Original Article

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Retrospective Analysis of Pelvic Fractures Managed in the Emergency Department

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Abstract

Objective: We aimed this study with the aim of contributing to the emergency service management of patients with pelvic fracture by examining the distribution of patients with pelvic fractures accepted to our clinic according to age and gender in terms of demographic and clinical characteristics.

Methods: A total of 1,324 patients diagnosed with pelvic fractures (ICD-10 codes S32 and T02.1) who presented to the emergency department between April 29, 2017, and April 29, 2022, were included in the study. Demographic characteristics, diagnoses, and the distribution of specialties received were analyzed. Group differences were analyzed using Cramér's V and Pearson's χ^2 tests, and Cliff's δ and Mann-Whitney U tests. Two-sided significance was assessed at $\alpha = 0.05$.

Results: Female patients constituted 55.4% of the cases (n=734; p<0.001). females had a higher mean age than male (female n = 40 [IQR: 26–53] – male n = 033 [IQR: 25–47], in male U = 188,543, p<0.001). Age group distributions differed significantly by sex (χ^2 = 30.43, p<0.001; Cramér's V = 0.15). Diagnoses differed by gender (χ^2 = 125.47, p<0.001; V = 0.31). Among pelvic fractures presenting to the emergency department, the most common diagnosis was closed coccyx fractures due to low-energy trauma. Case numbers decreased sharply in 2020, coinciding with the COVID-19 pandemic (p<0.001).

Conclusions: In our study of patients diagnosed with pelvic fractures admitted to the emergency room, the most common pelvic fracture was the coccygeal fracture. The most common pelvic fracture occurring with low-energy traumas was the coccygeal fracture. While it is seen in all age groups in women due to their tendency towards osteoporosis, it is more concentrated in older ages. In men, it occurs at younger ages due to high-energy traumas.

Keywords: Pelvic Fractures, High-Energy Trauma, Epidemiology, Emergency Medicine

Introduction

Pelvic fractures, among their etiological causes, can be due to high-energy trauma such as falls from heights or motor vehicle accidents, or to low-energy trauma due to osteoporosis in the elderly. As urgent trauma cases, they constitute a significant patient group in emergency departments (1–3). In elderly patients, injuries are more likely to occur due to low-energy trauma, while in younger patients, injuries are more likely to occur due to high-energy trauma (4). Although it is seen at low rates of 3-8%, mortality and morbidity rates are quite high (5).

Etiopathogenesis varies according to age, gender and accident mechanism. While it is increasingly seen in women due to osteoporosis with aging, it is more common in young men due to high-energy traumas and work accidents (6-7). Fracture type and comorbidity factors, along with treatment methods and duration, affect mortality and morbidity (8-11). Pelvic fractures range from life-threatening, complicated fractures with high mortality to osteoporotic fractures in elderly patients. However, recent advances have also recognized the importance of minor fractures in elderly patients in terms of improving quality of life and preserving health (12-13). Recent studies have shown that minor pelvic fractures require the same critical approach as major fractures to prevent their negative effects on health (14-16).

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Our study investigates the demographic and clinical characteristics of patients admitted to the hospital with pelvic fractures and their management in the emergency department. Our study was conducted between 2017 and 2022 at a tertiary hospital, encompassing a period encompassing the COVID-19 pandemic and external factors. A data-driven approach was employed.

Objectives of the Study

To reveal the demographic and clinical characteristics of patients diagnosed with pelvic fractures. To reveal the distribution of branches from which patients with pelvic fractures receive care and the most common fracture types.

Significance of the Study

To improve the quality of care provided to patients with pelvic trauma admitted to the emergency department and to improve the quality of pelvic fracture treatment management.

Materials And Methods

Approval for this study was received from the Gazi Yaşargil Training and Research Hospital Scientific Research Ethics Committee (Approval Date: 28.02.2025; Approval Number: 375). Between April 29, 2017 and April 29, 2022, 1324 patients admitted to the hospital with a diagnosis of pelvic fracture were included in the study. Patients with incomplete or incorrect records were not included in the study. Primary comparisons focused on age by gender, assessed using the Mann–Whitney U test with Cliff's δ. Secondary analyses examined associations between age group and gender, provision type and gender, and diagnosis (top eight categories) and gender, using Pearson's χ^2 test with Cramér's V. For multiple pairwise comparisons, p-values were adjusted using the Benjamini–Hochberg procedure. Statistical significance was defined as two-sided $\alpha = 0.05$. The Python program was used for statistical analysis of the data. The Pandos Library was used for data processing. Visualizations were created using Seaborn and Matplotlib.

Results

A total of 1,324 patients met the inclusion criteria, comprising 734 females (55.4%) and 590 males (44.6%). The age distribution revealed that pelvic fractures were most frequently observed in young adults, particularly in the 25–34 (316 cases; 23.9%) and 15–24 (304 cases; 22.9%) age groups. Across most age groups, the number of female patients was either slightly higher than or comparable to that of males, except for the 1–4 age group, in which all four cases were male. In contrast, gender predominance was observed among elderly patients: within the 65+ age group, females (95 cases) outnumbered males (41 cases). The 45–64 age groups also represented a substantial proportion of cases (269 patients; 20.3%). Pediatric fractures were uncommon, with only 55 patients (4.2%) aged 1–14 years diagnosed during the study period. Collectively, the findings indicated that pelvic fractures predominantly affected young and middle-aged adults (15–64 years), accounting for 1,133 patients (85.6%), with a slight female predominance across most age categories (Table 1, Figure 1, Figure 2).

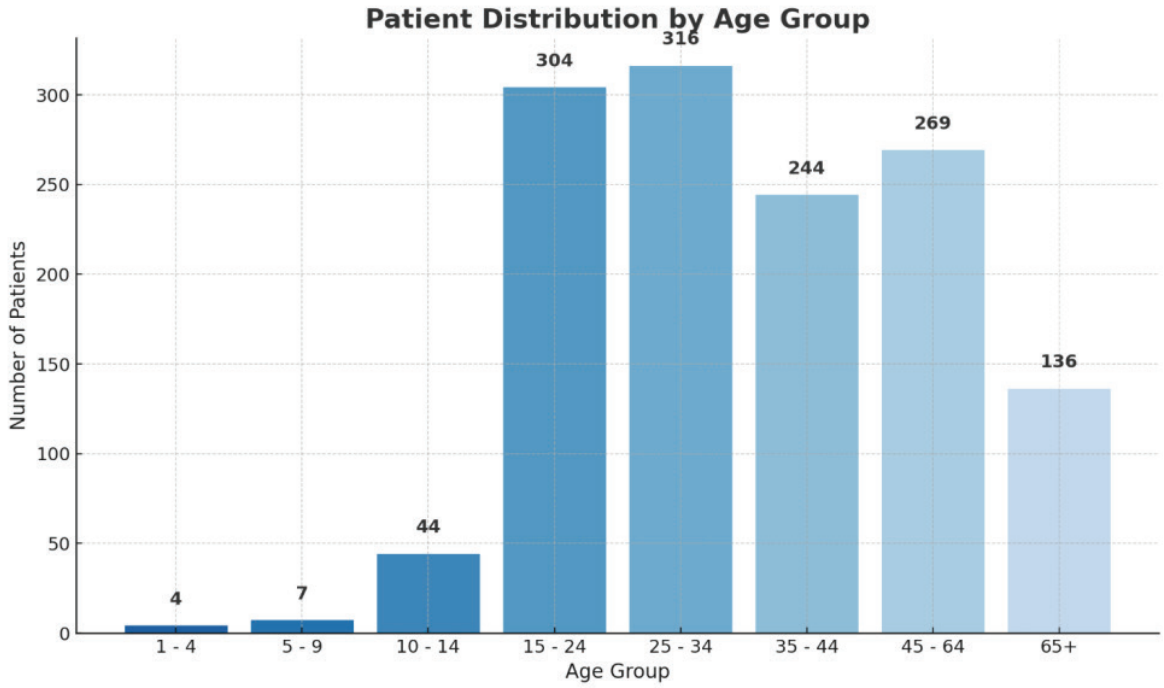

Figure 1. Age and patient distribution with pelvic fractures.

Table 1. Age and Gender Distribution of Patients with Pelvic Fractures

Age Group	Female		Male		Total	
	n	%	n	%	n	%
1-4	0	0.0	4	0.7	4	0.3
5-9	4	0.5	3	0.5	7	0.5
10-14	24	3.3	20	3.4	44	3.3
15-24	154	21.0	150	25.4	304	23.0
25-34	151	20.6	165	28.0	316	23.9
35-44	145	19.8	99	16.8	244	18.4
45-64	161	22.0	108	18.3	269	20.3
65+	95	12.3	41	7.0	136	10.3
Total	734	100.0	590	100.0	1324	100.0

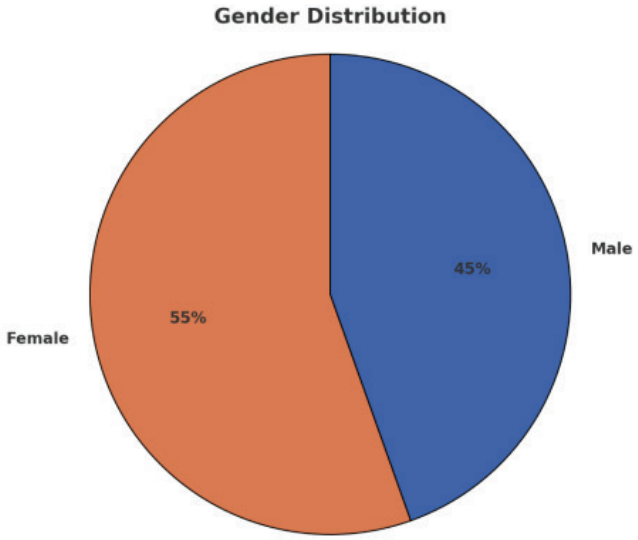

Figure 2. Gender distribution of pelvic fracture patients.

Values are reported as n. The overall association between age group and gender was significant (χ^2 = 30.43, p<0.001; Cramér's V = 0.152). Totals were excluded from the χ^2 test.

Female 55.4% (734/1324) and 50%: binomial test p<0.001. Figure 2 presents the gender distribution of patients with pelvic fractures. Of the 1,324 cases, 734 (55.4%) were female and 590 (44.6%) were male, demonstrating a modest female predominance in the study population.

Overlaid histograms and kernel density estimates show right-skewed age distributions in both groups. The median age [IQR] was 40 [26–53] in women and 33 [25–47] in men, with a significant difference between them (Mann–Whitney U = 188.543, p<0.001). Figure 3 shows the age distribution of male and female cases. Figure 3 shows the age distribution of cases for men and women. Most cases were distributed between the ages of 15 and 64, with the highest number of cases occurring in the 25-34, 15-24, and 45-64 age groups, respectively. Fractures are more common in men in early adulthood, while in women, two distinct peaks are seen in the 65-and-over age group and in younger age groups.

Significant changes were observed in the annual number of cases, with a particularly significant decrease in 2020 (χ^2 goodness of fit = 230.49, p<0.001). Figure 4 shows the patient distribution between 2017 and 2022. The highest number of patients was 340 in 2018 and 320 in 2019. However, this number dropped to 100 in 2020. Following an increase in 2021, a decrease was observed again in 2022. The decrease in the number of cases during the COVID-19 pandemic period suggests that it may be

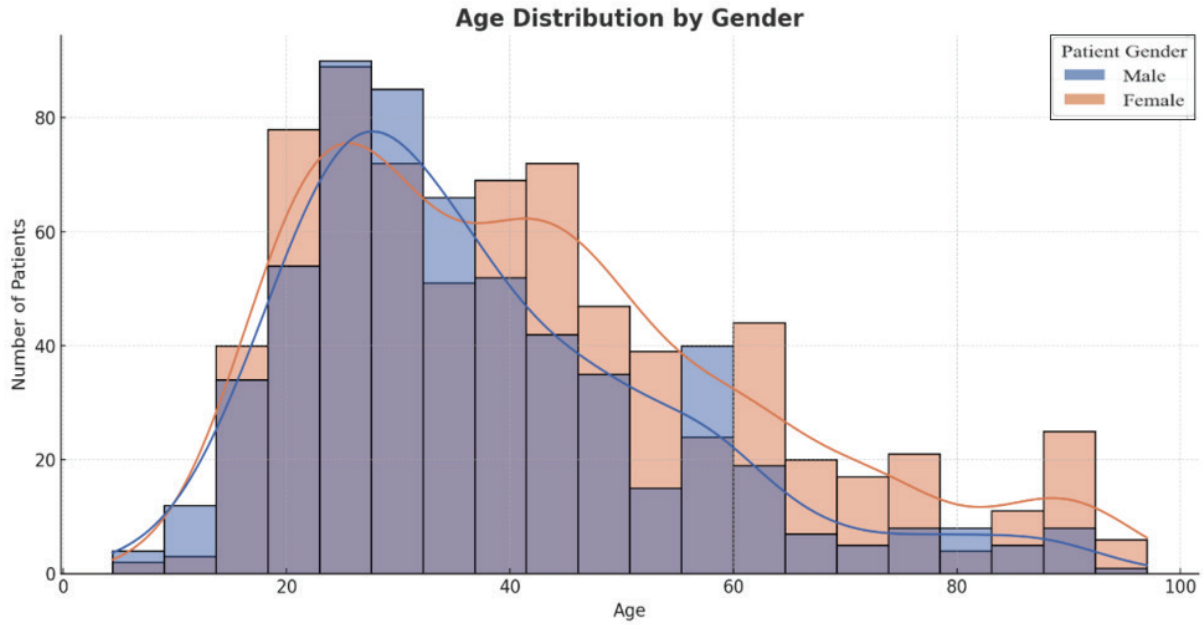

Figure 3. Age distribution by gender (female: n = 734; male: n = 590).

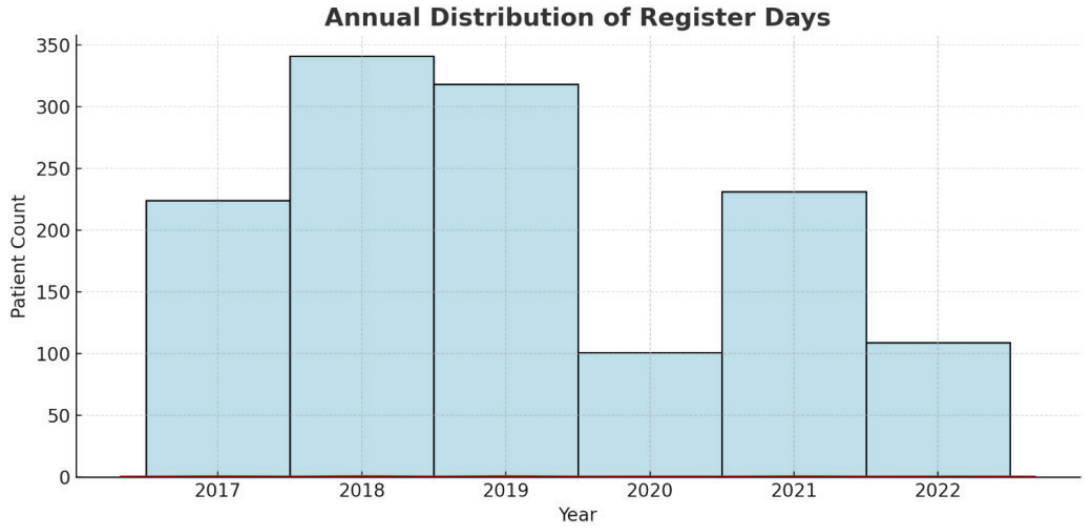

Figure 4. Annual distribution of register days.

related to the pandemic measures implemented during the pandemic.

Figure 5 illustrates the distribution of the most frequently diagnosed pelvic fracture types within the study cohort. The most common diagnosis was closed coccyx fracture, recorded in 642 patients and accounting for nearly half of all cases. Other frequent fracture types included:

- Fractures of other or unspecified parts of the lumbar vertebra and pelvis (129 cases)
- Closed acetabular fractures (122 cases)
- Closed pubic fractures (120 cases)
- Thoracic, lumbar, and pelvic fractures (85 cases)
- Multiple fractures of the lumbar spine and pelvis (79 cases)
- Closed sacral fractures (74 cases)
- Closed ilium fractures (61 cases)

In contrast, open fractures were rare, with only 5 cases of open ilium fracture, 3 of open acetabular fracture, and 2 cases each of open coccyx fracture and open fracture of unspecified pelvic regions.

Fracture cases applying to the emergency service were mostly coccyx fractures. They were seen more occurrent with low-energy trauma. These results showed that pelvic region fractures were mostly closed. It has been concluded that these fractures are most commonly caused by low-energy trauma resulting from falls. It has also sometimes been concluded that they are caused by compression forces. It has been concluded that they are seen in both young and old individuals. Open fractures are associated with high energy, are more common in young individuals, and are clinically significant.

Figure 6 shows the age distribution of fractures stratified by sex and visualized with a boxplot. Coccyx frac-

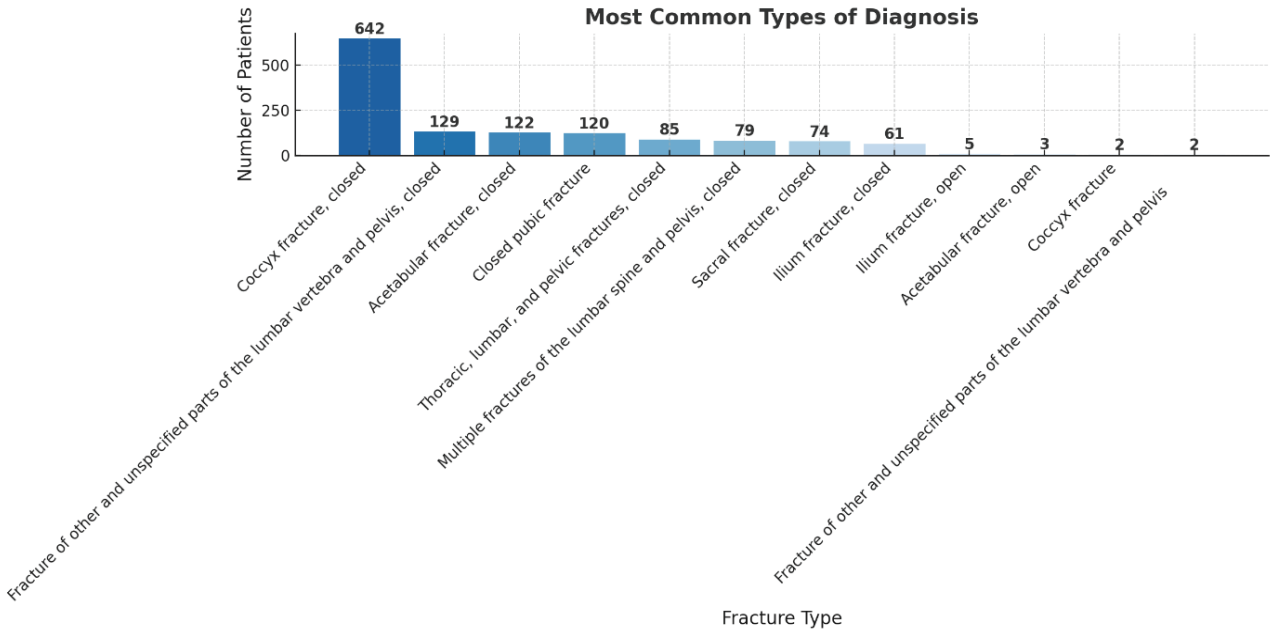

Figure 5. Distribution of pelvic fracture diagnoses.

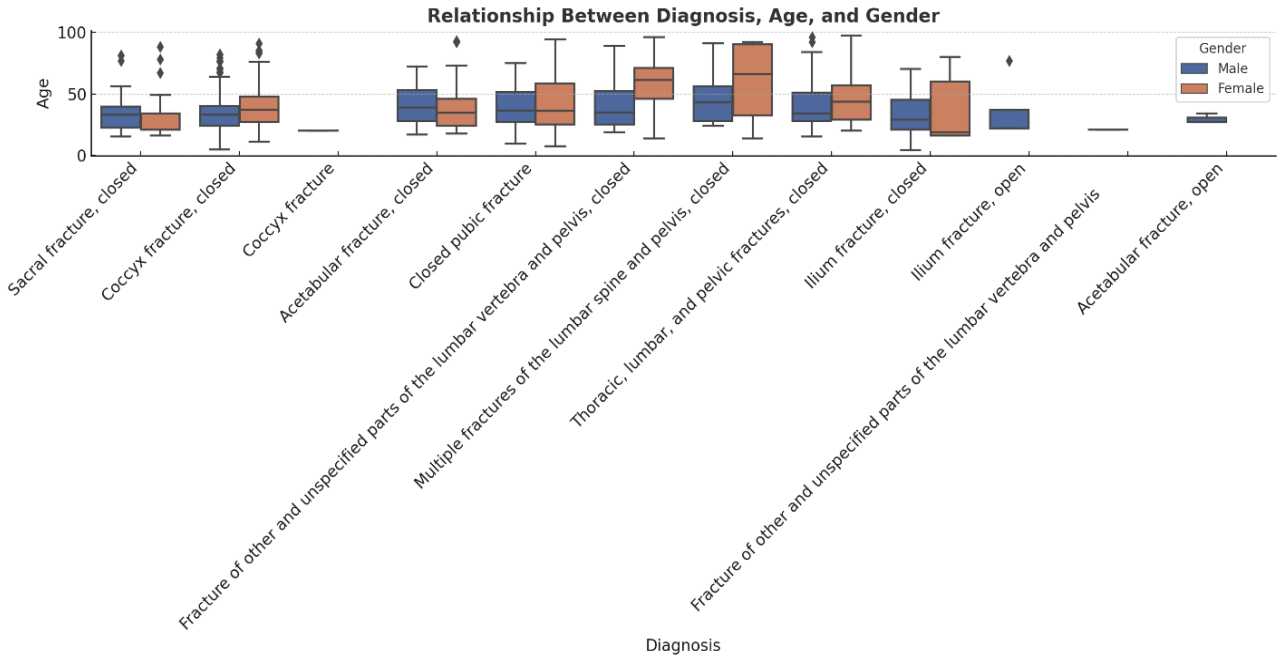

Figure 6. Relationship between diagnoses, age, and gender.

tures are the most common diagnosis. They show a wide age range in both men and women. Closed acetabular fractures are more common in predominantly middle-aged women. Closed pubic and sacral fractures are also seen in more commonly older ages.

Closed torsion vertebral fractures are more common in young men. Pelvic fractures are sometimes seen in conjunction with thoracic and lumbar vertebral fractures due to high-energy trauma. These multiple fractures are also seen in young men in association with high-energy traumas such as falls from heights, motor vehicle accidents, and workplace accidents. Open fractures, which occur from the same mechanisms, are also more common in young men.

Multiple fractures localized to more than one anatomic site were found to be more common in women. A wide age range was observed in female patients with multiple fractures. This condition was associated with osteoporosis in women.

Figure 7 shows the distribution of patients with pelvic fractures by age and gender, according to the department they receive care from. Emergency room and orthopedic

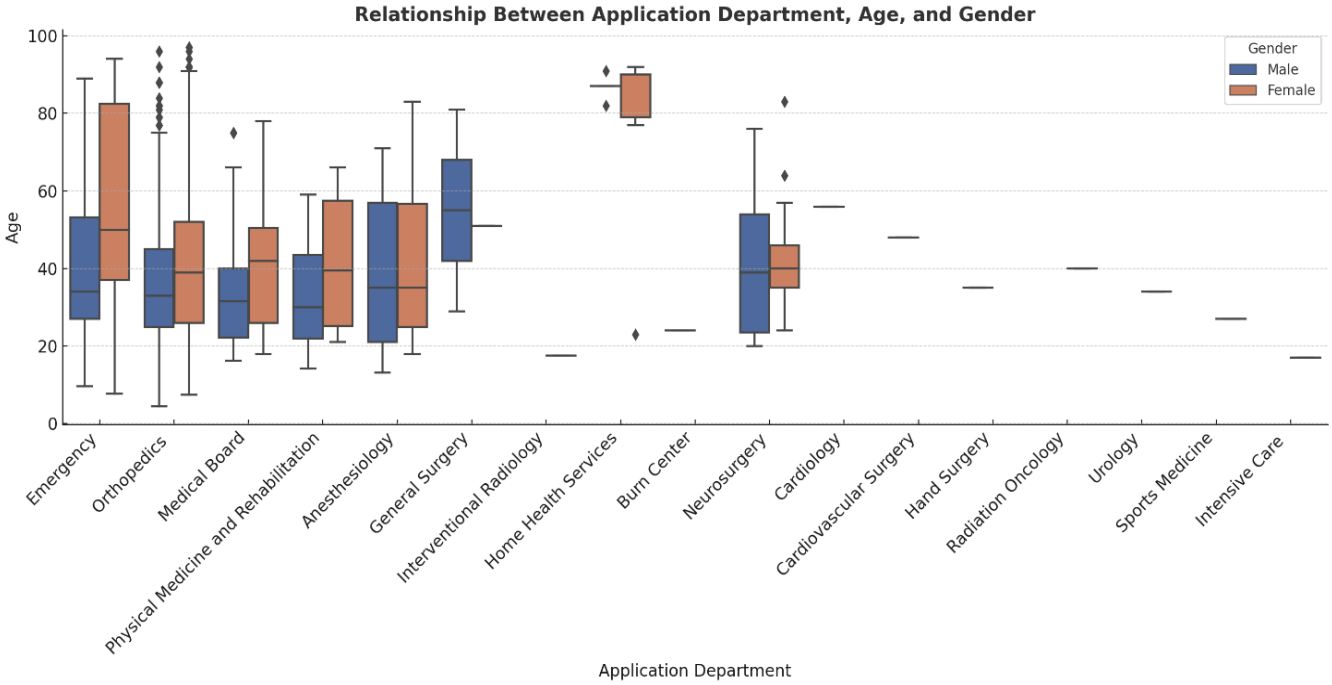

Figure 7. Relationship between application department, age, and gender.

Table 2. Analysis of age distribution by provision type and gender.

Provision Type	Median Age [IQR]	Kruskal–Wallis H (p)	Gender Difference Test	p (Gender)	Interpretation
Emergency	77 [51–89]	**H = 75.20** (<0.001)	Mann–Whitney U	> 0.12	No significant gender difference
Normal	35 [25–49]		Mann–Whitney U = 179.255	**< 0.001**	Significant gender difference
Traffic accident	34 [21–49]		Mann–Whitney U	> 0.12	No significant gender difference
Work accident	44 [29–45]		Mann–Whitney U	> 0.12	No significant gender difference
Forensic case	33 [23–68]		Mann–Whitney U	> 0.12	No significant gender difference

departments cover the widest age range. There is a predominance of males.

Table 2 shows median values of age. This reveals significant differences in age across provision types (Kruskal–Wallis H = 75.20, p<0.001). Median age [IQR]: Emergency 77 [51–89], Normal 35 [25–49], Traffic accident 34 [21–49], Work accident 44 [29–45], Forensic case 33 [23–68]. Within provision types, gender differences were observed only for normal admissions (Mann–Whitney U = 179.255, p<0.001); no significant gender differences were found in other categories (p>0.12).

Forensic cases are more concentrated in the age group (20-50). The male predominance is notable. The age distribution of traffic accidents is concentrated in the age group 20-40.

Table 3 show zero-inflated, right-skewed distributions with occasional long stays. Median LOS was 0 days in both groups; males had slightly higher LOS overall (Mann–Whitney U=222,006, p=0.026; Cliff's δ=0.025). The proportion with ≥1 hospital day was 5.8% in males vs 3.3% in females (χ^2=4.28, p=0.039).

Most male patients had a hospital stay of no more than 1-2 days, although some extended stays exceeding 40 days were observed. In our study, patients with pelvic fractures had short hospital stays. These were women who were prone to osteoporosis. However, pelvic fractures caused by high-energy trauma and open pelvic fractures were treated as hospitalizations. These cases were more common in young men.

Figure 8 shows the distribution of hospitalizations for pelvic fractures over time. Collaboration with orthopedic surgeons is essential for patients with pelvic fractures presenting to the emergency department. In our study, patients diagnosed with pelvic fractures were admitted to the Thoracic Surgery Department. This trend is reflected in cases involving pelvic fractures and torsion injuries in high-energy trauma. For example, pelvic fractures associated with rib fractures, pneumothorax, and diaphragmatic rupture make intervention by a thoracic surgeon essential. Our findings suggest that the vast majority of patients with acute pelvic fractures are treated collaboratively by the emergency department and orthopedics department.

Discussion

Our study was a retrospective, cross-sectional study. The demographics and clinical characteristics of 1,324 patients with pelvic fractures who presented to the emergency department over a five-year period were examined. Pelvic fractures were most common in young adults aged 25-34 and 15-24. This finding suggests that young men are more likely to experience high-energy trauma such as falls from high places, motor vehicle accidents, and workplace accidents (17–18). Pelvic fractures were found to be increased in women due to a tendency toward osteoporosis. Pelvic fractures are more common in women aged 65 and older due to a greater tendency toward frailty (19–20).

In our study, the most common fracture was a closed coccyx fracture, followed by acetabular and pubic fractures. Acetabular, pubic, and sacral fractures are more commonly caused by high-energy trauma. Open fractures are less common and occur as a result of multiple high-energy traumas.

Table 3. Distribution of hospitalization days (LOS) by gender.

Variable	Male	Female	Statistical Test	Test Statistic	p-value	Effect Size / Interpretation
Median LOS[IQR] (days)			Mann–Whitney U	U=222,006	p=0.026	Cliff's δ=0.025
Proportion with ≥1 hospital day (%)	5.8%	3.3%	χ^2 test	χ^2=4.28	p=0.039	Significant difference
Distribution shape (violin plot observation)	Zero inflated, right scewed, occasional long stays	Zero inflated, right scewed, occasional long stays				Similar pattern across genders

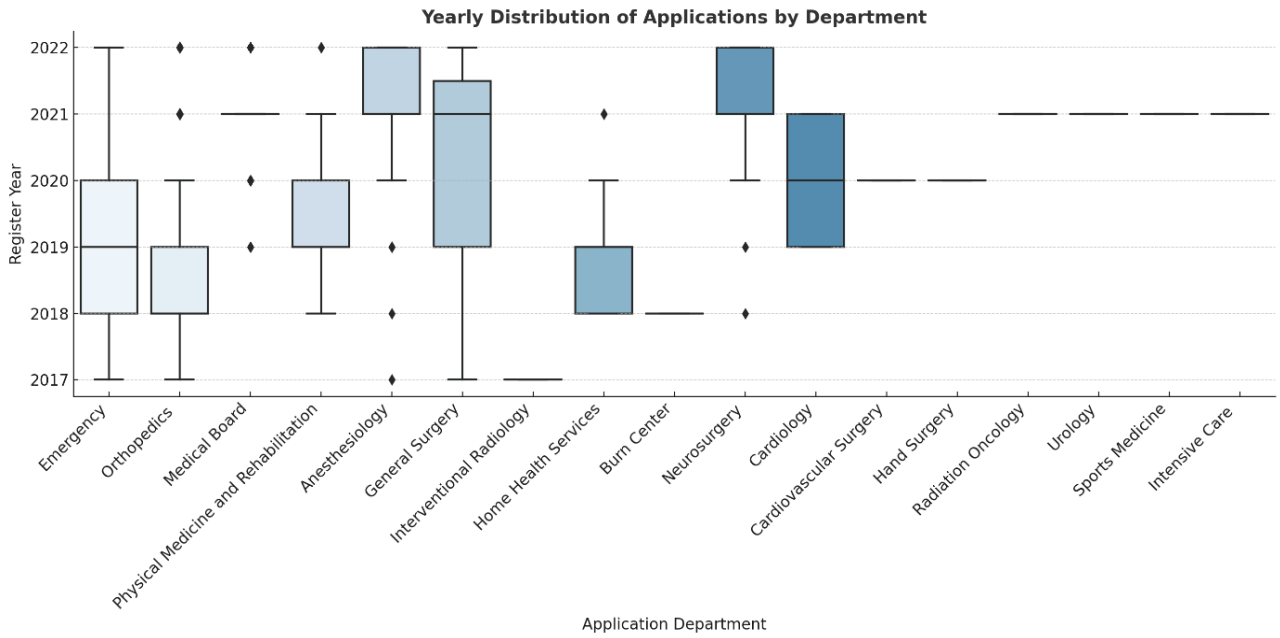

Figure 8. Yearly distribution of applications by department.

Men had more hospitalizations. Pelvic fractures were found to be more complicated and required longer hospital stays. Genitourinary and lower extremity injuries were more common due to high-energy trauma (17–18). Women had shorter hospital stays, a finding attributed to the fact that fractures in women were more likely to occur from low-energy trauma (19–21).

The COVID-19 pandemic was also found to be an external factor influencing the disease's development. Emergency room visits for trauma cases also decreased during the pandemic (22).

The highest case volume was observed in the emergency department and orthopedics departments. The thoracic surgery department highlights the association of pelvic fractures with multiple injuries within the field of thoracic surgery. It particularly highlights the association of pelvic fractures resulting from high-energy trauma with thoracic injuries. In the presence of thoracic surgery-requiring injuries, such as hemathorax and pneumothorax, it highlights the need for a coordinated multidisciplinary approach between emergency medicine, thoracic surgery, and orthopedics.

In elderly patients and in certain specific patients, MRI may be necessary in addition to conventional imaging to delineate the location of pelvic fractures (23). The Tile and Young-Burgess classification systems are used to classify pelvic fractures. Comminuted pelvic fractures can be life-threatening conditions such as hemorrhagic shock. Sharp bone ends can disrupt intra pelvic organs and the integrity of surrounding vessels and nerves. These conductions can cause potentially life-threatening trauma. Bleeding can also originate from the fracture itself. Embolism from a fracture can occur and be life-threatening (24). In our study, closed coccyx fractures were more common. Reducing mortality and morbidity in high-energy pelvic trauma depends on prompt bleeding control and coordination in emergency department patient management (25).

Overall, the findings support the implementation of age- and gender-specific preventive strategies, including traffic safety regulations, occupational risk reduction, osteoporosis screening, and early rehabilitation programs.

Strengths and Limitations

The strength of our study is its 5-year dataset and the use of a Python-based program. Our study's weaknesses include its single-center nature, lack of long-term follow-up, and inadequate diagnostic validation.

We believe this study will serve as an example for future multicenter studies with long-term follow-up. It has contributed to the literature on the epidemiological and clinical characteristics of pelvic fractures, the management of patients with pelvic fractures in the emergency department, and patient registration systems.

Conclusion

Our study included 1,324 patients presenting to the emergency department of a tertiary-level teaching and research hospital and diagnosed with pelvic fractures. The most common pelvic fracture was the coccyx fracture. Pelvic fractures are more common in women due to their predisposition to osteoporosis. Pelvic fractures in women are associated with low-energy trauma. Although the prev-

alence is across all ages, there is a higher prevalence in older age groups. Pelvic fractures in women are associated with low-energy trauma. Lower age is higher in men with low-energy trauma. It is more common in men due to high-energy trauma and at younger ages. Open and comminuted fractures are more common in men. We believe that men are at greater risk for mortality and morbidity. During the COVID-19 pandemic, emergency department visits with a diagnosis of pelvic fracture were observed to decrease in both genders.

Conflict of Interest Statement: The authors declare that there are no competing interests.

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