ORIGINAL ARTICLE

Factors affecting postoperative mortality in patients older than 65 years undergoing surgery for hip fracture

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ABSTRACT

BACKGROUND: The aim of this study was to determine the factors affecting postoperative mortality in patients older than 65 years of age undergoing surgery for hip fracture.

METHODS: A total of 308 patients (219 males and 89 females) were included into the study. Spinal-epidural anaesthesia was administered in 203 patients and general anaesthesia in 105 patients. In the evaluation of the patients regarding ASA, two groups were determined ASA 1-2 and ASA 3-4. Systemic diseases present in the patients were determined preoperatively.

RESULTS: Seventy-seven (25%) of the total 308 patients died. In addition, patients with preoperative cardiac disease, patients on whom general anaesthesia was administered, patients in the ASA 3-4 group, and age were found to be significantly higher in mortality. When logistic regression analysis was performed for these four efficient factors, age, general anaesthesia, presence of cardiac disease were effective in mortality. However, ASA score changed depending on the age and cardiac disease.

CONCLUSION: In case of presence of multiple risk factors, it is necessary to determine which factor is, in fact, more effective. Age, ASA score, type of anaesthesia, and presence of cardiac disease are effective in mortality. However, ASA score affects mortality depending on the cardiac disease and age.

Key words: Hip fracture; mortality; risk factors.

INTRODUCTION

Life expectancy has recently increased in the elderly population. Hip fractures seen in the geriatric population together with the decrease in bone mass have become a great health concern.[1]

Hip fractures in the elderly population are the second leading cause of hospitalization.[2,3] After hip fractures, mortality risk indicates an increase in the subsequent two-three years and especially in the first year.[4-6]

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It was shown that the highest risk of mortality for hip fractures was in the first sixth month. 23.8% of the patients with hip fracture die within the first year.[7]

Method of choice for almost all patients with hip fractures is surgery. In regard to the literature, returning to optimal level of function after surgery has been associated with preoperative comorbidity rather than the type of surgery.[8]

The American Society of Anesthesiologists (ASA) classification system[9] is a useful risk assessment system for patients with hip fractures. Independently from ASA medical and surgical assessments used worldwide, general health status of the patient is assessed by an anesthesiologist.[9] ASA classification system consists of five types including ASA type 1, normal healthy patient; ASA type 2, patient with mild systemic disease; ASA type 3, patient with severe systemic disease which is not incapacitating; ASA type 4, patient with incapacitating systemic disease which is a constant threat to life; and ASA type 5, moribund patient not expected to live twenty-four h. Hip fractures are classified according to anatomic location.

Although patients with intertrochanteric fractures are generally found to have more risk for mortality according to collum fracture, there are also studies indicating that there is no significant difference between them.[10-12]

Considering anaesthesia methods independently from the type of surgery performed, it has been shown that epidural and spinal anesthesia reduce mortality compared to general anesthesia.[13]

The aim of this study was to determine the factors affecting mortality in patients with collum femoris fractures and intertrochanteric fractures.

MATERIALS AND METHODS

This study was approved by the ethics committee with the protocol number of 2013-10. Patients with collum femoris fractures and intertrochanteric fractures treated surgically between January 2007 and January 2012 were included into the study. The preoperative criteria of this study were gender, type of fracture, age, comorbid factors, hospitalization duration, type of anesthesia and ASA assessments. Mortality rates and type of treatment were evaluated postoperatively.

Patients older than 65 years of age experiencing hip fracture following low-energy trauma and undergoing hemiarthroplasty or internal fixation were included into the study. Our exclusion criteria were multiple traumatic injuries, high-energy traumas and malignancies. Patient screening was performed retrospectively from hospital electronic medical record system. Types of fractures and surgeries performed were determined investigating preoperative and postoperative X-rays of all patients. Internal fixation and hemiarthroplasty were performed for intertrochanteric fractures and hemiarthroplasty was performed for collum femoris fractures. Mean ages of the patients as 65-100 (Mean±SD 80.04±8.40), admission dates of all patients, time to surgery and types of treatments were recorded by the surgeon. Types of anesthesia (spinal/epidural), comorbidities and ASA scores of the patients were recorded.

Statistical Evaluation

NCSS (Number Cruncher Statistical System) 2007&PASS (Power Analysis and Sample Size) 2008 Statistical Software (Utah, USA) program was used for statistical analysis. During the assessment of the study data, Student t test was used for the comparison of quantitative data in addition to descriptive statistical methods (Mean, Standard Deviation, Frequency, Rate). Yates Continuity Correction test (Yates Corrected Chi-Square) was used for the comparison of qualitative data. Kaplan-Meier Survival analysis and Log-Rank test was used for evaluations of survival. Significance was evaluated at the levels of $p<0.01$ and $p<0.05$.

RESULTS

A total of three hundred and eight patients meeting our study criteria comprised our study population. 28.9% of the patients (n=89) were males and 71.1% (n=219) of them were females. Demographic characteristics of the patients are shown in Table 1.

38.6% of the patients (n=119) were diagnosed with intertrochanteric femur fracture and 61.4% of them (n=189) were diagnosed with collum femur fracture. 32.1% of the patients (n=99) underwent internal fixation and 67.92% (n=209) underwent hemiarthroplasty. While hemiarthroplasty was performed in 16.8% (n=20) of the one hundred and nineteen patients with intertrochanteric femur fracture diagnosis, internal fixation was performed in 83.2% of them (n=99). Hemiarthroplasty was performed in all (100%) one hundred and eighty-nine patients with collum femur fracture diagnosis.

Time to surgery, total hospitalization duration, diagnosis, treatment, gender, type of anesthesia, ASA score, systemic diseases, and mortality rates of the patients are shown in Table 2. It was determined that advanced age increased the mortality rate significantly ($p<0.01$). Mortality rate was higher in patients receiving general anesthesia ($p<0.01$). Mortality rates of the patients with ASA score 3-4 were significantly higher than the mortality rates of the patients with ASA score 1-2 ($p<0.01$). Mortality rates of the patients with cardiac disease were found to be higher than the mortality rates of the patients without cardiac disease ($p<0.01$).

Survival Analysis

When the patients were assessed according to diagnosis, it was determined that eighty-five (71.4%) of one hundred and nineteen patients with intertrochanteric fracture diagnosis survived and thirty-four of them died; one hundred and forty-six (77.2%) of one hundred and eighty-nine patients with collum fracture diagnosis survived and forty-three of them died. When the patients were assessed according to treatment, it was determined that one hundred and fifty-two (72.7%) of two hundred and nine patients who underwent hemiarthroplasty survived and fifty-seven of them died; seventy-nine (79.8%) of ninety-nine patients who underwent internal fixation survived and twenty of them died.

When the patients were assessed according to ASA scoring (Fig. 1), it was determined that seventy-nine (85.9%) of ninety-two patients with ASA score 1-2 survived and thirteen of them died. It was determined that one hundred and fifty-two (70.4%) of two hundred and sixteen patients with ASA score 3-4 survived and sixty-four of them died. Mortalities of the patients with ASA score 3-4 were significantly higher than the mortalities of the patients with ASA score 1-2 ($p=0.001$). ODDS rate was determined 2.559 (95% CI: 1.33-4.93).

A highly statistically significant difference was determined between the mean ages of the cases according to mortality (p=0.001). Mean ages of the cases with mortality were significantly higher than the mean ages of the cases without mortality (Fig. 2). ODDS rate was determined 1.728 (95% CI: 1.02-2.93).

Table 1. Distribution of descriptive characteristics

	n	%	Min-Max	Mean±SD
Age (year)			65-100	80.04±8.40
Time to Surgery (day); (Median)			0-19	7.50±3.11 (7)
Mean follow-up period (month)			0-60	31.02±15.0
Total Hospitalization Duration (day); (Median)			1-32	12.02±4.05 (11)
ASA Score; (Median)			1-4	2.88±0.75 (3)
Gender				
Female	219	71.1		
Male	89	28.9		
ASA Score				
1-2	92	29,9		
3-4	216	70.1		
Type of anesthesia				
Spinal/epidural	203	65.9		
General	105	34.1		
Diagnosis				
Intertrochanteric	119	38.6		
Collum	189	61.4		
Treatment				
Internal fixation	99	32.1		
Hemiarthroplasty	209	67.9		
Side				
Right	162	52.6		
Left	146	47.4		
Cardiac disease				
Absent	148	48.1		
Present	168	51.9		
Renal disease				
Absent	269	87.3		
Present	39	12.7		
Pulmonary disease				
Absent	235	76.3		
Present	73	23.7		
Neurological disease				
Absent	261	84.7		
Present	47	15.3		
Endocrine disease				
Absent	288	93.5		
Present	20	6.5		
Mortality				
Absent	231	75.0		
Present	77	25.0		

Table 2. Assessments according to mortality

	Mortality						[a]p
	Absent (n=231)			Present (n=77)			
	n	%	Mean±SD	n	%	Mean±SD	
Age (year)			79.06±8.48			82.97±7.47	0.001**
Time to surgery (day)			7.47±3.12			7.58±3.08	0.776
Total hospitalization duration (day)			11.84±3.91			12.55±4.43	0.186
Gender							
Male	70	30.3		19	24.7		0.425[b]
Female	161	69.7		58	75.3		
Diagnosis							
intertrochanteric	85	36.8		34	44.2		0.311[b]
Collum	146	63.2		43	55.8		
Treatment							
Internal fixation	79	34.2		20	26.0		0.231[b]
Hemiarthroplasty	152	65.8		57	74.0		
Type of anesthesia							
Spinal/epidural	166	71.9		37	48.1		0.001**
General	65	28.1		40	51.9		
ASA Score							
1-2	79	34.2		13	16.9		0.006[b,**]
3-4	152	65.8		64	83.1		
Cardiac							
Absent	125	54.1		23	29.9		0.001[b,**]
Present	106	45.9		54	70.1		
Renal							
Absent	199	86.1		70	90.9		0.373[b]
Present	32	13.9		7	9.1		
Neurologic							
Absent	201	87.0		60	77.9		0.082[b]
Present	30	13.0		17	22.1		
Pulmonary							
Absent	175	75.8		60	77.9		0.816[b]
Present	56	24.2		17	22.1		
Endocrine							
Absent	216	93.5		72	93.5		1.000[b]
Present	15	6.5		5	6.5		

[a]Student t Test; [b]Yates Continuity Correction; **p<0.01

Mortality rate of the patients receiving general anesthesia was found to be higher than the mortality rate of the patients receiving spinal/epidural anesthesia (p<0.01). ODDS rate was determined 2.761 (95% CI: 1.62-4.69) (Fig. 3).

Mortality rate of the patients with cardiac disease was found to be higher than the mortality rate of the patients without cardiac disease (p<0.01). ODDS rate was determined 2.769 (95% CI: 1.59-4.81) (Fig. 4).

DISCUSSION

When an elderly patient is present with cardiac disease and higher ASA score and receives general anesthesia,which of the four factors is in fact more effective? This question should

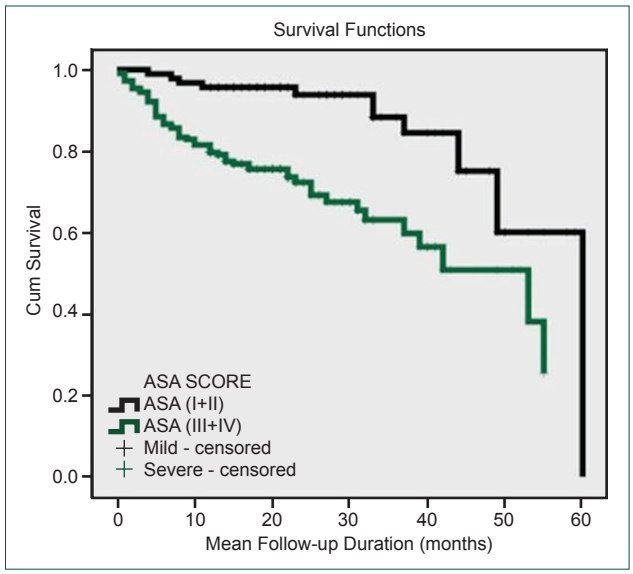

Figure 1. Plot for survival against ASA Scores.

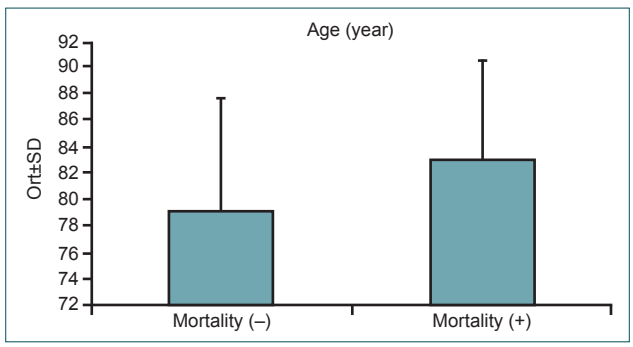

Figure 2. Distribution of ages according to mortality.

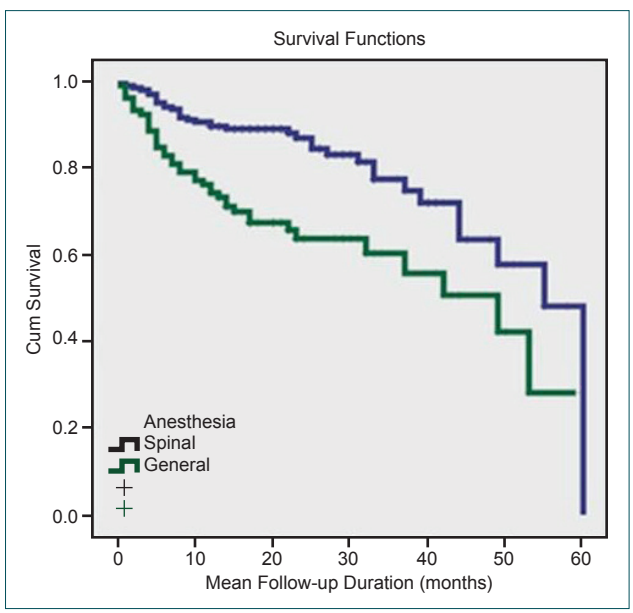

Figure 3. Mean survival analysis according to type of anaesthesia.

be addressed to in studies including multiple risk factors. Accordingly, the effects of risk factors such as age, type of anesthesia, ASA score, and cardiac disease in mortality were evaluated using logistic regression analysis. It was observed that coefficiency for general explanatories of the model was 73.7%, sensitivity was 49.4%, and specificity was 81.8% (Table 3). When the variables considered to be affecting mortality were evaluated using Backward (Conditional) Logistic regression analysis model, was found to be significant (p=0.001; p<0.01).

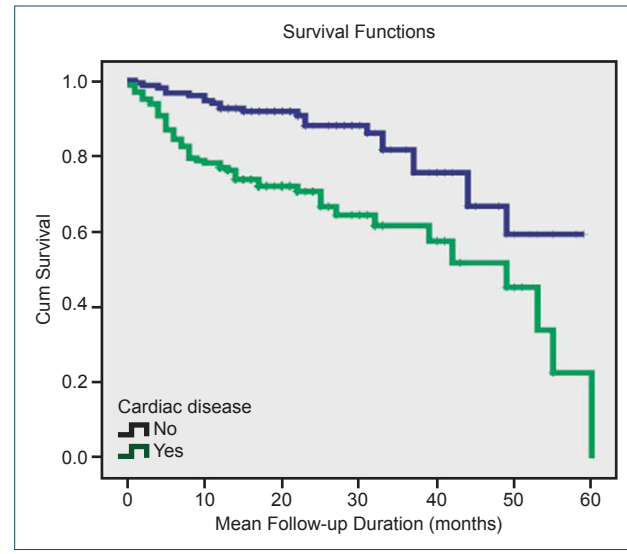

Figure 4. Mean survival analysis according to the presence of cardiac disease.

When Table 4 was evaluated, it was seen that the effects of age, general anesthesia, and presence of cardiac disease alone were significant in mortality (p<0.01). ODDS rates of age, receiving general anesthesia and presence of cardiac disease in mortality were determined to be 1.059 (95% CI: 1.02-1.09), 2.93 (95% CI: 1.68-5.13), and 2.365 (95% CI: 1.33-4.21), respectively. It was seen that the effect of ASA score in mortality was not significant (p>0.05).

The incidence of hip fracture in general population is gradually increasing with advancing age.[14] Seventy-seven (25%) of the total three hundred and eight patients, who underwent surgery due to hip fracture and included into our study, died. In this study, mortality rate was maximal within the first year and decreased in due course in both types of fractures and treatments. However, there were not any significant differences in the mortality rates of both types of fractures and treatments. In this respect, our study was consistent with the literature.[15-17] In some studies, mortality rates of the patients treated with internal fixation have been significantly lower than the mortality rates of the patients treated with hemiarthroplasty.[18,19] There are also studies advocating the opposite.[20,21] Time to surgery prolongs in many elderly patients due to present multiple medical problems. Some studies suggest that surgical delay affects mortality.[22] In our study, surgical delay did not affect mortality. It has been shown in studies that as the rate

Table 3. Classification table in logistic regression analysis

		Estimated		
		Mortality		Percent of accuracy
		Absent	Present	
Observed	Mortality			
	Absent	189	42	81.8
	Present	39	38	49.4
	Overall percentage			73.7

Table 4. Logistic regression analysis of the factors affecting mortality

	p	ODDS	95% CI	
			Lower	Upper
Age	0.002**	1.059	1.022	1.098
Type of anesthesia (general)	0.001**	2.931	1.676	5.129
Presence of cardiac disease	0.003**	2.365	1.329	4.211

**p<0.01

of comorbid diseases increases the mortality rate increases.[23] However, when the patient group with isolated disease was compared with the patient group with multiple diseases, no significant difference was found. A separate paragraph was intended for high ASA score. According to studies, it has been seen that high ASA score (ASA 3-4) increases the mortality rate.[24] However, when ASA scoring is defining, patient age and presence of systemic diseases should be kept in mind among the assessment criteria. Therefore, ASA score is considered to be a dependent variable in patient age and cardiac disease and it does not give significant results due to its dependency. However, in most studies, no analysis has been performed to show which of the multiple risk factors is more effective, making our study more effective in this respect (Fig. 5).

Conflict of interest: None declared.

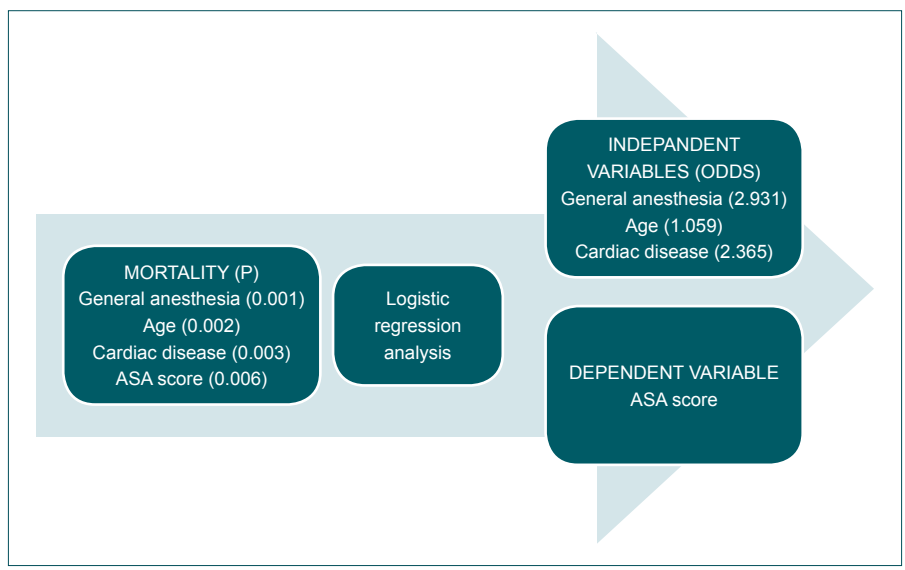

Figure 5. Visual assessment of risk factors affecting on the mortality by using logistic regression analysis.

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KLİNİK ÇALIŞMA - *ÖZET*

Kalça kırığı nedeni ile ameliyat edilen 65 yaş üstü hastalarda mortaliteye etki eden faktörler

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AMAÇ: Çalışmamızdaki amaç 65 yaş üstü kalça kırığı nedeni ile ameliyat olan kalça kırığına etki eden mortalite faktörlerinin belirlenmesi.
GEREÇ VE YÖNTEM: Altmış beş yaş üstü 219 erkek, 89 kadın toplam 308 hasta dahil edildi. Anestezi tipi olarak 203 hastaya spinal/epidural ve 105 hastaya genel anestezi verildi. Hastaların ASA değerlendirilmesinde ASA 1-2 ve ASA 3-4 olarak iki grup belirlendi. Ameliyat öncesinde hastaların mevcut olan sistemik hastalıkları belirlendi.
BULGULAR: Toplam 308 hastanın 77'si (%25) öldü. Ayrıca ameliyat öncesinde olarak kardiyak hastalığı olan hastalar, genel anestezi yapılan hastalar, ASA3-4 grubu olan hastalar ve yaş mortalite için anlamlı yüksek bulundu. Bu dört etkili faktöre lojistik regresyon analizi yapıldığında ise yaş, genel anestezi, kardiyak hastalığın varlığı mortalite üzerinde etkilidir. Ancak ASA skoru yaşa ve kardiyak hastalığa bağımlı olarak değişmektedir.
TARTIŞMA: Çoklu risk faktörlerinin bulunduğu durumlarda hangi faktörün gerçekte daha etkili olduğunu hesaplamak gerekli. Yaş, ASA skoru, anastezi şekli ve kardiyak hastalık varlığı mortaliteyi etkilemektedir. Ancak ASA skoru kardiyak hastalık ve yaş faktörüne bağımlı olarak mortaliteyi etkilemektedir.

Anahtar sözcükler: Kalça kırığı; mortalite; risk faktörü.

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