ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA MAKALESİ

Association Between Type of Fracture and Mortality Rate in Hip and Femur Fractures

Kalça ve Femur Kırıklarında Kırık Tipi ile Mortalite İlişkisi

Çağrı Kokkoz[1], Arife Erdoğan[2], Funda Karbek Akarca[3]

ABSTRACT

Aim: This study included patients who presented to the emergency department with hip and femur fractures. By investigating which fracture type carried the highest risk for mortality, we aimed to provide a basis for surgeons to help them prioritize patients.

Material and Methods: This was a single-center retrospective study. A total of 336 patients who presented to the emergency department with traumatic, isolated hip or femur fractures were included. The same surgical team operated all patients within four days. The fractures were categorized according to the fracture types. Patients were followed up about mortality during 28 days.

Results: A total of 336 patients were included in the study, and 51 patients died in 28 days follow-up. Patients were divided into three groups according to their ages as 18-44, 45-64, and > 64. There was no significant difference between the fracture types and mortality according to age groups. When the patients included in the study were evaluated as a single group, intertrochanteric fracture types were significantly related to mortality (p<0.010).

Discussion: In this study, mortality rates were found to be higher in patients with intertrochanteric fractures among all patients.

Keywords: Fracture, mortality, hip, femur, emergency

ÖZ

Amaç: Bu çalışmaya acil servise kalça ve femur kırığı şikayeti olan hastalar dahil edildi. Hangi kırık tipinin mortalite için en yüksek riski taşıdığını araştırarak, cerrahların hastaları önceliklendirmelerine yardımcı olmaları için bir temel oluşturmayı amaçladık.

Gereç ve Yöntemler: Bu tek merkezli retrospektif bir çalışmaydı. Acil servise travmatik, izole kalça veya femur kırığı şikayeti ile başvuran 336 hasta dahil edildi. Tüm hastalar aynı cerrahi ekip tarafından 4 gün içinde ameliyat edildi. Kırıklar kırık tiplerine göre kategorize edildi. Hastalar mortalite açısından 28 gün boyunca takip edildi.

Bulgular: Çalışmaya toplam 336 hasta alındı ve 28 gün takipte 51 hasta öldü. Hastalar yaşlarına göre 18-44, 45-64 ve > 64 olarak 3 gruba ayrıldı. Kırık tipleri ile yaş grupları arasında mortalite açısından anlamlı fark yoktu. Çalışmaya alınan hastalar tek bir grup olarak değerlendirildiğinde, intertrokanterik kırık tipleri mortalite ile anlamlı olarak ilişkiliydi. (p <0.010).

Sonuç: Bu çalışmada tüm hastalardan intertrokanterik kırığı olanların mortalite oranları daha yüksek bulundu.

Anahtar Kelimeler: Kırık, mortalite, kalça, femur, acil

Received: July 24, 2020 Accepted: August 28, 2020

[1] Soma State Hospital, Emergency Department, Manisa, Turkey.

[2] Cigli Regional Education Hospital, Emergency Medicine Department, Izmir, Turkey

[3] Ege University, School of Medicine, Emergency Medicine Department, Izmir Turkey.

Corresponding Author: Cagri Kokkoz, MD **Address:** Soma State Hospital, Emergency Department, Manisa, Turkey. **Phone:** +90 236 444 00 45 **e-mail:** cagrikokkoz@gmail.com

Atıf için/Cited as: Kokkoz C Erdogan A, Akarca FK. Association Between Type of Fracture and Mortality Rate in Hip and Femur Fractures. Anatolian J Emerg Med 2020;3(3); 71-75.

Introduction

Although hip and thigh fractures are the most common fractures requiring hospitalization in the elderly, it is a significant cause of mortality and morbidity. Also, age and gender are important predisposing factors for hip and thigh fractures (1-2).

These fractures are often associated with low mineral density in the bone and are caused by small energy trauma (3). Also, the incidence of hip fracture and dislocation due to high-energy trauma has been increasing in the younger population. Hip fractures are linked with higher mortality and high economic costs. Most research on the associations between fracture and mortality has focused on death after hip fracture in patients (4). In-hospital mortality has been associated with the type of fracture sustained, and the treatments received (5). Previous studies have demonstrated that surgical delay increased postoperative mortality rates due to more extended periods of immobilization and inflammation (6-7). Patients who were operated within 1 or 2 days of injury were found to have lower mortality rates compared to those who were more than two days late in surgery (8-11). A shorter duration between injury and was associated with lower mortality rates (12). Operative delays are common in trauma centers with high volumes of patients (13).

Lower levels of hemoglobin in older patients are associated with increased short-term morbidity and surgical mortality (14-15). Some studies examined hemoglobin levels as a predictor of postoperative morbidity, mortality, and recovery of the functional status of prefracture in the elderly with hip fractures.

Because of its critical role in bone structure and metabolic bone balance (16-17), calcium has strong preventive effects on fractures. Serum calcium level shows some variations in different fracture healing phase times, and serum calcium level alterations may reflect calcium transport, reservation, meta bolism, and restoration capabilities. Thus, we were also looking into the correlation between clinical outcome and serum calcium and hemoglobin levels in our study.

In this study, we aimed to establish the relationship between the form of fracture and mortality in patients with hip or femur fracture. According to this relation, we will be able to provide a basis to help surgeons prioritize patients on the surgical waiting list according to the fracture type.

Material and Methods

Study setting and population

Our study is a single center retrospective study. A total of 336 patients who presented traumatic, isolated hip or femur fractures to the emergency department between 1 January 2013 and 31 June 2015 and who met the inclusion criteria have been included. The fractures were categorized as transcervical, intertrochanteric, subtrochanteric, femoral shaft, and distal femoral fractures. Patients are divided into three groups as 18-44, 45-64, and >64 aged people. The relationship between fracture type and mortality was researched for each group.

The first 28 days after application, patients included in the study were followed for mortality. The same surgical team operated all patients included within four days of presenting to the emergency department. Although they had surgery within the first four days, they had operated on different days. At the time of admission, blood samples were collected and measured by using the automatic biochemical analyzer. The relationship between operating days and mortality was investigated. Patients younger than 18 years of age and patients with multiple fractures, multi-trauma, pathological fractures, pregnancy, chronic kidney disease, chronic liver disease, heart failure, or active malignancy were excluded. The study has received review and approval from Izmir Katip Celebi University, Non-interventional Clinical Studies Institutional Review Board (The approval number: 235 and approval date: June 20th, 2018)

Statistical analysis

All statistical analyses were carried out using the Statistical Package for Social Sciences (SPSS) ver 25.0 software (IBM Corporation, Armonk, New York, United States). The normal distribution of numerical data was assessed using the Shapiro Wilk test. The Mann-Whitney U test was used in comparing two independent groups according to quantitative results, to get results with Monte Carlo. Comparing categorical variables with each other, the Fisher-Freeman Holton test was tested with the Monte Carlo Simulation technique with Fisher Exact results, and the column ratios compared with each other and expressed according to the Benjaminini-Hochbergcorrected p-values. (Rewrite the sentence) The quantitative variables were shown as median (Minimum / Maximum) on the tables and n (%) as categorical variables. Variables were tested at a confidence level of 95 % and $p<0.05$ was found statistically significant.

Results

The study included a total of 336 patients, and 51 of them died within 28 days of application. The study included a minimum age of 18 years and a maximum age of 107 years. The age-related mortality was found to be significant. Patients were separated into three groups according to their ages as 18-44, 45-64, and> 64. 114 people in the 18-44 age group, 72 people in the 45-64 age group, and 150 people in the > 64 age group.

When the patients included in the study were evaluated as a single group, 25.5% of the 97 patients with transcervical fractures were dead. 52.9% of 117 patients with

intertrochanteric fractures died and 9.8% of the 24 patients with subtrochanteric fractures died. Besides that 5% of 69 patients with femoral shaft fractures died and 3.4% of the 29 patients with distal femur fractures died. After 28 days of follow-up, intertrochanteric fracture types were found to be significantly associated with mortality (p <0.010).

All patients underwent surgery at different times during the first 4-day period following the application. Forty-eight patients were operated on day 1, 102 patients were on day 2, 124 patients were on day 3, 62 patients were operated on day 4. No significant difference was found between operating days and mortality (Table 1). When we compared the fracture types by age groups, we could not find a significant difference in mortality of the fracture types (p>0.05) (Table 2).

	Survivor (n=285) Median (Min/ Max)	Non-survivor (n=51) Median (Min / Max)	Total (N=336) Median (Min/ Max)	P Value
Age	55 (18 / 95)	80 (24 / 107)	62 (18 / 107)	**<0,001**
	n (%)	**n (%)**	**n (%)**	
Age				
18-44	113 (39,6)	1 (2,0)	114 (33,9)	
45-64	65 (22,8)	7 (13,7)	72 (21,4)	
64<	107 (37,5)	43 (84,3)	150 (44,6)	**<0,001**
Gender				
Male	163 (57,2)	34 (66,7)	197 (58,6)	0,221
Female	122 (42,8)	17 (33,3)	139 (41,4)	
FractureType				
Transcervikal	84 (29,5)	13 (25,5)	97 (28,9)	
Intertrochanteric	90 (31,6)	27 (52,9)	117 (34,8)	**0,010**
Subtrochanteric	19 (6,7)	5 (9,8)	24 (7,1)	
Femurshaft	64 (22,5)	5 (9,8)	69 (20,5)	
Femurdistal	28 (9,8)	1 (2,0)	29 (8,6)	
SurgeryDay				
1	36 (12,6)	12 (23,5)	48 (14,3)	0,145
2	85 (29,8)	17 (33,3)	102 (30,4)	
3	108 (37,9)	16 (31,4)	124 (36,9)	
4	56 (19,6)	6 (11,8)	62 (18,5)	

Table.1 Demographic data, fracture type and mortality, surgery time and mortality

Additionally, we investigated the serum calcium and hemoglobin levels of patients. The mean hemoglobin level was 12.1±2.1 g/dL and 11±2.1 g/dL in the survivor and non-survivor groups, respectively. The statistically significant difference in mean hemoglobin rates was observed between the survivor and the non-survivor groups (p<0.001). The mean calcium level was 9.2±0.9 mg/dL in survivors and 8.9±0.7 mg/dL in non-survivors. As in hemoglobin levels, a statistically significant difference between the mean calcium levels of the two groups was observed (p=0.045).

Discussion

In this research, we aimed to establish the relationship between fracture type and mortality in patients presenting with hip or femur fracture at the emergency department and to provide a basis for surgeons to help them prioritize patients according to the risk of mortality determined by the fracture type. Previous studies focused mainly on topics such as the association between hip fracture and mortality, factors affecting mortality in patients with hip fractures, and the link between mortality and timing of surgery in patients with hip fractures. However, when you search the literature, studies about the relationship between fracture type and mortality are rare.

	18-44 years		45-64 years		64< years	
	Survivor	Non-survivor	Survivor	Non-survivor	Survivor	Non-survivor
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
FractureType						
Transcervical	27 (23,9)	0 (0,0)	24 (36,9)	2 (28,6)	33 (30,8)	11 (25,6)
Intertrochanteric	15 (13,3)	0 (0,0)	22 (33,8)	1 (14,3)	53 (49,5)	26 (60,5)
Subtrochanteric	11 (9,7)	0 (0,0)	3 (4,6)	1 (14,3)	5 (4,7)	4 (9,3)
Femurshaft	44 (38,9)	1 (100,0)	10 (15,4)	3 (42,9)	10 (9,3)	1 (2,3)
Femurdistal	16 (14,2)	0 (0,0)	6 (9,2)	0 (0,0)	6 (5,6)	1 (2,3)

Table 2. Mortality rate of fracture types by age groups

In the study by Haentjens et al., patients over the age of 50 were found to have a 3- to 5-fold higher mortality risk within the first three months following a hip fracture. The 1-year mortality rate was found to be 8 % for females and 18 % for males in patients over 80 years (18). In our study, no relationship was observed between gender and mortality.

Gdalevich et al. performed a report on 651 patients over the age of 60 and studied the mortality relationship and the timing of surgery following a hip fracture. Survival levels in patients who underwent surgery within 48 hours of fracture were found to be higher compared with those who underwent surgery more than 48 hours after the fracture (8). McGuire et al. performed a study on 18,209 patients with hip fractures who were older than 65 years and mortality was found to be 15 percent higher in patients with an operating delay of 2 days or more (8). According to a study by Czertock G et al., delayed surgeries increase the mortality rate (22). In their study on 720 patients aged older than 65 years, Maheshwari et al. found that the mean duration between admission and surgery was 30 hours and that each 10-hour delay increased mortality by 5%. They concluded that similar to a stroke and myocardial ischemia; hip fractures require urgent treatment (19). In our study, there was no correlation between the time of operation and survival rates for the first four days. This may be because the patients taken into the study were selected from patients without the comorbid disease.

As we reported earlier, anemic patients were more likely to have suffered an intertrochanteric fracture. Stay-length hospitalization and mortality rates at six and twelve months were substantially higher for patients on admission who were anemic. Concerning this study, patients at risk of poor results after hip fracture can be identified by evaluating the levels of hemoglobin at hospital admission (23). In our research, this may be confirmed because of that; we observed a statistically significant difference in mean hemoglobin levels between the survivor and the non-survivor groups.

According to Li et al., reservation and regeneration capabilities of serum calcium in patients with femoral neck fracture are higher than in patients with femoral intertrochanteric fractures. A low calcium level in the serum may be susceptible to intertrochanteric femoral fracture (24). In our study, we found that a statistically major difference between the mean calcium levels of the two groups (survivors/non-survivors). This knowledge about the effect of serum calcium levels on type of fracture and the relationship between fracture type and mortality rate needs to be investigated in more detail within the future studies.

In the study by Somersalo et al, found that proximal lower extremity fractures were associated with increased mortality in younger as well as older patients (1). It has been suggested as an explanation for this that older people with proximal fractures are vulnerable and come down with comorbidities (3). Thus, those suffering from distal lower extremity fractures may be healthier and more active than their peers with more proximal fractures. Velásquez-Sarria et al compared mortality rates of hip fractures and mid-shaft femoral fractures in a series of 146 patients over 65 years of age. They found no difference in mortality between the two types of fractures (20). In our study, intertrochanteric fracture types were significantly related to mortality.

Furthermore, Streubel et al. compared the mortality rates of distal femoral fractures and hip fractures in patients over 60 years of age. They found no difference in mortality between the two forms of fractures. However, mortality rates were found to be higher in patients with an operating period of more than four days compared to those who underwent surgery within 48 hours of fracture (21).

Conclusion

In this study, mortality rates were found to be higher in patients with intertrochanteric fractures among all patients. When the patients were divided into age groups, statistically, the types of fractures were not significantly different and mortality. Still, in 18-44, 45-64 aged groups femoral shaft fracture was found to have the highest mortality rate. Intertrochanteric fracture has been found to have the highest mortality rate in>64 aged classes. According to this result, determining the surgical priority of patients according to the type of fracture may reduce the risk of mortality.

Limitations

Our study has some limitations. Firstly, the number of patients included in our study is limited. Secondly, the study was a single-center study. The research did not include patients with chronic kidney disease, chronic liver disease, congestive heart insufficiency, and persistent malignancy. However, other chronic diseases, such as hypertension and diabetes were not excluded. Therefore, the effect of chronic diseases on morbidity was not investigated.

Conflict of Interest: The authors declare no any conflict of interest regarding this study.

Financial Disclosure: The authors declared that this study received no financial support.

Authors' Contribution: Conceptualization, Data curation, Project administration, Resources, Supervision, Roles/Writing - original draft, Writing - review & editing (CK, AE) Formal analysis, Methodology, Validation, Visualization (CK, FKA) Funding acquisition, Investigation, Methodology, Project administration, Software (CK, AE, FKA)

Ethical Statement: The study was approved by the Clinical Research Ethics Committee of a tertiary hospital with the decision number 235 on 20 June 2018.

All authors declared that they follow the rules of Research and Publication Ethics.

References

1. Somersalo A, Paloneva J, Kautiainen H, et al. Incidence of fractures requiring inpatient care. Acta Orthop 2014; 85 (5): 525-30.

2. Penrod JD, Litke A, Hawkes WG, et al. The association of race, gender, and comorbidity with mortality and function after hip fracture. J Gerontol A Biol Sci Med Sci 2008;63 (8):867-72.

3. Cummings SR, Melton LJ. Epidemiology and outcomes of osteoporotic fractures. Lancet 2002; 359 (9319): 1761-7.

4. Haentjens P, Magaziner J, Colon-Emeric CS, et al. Meta-analysis: Excess mortality after hip fracture among older women and men. Ann Intern Med 2010; 152 (6): 380-90.

5. Vestergaard P, Rejnmark L, Mosekilde L. Loss of life years after a hip fracture. Acta Orthop 2009;80(5):525-30.

6. Beloosesky Y, Grinblat J, Pirotsky A, et al. Different C-reactive protein kinetics in post-operativehip-fractured geriatric patients with and without complications. Gerontology 2004;50(4):216-22.

7. Beloosesky Y, Hendel D, Weiss A, et al. Cytokinesand C-reactive protein production in hip-fracture-operated elderly patients. J Gerontol A Biol Sci Med Sci 2007;62(4):420-

8.Gdalevich M, Cohen D, Yosef D, et al. Morbidity and mortality after hip fracture: the impact of operative delay. Arch Orthop Trauma Surg 2004;124(5):334-40. Epub 2004 Apr 17.

9. McGuire KJ, Bernstein J, Polsky D, et al. The 2004 Marshall Urist Award: delays until surgery after hip fracture increases mortality. Clin Orthop Relat Res 2004;428:294-301.

10. Weller I, Wai EK, Jaglal S, et al. The effect of hospital type and surgical delay on mortality after surgery for hip fracture. J Bone Joint Surg Br. 2005;87 (3):361-6.
11. Bottle A, Aylin P. Mortality associated with delay in operation after hip fracture: observationa lstudy. BMJ. 2006;332(7547):947-51. Epub 2006 Mar 22.
12. Sheehan KJ, Sobolev B, Guy P. Mortality by Timing of HipFracture Surgery: Factors and Relationships at Play.J Bone Joint Surg Am. 2017;99(20):e106.
13. Kristensen PK, Thillemann TM, Johnsen SP. Is bigger always better? A nationwide study of hip fracture unit volume, 30-day mortality, quality of in-hospitalcare, and length of hospital stay. MedCare. 2014;52(12):1023-9.
14. Lunn JN, Elwood PC. Anaemia and surgery. BMJ 1970;3:71–73.
15. Rawstron RE. Anemia and surgery. A retrospective clinical study. Aust NZ J Surg. 1970;39:425–432.
16. Reid IR, Bolland MJ, Grey A. Effect of calcium supplementation on hip fractures. Osteoporos Int. 2008;19(8):1119-23. doi: 10.1007/s00198-008-0563-9.
17. Oppl B, Michitsch G, Misof B, et al. Low bone mineral density and fragility fractures in permanent vegetative state patients. J Bone Min Res. 2014;29(5):1096-100. doi: 10.1002/jbmr.2122..
18. Haentjens P, Magaziner J, Col´on-Emeric CS,et al. Meta-analysis: excess mortality after hip fracture among older women and men. Ann Intern Med. 2010;152(6):380-90.
19. Maheshwari K, Planchard J, You J, et al. Early Surgery Confers 1-Year Mortality Benefit in Hip-Fracture Patients. J OrthopTrauma. 2018 Mar;32(3):105-110.
20. Velásquez-Sarria A, Andrade-Montoya IA, Flores-Luce A, et al. Comparison of mortality by femur fracture versus hip fracture in elderly patients in a period of fiveyears. Rev Med Inst Mex Seguro Soc. 2017;55(6):704-707.
21. Streubel PN, Ricci WM, Wong A, et al. Mortality after distal femur fractures in elderly patients. Clin Orthop Relat Res. 2011;469(4):1188-96.
22. Czertock G, Geiss C, Ribeyre JP, et al. Reeducation desfractures de l'extrémité supérieure du fémur. Étudechez 506 patients de 60 ans et plus. In: La fracture de l'extrémité supérieure du fémur. Paris: Masson; 1990. p. 195—7
23. Gruson, KI, Aharonoff GB, Egol KA, Zuckerman J D, et al. The relationship between admission hemoglobin level and outcome after hip fracture. Journal of orthopaedic trauma. 2002;16(1), 39-44.
24. Li PF, Lin ZL, Pang ZH, et al. Does serum calcium relate to different types of hip fracture? A retrospective study. Chinese Journal of Traumatology, 2016;19(5), 275-277.