

## IS THE PRESENCE OF VASCULAR CALCIFICATION IN HIP X-RAYS A PREDICTOR OF POSTOPERATIVE MORTALITY IN INTERTROCHANTERIC FRACTURE OF THE FEMUR?

### *Kalça Grafilerinde Vasküler Kalsifikasyon Varlığı İntertrochanterik Femur Kırığında Postoperatif Mortalite Öngörücüsü Müdür?*

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#### ABSTRACT

**Objective:** We aimed to investigate the relationship between the presence of radiological femoral arterial calcification (FAC) and mortality in patients over 65 years of age with intertrochanteric femur fracture (ITFC).

**Material and Methods:** Between 2014 and 2019, 303 patients diagnosed with ITFC who were operated on using a short proximal femoral nail (PFN) were evaluated retrospectively. Research data were obtained from preoperative anesthesia records and patient medical records using the electronic patient record system. Death records were obtained from the national population management system. Patients with FAC detected in roentgenography formed the study group, and patients in whom it could not be detected constituted the control group. Age, gender, ASA score, waiting time until surgery, need for postoperative intensive care, length of stay in the intensive care unit, and the first 30 days, first-year and general mortality rates were evaluated.

**Results:** While FAC was detected in 117 (38.6%) patients, FAC was not detected in 186 (61.4%) patients. The patients in the study group were older ( $p<0.05$ ), and the male population was more prominent ( $p<0.001$ ). A statistically significant difference was found between the ASA scores compared between the groups ( $p<0.05$ ). There was no statistically significant difference between the groups regarding waiting time until surgery, need for postoperative intensive care, and length of stay in the intensive care unit ( $p>0.05$ ). A statistically significant difference was found when the presence of FAC was compared in terms of overall mortality and postoperative first-month mortality ( $p<0.05$ ). In patients with FAC, the overall mortality risk increased 1.63 times, the risk of mortality in the first one month increased 1.99 times and the risk of mortality in the first one year increased 1.57 times.

**Conclusion:** Our study showed that the presence of FAC could be evaluated as a predictor of mortality in elderly patients with ITFC who underwent osteosynthesis with short PFN.

**Keywords:** Arterial calcification, hip fracture, mortality, elderly

#### ÖZ

**Amaç:** Altmış beş yaş üstü intertrokanterik femur kırığı (İTFK) olan hastalarda radyolojik femoral arteriyel kalsifikasyon (FAC) varlığı ile sağ kalım arasındaki ilişkiyi araştırmayı amaçladık.

**Gereç ve Yöntemler:** 2014-2019 yılları arasında, instabil İTFK tanısı ile kısa proksimal femur çivisi (PFN) kullanılarak ameliyat edilen 303 hasta retrospektif olarak değerlendirildi. Araştırma verileri elektronik hasta kayıt sistemi kullanılarak preoperatif anestezi kayıtları ve hasta tıbbi kayıtlarından elde edildi. Ölüm kayıtları ulusal nüfus yönetim sisteminden elde edildi. Röntgenografilerde FAC tespit edilen hastalar çalışma grubunu, tespit edilemeyen hastalar kontrol grubunu oluşturdu. Yaş, cinsiyet, ASA skoru, CCİ Skoru, hastanede yatış süresi, yoğun bakımda yatış süresi, ameliyata kadar bekleme süresi, kan replasmanı, ameliyat sonrası yoğun bakım gereksinimi ve ilk 30 gün, ilk 1 yıl ve genel mortalite oranları değerlendirildi.

**Bulgular:** Yüz on yedi (%38.6) hastada FAC tespit edilirken 186 (%61.4) hastada FAC tespit edilmedi. Çalışma grubundaki hastalar daha yaşlıydı ( $p<0.05$ ) ve erkek cinsiyet daha fazlaydı ( $p<0.001$ ). Gruplar arasında yapılan karşılaştırmada ASA sınıfı ve CCİ'yi toplam puanı arasında istatistiksel olarak anlamlı fark tespit edilmiştir ( $p<0.05$ ). Gruplar arasında hastanede yatış süresi, yoğun bakımda yatış süresi, ameliyata kadar bekleme süresi, kan replasmanı ve ameliyat sonrası yoğun bakım gereksinimi açısından istatistiksel olarak anlamlı fark tespit edilmedi ( $p>0.05$ ). FAC varlığı genel mortalite ve operasyon sonrası ilk 1 aylık mortalite açısından karşılaştırıldığında istatistiksel olarak anlamlı fark tespit edilmiştir ( $p<0.05$ ). FAC olan hastalarda genel mortalite riski 1.63 kat, ilk 1 ayda mortalite riski 1.99 kat ve ilk 1 yıl mortalite riski 1.57 kat artmıştır.

**Sonuç:** Çalışmamız, FAC varlığının kısa PFN ile osteosentez yapılan yaşlı İTFK'lı hastalarda mortalite öngörücüsü olarak değerlendirilebileceğini göstermiştir.

**Anahtar Kelimeler:** Arteriyel kalsifikasyon, kalça kırığı, mortalite, yaşlı



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## INTRODUCTION

Hip fractures have become one of the important public health problems that cause high morbidity and mortality in elderly patients, primarily due to increasing life expectancy and osteoporotic population (1). The incidence of hip fracture has increased significantly in recent years with the increase in the elderly population, and it is expected to increase gradually (2). Most patients with hip fractures are of advanced age and usually have more than one comorbidity (3,4). One-year mortality rates after hip fracture in elderly patients reach up to 33% (14-47%) (5). Studies have been conducted in the literature on many factors, such as the patient's comorbidity factors, surgical technique, patient care, and laboratory and radiological criteria related to mortality after hip fracture (6-8).

Arterial calcification can occur systemically in almost all vascular beds in the medial and intimal layers and is associated with atherosclerosis. Studies have shown that lower extremity arterial calcification is associated with many traditional coronary artery disease risk factors (9,10). It is well known that arterial calcification

increases the risk of cardiovascular disease and mortality independently of traditional risk factors (11).

The literature has emphasized that the main effect of arterial calcification on bone is an increase in osteoporosis and fracture risk due to decreased bone turnover (12). This study investigates the relationship between femoral arterial calcification (FAC) detected on hip radiographs and postoperative mortality in elderly patients with intertrochanteric femur fractures.

## MATERIALS AND METHODS

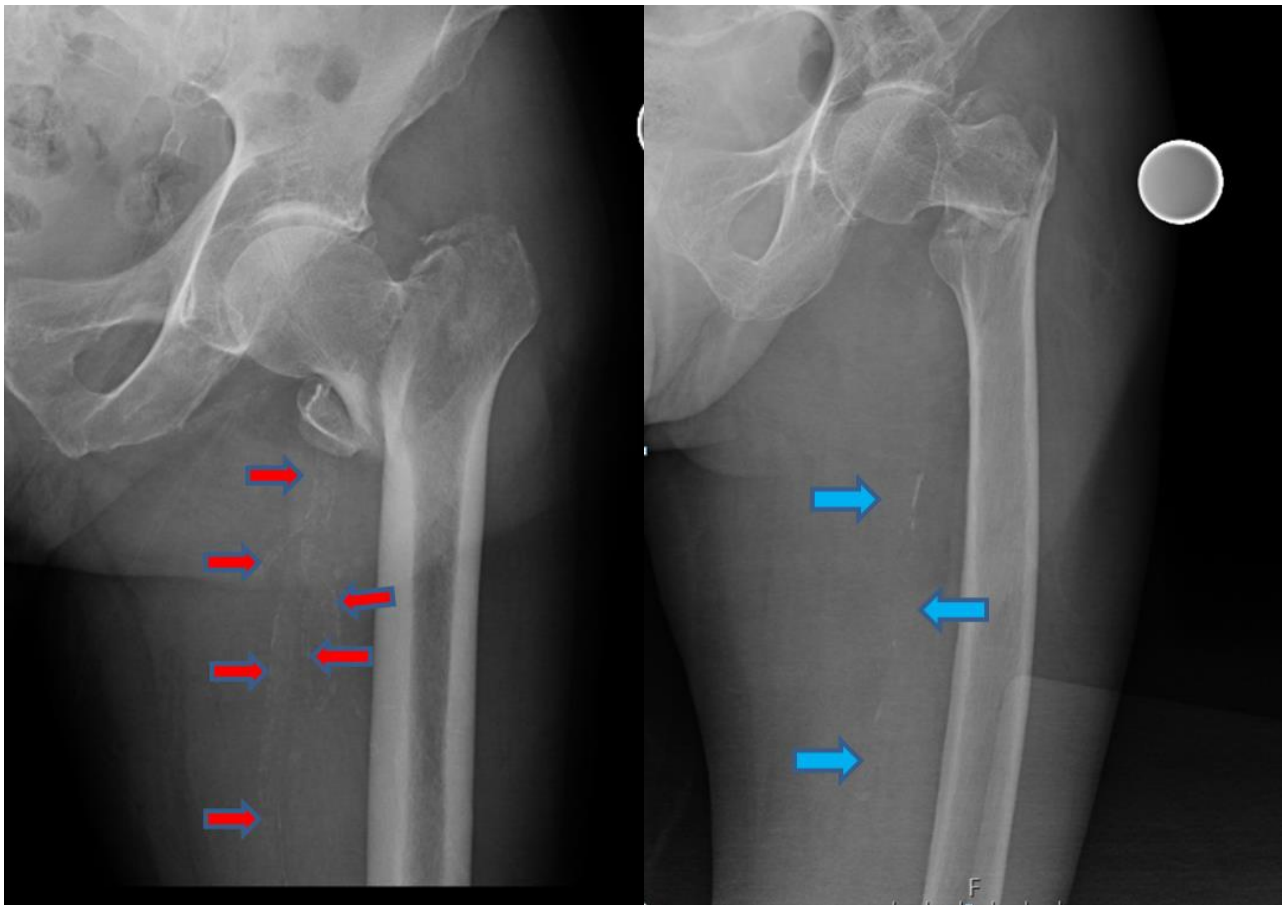
The study was designed as a retrospective cohort study. GOKA 2021/17/3 numbered local ethics committee approval was obtained (Health Sciences University Samsun Training and Research Hospital Non-Interventional Clinical Research Ethics Committee, date: 20.10.2021, issue number: 2021/17/3). Between 2014 and 2019, patients who were operated on with a diagnosis of an unstable intertrochanteric fracture in a single center using a short proximal femoral nail were evaluated (Figure 1).



**Figure 1:** Preoperative and postoperative roentgenographic image of an 89-year-old male patient

Patients who met the inclusion criteria (acute hip fracture (<7 days); age  $\geq$  65 years, low-energy trauma, closed reduction internal fixation with a short proximal femoral nail) constituted the study sample. Exclusion criteria were bilateral hip fractures, fractures extending to the subtrochanteric region or femoral shaft, patients with pathological fractures, multi-trauma, multiple fractures, incomplete clinical data, and severe cognitive impairment. Patients with FAC on the fracture and intact side on preoperative hip radiographs constituted the

study group, and those who could not be detected constituted the control group. Two orthopedics and traumatology specialists examined X-rays of the hip (AP and Lateral) and/or pelvis at the patient's emergency or outpatient clinic presentation. On roentgenographs, FAC ranged from small punctate appearance to significant calcifications. No classification was used for calcification grading. The presence of any calcification was considered a positive sign of FAC in this study (Figure 2).



**Figure 2:** Roentgenographic view of femoral artery calcification

Age, gender, ASA score, waiting time until surgery, need for postoperative intensive care, length of stay in the intensive care unit, the first 30 days, the first one year, and general mortality rates were evaluated. Research data were obtained from preoperative anesthesia records and patient medical records using the electronic patient record system and patient files. Death

records were obtained from the national population management system.

**Statistical Analysis:** Statistical analysis was performed using SPSS software version 22 (SPSS Inc., IBM, NY, USA). Categorical variables were given as frequency, while continuous numerical variables were given mean values with standard deviations. Equality of variance

and normality of distribution was tested for all variables. The comparison of the non-normally distributed Age, Length of Hospitalization (Days), Length of Hospitalization in the Intensive Care Unit (Days), and Waiting Time until Surgery (Days) between the groups were analyzed using the Mann-Whitney U test. Categorical variables such as gender, ASA classification, need for postoperative intensive care, general mortality, first-month mortality, and first-year mortality were analyzed by chi-square test. P values less than 0.05 were considered statistically significant.

## RESULTS

The sample of the study consists of 303 patients. While FAC was detected in 117 (38.6%) patients, FAC was not detected in 186 (61.4%) patients. While the mean age of the study group was  $84.8 \pm 8.9$  years, the mean age of the control group was  $81.5 \pm 8.3$  years. There was a statistically significant difference between the groups in terms of mean age ( $p < 0.05$ ) (Table 1). While 58.2% of the patients with FAC were male, this rate was 33.3% in the group without calcification. There was a statistically significant difference between the distributions of their genders ( $p < 0.001$ ) (Table 2).

**Table 1:** Comparison of numerical variables between groups

	Group	n	Mean $\pm$ SD	p*
Age	Control Group	186	$81.5 \pm 8.3$	<b>0.001</b>
	Study group	117	$84.8 \pm 8.9$	
Length of Hospitalization (Days)	Control Group	186	$8.5 \pm 7.4$	0.904
	Study group	117	$8.1 \pm 4.5$	
Length of Hospitalization in the Intensive Care Unit (Days)	Control Group	186	$1.9 \pm 6.9$	0.212
	Study group	117	$1.6 \pm 2.5$	
Waiting Time until Surgery (Days)	Control Group	186	$2.8 \pm 2.3$	0.292
	Study group	117	$3.1 \pm 2.7$	

\*Mann Whitney U Testi

The proportion of patients with ASA 2 scores in the whole sample was 6.6%, the rate of patients with ASA 3 scores was 76.6%, and the rate of patients with ASA 4 scores was 16.8%. In the comparison between the groups, a statistically significant difference was found between the ASA class ( $p < 0.05$ ) (Table 2). These findings support that systemic diseases are more common in patients with FAC. There was no statistically significant difference between the groups in terms of waiting time until surgery, need for postoperative intensive care, and length of stay in the intensive care unit ( $p > 0.05$ ) (Tables 1,2)

It was determined that 149 (49.2%) patients died in the whole sample. The rate of those who died in the first 30

days was 16.2%, and for those who died within one year was 33%. A statistically significant difference was found when the presence of FAC was compared in terms of overall mortality and postoperative first-month mortality ( $p < 0.05$ ). The overall mortality risk was 1.63 times higher in patients with FAC, and the mortality risk in the first month was 1.99 times higher. There was no statistically significant difference between the groups regarding mortality in the first year. However, the mortality rates in the first year were higher in patients with FAC, although it was not statistically significant, and the risk of mortality in the first year was 1.57 times higher in this group than in the group without FAC (Table 2).

**Table 2:** Comparison of numerical variables between groups

	FAC			OR (%95 CI)	p*
	Positive n (%)	Negative n (%)	Total n (%)		
<b>Gender</b>					
Female	49 (41.8)	124 (66.7)	173 (57.1)	2.85 (1.76-4.61)	<b>&lt;0,001</b>
Male	68 (58.2)	62 (33.3)	130 (42.9)		
<b>ASA Classification</b>					
2	3(2.6)	17 (9.1)	20 (6.6)	2,781(1.66-4.51)	<b>0.047</b>
3	86 (73.5)	146 (78.5)	232 (76.6)		
4	28 (23.9)	23 (12.4)	51 (16.8)		
<b>Need for postoperative intensive care</b>					
Yes	70 (59.8)	99 (53.2)	169 (55.8)	0.74 (0.46-1.19)	0.132
No	47 (41.2)	87 (46.8)	134 (44.2)		
<b>General Mortality</b>					
Life	51 (43.6)	103 (55.4)	154 (50.8)	1.63 (1.02-2.61)	<b>0.039</b>
Exitus	66 (56.4)	83 (44.6)	149 (49.2)		
<b>First-month mortality</b>					
Life	91(77.8)	163 (87.6)	254(83.8)	1.99 (1.06-3.71)	<b>0.028</b>
Exitus	26(22.2)	23 (12.4)	49 (16.2)		
<b>First-year mortality</b>					
Life	77 (65.8)	126 (67.7)	203 (67)	1.57 (0.95-2.59)	0.078
Exitus	40 (34.2)	60 (32.3)	100 (33)		

\*Pearson Ki-Kare Testi;

## DISCUSSION

Since hip fracture is associated with high mortality among the elderly, many studies have examined patient survival, mortality rates and prognostic factors (6-8). Few studies examine the relationship between the mortality rate and radiological parameters in patients with hip fractures (6,13). In the study of Bayram et al., the sample consisted of patients with femoral intertrochanteric or femoral neck fractures, and treatment procedures ranged from intramedullary nailing to total hip arthroplasty (6). On the other hand, the studies of Pazarıcı et al. were on the effect of FAC on mortality in patients who underwent cemented partial hip replacement (13). Our study differs from these studies by investigating the effect of FAC on mortality in intertrochanteric fractures that underwent osteosynthesis with an isolated proximal femoral nail.

Most patients with hip fractures are of advanced age (2). It has been reported that advanced age is strongly associated with mortality after hip fracture surgery (2,14). In our study, the mean age of the patients in both the study and control groups was over 80, and statistically, the patients in the study group were older. When the literature is examined, it is seen that peripheral artery calcification increases with age (15-17). We think that patients with radiographic arterial calcification are older as the metabolic and/or inflammatory process exceeds a certain threshold and requires a more significant amount of accumulation in the vascular bed for vascular calcification to become visible radiographically (18,19).

The ratio of the male population in the study group was statistically significantly higher than in the control group. The literature shows that the male gender is predominant in patients with arterial calcification in

roentgenographic and ultrasonographic examinations before knee arthroplasty (15,20). In studies examining lower extremity arterial calcification as a determinant of coronary atherosclerosis in patients with peripheral artery disease, it was observed that the male population was predominant (22). While 58.1% of the patients with FAC were male, this rate was 33.3% in the group without calcification, which supports the literature.

Studies have shown that a high ASA score is associated with mortality (23-26). The high ASA values in our study group support the literature. In addition, it has been reported in the literature that a significant majority of cases with arterial calcifications detected in roentgenographic and ultrasonographic examinations before knee arthroplasty have an ASA4 score (15,20). We believe that the presence of FAC causes an increase in the ASA score due to the presence of other systemic diseases, especially coronary artery diseases.

Our 30-day and first-year mortality rates in this study were consistent with mortality rates in Turkey and around the world (5,27-29). We found that the presence of FAC increased the risk of mortality. In our study, the overall mortality risk increased 1.63 times, the risk of mortality in the first 1 month increased 1.99 times and the risk of mortality in the first 1 year increased 1.57 times in patients with FAC. Pazarcı et al. examined 145 patients over 65 years of age who underwent cemented partial hip prosthesis after hip fracture and found that the presence of FAC on the contrary had no effect on mortality (13). Bayram et al., in their study examining the radiological parameters related to the survival of elderly patients with hip fracture, found that the presence of femoral and iliac artery calcifications on the fractured and unaffected sides was significantly higher in the deceased group than in the living group (6). When the literature is examined, it has been stated that peripheral artery calcification can be a useful marker in predicting coronary artery diseases (22). In addition, it has been shown that lower extremity arterial calcification is associated with and predicts increased

cardiac mortality and morbidity in patients with symptomatic peripheral arterial disease (9,10,21,22). The perioperative ischemia evaluation study reported that 6.9% of patients who underwent non-cardiac surgery and were at risk for cardiovascular disease would experience a major adverse cardiac event postoperatively (30). Since the presence of FAC is associated with the risk of cardiovascular disease, it may contribute to mortality in patients with intertrochanteric fractures.

The negative aspects of our study are that it is a retrospective cross-sectional study, the sample size is not large enough, and the systemic diseases that will contribute to mortality and the causes of mortality are not examined, and there is a significant difference between the groups in terms of age and gender. In addition, the fact that it is a single-center study may affect the generalization of our results.

Our study showed that the presence of FAC could be evaluated as a predictor of mortality in elderly patients with ITFC who underwent osteosynthesis with short PFN. However, further studies with larger patient groups are needed.

*Conflict of Interest:* None

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