

# Evaluation of The Major Predictors of Long-Term Mortality in Patients Who Underwent Hemiarthroplasty for Hip Fracture

Seçkin Özcan   
Erdoğan Genç 

## Kalça Kırığı Sonrası Hemiartroplasti Yapılan Hastalarda Uzun Dönem Mortalitenin Başlıca Öngörücüleri

### ABSTRACT

**Objective:** The aim of this study was to determine long-term mortality and related predictors in patients who underwent hemiarthroplasty.

**Method:** In this study, clinical data of 282 patients were evaluated. Patients with a pathologic fracture, incomplete medical data, and those who died postoperatively before being discharged were excluded from the study. Patient characteristics related to age, gender, fracture type, comorbidities (0-2, 3+), time until surgery, American Society of Anesthesiologists (ASA) score, anesthesia type, duration of surgery, postoperative intensive care unit (ICU) stay, postoperative hospital stay and mortality within the 3 years after discharge were examined. The mean survival rates were obtained with the Kaplan-Meier method. In addition, Cox regression method was used to analyze the factors that were effective on the mortality.

**Results:** Two hundred and sixty-three patients were included in our study. The median follow-up period was 32 months (range 0-86). The mortality rate was 56% at 3 years after discharge. The mean age of surviving patients in the third year was significantly lower ( $p<0.001$ ). Frequency of having 3 or more comorbidities and ICU stay were higher in the non-survivor group ( $p<0.001$  and  $p=0.007$ , respectively). ASA score were  $\geq 3$  in 104 (71%) of the 147 patients who did not survive, whereas it was  $\geq 3$  in 69 (59%) of the 116 patients from the surviving group ( $P=0.056$ ).

**Conclusion:** In our study, age, presence of  $\geq 3$  comorbidity, time until surgery and anesthesia type were detected as risk factors for mortality.

**Keywords:** hip fracture, hemiarthroplasty, mortality

### ÖZ

**Amaç:** Bu çalışmanın amacı, kalça kırığı nedeniyle hemiarthroplasti yapılan hastalarda uzun dönem mortaliteyi ve ilişkili olduğu faktörleri belirlemektir.

**Yöntem:** İki yüz seksen iki hastanın klinik verileri değerlendirildi. Tıbbi kayıtları tam olmayanlar, patolojik kırığı olanlar, ameliyat sonrası taburcu olmadan ölen hastalar çalışma dışı bırakıldı. Yaş, cinsiyet, komorbidite (0-2, 3+), ASA (American Society of Anesthesiologists) skorları (1-2, 3-4), anestezi tipi (genel, rejyonel), ameliyat öncesi ve sonrası hastanede kalış süresi, ameliyat süresi, ameliyat sonrası yoğun bakım ünitesi (YBÜ) gereksiniminin varlığı ve taburculuk sonrası 3 yıllık mortalite verileri kaydedildi. Ortalama sağkalım Kaplan-Meier yöntemi ile elde edilmiştir. Mortalite üzerinde etkili olan faktörleri analiz etmek için Cox regresyon yöntemi kullanıldı.

**Bulgular:** İki yüz altmış üç hasta çalışmamıza dâhil edildi. Ortanca takip süresi 32 aydı (0-86 ay). Ölüm oranı üçüncü yılda %56 idi. Üçüncü yılda hayatta kalan hastaların yaş ortalaması ( $81,6\pm 8,09$ ) anlamlı olarak daha düşüktü ( $p<0,001$ ). Komorbiditesi 3 ve üzerinde olanlar (%52) ile cerrahi sonrası YBÜ ihtiyacı olanların oranı (%56) üçüncü yılda hayatta olmayan hastalarda daha yüksekti (sırasıyla  $p<0,001$  ve  $p=0,007$ ). Ölen 147 hastanın 104 tanesinde (% 71) ASA skoru  $\geq 3$  iken, sağ kalan gruptaki 116 hastanın 69'unda (% 59)  $\geq 3$  idi ( $p=0.056$ ).

**Sonuç:** Çalışmamızda, yaş, 3'ten fazla komorbidite varlığı, cerrahiye kadar geçen süre ve anestezi tipinin uzun dönem mortalite için risk faktörleri olarak saptanmıştır.

**Anahtar kelimeler:** kalça kırığı, hemiarthroplasti, mortalite

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Seçkin Özcan  
Yalova Devlet Hastanesi  
Yalova - Türkiye  
✉ seckinozcan1301@gmail.com  
ORCID: 0000-0002-9209-5865

E. Genç 0000-0002-1260-6443  
Sağlık Bilimleri Üniversitesi  
İstanbul Bağcılar Eğitim ve Araştırma  
Hastanesi  
İstanbul - Türkiye

## INTRODUCTION

Hip fractures are among the most important causes of death associated with orthopedics and traumatology in the elderly<sup>(1,2)</sup>. The hip fractures have become more common worldwide due to aging of the population<sup>(3)</sup>. It has been reported that in the whole world the number of patients with hip fractures will be 2.6 million by 2025<sup>(4)</sup>.

Different factors such as age, gender, comorbidity, time to surgery, and treatment type have been shown to affect mortality rates in patients with hip fractures<sup>(5,6)</sup>. However, there is no consensus on the systemic factors affecting hip fracture mortality<sup>(1)</sup>. According to some studies, femoral neck fracture have lower mortality risk than pertrochanteric hip fractures. However, patients who underwent hemiarthroplasty for hip fracture have the higher mortality risk<sup>(5,7,8)</sup>.

Prolonged preoperative waiting time more than 48 hours will increase the length of hospital stay. However, medical and social reasons affecting the pre-, and postoperative period also affect the length of hospital stay. Surgical delay and prolonged hospitalization are the major risk factors negatively-affecting the long-term mortality in patients with femoral neck fractures. Therefore, surgical treatment of hip fracture should not be delayed unnecessarily<sup>(9-12)</sup>. In addition, it has been reported that pulmonary and cardiac problems are common causes of death following surgical treatment of the femoral neck fractures<sup>(5)</sup>.

There are many studies related to early- term mortality after a hip fracture. However, the studies related to predictors of long term mortality have been inadequate<sup>(13)</sup>. We hypothesized that personal variables (such as; gender, age, comorbidity, ASA etc.) affect the long-term mortality more than expected in the patients with hip fractures. Therefore, we aimed to investigate 3-year mortality rates in patients who underwent hemiarthroplasty for hip fracture and evaluate relationship between mortality and the pre-, or postoperative factors.

## MATERIAL and METHODS

Our study was performed retrospectively under the

approval of our institution's ethical review board and performed under the Declaration of Helsinki. In our study, clinical records on 282 patients who underwent hemiarthroplasty for a hip fracture (femoral neck or pertrochanteric) between January 2013 and January 2017 were analyzed. The patients were reviewed from our electronic clinical data. The follow-up period for survivor patients was minimum 3 years. Cases with fractures associated with a bone tumor, those with inadequate medical data in their hospital records, and patients who died during postoperative period without being discharge were excluded from the study. Nineteen patients fulfilled the exclusion criteria. Therefore, 263 patients were included in the final analysis (Figure 1). Patients were classified as survivors or non-survivors within the postoperative third year.

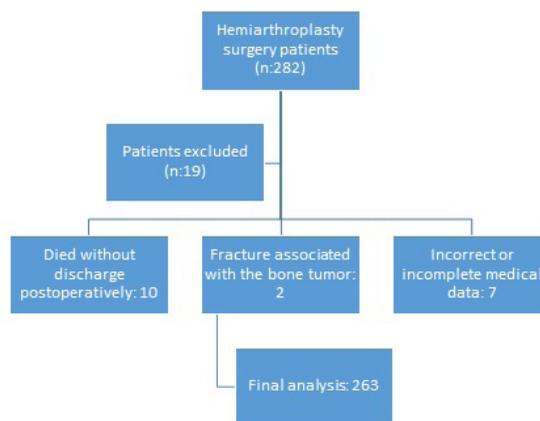


Figure 1. Flow chart of patients in our study.

Records about the age, gender, fracture type, comorbidities (0-2, 3+), time until surgery, American Society of Anesthesiologists (ASA) grade (1 or 2 vs. 3 or 4), anesthesia type (general or regional), duration of surgery, postoperative need of intensive care unit (ICU), length of pre-,and postoperative hospital stay and mortality were examined. The most common comorbidity was hypertension in 62% (n: 163) of the patients. In addition, diabetes mellitus and chronic obstructive pulmonary disease were present in 71 (27%) and 46 (17.5%) patients, respectively. Thirty-seven (14%) patients had no comorbidities.

Statistical analysis was performed by using the IBM SPSS Statistics for Windows, Version 21.0. Armonk NY: IBM Corp. Numeric variables were given as mean

± standard deviation for normally distributed data and median (minimum–maximum) for non-normally distributed data. Categorical variables were expressed as frequencies and percentages. The comparison of means was performed using Student t-test or Mann–Whitney U test, and then Kolmogorov–Smirnov normality test. A comparison of categorical variables was performed by the chi-square test. The mean survival rates were obtained with the Kaplan-Meier method. The log-rank test was used in consideration of the determined p value. In addition, Cox regression method was used to analyze the factors that are effective on the mortality. P-values lower than 0.05 were considered statistically significant.

### RESULTS

Two hundred and sixty- three patients (103 men, 160 women) with a median age of 81 (range: 51-102) years were included in the study . The main characteristics of patients are shown in Table 1. The median follow up time was 32 months (range. 0-86). The clinical follow up time for survived patients was minimum 3 years in our study. Of the 263 patients, 147 (56%) had died within 3 years, and 85 (32%) had died within 1 year after hemiarthroplasty surgery. The results of Kaplan-Meier cumulative survival analysis is presented in Figure 2.

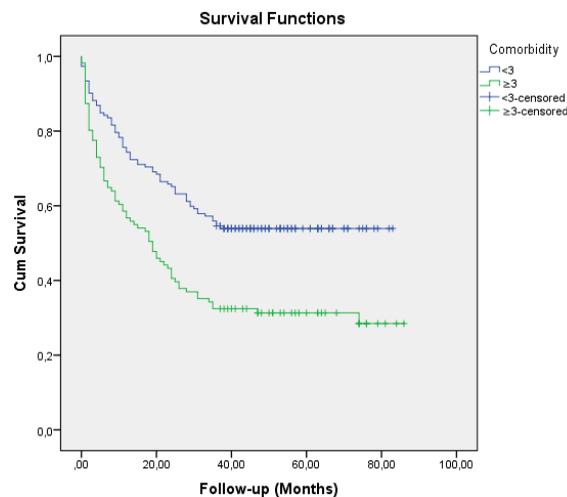


Figure 2. The figure shows the Kaplan Meier cumulative survival analysis by comorbidity in patients with hip fractures.

Preoperative diagnosis was intracapsular femoral neck fracture in 256 (97%) and extracapsular hip fracture in 7 (3%) patients. All patients underwent

Table 1. Demographic and main characteristics of patients according to 3 year mortality.

Variable	Survivor (n: 116)	Non-Survivor (n: 147)	P Value
<b>Gender</b>			0.716
Female	72	88	
Male	44	59	
<b>Age</b>	77 (51-94)	84 (62-102)	<0.001
<b>Side</b>			0.161
Right	46	71	
Left	70	76	
<b>Fracture type</b>			0.946
Extracapsular	3	3	
Intracapsular	113	144	
<b>Comorbidity</b>			<0.001
< 3	82	70	
≥ 3	34	77	
<b>ASA*</b>			0.056
1-2	47	43	
3-4	69	104	
<b>Anesthesia type</b>			0.285
General	5	11	
Regional	111	136	
<b>Duration of surgery (minutes)</b>	120 (60-205)	120 (60-210)	0.470
<b>Postoperative ICU** stay</b>			0.007
Yes	46	83	
No	70	64	
<b>Time until surgery (days)</b>	4 (0-14)	4 (0-18)	0.081
<b>Postoperative hospital stay (days)</b>	5 (2-35)	6 (2-23)	0.022

\* American Society of Anesthesiologists, \*\* Intensive Care Unit

hemiarthroplasty. Seventy-three percent of the patients was 75 years old or over. The mean age of survived patients at the third year was lower than non-survived ones (p<0.001). One hundred and eleven (42%) patients and 77 (52%) of the non-survived patients had 3 or more comorbidities. A significant effect of three or more comorbidities on three-year -mortality was observed. ASA scores were divided into two groups: ASA 1 or 2 and 3 or 4. This categorization has been used in the literature (8). ASA scores were three or more in 173 (66%) patients. At the third year, the ASA scores was ≥ 3 in 104 (71%) of the 147 patients who did not survive (p=0.056).

In our study, any significant difference was not found

**Table 2. Long-term mortality related risk factors were evaluated by the Cox regression model.**

Variable	P Value	Hazard Ratio	Hazard Ratio 95% Confidence Interval	
			Lower	Upper
Age	<0.001	1.058	1.033	1.083
Gender	0.928	0.984	0.694	1.395
Comorbidity	<0.001	0.501	0.355	0.708
ASA* grade	0.722	0.933	0.637	1.367
Anesthesia type	0.036	1.984	1.046	3.763
Duration of surgery	0.103	1.005	0.999	1.011
Postoperative ICU** stay	0.569	0.904	0.638	1.280
Time until surgery	0.007	1.068	1.018	1.120
Postoperative hospital stay	0.128	1.037	0.990	1.086

\* American Society of Anesthesiologists, \*\* Intensive Care Unit

between the two groups in terms of duration of surgery ( $p=0.470$ ). Postoperative stay in an ICU was needed in 129 (49%) of 263 patients. ASA score was  $\geq 3$  in 96 (74%) of the 129 patients who required postoperative ICU stay. The rate of patients who stayed in postoperative ICU was higher in the patients who did not survive within the third year ( $p=0.007$ ). The median pre-, and postoperative hospitalization times were 4 and 6 days in nonsurvivor patients, respectively. Time until surgery did not differ significantly between groups ( $p=0.081$ ). However, significant difference was observed between the groups in terms of length of postoperative hospitalization ( $p=0.022$ ).

Cox proportional regression analysis models were used to determine the parameters associated with mortality. Age, presence of  $\geq 3$  comorbidity, time until surgery and anesthesia type were detected as risk factors for mortality according to the results of Cox proportional regression analysis (Table 2).

## DISCUSSION

Hip fractures have been considered as one of the most important causes of mortality and increased hospitalization associated with the discipline of orthopedics and traumatology in the elderly<sup>(1,2,14)</sup>.

In this article, the major predictors of long-term mortality in 263 patients treated by hemiarthroplasty due to hip fracture in orthopedics and traumatology clinic were evaluated. In the current study, 1-month-, 1-year- and 3-year- mortality rates were observed to be 6%, 32% and 56%, respectively. In

our study, statistically significant differences were found between the two groups in terms of age, comorbidity, need of intensive care unit and postoperative hospital stay. The effect of these factors on the mortality was evaluated with Cox regression analysis. Old age, presence of  $\geq 3$  comorbidities, long preoperative wait time and general anesthesia were identified as main predictors of long-term mortality. There are many studies about the mortality rates of patients after surgery performed for hip fracture. In elderly patients who had hip fracture, 1-year mortality rates after surgery were reported between 15% to 30%<sup>(15-17)</sup>. Paksima et al. published the results of a 10-year prospective study associated with predictors of mortality. In their study, the 1-, 2-, 5-, and 10-year mortality rates after hip fracture were reported as 11.9%, 18.5%, 41.2%, and 75.3%, respectively<sup>(18)</sup>.

In our study, median age of the survived group was significantly lower; however, there was no difference between the two groups regarding personal characteristics (gender, side and fracture type). Clinical status and mortality of patients after hip fracture surgery may be affected by many variables such as, patient specific (age or gender) or, fracture type and operative factors. Bilsel et al. reported that the patients aged 80 and older who were surgically treated for hip fracture had higher mortality rates, especially within the first year after surgery<sup>(19)</sup>. In many studies, there was a significant positive correlation between age of patients and the risk of mortality after surgery<sup>(16,18-20)</sup>.

In the current study, mortality rates of the patients who had  $\geq 3$  comorbidities,  $\geq 3$  ASA scores and post-

operative need of ICU were higher. A total of 129 (49%) patients were hospitalized in ICU during post-operative period. Of these 83 (64%) had died within 3-years after surgery. Of the 129 patients, 96 (74%) who needed an ICU stay had 3 or more ASA scores. Significant effect of low health status (ASA score 3-5) or the burden of comorbidities on the long-term mortality was evaluated in many studies<sup>(20-22)</sup>. Roche et al. examined the effect of comorbidities on the mortality rates after surgery. They reported that the presence of 3 or more comorbidities in patients who underwent surgery for hip fractures signified a higher mortality risk<sup>(23)</sup>. Çamurcu et al. reported that presence of  $\geq 3$  comorbidities and ASA scores of  $\geq 3$  were significantly correlated with 1-year mortality in patients who underwent cemented bipolar hemiarthroplasty for unstable intertrochanteric fractures<sup>(24)</sup>.

In this study, general anesthesia was used in 16 (6%) of 263 patients. According to results of Cox regression analysis, general anesthesia was one of the main predictors of long term mortality. The effect of general or regional anesthesia on the mortality has been evaluated in different studies. However, there is no consensus on which type of anesthesia is better for patients who underwent hip fracture surgery<sup>(4)</sup>.

In our study, significant effect of preoperative period on 3-year- mortality rate was observed. One of the most important reasons for surgical delay is preoperative medical evaluation in the elderly patients. There are different reports on the impact of preoperative wait time on patient mortality. Many studies reported that surgical delay was one of the most important predictors of mortality<sup>(22,25,26)</sup>.

Our results have provided comprehensive information about long-term mortality based on risk factors in patients who underwent hemiarthroplasty for hip fracture. This study had some limitations. First, it was a retrospective study. Second, there was no detailed data on blood loss, blood transfusion requirement, albumin level, mobilization time and mental status etc. that will affect the mortality. Third, there were no patients who underwent internal fixation for hip fracture. Looking forward, further work is certainly required to disentangle these complexities.

**Ethics Committee Approval:** Approval was obtained from Clinical Research Ethics Committee (29.05.2020 - 2020.05.2.01.045.r1.57).

**Conflict of Interest:** The authors declare that they have no conflict of interest.

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