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Which factor is more associated with survival of patients with hip fracture over 90 years: Type of fracture or treatment modality?

Mehmet Ekinci,[1] Serkan Bayram,[2] Erol Gunen,[1] Murat Yilmaz[1]

[1]Department of Orthopaedics and Traumatology, Haseki Training and Research Hospital, Istanbul, Turkiye

[2]Department of Orthopaedics and Traumatology, Istanbul University Istanbul Faculty of Medicine, Istanbul, Turkiye

ABSTRACT

OBJECTIVE: We aimed to analyze prognostic factors affecting the mortality and to evaluate whether the fracture type (collum femoris or intertrochanteric fracture) or treatment method (proximal femoral nail or hemiarthroplasty) affects the mortality in patients with hip fractures and older than 90 years old.

METHODS: In our study, we retrospectively reviewed the patients aged >90 years and operatively treated hip fractures. Patients were categorized according to fracture type and treatment method. Finally, three groups were created. Demographic values, laboratory values were analyzed for prognostic factors and determining independent factors associated with survival for each group.

RESULTS: A total of 193 patients were included with an average age of 92.5±2.4 (range, 90–104) years. There were 144 women and 49 men. There were 126 (65.2%) patients with intertrochanteric fracture and 67 (34.8%) patients with collum femoris fracture. At the time of this study, 142 (73.5%) patients had deceased. Staying in intensive care unit for collum femoris group, general anesthesia for intertrochanteric fracture treated with hemiarthroplasty group and delay to surgery and preoperative albumin level for intertrochanteric fracture treated with proximal femoral nail group were associated with poor survival.

CONCLUSION: Staying intensive care unit, general anesthesia, delay to surgery and preoperative albumin levels should be carefully evaluated for patients aged over 90 years with hip fractures. Our study showed that both fracture type and treatment modality were not associated with poor overall survival of the patients aged >90 years following hip fracture surgery.

Keywords: Aged over 90 years; hip fractures; mortality; prognostic factors.

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Hip fractures have become a major public health concern because of the increasing life span and osteoporotic population. They are significantly associated with decreased functional levels and high rate of mortality in patients older than 90 years old [1–3]. The goals of treatment of hip fractures in elderly patients are to provide rapid patient mobilization, to allow the patients to return to pre-fracture functional level, and to prevent complications such as deep vein thrombosis, pulmonary embolism, infections, and bed sores [4, 5].

There are several prognostic factors for mortality reported in the literature in patients treated for hip fracture. The factors affecting mortality and morbidity of patients are age, gender, mental status, surgery time and surgical method, American Society of Anesthesiologists (ASA) score, and some laboratory markers (hemoglobin, albumin, red cell distribution width (RDW), etc.) [6–10].

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Correspondence: Serkan BAYRAM, MD. Istanbul Universitesi Istanbul Tip Fakultesi, Ortopedi ve Travmatoloji Anabilim Dali, Istanbul, Turkiye.
Tel: +90 212 414 20 00 e-mail: dr.serkanbayram89@gmail.com

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The number of geriatric population is increasing annually with the increasing life expectancy, so the number of the patients over 90 years are expected to rise [11]. This relatively small and fragile patient group may have more comorbidities than the younger individuals [12]. Notwithstanding the improvements in medical sciences and implant technology, mortality rate in the older adults remains high in patients diagnosed with hip fracture [13]. So, our study analyzes the prognostic factors affecting mortality and evaluates whether the fracture type (femoral neck fracture (FNF) or intertrochanteric fracture (IF)) or treatment method (proximal femoral nail (PFN) or hemiarthroplasty) affects the mortality of these patients aged more than 90 years.

MATERIALS AND METHODS

This study has an Institutional Review Board approval of Haseki Training and Research Hospital (date: 08.07.2020, number: 2020-144). The procedures used in this study adhere to the tenets of the Declaration of Helsinki. After the institutional review board of our hospital approved this study, we retrospectively reviewed patients diagnosed with hip fracture between January 2013 and June 2019 in our institutional database. Written informed consent had been obtained from all the patients. Patients who were aged >90 years, had available medical records and demographic data, had low-energy osteoporotic fracture, and were admitted immediately to the hospital after the trauma were included in the study, whereas those with polytrauma, subtrochanteric fracture, hip fracture with high-energy trauma, and neglected fracture were excluded from the study.

The demographic data; gender; fracture side; preoperative comorbidities; and ASA score; type of anesthesia, fracture, and implant; need for intensive care unit (ICU) stay; follow-up period; duration of hospital stay; time to surgery; and preoperative and postoperative laboratory studies were evaluated using patients' medical records. Time to surgery was described as the period between entry to the emergency room and operation room. Preoperative and postoperative radiographs were evaluated using our institution's picture archiving and communication system. The death and death-time of patients were confirmed from the National Death Report System.

Comorbidities were classified as hypertension, diabetes mellitus, dementia, chronic cardiovascular disease, chronic pulmonary disease, cerebrovascular disease, chronic renal disease, malignancy, and other chronic diseases. Moreover, preoperative and postoperative albumin and hemoglobin levels, white blood cell (WBC) count, neutrophil–lymphocyte ratio (NLR), platelet–lymphocyte ratio (PLR), and RDW were used as prognostic factors in the analyses. The NLR was defined as the absolute neutrophil count divided by the absolute lymphocyte count, and the PLR was defined as the absolute platelet count divided by the absolute lymphocyte count. These values were calculated preoperatively and postoperatively. Laboratory values at first admission to the hospital were used for preoperative evaluation to get an idea about long-term health status of the patients. Furthermore, laboratory values on postoperative day 2 were used for postoperative evaluation.

> **Highlight key points**
> - Fracture type and treatment modality were not associated with overall survival of the patients aged over 90 years.
> - The survival rates first year after surgery was 54.5% with a mean survival of 20 months.
> - Staying in the intensive care unit, operated under general anesthesia and delay to surgery and preoperative albumin level were associated with poor survival.

The primary outcome was survival, defined as the time from surgery to death or the end of the study. The patients were divided into three groups according to the type of fracture (FNF vs. IF) and surgical method (PFN vs. hemiarthroplasty). All patients with FNF underwent cemented bipolar hemiarthroplasty. Some patients with IF underwent cemented hemiarthroplasty, whereas the others underwent PFN with the surgeon's recommendation and the consent of the patient and/or her relatives. Finally, three groups were created as follows: FNF treated with hemiarthroplasty (FNF-H) group, IF treated with PFN (IF-PFN) group, and IF treated with hemiarthroplasty (IF-H) group.

Demographic and laboratory values were analyzed for validity as prognostic factors for each group.

Statistical Analysis

The data were analyzed using Statistical Package for the Social Sciences (version 15.0; IBM Corp., Armonk, NY, USA). Categorical data were analyzed using the chi-squared test. The survival of the patients was analyzed using the Kaplan–Meier survival analysis. Comparisons of survival periods were performed using Log-rank test between the three groups. Univariate Cox regression

Table 1. Demographic data of the all patients

	Patients with hip fracture	
	Mean±SD	Min–Max
Age, years	92.5±2.4	90–104
Gender, F/M	144/49	
Side, R/L	104/89	
Fracture type IF/FNF	126/67	
Treatment method IMN/HA	91/102	
Survive/deceased	51/142	
Survive, months	20.4±20.7	0.1-95
Preoperative hospital stay, day	5.6±3.6	1-20
Postoperative hospital stay, day	7.4±7.8	1-72
Hospital stay, day	13.1±8.6	2-74
Comorbidities		
Hypertension, (%)	64.2	
Diabetes mellitus, (%)	22.3	
Dementia, (%)	16.6	
Chronic heart failure, (%)	36.3	
Chronic lung disease, (%)	9.8	
Cerebrovascular disease, (%)	8.8	
Chronic renal failure, (%)	6.7	
Cancer, (%)	3.1	
Other, (%)	2.1	
Operation time, minute	98.3±37.1	29–180
Length of intensive care, day	0.7±0.4	0–1
Type of anesthesia G/R	24/169	

F: Female; M: Male; R: Right; L: Left; SD: Standard deviation; Min: Minimum; Max: Maximum; G: General; R: Regional; IF: Intertrochanteric fracture; FNF: Femoral neck fracture; IMN: Intramedullary nailing; HA: Hemiarthroplasty.

analysis was used to determine potential prognostic factors. P values of 0.1 or less were added to the multivariate Cox model and variables with p values of 0.05 or less were accepted as independent risk factors. P values of <0.05 were used to denote statistical significance. The receiver operating characteristic (ROC) curve was used to estimate the cutoff value of delay to surgery and preoperative albumin level in the IF-PFN group.

RESULTS

One hundred ninety-three patients (144 female and 49 male) with a mean age of 92.5±2.4 years (range, 90–104 years) were included in this retrospective cohort study. The right femur was involved in 104 (53.8%) patients and the left femur in 89 (46.2%) patients. One hundred twenty-six (65.2%) patients had IF, and 67 (34.8%) patients had FNF. All patients with FNF underwent hemiarthroplasty, whereas 91 (72.2%) and 35 (27.8%) patients in the IF group underwent intramedullary nailing (IMN) and hemiarthroplasty, respectively. During the study period, 142 (73.5%) patients died (Table 1). The survival rates one month, six months, and one year after surgery were 88.1%, 61.2%, and 54.5%, respectively, in all patients (Fig. 1). The mean survival was 20.4±20.7 months (range, 0.1–95 months) for deceased patients and 37.4±27.8 (range, 12–113) for surviving patients. No significant difference in survival was found between the three groups (p=0.509) (Fig. 2).

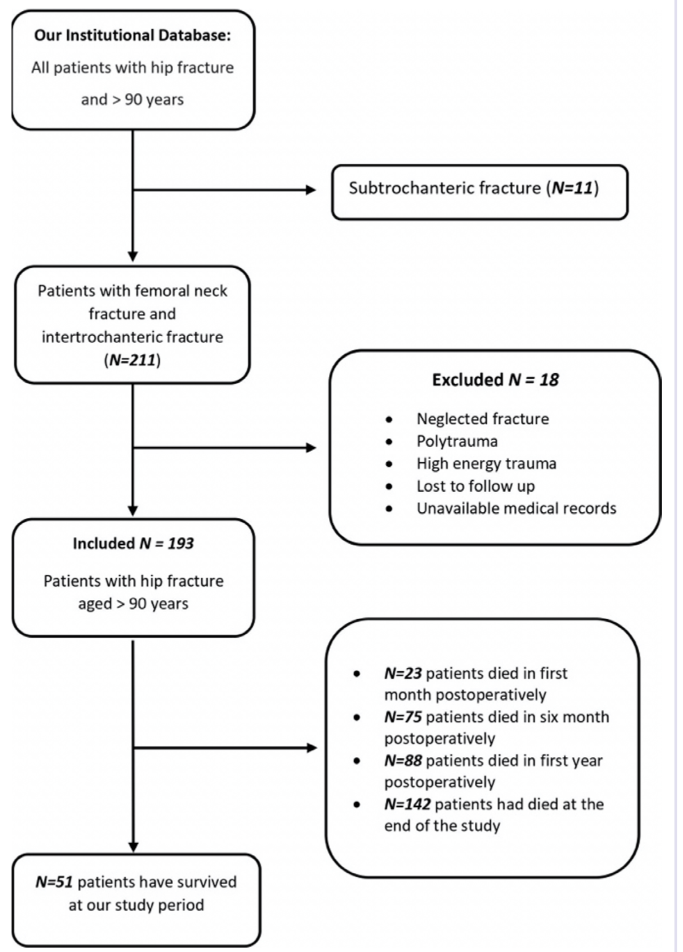

Figure 1. Flow chart of the study.

Prognostic Factor Analyses for the FNF-H Group

The survival rates one month, six months, and one year after surgery were 90.9%, 62.9%, and 57.8%, respectively, in the FNF-H group. Univariate analysis demonstrated

Table 2. Univariate and multivariate Cox regression analysis for FNF-H group

Factors	β Regression coefficient*	Hazard ratio and the 95% CI	p
Univariate Cox regression analysis			
Age	-0.012±0.059	0.988 (0.880–1.108)	0.834
Sex			
Male			
Female	Reference	Reference	Reference
	0.338±0.335	1.433 (0.728–2.703)	0.326
ASA score			
1	Reference	Reference	Reference
2	0.079±0.312	1.082 (0.587–1.993)	0.800
3	0.506±0.433	1.658 (0.710–3.871)	0.243
4	-0.616±0.748	0.540 (0.125–2.339)	0.410
Side			
Right	Reference	Reference	Reference
Left	-0.143±0.280	0.867 (0.500–1.502)	0.610
Delay to surgery	-0.011±0.032	0.989 (0.929–1.054)	0.738
Hospital stay	0.021±0.024	1.021 (0.975–1.070)	0.375
Intensive care	1.164±0.329	3.202 (1.681–6.099)	<0.001*
Type of anesthesia			
Regional	Reference	Reference	Reference
General	0.391±0.356	1.478 (0.736–2.969)	0.272
Operation time	-0.005±0.006	0.995 (0.984–1.007)	0.416
Comorbidities			
1–2	Reference	Reference	Reference
3–4	0.539±0.558	1.715 (0.554–5.122)	0.334
>5	1.195±1.104	3.304 (0.380–28.754)	0.279
Preoperative CRP	-0.001±0.003	0.999 (0.994–1.005)	0.825
Hemoglobin			
Preoperative	0.197±0.100	1.218 (1.001–1.483)	0.049*
Postoperative	-0.097±0.107	0.907 (0.735–1.120)	0.364
Red cell distribution width			
Preoperative	0.111±0.074	1.117 (0.966–1.292)	0.136
Postoperative	0.061±0.057	1.063 (0.951–1.188)	0.285
Mean corpuscular volume			
Preoperative	0.024±0.025	1.024 (0.975–1.075)	0.340
Postoperative	0.030±0.027	1.030 (0.978–1.085)	0.268
Albumin			
Preoperative	-0.201±0.198	0.818 (0.555–1.204)	0.308
Postoperative	-0.002±0.329	0.998 (0.524–1.901)	0.994
Total leucocyte count			
Preoperative	0.000	1.000	0.743
Postoperative	0.000	1.000	0.140
Neutrophil/lymphocyte ratio			
Pre-operative	0.058±0.034	1.059 (0.992–1.132)	0.088*
Post-operative	0.023±0.035	1.023 (0.955–1.096)	0.514
Platelet/lymphocyte ratio			
Pre-operative	0.001±0.001	1.001 (1.000–1.003)	0.143
Post-operative	0.002±0.001	1.002 (0.999 –1.004)	0.153
Multivariate Cox regression analysis			
Intensive care	1.479±0.525	4.387 (1.567–12.281)	0.005**
Hemoglobin			
Preoperative	0.148±0.098	1.159 (0.957–1.404)	0.131
Neutrophil/lymphocyte ratio			
Pre-operative	0.042±0.035	1.042 (0.974–1.116)	0.233

CI: Confidence interval; CRP: C-reactive protein; FNF: Femoral neck fracture; *: <0.05; **: <0.001.

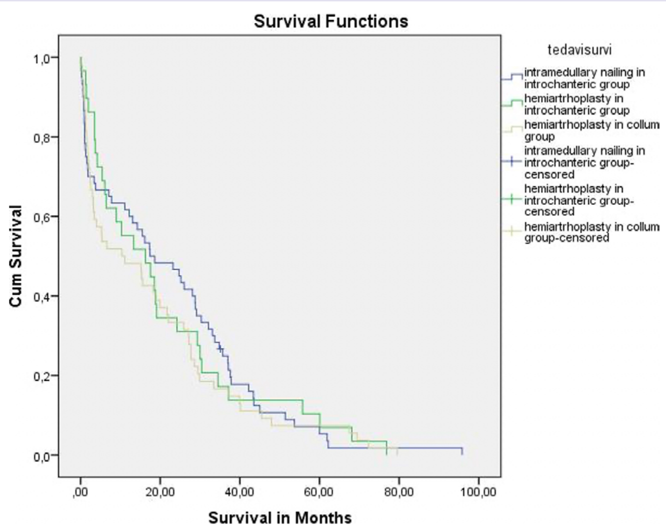

FIGURE 2. Kaplan–Meier survival curves showing the overall survival of all the three patients groups.

that staying in the ICU (p<0.001), preoperative hemoglobin (p=0.049), and preoperative NLR (p=0.088) were associated with poor overall survival. Multivariate analysis demonstrated that ICU stay (hazard ratio (HR), 4.387; 95% confidence interval (CI), 1.567–12.281; p=0.005) was independently associated with poor overall survival (Table 2).

Prognostic Factor Analyses for the IF-H Group

The survival rates one month, six months, and one year after surgery were 97%, 72.7%, and 60.6%, respectively, in the IF-H group. Univariate analysis revealed that the type of anesthesia (general anesthesia) (p=0.002), preoperative total leucocyte count (p=0.085), and postoperative leucocyte count (p=0.047) were associated with poor overall survival. Multivariate analysis revealed that general anesthesia (HR, 3.812; 95% CI, 1.157–12.564; p=0.028) was independently associated with poor overall survival (Table 3).

Prognostic Factor Analyses for the IF-PFN Group

The survival rates one month, six months, and one year after surgery were 89%, 78%, and 74.5%, respectively, in the IF-PFN group. Univariate analysis demonstrated that the female gender (p=0.055), delay to surgery (p<0.001), preoperative CRP level (p= 0.025), and preoperative albumin level (p=0.027) were associated with poor overall survival. Multivariate analysis demonstrated that delay to surgery (HR, 1.346; 95% CI, 1.192–1.519; p<0.001) and preoperative albumin level (HR, 0.379; 95% CI, 0.174–0.828; p=0.015) were independently associated with poor overall survival (Table 4). ROC curve analysis to determine the optimal cutoff values of delay to surgery and preoperative albumin level were performed and calculated as 5.5 days and 3.2 g/dl, respectively.

DISCUSSION

Our study showed that being in the ICU for the FNF group, general anesthesia for the IF-H group, and delay to surgery and preoperative albumin level for the IF-PFN group were associated with poor overall survival. Furthermore, our study showed that the overall survival rates were similar regarding the fracture type (FNF vs. IF)(p=0.12); moreover, we could not find any significant differences in overall survival of the patients when patients were classified according to the treatment modalities (hemiarthroplasty vs. PFN)(p=0.78). The survival rates one month, six months, and one year after surgery were 88.1%, 61.2%, and 54.5%, respectively, in all patients.

Preoperative comorbidities are important factors associated with lower survival. We evaluated the patients' preoperative comorbidities using their ASA scores. Although several studies have reported that high ASA scores were a negative prognostic factor for hip fracture [14, 15], our study did not find any correlation between the patients' ASA scores and their survival in the three groups. However, we found that staying in the ICU postoperatively was a negative prognostic factor for patients aged over 90 years with FNF. This may be related to problems that may develop in the preoperative period or during the surgery, regardless of the patients' preoperative ASA scores, even though patients with higher ASA scores are more prone to stay in the ICU postoperatively.

The type of anesthesia as a prognostic factor on survival has not been extensively studied in patients with hip fractures aged over 90 years. Bilsel et al. [15] in their retrospective study including 578 patients with hip fractures showed that the type of anesthesia has no effect on mortality. Mutlu and Dasar [16] in their study evaluating hip fractures in patients aged over 90 years reported that the type of anesthesia did not affect mortality. Contrary to these results, our study revealed that general anesthesia was a prognostic factor for mortality in the IF-H group only. Additionally, the type of anesthesia did not have an effect on mortality in the other groups in this study.

Table 3. Univariate and multivariate Cox regression analysis for IF-H group

Factors	β Regression coefficient*	Hazard ratio and the 95% CI	p
Univariate Cox regression analysis			
Age	0.099±0.082	1.104 (0.940–1.295)	0.228
Sex			
Male			
Female	Reference	Reference	Reference
	-0.549±0.462	0.577 (0.233–1.428)	0.234
ASA score			
1	Reference	Reference	Reference
2	-0.209±1.057	0.811 (0.102–6.435)	0.843
3	0.459±1.054	1.583 (0.201–12.481)	0.663
4	0.455±1.088	1.576 (0.187–9.282)	0.676
Side			
Right	Reference	Reference	Reference
Left	-0.055±0.387	0.947 (0.443–2.023)	0.887
Delay to surgery	-0.019±0.053	0.982 (0.885–1.089)	0.727
Hospital stay	-0.030±0.040	0.971 (0.898–1.049)	0.452
Intensive care	0.629±0.522	1.806 (0.701–5.024)	0.210
Type of anesthesia			
Regional	Reference	Reference	Reference
General	0.391±0.356	1.478 (0.736–2.969)	0.002*
Operation time	-0.005±0.005	0.995 (0.984–1.006)	0.349
Comorbidities			
1–2	Reference	Reference	Reference
3–4	0.417±0.580	1.518 (0.487–4.733)	0.472
>5	0.195±0.844	1.100 (0.210–5.742)	0.910
Preoperative CRP	0.004±0.005	1.004 (0.993–1.014)	0.476
Hemoglobin			
Preoperative	-0.068±0.102	0.934 (0.765–1.141)	0.504
Postoperative	-0.103±0.137	0.902 (0.689–1.180)	0.450
Red cell distribution width			
Preoperative	0.047±0.130	1.048 (0.812–1.353)	0.718
Postoperative	0.108±0.129	1.115 (0.866–1.435)	0.400
Mean corpuscular volume			
Preoperative	0.002±0.028	1.002 (0.949–1.058)	0.944
Postoperative	0.009±0.031	1.009 (0.949–1.073)	0.775
Albumin			
Preoperative	-0.654±0.465	0.520 (0.209–1.293)	0.159
Postoperative	-0.461±0.420	0.631 (0.277–1.436)	0.272
Total leucocyte count			
Preoperative	0.000	1.000	0.085*
Postoperative	0.000	1.000	0.047*
Neutrophil/lymphocyte ratio			
Pre-operative	-0.018±0.038	0.982 (0.913–1.058)	0.658
Post-operative	0.053±0.032	1.055 (0.991–1.122)	0.100
Platelet/lymphocyte ratio			
Pre-operative	0.000±0.001	1.000 (0.998–1.003)	0.889
Post-operative	0.001±0.001	1.001 (0.999–1.002)	0.474
Multivariate Cox regression analysis			
Type of anesthesia			
Regional	Reference	Reference	Reference
General	1.338±0.608	3.812 (1.157–12.564)	0.028**
Total leucocyte count			
Preoperative	0.000	1.000	0.513
Postoperative	0.000	1.000	0.373

CI: Confidence interval; CRP: C-reactive protein; IF: Intertrochanteric fracture; *: <0.05; **: <0.001.

Table 4. Univariate and multivariate Cox regression analysis for IF-PFN group

Factors	β Regression coefficient*	Hazard ratio and the 95% CI	p
Univariate Cox regression analysis			
Age	-0.032±0.051	0.968 (0.876–1.070)	0.526
Sex			
Male			
Female	Reference	Reference	Reference
	0.588±0.306	1.801 (0.988–3.281)	0.055*
ASA score			
1	Reference	Reference	Reference
2	6.853±59.877	946.422	0.909
3	7.035±59.876	1135.099	0.906
4	8.186±59.879	3591.882	0.891
Side			
Right	Reference	Reference	Reference
Left	0.052±0.264	1.053 (0.628–1.766)	0.845
Delay to surgery	0.183±0.044	1.200 (1.101–1.309)	<0.001*
Hospital stay	0.014±0.011	1.014 (0.991–1.037)	0.232
Intensive care	0.081±0.285	1.084 (0.621–1.895)	0.776
Type of anesthesia			
Regional	Reference	Reference	Reference
General	0.815±0.525	2.258 (0.807–6.316)	0.121
Operation time	0.003±0.005	1.003 (0.994–1.012)	0.520
Comorbidities			
1–2	Reference	Reference	Reference
3–4	0.537±0.576	1.710 (0.553–5.285)	0.351
>5	-0.853±1.122	0.426 (0.047–3.817)	0.447
Preoperative CRP	0.004±0.002	1.004 (1.001–1.008)	0.025*
Hemoglobin			
Preoperative	0.000±0.062	1.000 (0.885–1.129)	0.995
Postoperative	0.036±0.066	1.037 (0.911–1.181)	0.584
Red cell distribution width			
Preoperative	0.014±0.014	1.014 (0.987–1.042)	0.321
Postoperative	-0.032±0.037	0.969 (0.901–1.042)	0.392
Mean corpuscular volume			
Preoperative	-0.014±0.012	0.986 (0.964–1.009)	0.240
Postoperative	0.012±0.017	1.012 (0.979–1.046)	0.492
Albumin			
Preoperative	-0.718±0.325	0.487 (0.258–0.922)	0.027*
Postoperative	-0.247±0.388	0.781 (0.366–1.671)	0.525
Total leucocyte count			
Preoperative	0.000	1.000	0.841
Postoperative	0.000	1.000	0.133
Neutrophil/lymphocyte ratio			
Pre-operative	-0.013±0.031	0.987 (0.929–1.049)	0.672
Post-operative	0.014±0.015	1.014 (0.986–1.044)	0.330
Platelet/lymphocyte ratio			
Pre-operative	0.000±0.001	1.000 (0.998–1.001)	0.642
Post-operative	0.000±0.001	1.000 (0.999–1.002)	0.720
Multivariate Cox regression analysis			
Sex			
Male	Reference	Reference	Reference
Female	0.576±0.386	1.778 (0.835–3.789)	0.136
Delay to surgery	0.297±0.062	1.346 (1.192–1.519)	<0.001**
Preoperative CRP	0.000±0.003	1.000 (0.994–1.005)	0.885
Albumin			
Preoperative	-0.970±0.398	0.379 (0.174–0.828)	0.015**

CI: Confidence interval; CRP: C-reactive protein; PFN: Proximal femoral nail; *: <0.05; **: <0.001.

Several studies have evaluated surgical timing and its association with survival of patients undergoing hip fracture surgeries, and they reported conflicting results. Some studies have shown that delayed surgery (>48 h) affected mortality [14, 17], whereas some reported that surgery delay (>48 h) did not affect the patients' mortality [15, 16]. Ergin et al. [14] found that delay to surgery was independently associated with poor overall survival. A prospective study by Bohm et al. [17] showed that surgery within 48 h decreased mortality and hospital stay. Our results indicate that delay to surgery was a negative prognostic factor for patients with IF who were treated with IMN.

The patients' nutritional status is important for fracture healing and mobility. Serum albumin is a plasma protein used as an indicator of malnutrition. Cabrerizo et al. [18] reported that hypoalbuminemia was associated with higher mortality while Laulund et al. [19] found that serum albumin level was an effective predictor of mortality in after hip fracture. The findings of our study were similar to these results, with preoperative albumin level being significantly associated with mortality in the IF-PFN group only. However, preoperative albumin level was not a prognostic factor in the CF-H and IF-H groups.

The mortality rate following contralateral hip fracture is found to be higher in the studies of Boston [20] and Berry et al. [21]. Boston [20] found that mortality was higher in the second fracture. In the study of Berry et al. [21], it was found that mortality increased from 16% at 1 year after a first fracture to 24% for a contralateral fracture. But, since it is a retrospective study, we did not evaluate the refracture or contralateral fracture in the current study.

There are several limitations in this study. Because of the retrospective nature of our study, we did not evaluate the functional scores of the patients. The treatment choice for IF was determined according to the surgeon's preference, and no standard treatment algorithm for the different types of IF existed. Lack of defined algorithm to decide which patients with intertrochanteric fractures are treated with an IMN or HA. Another limitation of our study is that all of the hemiarthroplasties included in our study were cemented. Cemented femoral component fixation is used in patients with poor bone quality, lower revision rates and thigh pain, but it may be associated with cardiorespiratory collapse, embolism and higher perioperative and early postoperative mortality [22, 23]. However, systematic reviews and meta-analysis including extremely large patient groups reported that there was no significant difference between cemented or uncemented HA regarding postoperative mortality rates [24, 25]. Nevertheless, our study had several strengths. In the literature, our study is one of the studies with the highest number of patients with hip fractures aged over 90 years. This study evaluated these patients by classifying them according to the type of fracture and treatment method. With the increase in the average lifespan, cut-off values are constantly updated by World Health Organization (WHO) in the classification of people according to their age. Therefore, we believe that the age of 90 may be the threshold value for the oldest-old group in the coming years. Considering that the average life expectancy has increased, the results of our study provide noteworthy data for surgeons who are dealing with this small frail group of patients.

Conclusion

Our study showed that neither fracture type nor treatment modality were associated with the overall survival of the patients aged over 90 years following hip fracture surgery. The survival rates one month, six months, and one year after surgery were 88.1%, 61.2%, and 54.5%, respectively, in all patients with a mean survival of 20.4±20.7 months (range, 0.1–95 months). Staying in the ICU for the FNF group, general anesthesia for the IF-H group, and delay to surgery and preoperative albumin level for the IF-PFN group were associated with poor survival. These parameters should be considered for the estimation of prognosis in patients with hip fracture aged over 90 years.

Ethics Committee Approval: The Haseki Training and Research Hospital Clinical Research Ethics Committee granted approval for this study (date: 08.07.2020, number: 2020-144).

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