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Surgical treatment of hip fractures in patients aged 90 years old and over: Multifactorial retrospective study

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Abstract

Hip fractures are an important cause of morbidity and mortality in the geriatric age group. Life expectancy is increasing day by day. In this study, we aimed to review the hip fracture patients aged 90 years and over in terms of treatment process, mortality rates and mortality risk factors as a separate group. Patients aged 90 years and over, who presented to our clinic within 24 hours after fracture, who underwent surgery with the diagnosis of proximal femur fracture (intertrochanteric or collum femoris fracture) and who had a postoperative follow-up for at least 1 year were included in the study. There were 62 patients (21male, 41female) who included the criteria for participation in the study. The average age of all patients was 92,9±2,94 (90-104) years. The fracture type of 29 (46.77%) patients was intertrochanteric femur fracture. Osteosynthesis was performed with a proximal femur nail in the surgery of these patients. The fracture type of 33 (53.23%) patients was collum femoris fracture. Bipolar cementless hemiartroplasty was performed in the surgery of these patients. The mortality rate in the first month after surgery was 20.97%. The mortality rate in the first year after surgery was 40.32%. High Charlson Comorbidity Index (CCI: 3 and above) ($p = 0.01$), high ASA score (ASA: 3-4) ($p = 0.04$), length of hospital stay ($p = 0.03$), need for intensive care follow-up ($p = 0.02$) and the number of days in intensive care ($p = 0.03$) were found to be associated with a high mortality rate.

Keywords: Hip fracture, mortality, morbidity, risk factors

Introduction

Hip fractures are an important cause of morbidity and mortality in the geriatric age group. Geriatric hip fractures usually develop after minor traumas due to the facilitating effect of osteoporosis. According to United States data between 1986 and 2005, the incidence was reported as 957.3 per 100,000 in women and 414.4 per 100,000 in men [1]. The number of hip fractures worldwide is expected to rise from 1.26 million in 1990 to 4.5 million in 2050 [2]. In addition to the difficult treatment process with high mortality, high morbidity and high complication rates, it also brings high economic costs [3]. Although there are many studies in the literature on geriatric hip fractures, the age limit in these studies was generally determined as 65 and above. But life expectancy is increasing day by day. The patient group aged 65 and over has a very large and heterogeneous structure. Therefore, in our study, we aimed to review the hip fracture patients aged 90 years and over in terms of treatment process, mortality rates and mortality risk factors as a separate group.

Material and Methods

Patient Selection and Data Collection

In our study, patients who underwent surgery with the diagnosis of proximal femur fracture between January 2015 and December 2018 in our clinic were retrospectively analyzed on the hospital registry system (Probel®). Patients aged 90 years and over, who presented to our clinic within 24 hours after fracture, who underwent surgery with the diagnosis of proximal femur fracture (intertrochanteric or collum femoris fracture) and who had a postoperative follow-up for at least 1 year were included in the study. Patients with pathological fractures due to reasons other than osteoporosis, subtrochanteric fractures and patients with incomplete medical records were excluded from the study.

Patients' age, gender, fracture type, American Society of Anesthesiologists (ASA) Score, Charlson Comorbidity Index (CCI), presence of calcification in the femoral artery, time before surgery, anesthesia method, performed surgical procedure, need

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for intensive care, postoperative follow-up and postoperative complications were collected through the hospital registry system (Probel®, Turkey). ASA 1-2 patients were defined as low ASA scores and ASA 3-4 patients with high ASA scores. Survival data were collected using hospital registry system (Probel®, Turkey) and phone calls.

Ethical Approval and Informed Consent

For our study, ethics committee approval was obtained from " University of Health Sciences Istanbul Education and Research Hospital Clinical Research Local Ethics Committee" with the decision number 2609, dated 11/12/2020. Informed consent form was obtained from all patients or their legal representatives.

Statistical Analysis

From descriptive statistical data; number, percentage, average and standart deviation(SD) values were used. Cox regression analysis was used to determine the relationship between various clinical parameters and mortality. Kaplan-Meier method was used for survival analysis. P<0,05 was considered statistically significant. Statistical analysis was performed using Statistical Package for Social Sciences® (SPSS®) version 21.0 program.

Results

Preoperative Period Data

There were 62 patients (21 male, 41 female) who included the criteria for participation in the study. The average age of all patients was 92,9±2,94 (90-104) years. The average age of male patients was 92,57±2,73 (90-100) years. The average age of female patients was 93,12±3,06 (90-104) years. The patients were evaluated preoperatively by anesthesiologists with ASA score. According to the ASA score, the patients were divided into two groups as ASA 1-2 and ASA 3-4. 10(16.13%) patients were in the ASA 1-2 group and 52(83.87%) patients were in the ASA 3-4 group. The average time between fracture and surgery was 4,03±1,86 (1-11) days. Patients were also evaluated with CCI in the preoperative period according to their comorbidities. The patients were divided into 2 groups according to CCI: CCI 0-1-2, CCI 3 and above. 36(58.06%) patients were CCI 0-1-2 group, 26(41.94%) patients were CCI 3 and above group. There was femoral artery calcification in the direct radiography taken for fracture diagnosis of 38(61.29%) patients.

Fracture Type and Surgical Procedure Data

The fracture type of 29 (46.77%) patients was intertrochanteric femur fracture. Osteosynthesis was performed with a proximal femur nail (PROFIN® - TST, Turkey or A-PFN® - TST, Turkey) in the surgery of these patients. The fracture type of 33 (53.23%) patients was collum femoris fracture. Bipolar cementless hemiartroplasty (F40; Biomet, Inc., Warsaw, IN, USA) was performed in the surgery of these patients. Hemiarthroplasty was not applied to any patient with a diagnosis of intertrochanteric fracture. 55(88.71%) patients were operated under spinal anesthesia and 7(11.29%) patients under general anesthesia. Inotropic therapy was applied to 5 patients due to hypotension during surgery.

Postoperative Period Data

38 (61.29%) patients were admitted to intensive care after surgery. The average intensive care stay of these patients was 2±6,4 (1-38) days. Luxation was detected after surgery in 2 patients who underwent bipolar hemiarthroplasty surgery. Open reduction was applied in one of these patient and revision surgery was applied in the other. Superficial surgical side infection was detected 15 days after surgery in 1 patient who underwent bipolar hemiarthroplasty surgery. Debridement and antibiotherapy were applied. Transient sciatic nerve palsy developed in a patient who underwent bipolar hemiarthroplasty. Implant failure was detected in 2 patients who underwent proximal femur nail surgery. Revision osteosynthesis was performed in one of these patients and total hip arthroplasty was performed in the other. Pulmonary embolism was detected in 3 patients in the postoperative period (1st day, 3rd day and 15th day).

Mortality Analysis and Risk Factors

13 of 62 patients died in the first month after surgery. The mortality rate in the first month after surgery was 20.97%. 25 of 62 patients died in the first year after surgery. The mortality rate in the first year after surgery was 40.32%. When we examined the mortality rates according to the surgery performed, the mortality rate in the first month after surgery was 15.15% in patients who underwent bipolar hemiarthroplasty, while it was 27.59% in patients who were applied proximal femoral nail. The mortality rate in the first year after surgery was 36.36% in patients who underwent bipolar hemiarthroplasty, while it was 48.33% in patients who were applied proximal femoral nail. Although the mortality rate was higher in patients who underwent osteosynthesis with the proximal femur nail, no statistically significant difference was found in the Kaplan-Meier Survival Analysis. (p=0.42) (Figure -1)

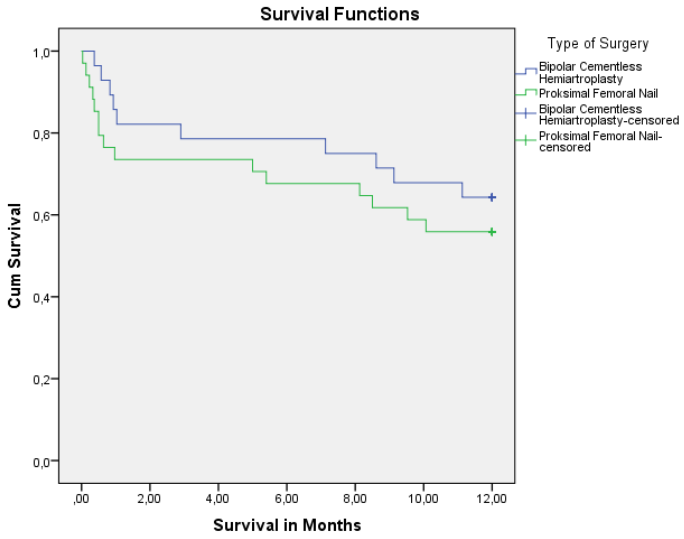

Figure 1. Postoperative 1-year survival curve according to the surgical method applied

Factors affecting mortality were reviewed using univariate Cox Regression Analysis. High Charlson Comorbidity Index (CCI: 3 and above) (p = 0.01), high ASA score (ASA: 3-4) (p = 0.04), length of hospital stay (p = 0.03), need for intensive care follow-up (p = 0.02) and the number of days in intensive care (p = 0.03)

were found to be associated with a high mortality rate. There was no significant difference when examining the relationship between age (p=0.18), gender (p=0.15), fracture type (p=0.42), time between fracture and operation (p=0.13), anesthesia method (p=0.97), and the presence of arterial calcification in radiography (p=0.97) with mortality. (Table 1)

Table 1. Factors affecting mortality according to univariate Cox Regression Analysis

Factors Affecting Mortality	Factors Not Affecting Mortality
High Charlson Comorbidity Index (CCI: 3 and above) (p = 0.01)	Age (p=0.18)
High ASA score (ASA: 3-4) (p = 0.04)	Gender (p=0.15),
Length of hospital stay (p = 0.03)	Type of fracture (p=0.42)
Need for intensive care follow-up (p = 0.02)	Type of surgery type (p=0.42)
The number of days in intensive care (p = 0.03)	Time between fracture and operation (p=0.13)
	Anesthesia method (spinal or general) (p=0.97)
	Presence of arterial calcification in radiography (p=0.97)

Discussion

Due to the prolongation of life expectancy, geriatric hip fractures maintain their importance as a public health problem. Effective risk factors for hip fracture were identified as: low bone mineral density (BMD), low body mass index (BMI), smoking and positive family history [4-5]. Laboratory findings in patients with hip fractures also showed an increase in serum osteocalcin and alkaline phosphatase activity, while a decrease in serum creatinine concentration [5].

High mortality rates are seen after geriatric hip fractures. In the literature, postoperative one year mortality rate in hip fractures under 65 years of age has been reported as 5% 6, while this rate has been reported between 19.3% to 30% in patients over 65 years of age [7–10]. Due to this serious increase in mortality rates, there has been a need to examine risk factors in the literature. In our study, we examined patients aged 90 and over, including the more sensitive population, in this respect.

One of the most important parameters affecting mortality in geriatric hip fractures is age. In a prospective cohort study (Benchimol JA et al.), geriatric patients aged less than 85 years and older than 85 years were compared in terms of one-year mortality after hip fracture. A significant increase in mortality was detected in patients aged 85 years and older[11]. In a study (Kadowaki M. et al.), patients who were diagnosed with geriatric hip fracture below the age of 90 and over the age of 90 were compared in terms of one-year mortality rates. A significant increase in mortality was detected in patients aged 90 years and older [12]. In our study, one-year mortality was found to be 40.32% in hip fracture patients aged 90 years and over. Considering the one-year mortality rates ranging from 19.3% to 30% in the literature after hip fractures aged 65 years and older and the mortality rate of 40.32% in our study, it is inferred that one-year mortality increases in patients with hip fractures 90 years and older depending on age [7–10]. The reason that there was no significant difference in the mortality rate according to age within the group in our study was thought to be related to the low age range.

Preoperative comorbidities of patients are generally evaluated with ASA score and CCI. The first version of the ASA score was presented to the literature in 1941 by Saklad M [13]. CCI was published by Charlson ME in 1987. It has been shown that the increasing score parallels the increase in mortality [14]. There are also different indexes used in the studies in the literature, especially the Elixhauser Comorbidity Index [15]. In our study, high CCI (CCI: 3 and above) (p = 0.01) and high ASA score (ASA: 3-4) (p = 0.04) were found to be associated with a high mortality rate. Publications in the literature also support that high ASA score and high CCI are associated with high mortality in both patients over the age of 65 and over 90. In the literature, it has been shown that increased scores in geriatric hip fractures are associated with increased one-year mortality rates [7-10-16].

In our study, length of hospital stay (p = 0.03), need for intensive care follow-up (p = 0.02) and the number of days in intensive care (p = 0.03) were found to be associated with a high mortality rate. This situation can be evaluated as a result rather than a cause. Because in patients with more comorbidities and developed complications; need for intensive care follow-up, total length of stay and length of stay in intensive care increased.

Another factor discussed in the literature regarding the effect on mortality is the surgical procedure. Although hemiarthroplasty surgery is performed with an open method, its most important advantage is providing early mobility. In cemented applications, complications due to cement can be seen. Osteosynthesis method with proximal femur nail is among minimally invasive surgical methods. The advantages of this method are the low blood loss and the short duration of the surgical procedure. However, the time to give full weight to the extremity may be prolonged. In our study, although the mortality rate was higher in patients who underwent osteosynthesis with the proximal femur nail, no statistically significant difference was found in the Kaplan-Meier Survival Analysis. (p=0.42) (Fugure 1) In the literature, there are studies in which the mortality rate after hemiarthroplasty is higher or there is no significant difference [17-18]. However, in these studies, comparisons were made on the same fracture type. We think that the difference with our study occurred because of this. Another method that can be applied in the treatment of hip fractures is total hip arthroplasty [19]. Because of the increasing complication rates and short life expectancy, we did not choose this method in patients over 90 years of age.

Morales DC. et al. reported that arterial calcification on radiography is a predictor for increased risk of cardiovascular events after total knee arthroplasty [20]. Therefore, in our study, we compared patients with and without arterial calcification in terms of 1-year mortality. There was no significant difference when examining the relationship between the presence of arterial calcification in radiography (p=0.97) with mortality. (Table 1)

Surgical site infections are one of the most important postoperative complications [21]. In our study, postoperative infection developed in only 1 patient (3.3%) who underwent hemiarthroplasty surgery. Postoperative infection was not detected in patients who underwent

osteosynthesis with the proximal femoral nail.

The most important limitations of our study are that it is retrospective and based on medical records. In addition, one of the most important factors in reducing postoperative complications is physical therapy applications [22]. In our study, postoperative physical therapy applications and mobility of the patients were not included.

CONCLUSION

Mortality is very high in patients with hip fractures 90 years and older. High Charlson Comorbidity Index (CCI: 3 and above) ($p = 0.01$), high ASA score (ASA: 3-4) ($p = 0.04$), length of hospital stay ($p = 0.03$), need for intensive care follow-up ($p = 0.02$) and the number of days in intensive care ($p = 0.03$) were found to be associated with a high mortality rate.

Conflict of interests
The authors declare that they have no competing interests.

Financial Disclosure
All authors declare no financial support.

Ethical approval
University of Health Sciences Istanbul Education and Research Hospital Clinical Research Local Ethics Committee" with the decision number 2609, dated 11/12/2020.

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