

*Osmangazi Journal of Medicine**e-ISSN: 2587-1579***The Diagnostic Value of Pelvic CT in Low-Energy Hip Fractures: A Retrospective Analysis of 451 Patients**

Düşük Enerjili Kalça Kırıklarında Pelvis BT'nin Tanısal Katkısı: 451 Hastanın Retrospektif Analizi

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Abstract: Hip fractures are a major health problem that increase morbidity and mortality in the elderly. Although the incidence of concomitant pelvic injuries after low-energy trauma is relatively low, the necessity of routine pelvic computed tomography (CT) remains controversial. A total of 451 patients who were admitted to the Emergency Department of Eskişehir City Hospital between 2019 and 2023 and diagnosed with hip fracture (femoral neck or trochanteric) were retrospectively evaluated. Pelvic CT scans were reported by radiologists and independently reviewed by two orthopedic surgeons. The rates of CT imaging and the presence of pelvic pathology were analyzed according to age, sex, and fracture subtype (femoral neck or trochanteric). The mean age of the patients was 76.2 ± 9.5 years; 58.5% were female and 41.5% were male. The overall rate of pelvic CT imaging was 36.1%. CT findings were normal in 99.4% of the cases, and only one patient (0.6%) had a pathological finding in the pelvis. The CT imaging rates were 41.8% in femoral neck fractures and 34.6% in trochanteric fractures ($p = 0.185$). Female patients had a significantly higher rate of CT imaging compared to males ($p = 0.023$). Age and fracture subtype had no significant effect on CT imaging frequency. The diagnostic value of routine pelvic CT in low-energy hip fractures is limited. CT should be performed only in cases of clinical suspicion or diagnostic uncertainty. The indication for imaging should be based on clinical evaluation and physical examination findings.

Keywords: Hip fracture, femoral neck fracture, trochanteric fracture, pelvis, computed tomography

Ethics Committee Approval: The study was approved by the Ethics Committee of Eskisehir City Hospital (decision date:20.03.2025, number:ESH/BAEK 2025/145).

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Özet: Kalça kırıkları, ileri yaşta morbidite ve mortaliteyi artıran önemli bir sağlık sorunudur. Düşük enerjili travma sonrası kalça kırıklarında pelvik yaralanmaların sıklığı sınırlı olmakla birlikte, rutin pelvis bilgisayarlı tomografi (BT) çekiminin gerekliliği tartışmalıdır. 2019-2023 yılları arasında Eskişehir Şehir Hastanesi Acil Servisi'ne başvuran ve kalça kırığı (femoral boyun - trokanter) tanısı alan 451 hasta retrospektif olarak değerlendirildi. Pelvis BT görüntüleri radyologlar tarafından raporlandı ve iki ortopedist tarafından bağımsız olarak incelendi. BT çekim oranları ve pelviste patoloji saptanma durumu; yaş, cinsiyet ve kırık alt tiplerine (femur boyun- trokanterik) göre analiz edildi. Hastaların ortalama yaşı $76,2 \pm 9,5$ yıl olup, %58,5'i kadın, %41,5'i erkekti. Pelvis BT çekilme oranı %36,1 olarak bulundu. BT görüntülemelerinin %99,4'ünde normal bulgular mevcutken, yalnızca 1 hastada (%0,6) pelviste patolojik bulgu saptandı. Femur boyun ve trokanterik kırıklarda BT çekim oranları sırasıyla %41,8 ve %34,6 idi ($p=0,185$). Kadınlarda BT çekilme oranı erkeklerle göre anlamlı olarak daha yüksek bulundu ($p=0,023$). Yaş ve kırık alt tipinin BT çekim oranı üzerinde anlamlı etkisi saptanmadı. Düşük enerjili kalça kırıklarında rutin pelvis BT çekiminin tanısal katkısı sınırlıdır. BT yalnızca klinik şüphe veya tanısal belirsizlik durumlarında endike olmalıdır. Görüntüleme endikasyonu klinik değerlendirme ve fizik muayene bulgularına dayandırılmalıdır.

Anahtar Kelimeler: Kalça kırığı, femur boyun kırığı, trokanterik kırık, pelvis, bilgisayarlı tomografi

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1. Introduction

Hip fractures are a major public health problem that cause a significant increase in morbidity and mortality among the elderly (1). With the increasing life expectancy, hip fractures have become a growing global health burden (2).

A large proportion of hip fractures occur as a result of low-energy trauma, such as a fall from standing height (3). Previous studies have reported the concomitant occurrence of pelvic fractures in 5–15% of hip fracture cases (4–6).

Along with the increasing incidence of hip fractures, the use of pelvic computed tomography (CT) imaging in these patients has also increased in recent years (7). Compared with conventional radiography, CT exposes patients to approximately eight times higher radiation doses (8). Therefore, routine CT examinations performed without clear clinical indication may result in unnecessary radiation exposure and impose an additional economic burden on the healthcare system.

However, there is no clear consensus regarding which patients with low-energy hip fractures truly require pelvic CT imaging. The diagnostic value of routine pelvic CT in the absence of clinical suspicion for concomitant pelvic injury remains controversial.

The aim of this study was to retrospectively evaluate patients diagnosed with hip fracture after low-energy trauma in the Emergency Department of Eskişehir City Hospital, in order to investigate the necessity of pelvic CT imaging and the presence of accompanying pelvic injuries. We hypothesized that routine pelvic CT performed without clear clinical indication does not provide a meaningful diagnostic contribution for detecting concomitant pelvic injuries in patients with low-energy hip fractures.

2. Materials and Methods

A total of 480 patients diagnosed with hip fracture who were admitted to the Emergency Department of Eskişehir City Hospital between 2019 and 2023 were retrospectively reviewed (Eskisehir City Hospital Non-Interventional Ethics Committee Approval No: ESH/BAEK 2025/145, Date: 20/03/2025). Twenty-nine patients with hip fractures resulting from high-energy trauma (such as motor vehicle accidents or falls from height) were excluded from the study. The remaining 451 patients with hip fractures due to low-energy trauma were evaluated in terms of sex, age, fracture subtype (femoral neck

fracture or trochanteric fracture), pelvic computed tomography (CT) imaging rates, and concomitant pelvic bone pathologies.

In addition, only femoral neck and intertrochanteric fractures resulting from low-energy trauma were included in the analysis. Femoral head fractures were excluded, as they are typically associated with high-energy trauma in younger patients. Isolated lesser trochanter fractures were excluded because they are generally considered pathological until proven otherwise and already warrant advanced imaging for etiological evaluation. Similarly, isolated greater trochanter fractures were excluded since further imaging (CT or MRI) is clinically indicated to assess potential intertrochanteric extension. These exclusions were applied to avoid confounding the assessment of routine pelvic CT use in typical low-energy proximal femur fractures. Plain radiographs and CT images were independently evaluated by two orthopedic and traumatology specialists. In addition, all CT scans were reported by radiologists. Subsequently, the reports prepared by radiologists and the evaluations of orthopedic surgeons were compared by an emergency physician to identify potential concomitant pelvic bone pathologies.

2.1. Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics version 31 (IBM Corp., Armonk, NY, USA). Descriptive statistics were expressed as mean $\pm$ standard deviation for continuous variables and as frequency (percentage) for categorical variables. The relationships between categorical variables were evaluated using the Pearson Chi-square test. Logistic regression analyses were conducted separately for hip fractures and their subtypes (femoral neck and trochanteric fractures) to examine the effects of sex and age on the likelihood of CT imaging. The goodness of fit of logistic regression models was assessed using the Hosmer–Lemeshow test. A type I error rate of 5% was considered statistically significant for all analyses.

3. Results

A total of 451 patients who presented to the emergency department after low-energy trauma and were diagnosed with hip fracture were included in the study. The mean age of all participants was 76.2 ± 9.5 years; the mean age was 75.6 ± 9.8 years in males and 76.6 ± 9.2 years in females. The mean age

was 78.2 ± 9.2 years in femoral neck fractures and 75.7 ± 9.5 years in trochanteric fractures. This difference was statistically significant ($p = 0.016$).

Of the participants, 58.5% were female ($n = 264$) and 41.5% were male ($n = 187$). Femoral neck fractures were observed in 21.7% ($n = 98$) and trochanteric fractures in 78.3% ($n = 353$) of the patients. The overall rate of pelvic CT imaging was 36.1% ($n = 163$) (Table 1). Among the patients who underwent CT, no pathological findings were detected in 99.4% ($n = 162$), whereas only one case

(0.6%) demonstrated a pathological finding in the pelvis (Table 1).

The patient with a pathological finding was an 86-year-old female who presented after a fall from standing height. Pelvic and hip CT imaging revealed pathological lesions involving both the proximal femur and the iliac region. This finding represented a pathological bone lesion rather than a concomitant traumatic pelvic fracture. While further investigation of the primary pathology was ongoing, the patient unfortunately passed away.

Table 1. Descriptive characteristics of the patients included in the study

Variables	n (%)
Sex	Female
	264 (58.5)
	Male
	187 (41.5)
CT Imaging	Performed
	163 (36.1)
	Not Performed
	288 (63.9)
CT Results	Normal
	162 (99.4)
	Pathological
	1 (0.6)
Fracture Type	Femoral Neck Fracture
	98 (21.7)
	Trochanteric Femur Fracture
	353 (78.3)

Values are presented as numbers and percentages

Femoral neck fractures were observed in 54.1% of female patients and 45.9% of male patients, while trochanteric fractures were seen in 59.8% of females and 40.2% of males. This difference was not statistically significant ($p = 0.312$) (Table 4). The rate of CT imaging was 41.8% in femoral neck fractures and 34.6% in trochanteric fractures, and the difference was not statistically significant ($p = 0.185$) (Table 2).

Table 2: Distribution of CT imaging according to femoral neck and trochanteric fracture types

Fracture type	No CT Imaging (n=288) n (%)*	CT Imaging Performed (n=163) n (%)*
Femoral neck (n=98)	57 (58,2)	41 (41,8)
Trochanteric (n=353)	231 (65,4)	122 (34,6)

When evaluated by sex, the CT imaging rate among all hip fracture cases was significantly higher in females (42.2%) than in males (31.8%) ($p = 0.023$). However, when fracture subtypes were analyzed separately, the difference in CT imaging rates between sexes was not statistically significant. In femoral neck fractures, CT imaging was performed in 48.9% of females and 35.8% of males ($p = 0.192$), while in trochanteric fractures, CT imaging was performed in 40.1% of females and 30.9% of males ($p = 0.071$) (Table 3).

Table 3. Distribution of CT imaging according to sex and fracture type

Fracture type	Sex (n)	No CT Imaging n (%)	CT imaging performed n (%)	p value **
Hip fracture	Female (187)	108 (57,8)	79 (42,2)	0.023
	Male (264)	180 (68,2)	84 (31,8)	
Femoral neck fracture	Female (45)	23 (51,1)	22 (48,9)	0.192
	Male (53)	34 (64,2)	19 (35,8)	
Trochanteric fracture	Female (142)	85 (59,9)	57 (40,1)	0.071
	Male (211)	146 (69,2)	65 (30,8)	

In the logistic regression analysis, the rate of CT imaging was found to be significantly higher in female patients with hip fractures (OR = 0.64; 95% CI: 0.43–0.95; $p = 0.025$). However, the effect of sex was not

statistically significant in the subgroups of femoral neck fractures ($p = 0.199$) and trochanteric fractures ($p = 0.075$) (Table 4). Since no significant association between age and CT utilization was identified, additional subgroup analyses based on age categories were not performed.

Table 4. Sex distribution in femoral neck and trochanteric fractures

	Female n (%*)	Male n (%*)	p value**
Femoral neck fracture (n=98)	53 (54,1)	45 (45,9)	0,312
Trochanteric fracture (n=353)	211 (59,8)	142 (40,2)	
Total	264 (58,5)	187 (41,5)	

* Row percentages are presented. **Pearson Chi-square test

The variable of age was not significantly associated with CT imaging in hip fractures overall ($p = 0.725$), in femoral neck fractures ($p = 0.702$), or in trochanteric fractures ($p = 0.718$). The Hosmer–Lemeshow test indicated adequate model fit for all regression models ($p = 0.645$, $p = 0.978$, and $p = 0.811$, respectively) (Table 5).

Table 5: Factors affecting the likelihood of CT imaging in hip fractures and subtypes

Fracture type	Variables	p value	OR (95% CI)	H-L
Hip fracture	Sex (female vs male)	0,025	0,64 (0,43 – 0,95)	0,645
	Age	0,725	1,00 (0,98 – 1,02)	
Femoral neck fracture	Sex (female vs male)	0,199	0,59 (0,26 – 1,32)	0,978
	Age	0,702	0,99 (0,95 – 1,04)	
Trochanteric fracture	Sex (female vs male)	0,075	0,67 (0,43 – 1,04)	0,811
	Age	0,718	1,00 (0,97 – 1,02)	

H-L: Hosmer-Lemeshow test

4. Discussion

Hip fractures are more common in women. In the literature, the female predominance has been reported to range between 60% and 80% (2,3,9); however, the incidence of hip fractures among men is increasing. In our study, females accounted for 58.5% of all patients. Postmenopausal anti-osteoporotic therapies have contributed to a reduction in fracture rates among women, whereas the lack of similar preventive programs in men may explain the rising incidence of osteoporosis and associated hip fractures in this group (10). In addition, higher rates of smoking and alcohol consumption among men may further increase their risk of developing osteoporosis (11,12).

In the present study, routine pelvic CT demonstrated a very low diagnostic yield in patients with low-energy hip fractures, with only one pathological case identified among 163 scans. Importantly, this case represented a pathological bone lesion rather than a concomitant traumatic pelvic fracture. These findings suggest that routine imaging of the entire pelvis may not be necessary in the absence of specific clinical suspicion. Similarly, recent data indicate that CT scans performed during initial trauma screening in older patients with proximal femur fractures rarely alter clinical management, supporting a more restrictive imaging policy (13).

Among the 451 patients, pelvic CT was performed in 36.1%, but additional traumatic pelvic injuries were almost never detected. Previous studies have reported concomitant pelvic fractures in 5-15% of hip fracture cases (4–6); however, many of these findings are derived from MRI-based studies or selected patient populations with persistent clinical suspicion. Our results, reflecting real-world emergency department practice, suggest that routine pelvic CT rarely provides clinically meaningful additional findings in typical low-energy hip fractures.

Three-dimensional analyses have demonstrated that both femoral neck and pertrochanteric fractures may exhibit complex displacement patterns not fully appreciated on plain radiographs (14,15). Furthermore, CT-based studies have shown that cortical buttress patterns, lateral wall thickness, and posterior cortical integrity are important determinants of surgical stability in intertrochanteric fractures (16,17). These findings emphasize that CT may be valuable when detailed fracture morphology assessment is required.

However, it is important to distinguish between pelvic CT and focused hip CT. While CT may be necessary in selected cases for preoperative planning—particularly for evaluating fracture geometry, comminution, or implant-related

considerations—routine imaging of the entire pelvis does not appear justified in the absence of suspicion for additional pelvic trauma. Proximal femoral axial length and anatomical variations may directly influence implant selection in femoral neck fractures, further supporting the value of focused hip imaging rather than routine whole-pelvis CT (18). In addition, advances in ultra-low-dose hip CT protocols have demonstrated that accurate assessment of proximal femoral subregions can be achieved with limited-field imaging (19).

In our study, CT utilization was significantly higher in female patients; however, age was not significantly associated with CT use. The comparable imaging rates between fracture subtypes and the lack of an age effect suggest that CT ordering may have been influenced more by physician preference or defensive medicine considerations rather than strict clinical necessity.

In the current era of increasing awareness regarding radiation exposure and healthcare costs, establishing evidence-based indications for pelvic CT in low-energy hip fractures is clinically important. When CT is required for surgical planning, limiting the imaging area to the fracture region rather than scanning the entire pelvis may reduce both radiation exposure and economic burden without compromising diagnostic adequacy.

The main limitations of this study include the inability to determine the exact clinical indications

for pelvic CT due to its retrospective design, the lack of MRI data, and its single-center nature, which may limit generalizability. Although no formal lower age limit was defined, the youngest patient included was 57 years old, and therefore the findings primarily reflect an older adult population.

Future prospective studies with clearly defined CT indication criteria and standardized documentation of clinical findings would provide stronger evidence regarding optimal imaging strategies in this patient group.

5. Conclusion

The diagnostic value of routine pelvic CT for detecting concomitant pelvic injuries in patients with low-energy hip fractures appears to be limited. In the absence of clinical suspicion for additional pelvic trauma, routine imaging of the entire pelvis does not provide meaningful additional diagnostic information.

While CT may be necessary in selected cases for preoperative planning, imaging limited to the fracture region—such as focused hip CT—may be sufficient. Restricting the imaging field may reduce unnecessary radiation exposure and help decrease the economic burden on the healthcare system. Therefore, pelvic CT should not be performed routinely in all low-energy hip fracture cases but rather reserved for patients with specific clinical indications.

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