite gelişen hastalar istatistiksel açıdan anlamlı olarak daha yaşlıydı ve daha yüksek bir demans prevalansına sahipti (sırasıyla p=0,021 ve p=0,014). Femur boyun kırığı olanlar hastalarda mortalite daha az iken (p=0,004) pertrokanterik kırığı olanlarda ise mortalite daha fazla idi (p<0,001). Kan üre azotu ve kreatinin değeri ölenlerde anlamlı olarak daha yüksekken, lenfosit sayısı anlamlı olarak daha düşüktü. Çok değişkenli lojistik regresyon analizinde demans varlığının 4,12 kat, pertorkanterik kırık varlığının 15,87 kat 30 günlük mortalite riskini artıran bağımsız risk faktörü olduğu saptandı.

Sonuç: Yaşlılarda kalça kırığının mortalitesi demans, pertorkanterik kırıklar ve lenfopenisi olan hastalarda daha yüksekti. Bu hastalar yakından takip edilmelidir.

Anahtar Kelimeler: Yaşlı, kalça kırığı, mortalite, prognostik faktörler, risk faktörleri

Introduction

The prevalence of osteoporosis rises with advancing age due to a combination of altered bone microarchitecture, diminished osteoblastic function, and heightened osteoclastic activity. Furthermore, advanced age is associated with an increased risk of falls secondary to visual and balance impairments, frailty, polypharmacy, gait instability, and sarcopenia. Consequently, osteoporotic individuals are at increased risk of hip fractures[1], which are among the most important orthopedic challenges in the geriatric population[2]. Beyond increasing mortality risk and socioeconomic burden, these fractures severely compromise quality of life and result in serious disability. With the ongoing aging of the global population, projections indicate a continuous climb in the yearly incidence of these injuries[3,4], with estimates anticipating up to 6.25 million cases by the year 2050[5].

Within the first 12 months following a hip fracture, the observed fatality rate in the geriatric population ranges from 14% to 36%[6]. However, evidence suggests that three-quarters of hip fracture-related deaths are associated with preexisting comorbidities rather than the fracture itself[7]. Additional variables shown to elevate post-fracture mortality risk include male sex, older age, institutionalization (such as nursing home residency), malnutrition elevated American Society of Anesthesiologists (ASA) classification, and specific conditions such as diabetes, dementia, cancer, and ischemic heart disease[8-10]. Typically, clinical guidelines recommend operative management of these fractures in elderly patients within 48 hours. While prompt surgical intervention is generally favored to mitigate both morbidity and mortality in the majority of cases, the effect of surgical timing on mortality is debated in the literature[11-13].

While the broader literature contains numerous epidemiological investigations of hip fractures, there is a notable scarcity of data specifically addressing post-fracture mortality among older adults in the national context. The primary objective of this study was to identify prognostic factors associated with survival in a cohort of older patients with hip fracture.

Materials and Methods

This cross-sectional, retrospective study included geriatric patients (age 60 and above) who were admitted with hip fractures to the orthopedics department of a tertiary academic medical hospital between January 2013 and January 2024. Patients who met the above criteria and received a radiological diagnosis (via computed tomography and/or direct X-ray) of femoral neck, pertrochanteric, or subtrochanteric fractures were eligible for inclusion. Patients were excluded if they refused hospitalization, presented with a pathological fracture, or had a documented prior hip fracture.

Patient files and electronic databases were reviewed to extract a comprehensive set of variables. These included survival status at 30 days, duration of inpatient stay, occurrence of postoperative adverse events, need for perioperative blood product transfusion, estimated blood loss, anesthesia modality (general, spinal, or epidural), ASA

classification, surgical technique, date of the fracture and subsequent surgery, time from injury to operation, presence of concomitant non-hip fractures, anatomical location and etiology of the hip injury, osteoporosis subtype and bone mineral density metrics, pharmacological profile (type and quantity of medications), existing chronic comorbidities, and baseline demographic details. Mortality outcomes were verified through the national death registry, and postoperative survival times were recorded.

Osteoporotic conditions were grouped into primary and secondary. Traumatic etiology was dichotomized into high-energy and low-energy mechanisms. We stratified postoperative adverse events into surgical and metabolic categories. Specifically, surgical complications encompassed surgical site infections, hip dislocations, and stress fractures, whereas metabolic complications included episodes of delirium, acute kidney injuries, cerebrovascular accidents, pulmonary embolisms, pneumonias, and respiratory failures. To quantify the cumulative impact of concurrent illnesses, we utilized the modified Charlson comorbidity index (mCCI). The mCCI was developed by Charlson et al.[14] in 1987 to estimate the 10-year mortality risk by measuring the burden of comorbid disease.

Additionally, to assess potential associations with mortality, a wide array of admission laboratory parameters was analyzed. This panel comprised levels of gamma-glutamyl transferase, alkaline phosphatase, magnesium, phosphorus, calcium, potassium, glucose, sodium, blood urea nitrogen (BUN), albumin, total protein, lactate dehydrogenase, alanine transaminase, aspartate transaminase, hematocrit, and hemoglobin, and counts of platelets, lymphocytes, neutrophils, and total white blood cells.

Prior to the commencement of the study, formal approval was obtained from the Clinical Research Ethics Committee of Atatürk University Faculty of Medicine (approval no: 06, date: 21.02.2024).

Statistical Analysis

Data analysis was conducted in IBM SPSS Statistics version 21.0 (IBM Corp). The normality of distributions of continuous variables was assessed using the Kolmogorov-Smirnov test. For parametric data, the Student's t-test was used to perform pairwise comparisons between independent groups; for non-parametric data, the Mann-Whitney U test was used. Associations among categorical variables were examined using chi-square tests. To evaluate predictors of early mortality, parameters that achieved statistical significance in univariate analyses were included in a multivariate logistic regression analysis (backward LR model with entry and removal criteria set at 0.05 and 0.10, respectively). The threshold for statistical significance was defined as a p-value below 0.05.

Results

A total of 250 older adults (aged 60 years and older) with hip fractures were analyzed. Women constituted 62.4% (n=156) of the cohort, and the median age was 80 years (range: 60-110). The 30-day mortality rate was 6.8% (n=17). Surgical intervention was the primary treatment modality for the majority of patients (97.2%, n=243).

Table 1 details the distribution of baseline demographics, comorbidities, and hip fracture characteristics, stratified by early mortality status. Compared with surviving patients, non-survivors were older (p=0.021) and more likely to have pre-existing dementia (p=0.014). Furthermore, the non-surviving group exhibited a higher median mCCI score (p=0.030). Anatomical fracture site was also significantly associated with 30-day survival outcomes, with femoral neck fractures associated with better survival (p=0.004) and pertrochanteric fractures associated with higher mortality (p<0.001). Individuals managed conservatively (without surgery) exhibited a higher rate of early mortality than those who underwent operative repair (p=0.008).

Table 2 outlines the relationship between 30-day mortality and perioperative factors, including the need for red-cell transfusion, anesthetic modality, time to surgery, and postoperative adverse events. Overall, 54 patients (22.2%) experienced at least one postoperative medical or surgical complication; of these, 7 developed multiple complications. The rate of early mortality was higher in patients who experienced postoperative adverse events (64.3% vs. 20.1%; p<0.001). Figure 1 illustrates the frequency of complications according to 30-day survival status. The most common surgical complication was surgical site infection (n=12), while the most common medical complications were pulmonary embolism (n=15) and acute kidney injury (n=16).

Table 3 summarizes the association between 30-day mortality and admission laboratory results. Non-survivors had significantly lower lymphocyte levels (p=0.003) and higher serum concentrations of creatinine (p=0.030) and BUN (p=0.006).

Table 1. Distribution of demographic characteristics, comorbidities, and features of hip fracture according to 30-day mortality			
	30-day mortality		p-value
	Yes (n=17)	No (n=233)	
Age, median (IQR)	83.0 (80.5-86.5)	79.0 (72.0-84.0)	**0.021**
Sex (female), n (%)	11 (64.7)	145 (62.2)	0.839
Comorbidity, n (%)			
HT	8 (47.1)	134 (57.5)	0.401
DM	2 (11.8)	40 (17.2)	0.431
CAD	6 (35.3)	76 (32.6)	0.821
CHF	2 (11.8)	17 (7.3)	0.377
CKD	6 (35.3)	39 (16.7)	0.055
CVD	3 (17.6)	27 (11.6)	0.458
HL	1 (5.9)	6 (2.6)	0.393
Malignancy	2 (11.8)	21 (9.0)	0.478
Thyroid disease	3 (17.6)	20 (8.6)	0.197
Dementia	8 (47.1)	49 (21.0)	**0.014**
Depression	-	17 (7.3)	0.290
Parkinson's	1 (5.9)	7 (3.0)	0.435
COPD	1 (5.9)	29 (12.4)	0.369
Asthma	1 (5.9)	5 (2.1)	0.348
Number of diseases, median (IQR)	3 (1-6)	3 (1-4)	0.436
mCCI score, median (IQR)	5 (4-6)	4 (4-6)	**0.030**
Number of medications used, median (IQR)	2 (0-5)	4 (1-6)	0.192
Cause of hip fracture, n (%)			0.488
Low-energy trauma	17 (100.0)	223 (95.7)	
High-energy trauma	-	10 (4.3)	
Location of hip fracture, n (%)			**0.001**
Femoral neck fracture	5 (29.4)	152 (65.2)	
Pertrochanteric fracture	12 (70.6)	64 (27.5)	
Subtrochanteric fracture	-	17 (7.3)	
Treated surgically, n (%)	14 (82.4)	229 (98.3)	**0.008**

IQR: Interquartile range, HT: Hypertension, DM: Diabetes mellitus, CAD: Coronary artery disease, CHF: Congestive heart failure, CKD: Chronic kidney disease, CVD: Cerebrovascular disease, HL: Hyperlipidemia, COPD: Chronic obstructive pulmonary disease, mCCI: Modified Charlson comorbidity index

To identify independent predictors of early mortality, we constructed a multivariate logistic regression model incorporating all variables that reached statistical significance in univariate testing (admission lymphocyte count, serum creatinine, serum BUN, surgical treatment, anatomical fracture site, dementia diagnosis, and patient age). As detailed in Table 4, this analysis identified pertrochanteric fracture location [odds ratio (OR)=15.87, p<0.001] and comorbid dementia (OR=4.12, p=0.021) as primary independent risk factors. Additionally, each single-unit decrease in baseline lymphocyte count correlated with a 0.2% increase in the odds of early mortality (OR=1.002, p=0.004). In contrast, operative treatment emerged as a robust protective factor, yielding a 97.7% reduction in the odds of mortality (OR=0.023, p<0.001).

Discussion

This study evaluated a cohort of 250 geriatric patients with hip fractures (median age 80 years; 62.4% women) to determine risk factors for early mortality. We determined that the odds of 30-day mortality were more than 4 times higher for patients with dementia and nearly 16 times higher for patients with pertrochanteric fracture. A lower

Table 2. Distribution of postoperative complications, time to surgery, type of anesthesia, and red cell transfusion according to 30-day mortality among operated patients (n=243)			
	30-day mortality		
	Yes (n=14)	**No (n=229)**	**p-value**
Surgery performed, n (%)			0.299
Hip replacement	14 (100)	195 (85.2)	
Proximal femoral pin	-	23 (10.0)	
Dynamic hip pin	-	11 (4.8)	
Postoperative complication, n (%)	9 (64.3)	46 (20.1)	**<0.001**
Type of complication, n (%)			0.293
Medical	8 (88.9)	31 (68.9)	
Surgical	-	10 (22.2)	
Medical+surgical	1 (11.1)	4 (8.9)	
Time to surgery (h), n (%)			0.273
0-12	3 (21.4)	14 (6.1)	
12-24	3 (21.4)	42 (18.3)	
24-36	1 (7.1)	27 (11.8)	
36-48	2 (14.3)	40 (17.5)	
>48	5 (14.3)	106 (46.3)	
Anesthesia received, n (%)			0.799
Spinal	6 (42.9)	109 (47.6)	
Epidural	5 (35.7)	86 (37.6)	
General	3 (21.4)	34 (14.8)	
Postoperative red cell transfusion, n (%)	8	143	0.375

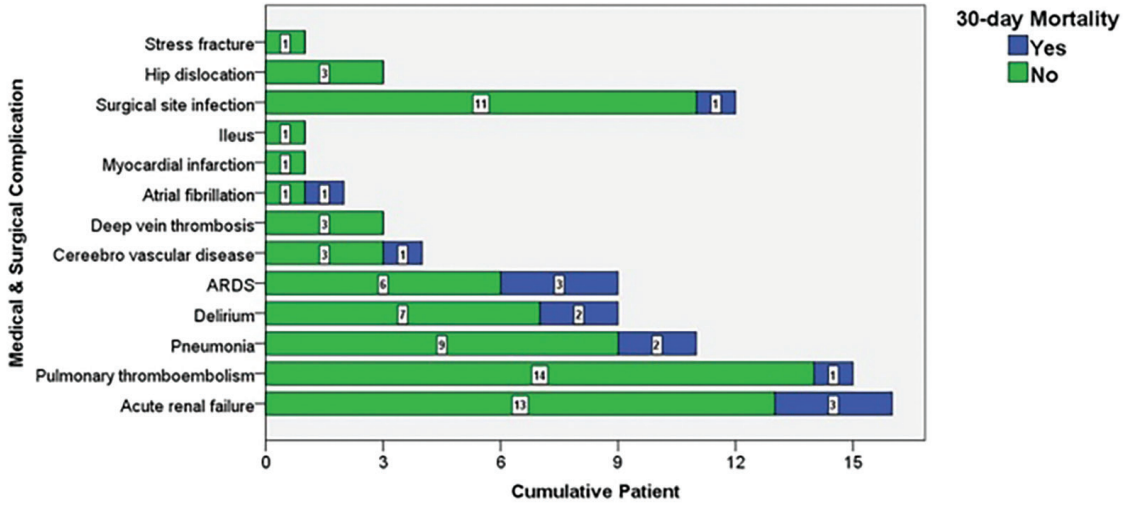

Figure 1. Distribution of medical and surgical complications by 30-day mortality

ARDS: Acute respiratory distress syndrome

Table 3. Comparison of laboratory parameters at hospital admission according to 30-day mortality

Laboratory parameters, median (IQR)	30-day mortality		
	Yes (n=17)	No (n=233)	p-value
Leukocytes (10^3/µL)	10.10 (7.94-12.10)	10.10 (8.06-12.41)	0.854
Lymphocytes (10^3/µL)	0.89 (0.68-1.05)	1.19 (0.86-1.68)	**0.003**
Neutrophils (10^3/µL)	8.34 (6.19-10.41)	7.87 (5.83-1.68)	0.540
Hb (g/dL)	11.50 (9.80-13.75)	12.70 (11.55-13.75)	0.102
Hct (%)	35.90 (30.35-40.40)	38.40 (34.85-41.40)	0.157
PLT (10^3/µL)	212 (154-251)	227 (184-290)	0.113
BUN (mg/dL)	26.17 (22.08-37.62)	21.5 (16.82-28.5)	**0.006**
Creatinine (mg/dL)	1.02 (0.86-1.12)	0.83 (0.63-1.1)	**0.030**
Na (mEq/L)	139 (137-141)	138 (136-140)	0.357
K (mEq/L)	4.09 (3.91-4.34)	4.14 (3.75-4.47)	0.988
AST (IU/L)	21 (16-37)	23 (18-28.8)	0.793
ALT (IU/L)	12 (11-14)	14 (10-19)	0.574
Ca (mg/dL)	8.7 (8.3-9.2)	8.8 (8.405-9.2)	0.541
P (mg/dL)	3.0 (2.4-3.3)	3.04 (2.5-3.5)	0.590
Mg (mg/dL)	1.71 (1.63-2.21)	1.87 (1.7-2.04)	0.490
Albumin (g/dL)	3.47 (3.13-3.91)	3.645 (3.36-3.9325)	0.283
ALP (IU/L)	103 (84-138)	86 (68-109.25)	0.061
Total protein (g/dL)	6.30 (5.95-7.2)	6.85 (6.41-7.30)	0.136

IQR: Interquartile range, Hb: Hemoglobin, Hct: Hematocrit, PLT: Platelet, BUN: Blood urea nitrogen, Na: Sodium, K: Potassium, AST: Aspartate transaminase, ALT: Alanine transaminase, Ca: Calcium, P: Phosphorus, Mg: Magnesium, ALP: Alkaline phosphatase

Table 4. Results of multivariate logistic regression of risk factors significant for 30-day mortality

Variables	B	OR	95% CI	p-value
Presence of dementia	1.417	4.124	1.242-13.695	**0.021**
Undergoing surgery	-3.760	0.023	0.003-0.172	**<0.001**
Pertrochanteric fracture	2.765	15.874	3.882-64.910	**<0.001**
Lymphocyte count	0.002	1.002	1.001-1.004	**0.004**

OR: Odds ratio, CI: Confidence interval

lymphocyte count was also significant (0.2% lower odds per unit decrease in lymphocyte count). Conversely, surgical treatment reduced the odds of early mortality by 97.7%.

A previous prospective study showed that in older adults, new functional losses occur throughout the first year after a hip fracture[15].Other studies demonstrated that the prevalence of frailty increased with decreased mobility, impaired balance, decreased muscle strength, impaired cognitive function, malnutrition, reduced physical activity, and greater falls risk[16-19]. In a cohort of women aged 65 and over, followed for 12 months post-hip fracture, elevated serum interleukin-6 levels were associated with persistent lower-extremity dysfunction. For patients with multiple pre-existing comorbidities, a hip fracture may trigger or accelerate frailty via inflammatory or immunological mechanisms, which can impact survival[20]. In this study, we aimed to identify independent predictors of mortality risk among older patients in whom hip fracture is known to be associated with a poorer prognosis.

In our geriatric cohort, the observed 30-day mortality rate after hip fracture was 6.8%. This rate ranges between 5.4% and 14.3% in the published literature[21,22]. Furthermore, our analysis identified dementia in 22.8% of the study population. Past research has reported a wide variation in

dementia prevalence (6.38% to 30%) among older adults with hip fracture, depending on variables such as genetic background, ethnicity, and demographic factors. Dementia is a known risk factor for frailty because it contributes to malnutrition, infection, and trauma, and it has also been linked to higher mortality after hip fracture[23,24]. Similarly, a review by Lai et al.[25] including 8.080 patients with dementia and 145.543 cognitively intact individuals confirmed that cognitive decline exacerbates 1- and 2-year mortality following a hip fracture. Furthermore, Bai et al.[26] synthesized 18 cohort studies in a meta-analysis, concluding that comorbid dementia multiplied the risk of mortality at 1, 6, and 12 months by 1.57, 1.97, and 1.77 times, respectively. In the present cohort, dementia was associated with an over 4-fold increase in the odds of 30-day mortality.

Surgical intervention remains the standard approach for managing hip fractures, as reflected by the 97.2% operation rate in our study. Surgical repair is considered crucial for expediting recovery and facilitating rehabilitation. Conversely, older individuals who are managed conservatively face heightened mortality risks associated with extended periods of bed rest. Consequently, our finding that surgery is an independent protective factor against early mortality is consistent with clinical expectations.

Regarding adverse events following surgery, at least one medical or surgical complication occurred in 22.2% of our cohort, and multiple complications affected 2.9% of our cohort. The most common medical complications were acute kidney injury and pulmonary embolism, and the most common surgical complication was surgical site infection. As anticipated, the occurrence of these postoperative complications was associated with higher 30-day mortality than in complication-free patients. In their 2019 study, Saul et al.[27] reported complications in 33% of patients, 11.5% of whom had surgical complications. Other reports have identified electrolyte imbalances and anemia as the prevailing non-surgical issues in this patient population[28].

Investigating surgical modalities, Parker and Gurusamy[29] concluded in a 2006 systematic review of 17 studies that total arthroplasty and internal fixation yielded no significant mortality differences in older adults with intracapsular fractures. Likewise, we observed no difference in mortality with respect to operative technique, although the anatomical location of the fracture substantially influenced outcomes. Mortality rates have been shown to be higher among individuals with subtrochanteric and trochanteric fractures relative to those with femoral neck fractures[30]. Additionally, extracapsular fractures are broadly recognized to portend worse survival outcomes than intracapsular fractures[31]. Ricci et al.[32] also documented elevated mortality rates among patients presenting with subtrochanteric or trochanteric fractures. In line with these findings, our data demonstrated a 15.87-fold increase in the odds of early mortality for patients with pertrochanteric fractures. Moreover, consistent with our own observations, prior research confirms that survival rates are generally more favorable following intracapsular trauma compared to extracapsular events[27].

Within the context of hip fractures, the effect of operative timing on patient survival remains a subject of debate. According to a meta-analysis by Moja et al.[33] delayed intervention correlated with a marked rise in pressure ulcer formation and overall mortality risk. Therefore, the general recommendation is that hip fractures be surgically repaired within a 24- to 48-hour window. Conversely, a 2018 prospective cohort study by Lizaur-Utrilla et al.[34] found no increased risk of mortality or complications when surgery was postponed for two or more days to medically optimize highly comorbid individuals. However, when organizational deficits caused the surgical delay, the researchers noted higher rates of one-year mortality and postoperative adverse events. Within our cohort, the interval between the traumatic event and the operation did not significantly alter 30-day survival outcomes. Given that our institution prioritizes prompt surgical fixation whenever feasible, we hypothesize that any operative delays in our cohort were deliberate measures to achieve adequate medical stabilization prior to surgery.

Another finding of our study was that patients who experienced early mortality following traumatic hip fracture had higher BUN and creatinine values and lower admission lymphocyte counts. Our findings are consistent with the results of previous studies. Blanco et al.[35] observed higher 30-day mortality in association with low lymphocyte and albumin levels at admission in their prospective cohort study. Another study conducted in our country in 2019 showed that patients who died within the first year following hip fracture repair exhibited a higher baseline neutrophil-to-lymphocyte ratio than survivors[36]. A subsequent meta-analysis revealed a significant relationship between the neutrophil-to-lymphocyte ratio and mortality at 1 year after hip fracture repair, but not at 30 days[37]. However, in the present study, we determined that for each one-unit decrease in admission lymphocyte count, the odds of early mortality increased by 0.2%. Further research is needed

to determine the predictive value of lymphocyte count for short-term mortality when evaluating early preoperative risk factors in hip fracture patients. Moreover, Seyedi et al.[38] demonstrated that patients with high BUN levels (>20 mg/dL) and patients with high creatinine (>1.3 mg/dL) levels had a 3-fold and 2.5-fold higher risk of mortality in the first 3 months, respectively.

Study Limitations

Certain limitations of this study must be acknowledged. First, the analysis was retrospective and included a small number of patients from a single center. Other factors that may be associated with mortality were not analyzed, such as the stage of dementia, malnutrition, and medication use. However, an important strength of this research is its contribution to the literature on predictors of early mortality following geriatric hip fractures in the Turkish population.

Conclusion

Older adults face a substantial risk of mortality following a hip fracture. Operative intervention significantly improved survival, whereas admission lymphopenia, comorbid dementia, and pertrochanteric fracture locations were associated with higher early mortality rates. Therefore, we recommend close monitoring in patients presenting with these specific vulnerabilities.

Ethics

Ethics Committee Approval: Prior to the commencement of the study, formal approval was obtained from the Clinical Research Ethics Committee of Atatürk University Faculty of Medicine (approval no: 06, date: 21.02.2024).

Informed Consent: Retrospective study.

Footnotes

Authorship Contributions

Surgical and Medical Practices: E.Ş., İ.D., Concept: M.K., P.T.T., Design: M.K., İ.D., P.T.T., Data Collection or Processing: B.A., E.Ş., Analysis or Interpretation: Ö.K., Literature Search: B.A., M.K., İ.D., Ö.K., P.T.T., Writing: B.A., M.K., İ.D., Ö.K., P.T.T.

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