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Retrospective evaluation of coccygeal fractures: clinical features and radiological findings from a single-centre study

İhsaniye Süer Doğan[1], Nezih Kavak[2]

[1]Department of Radiology, Ankara Etlik City Hospital, Ankara, Turkiye
[2]Department of Emergency Medicine, Ankara Etlik City Hospital, Ankara, Turkiye

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Corresponding Author: İhsaniye Süer Doğan, dr.ihsaniye@gmail.com

ABSTRACT

Aims: This study aims to evaluate the demographic, epidemiological, and radiological characteristics of patients diagnosed with coccyx fractures in the emergency department.

Methods: Patients who presented between October 2022 and January 2025 and were diagnosed with coccygeal fractures in the emergency department were retrospectively evaluated. Patient variables analysed included age, sex, season of presentation, mechanism of trauma, type(s) of radiological investigations performed, and the presence of any accompanying injuries.

Results: 105 patients were included in the study, the mean patient age was 46.00±18.45 years (range: 18–82 years). Of the patients, 41.9% were female and 58.1% were male. The highest incidence of presentation occurred during the winter season, accounting for 50.5% (n=53) of cases. The most prevalent trauma mechanism was ground-level falls, observed in 51.4% (n=54) of patients. Direct radiography was performed in 55.2% (n=58) of cases. The most common associated injury was pelvic or sacral trauma, noted in 52.6% (n=10) of patients with concomitant injuries. No statistically significant differences were identified between male and female patients regarding age, trauma mechanisms, or the presence of accompanying injuries ($p>0.05$ for all comparisons).

Conclusion: Coccygeal fractures, while frequently underestimated, can significantly impair quality of life and are more prevalent in females and during the winter months. Ground-level falls were the most common cause, and although often isolated, some cases were associated with pelvic or sacral injuries.

Keywords: Coccyx fracture, trauma, emergency department

INTRODUCTION

The coccyx, or tailbone, is a small triangular bone located at the distal end of the vertebral column, typically composed of three to five fused vertebrae, with its proximal segment articulating with the sacrum.[1] Its name is derived from its resemblance to a cuckoo bird's beak.[2] Although often considered vestigial, the coccyx serves a significant anatomical role as part of the pelvic tripod, alongside the ischial bones, and functions as a critical attachment site for numerous ligaments and muscles of the pelvic floor.[3] It bears weight in the seated position and contributes to postural support.

The true incidence of coccygeal fractures remains unclear, largely due to underreporting and diagnostic challenges.[4] Such fractures may result from various mechanisms, most commonly low-energy trauma such as ground-level falls, or obstetric events like childbirth. Trauma-induced coccygeal pain, clinically referred to as coccydynia, can significantly impair quality of life, particularly when sitting.

Diagnosis of coccyx fractures typically requires a combination of clinical examination and imaging modalities.

This study aimed to assess the demographic, epidemiological, and radiological characteristics of patients diagnosed with coccygeal fractures in the emergency department (ED).

METHODS

Ethics

This retrospective study was approved by the Ankara Etlik City Hospital Evaluation of Scientific Researches and Ethics Committee (Date: 26.02.2025, Decision No: 2025-0241). All

procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Study Design and Subjects

Patients who presented between October 2022 and January 2025 and were diagnosed with coccygeal fractures were retrospectively evaluated.

Inclusion criteria comprised individuals aged 18 years or older who were diagnosed with a coccyx fracture upon presentation to the ED. Exclusion criteria included a prior history of coccygeal or sacral injury, presence of infectious processes or space-occupying lesions in the sacrococcygeal region, and absence of radiological imaging.

Patient variables analysed included age, sex, season of presentation, mechanism of trauma, type(s) of radiological investigations performed, and the presence of any accompanying injuries.

Statistical Analysis

Descriptive statistics for continuous variables were expressed as mean±standard deviation, median, minimum, and maximum values, while categorical variables were summarised as counts and percentages. The Mann–Whitney U test was employed for comparing age between male and female patients. For categorical comparisons between sexes, Chi-square or Fisher's exact tests were used where appropriate. All analyses were conducted using IBM SPSS Statistics for Windows, version 20.0 (IBM Corp., Armonk, NY, USA). A p-value of less than 0.05 was considered statistically significant.

RESULTS

105 patients were included in the study, The mean age was 46.00±18.45 years, with patient ages ranging from 18 to 82 years. Of the cohort, 41.9% were female and 58.1% were male. The majority of presentations (50.5%, n=53) occurred during the winter season. The most frequently reported trauma mechanism was ground-level falls, observed in 51.4% (n=54) of cases.

Direct radiography was performed in 55.2% (n=58) of patients. Imaging modalities varied across the cohort: 30.5% (n=32) of patients underwent direct radiography alone, 24.8% (n=26) underwent both direct radiography and computed tomography (CT), and 35.2% (n=37) underwent CT alone. The most commonly observed concomitant injury was pelvic or sacral trauma, reported in 52.6% (n=10) of those with associated injuries (**Table 1, Figure 1a, b, Figure 2a, b, c, d, e, Figure 3a, b, Figure 4a, b**).

A statistically significant difference was observed between the ages of female and male patients (p<0.001) (**Table 2**).

No statistically significant differences were found between female and male patients in terms of trauma mechanisms or the presence of associated injuries (p>0.05) (**Table 3**).

DISCUSSION

Coccygeal fractures, although often underestimated, are clinically important due to their impact on daily functioning and the difficulties they pose in diagnosis and treatment. Such fractures may result in coccydynia, a painful condition

Table 1. Distribution of patients by age, sex, radiological evaluation, and associated injuries

	Mean±SD median (min–max)	
Age (years)	46.00±18.45 43 (18-82)	
	n	**%**
Sex		
Female	44	41.9
Male	61	58.1
Season of patient presentation		
Winter	53	50.5
Summer	14	13.3
Autumn	27	25.7
Spring	11	10.5
Mechanism of trauma		
Fall from height	17	16.2
Ground-level fall	54	51.4
Motor vehicle accident	15	14.3
Assault	7	6.7
Fall from animal riding	2	1.9
Bicycle/motorcycle fall	10	9.5
Absent	47	44.8
Present	58	55.2
Direct radiography performed		
Absent	47	44.8
Present	58	55.2
Computed tomography performed		
Absent	42	40.0
Present	63	60.0
Associated injuries		
Absent	86	81.9
Present	19	18.1
Location of associated injury (n=19)		
Pelvis/sacrum	10	52.6
Traumatic brain injury	2	10.5
Vertebral fractures	4	21.1
Rib fractures	2	10.5
Radius fracture	1	5.3

SD: Standard deviation, Min: Minimum, Max: Maximum

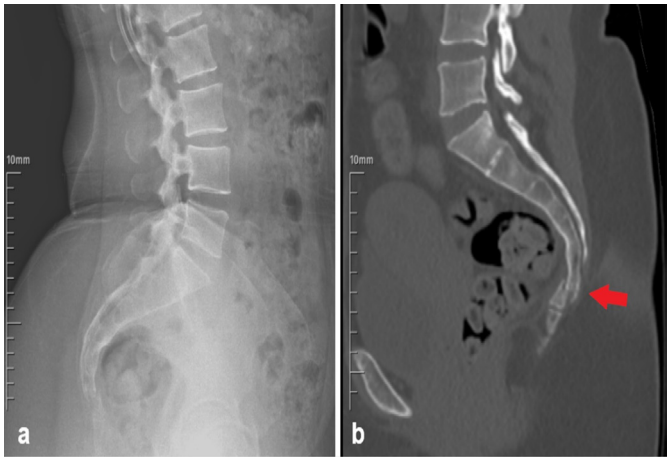

Figure 1a, b. X-ray lateral view, oblique radiolucency in the second coccygeal segment suggestive of a fracture (**a**), Sagittal bone window reformat computed tomogrphy, fracture of the second coccygeal segment, with minimally displaced fragments (red arrow) (**b**).

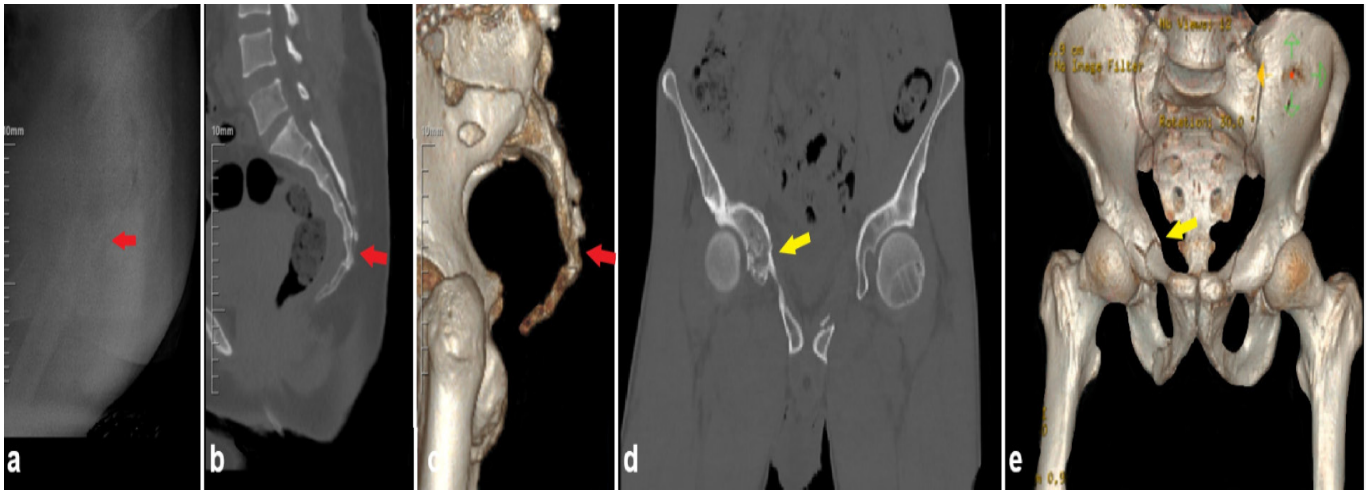

Figure 2a, b, c, d, e. X-ray lateral view oblique radiolucency in the first coccygeal segment suggestive of a fracture (red arrow) (**a**), sagittal bone window reformat computed tomography fracture of first coccygeal segment (red arrow) (**b**), 3-dimensional computed tomography fracture of first coccygeal segment (red arrow) (**c**), coronal bone window reformat computed tomography right acetabulum segmented non-displaced fracture (yellow arrow) (**d**), 3-dimensional computed tomography right acetabulum segmented non-displaced fracture (yellow arrow) (**e**).

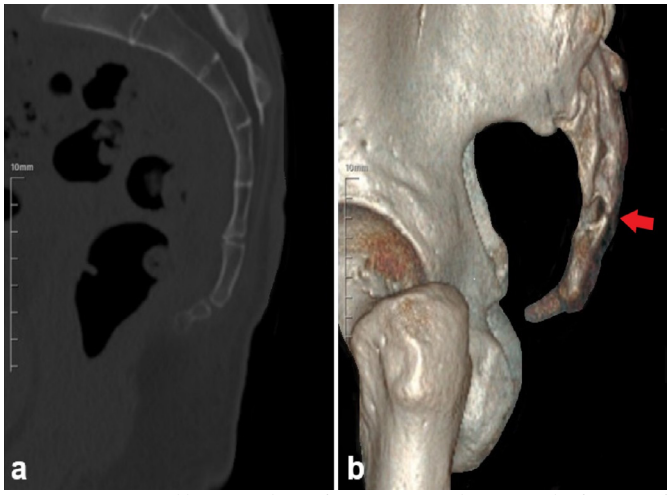

Figure 3a, b. Sagittal bone window reformatcomputed tomography fracture of first coccygeal segment (**a**), 3-dimensional computed tomography fracture of first coccygealsegment (red arrow) (**b**)

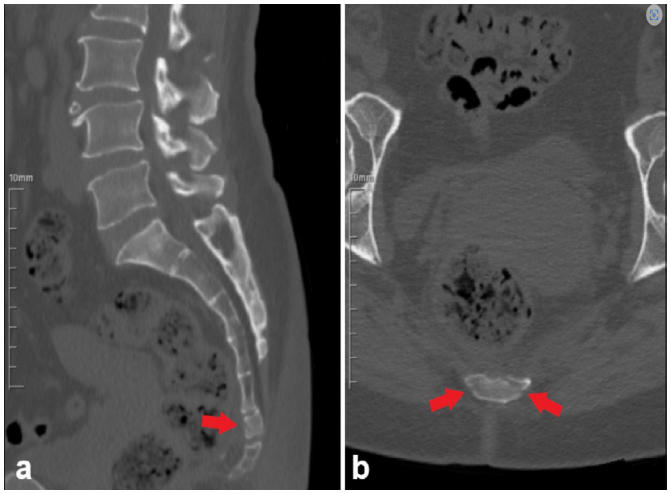

Figure 4a, b. Sagittal bone window reformat computed tomography fracture of first coccygeal segment (red arrow) (**a**), axial bone window computed tomography fracture of first coccygeal segment (red arrow) (**b**)

Table 2. Comparison of age between female and male patients

	Female	Male	p
	Mean±SD median (min-max)	Mean±SD median (min-max)	
Age (years)	50.18±21.10 53 (18-82)	43.00±15.79 41 (18-77)	0.001

Mann-Whitney U test, SD: Standard deviation, Min: Minimum, Max: Maximum

Table 3. Comparison of trauma mechanisms and associated injuries between female and male patients

	Female		Male		p
	n	%	n	%	
Trauma mechanism					
Fall from height	5	11.4	12	19.7	0.314
Ground-level fall	27	61.4	27	44.3	
Motor vehicle accident	7	15.9	8	13.1	
Assault	1	2.3	6	9.8	
Fall from animal riding	0	0	2	3.3	
Bicycle/motorcycle fall	4	9.1	6	9.8	
Associated injuries					
Absent	38	86.4	48	78.7	0.313
Present	6	13.6	13	21.3	

Chi-square test/Fisher's exact test

localised to the coccyx, that can markedly impair functional capacity, particularly during prolonged sitting. Maigne et al.[5] reported that traumatic events occurring within one month prior to symptom onset substantially increase the likelihood of developing coccydynia. This study examined the demographic, epidemiological, and radiological characteristics of patients diagnosed with coccygeal fractures in the ED setting.

A population-based study conducted in South Korea identified 238.906 cases of coccyx fractures between 2010 and 2018, reporting a higher incidence in females, with a female-to-male ratio of 2.6:1. The highest frequency occurred during puberty in males (ages 10–14) and during the menopausal period in females (ages 50–54).[6] Decreased bone mineral density due to osteoporosis significantly increases the risk of coccygeal fractures in older adults by making bones more susceptible to low-energy trauma. The elevated incidence of such fractures among postmenopausal women reflects the combined effects of ageing and hormonal changes on skeletal health.[6] Consistent with previous findings, the present study also demonstrated a higher frequency of coccygeal fractures in females at older ages compared to males. Promoting regular physical activity

and encouraging a balanced diet rich in calcium and vitamin D may contribute to maintaining bone health and reducing the risk of osteoporosis-related fractures.[7]

Risk factors for coccygeal fractures include childbirth, particularly in cases involving difficult or instrument-assisted deliveries, as well as falls on slippery surfaces.[8,9] The incidence of these fractures has been shown to inversely correlate with ambient temperature, with a higher prevalence during the winter months.[6] In the present study, coccygeal fractures were also observed more frequently during winter. Enhancing public awareness of ice-related hazards and promoting safe practices, such as the use of appropriate footwear and walking aids, may help reduce fracture incidence. Furthermore, coccygeal fractures were also recorded in other seasons, particularly autumn. This may be attributable to rain-induced slippery surfaces during autumn, as well as other mechanisms such as motor vehicle accidents and high-impact falls occurring in different months.

Coccygeal fractures can be challenging to diagnose due to their often subtle presentation on radiographic imaging. Early identification and individualised management are essential for improving clinical outcomes, particularly in cases involving concomitant injuries or comorbid conditions. While conventional radiography remains a standard initial diagnostic tool, its sensitivity is limited, especially for minimally displaced or occult fractures. Standard sacrococcygeal radiographs demonstrate low diagnostic yield; one study reported a positivity rate of only 8.4% among 687 patients.[9]

CT is considered the gold standard for the initial evaluation of coccyx fractures, owing to its superior ability to delineate fracture morphology, guide decisions regarding surgical intervention, and provide rapid assessment in emergency settings.[10,11] The selection of imaging modality may also depend on institutional availability and the specific clinical context. In the present study, direct radiography and CT were employed as standalone diagnostic modalities at nearly equal frequencies.

Coccygeal fractures may coexist with pelvic injuries, particularly in the context of high-energy trauma. The concurrence of pelvic-acetabular and coccygeal fractures is frequently observed in patients presenting with severe polytrauma.[12] Sacral fractures, which are commonly linked to pelvic ring disruptions, may also accompany coccygeal fractures. Although coccygeal fractures typically present as isolated injuries, they have been reported in vertical shear trauma patterns involving the pelvic ring.[13,14] Moreover, one study identified coccygeal fractures in 34.62% of patients with spinal cord injuries who presented with pain localised to the lower back, hip, gluteal region, or thigh.[15] In instances of high-energy trauma, anterior displacement of the coccyx may be associated with complications such as cerebrospinal fluid leakage and bladder dysfunction.[16,17]

Although conservative management remains the standard approach for most coccygeal fractures, treatment strategies should be individualised based on the intensity of symptoms, the presence of complications, and patient-specific considerations.

Limitations

This study has several limitations. First, its single-centre design may restrict the generalisability of the findings to broader populations. Although dynamic X-ray imaging is valuable for assessing coccygeal hypermobility and dislocation, standard radiographs in this study were not obtained dynamically, which constitutes a major methodological limitation. Furthermore, long-term follow-up data on clinical outcomes were not available, precluding evaluation of symptom progression or treatment efficacy.

Future multi-centre studies incorporating dynamic imaging protocols and longitudinal patient monitoring are warranted to enhance diagnostic accuracy and to better understand the long-term consequences and management outcomes of coccygeal fractures.

CONCLUSION

Coccygeal fractures, while frequently underestimated, can significantly impair quality of life and are more prevalent in females and during the winter months. Ground-level falls were the most common cause, and although often isolated, some cases were associated with pelvic or sacral injuries. CT demonstrated superior diagnostic value compared to conventional radiography. These findings contribute to the limited national data and underscore the importance of preventive strategies, particularly in older adults and during high-risk seasons.

ETHICAL DECLARATIONS

Ethics Committee Approval

Approved by the Ankara Etlik City Hospital Evaluation of Scientific Researches and Ethics Committee (Date: 26.02.2025, Decision No: 2025-0241).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version

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