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Ten-Year Trends in Pelvic Fractures Among China's Aging Population: A Retrospective Single-Center Study

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Data Interpretation D
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Conflict of interest: None declared

Background: Pelvic fractures are a growing concern, particularly among the elderly, but data on fracture patterns in mainland China are limited. This study investigated the epidemiological trends of pelvic fractures amid an aging population in China.

Material/Methods: This retrospective study enrolled consecutive pelvic fracture patients aged ≥14 years treated at a level-1 trauma center in Beijing, China, between January 2013 and December 2022. Clinical and radiological data were collected and fractures were classified using Young-Burgess and AO/OTA systems based on X-ray and CT scans. Epidemiological trends were analyzed over the decade.

Results: A total of 1037 eligible patients were enrolled in this study. We observed an increase in case numbers and mean age of pelvic fracture patients, along with marked growth in both the number and proportion of elderly patients (≥60 years). Males were more prevalent overall, but females outnumbered males in patients over 70 years. Elderly patients had fewer urethral, spinal, and abdominal injuries but more comorbidities compared to younger patients. Fracture classification distribution remained stable over time ($P>0.05$) but differed significantly between younger and elderly patients ($P<0.05$). Surgical intervention rates increased significantly in the latter 5 years ($P<0.05$), with higher rates in younger patients ($P<0.05$).

Conclusions: The study reveals notable epidemiological shifts in pelvic fractures in China from 2013 to 2022, with a rise in elderly patients and variations in fracture patterns and treatments across age groups, highlighting the effects of an aging population.

Keywords: **Aging • Epidemiology • Fractures, Bone • Patients • Pelvis • Retrospective Studies**

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Introduction

The global aging population has profoundly reshaped the epidemiology of fragility fractures [1], with pelvic fractures emerging as a critical concern in geriatric trauma care [2-6]. Recent multinational studies reveal divergent trends. While Belgium reported a persistent rise in pelvic fracture incidence (1988-2018), predominantly among older adults [4], and Finland documented a sharp increase in osteoporotic pelvic fractures since the 1970s [5], U.S. data paradoxically showed declining rates (2007-2014) despite aging demographics [7]. These discrepancies underscore the need for region-specific analyses, particularly in developing nations. Notably, despite accounting for 20% of the world's elderly population, mainland China lacks comprehensive national data on aging-related pelvic fracture patterns.

To bridge this critical research gap, we established a project to build a Chinese pelvic fracture registry database in 2024, which will serve as a national-level platform for long-term monitoring of fracture patterns, treatment outcomes, and functional recovery. The project has systematically collected cases collated from various previous pelvic fracture-related clinical studies and plans to systematically collect case records for newly included cases; meanwhile, the project will include more orthopedic clinical centers in the future to diversify the sources of cases. This registry is expected to inform evidence-based prevention strategies, optimize resource allocation in trauma care, and ultimately improve population health by reducing disability burden associated with pelvic injuries, particularly in the context of China's rapidly aging society. In this study, we conducted an analysis of clinical data from the pelvic fracture registry database mentioned above. This was a single-center retrospective study from the National Orthopaedic Center between 2013 and 2022. This orthopedic center is located in northern China, with cases mainly from the northern and most of the central part of the country, but also from the southern part of the country, with an average of more than 200 pelvic fracture surgeries per year in recent years. This study aimed to elucidate the evolving epidemiological trends of pelvic fractures in the Chinese population, with particular emphasis on the aging demographic. The findings of this investigation are expected to provide valuable insights and evidence-based guidance for clinical practice and public health interventions in this increasingly important area of geriatric trauma care.

Material and Methods

This was a retrospective cohort study, and received ethics approval from the Institutional Review Board of our hospital. The study population comprised consecutive patients diagnosed with pelvic fractures who were admitted to the Department of Orthopedics and Traumatology at our level-1 trauma center between January 2013 and December 2022. In this database study, pelvic fracture cases were identified by screening medical records in the hospital system. Comorbidities and associated injuries were determined based on clinical diagnoses and validated ICD codes during data entry. Comprehensive patient data were systematically extracted from the registry database, with pelvic fracture diagnoses confirmed through radiographic evidence. Patients who met the following criteria were excluded: (1) patients aged below 14 years at the time of injury; (2) cases lacking either admission X-ray or computed tomography (CT) imaging; (3) patients presenting 21 days or more after injury; and (4) cases involving concomitant acetabular fractures.

After rigorous application of the inclusion and exclusion criteria, we conducted a comprehensive analysis of the epidemiological characteristics and temporal trends among the identified pelvic fracture cases across the 10-year study period. Moreover, to ensure diagnostic reliability and classification accuracy, 3 investigators independently evaluated all radiographic examinations, including pelvic X-rays and computed tomography (CT) scans. Fracture patterns were systematically classified according to both the Young-Burgess and AO/OTA classification systems. Discrepancies in initial classification were resolved through structured consensus meetings with joint image review by the 3 investigators who performed the original assessments, and final classification was determined by majority vote. Finally, we conducted a comprehensive analysis of pelvic fracture pattern variations from multiple perspectives.

Continuous variables are presented as mean standard deviation (SD) and the categorical variables are presented as frequency (%). The *t* test was used for continuous variables, while the chi-square test was used for categorical variables. Statistical analysis was performed using the IBM SPSS Statistical Package (version 25) (SPSS, Inc., Chicago, IL, USA). All statistical significance was established at $P<0.05$.

Results

The study cohort comprised 1037 eligible patients (mean age: 45.4±17.7 years; range: 14-93 years) for epidemiological trend analysis over the study decade. Notably, 231 patients (22.3%) were aged 60 years or older, forming the elderly subgroup. **Figure 1** presents the detailed study flowchart, illustrating patient enrollment and selection processes.

There was an overall upward trend in pelvic fracture incidence, with moderate annual fluctuations throughout the study period. The first 5 years accounted for 460 cases, while the subsequent 5 years showed a notable increase to 577 cases.

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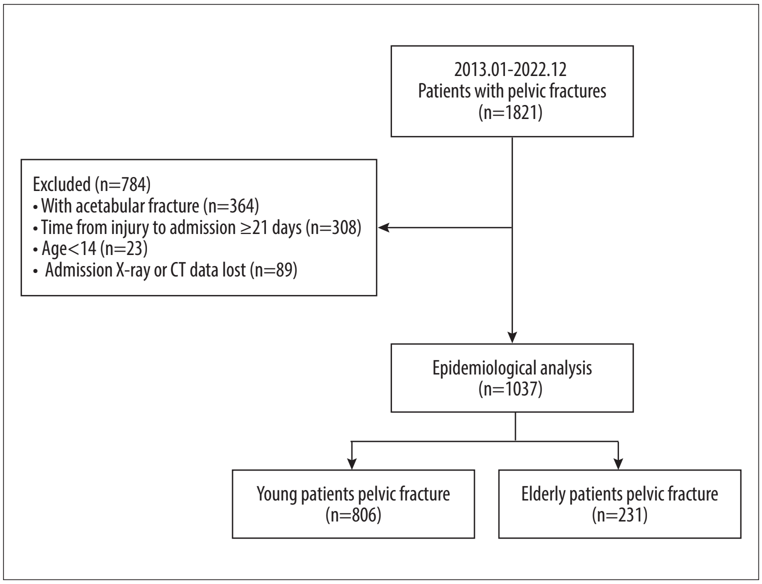

Figure 1. Flowchart of the study. (*PowerPoint 2019, version 2504, Microsoft*).

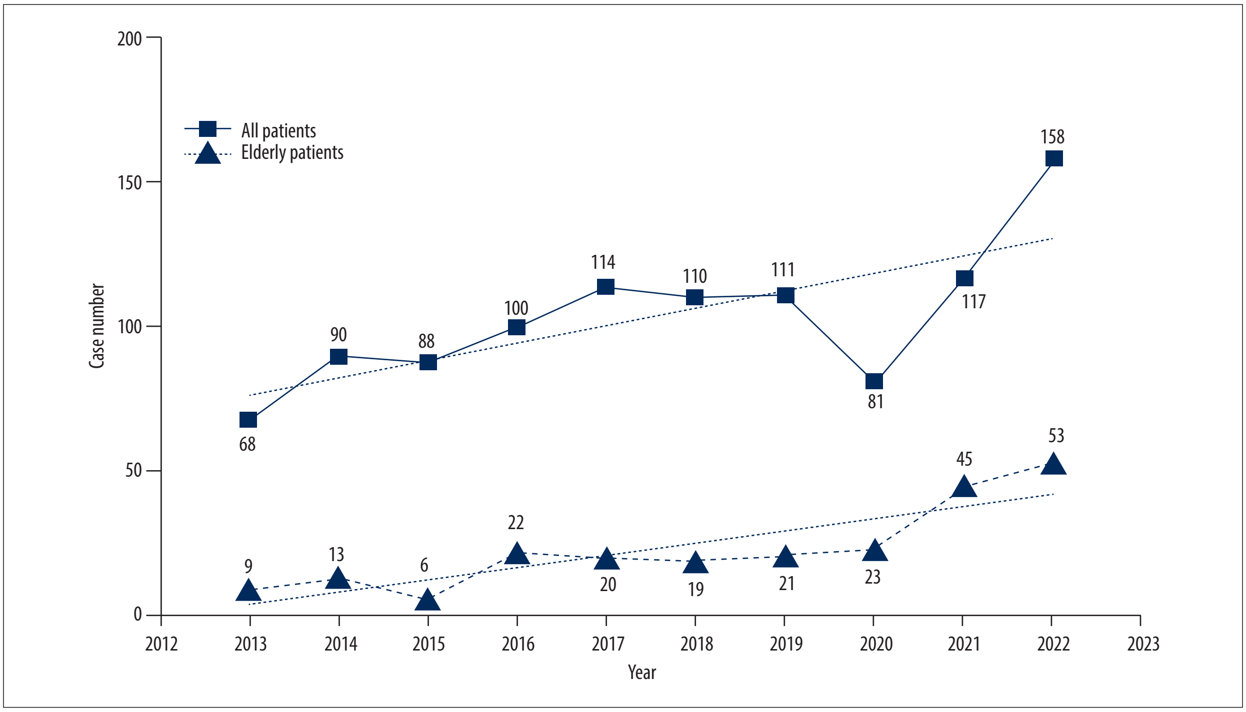

Figure 2. Case number of pelvic fracture change over years. (*GraphPad Prism, version 9.5.0.730, GraphPad*).

Similarly, the geriatric subgroup (age ≥60 years) demonstrated a pronounced yet fluctuating upward trajectory, with 70 cases identified in the first 5 years compared to 161 cases in the latter period, representing a 2.3-fold increase (**Figure 2**).

From 2013 to 2022, the proportion of elderly pelvic fracture patients showed a marked increasing trend with some fluctuations, as illustrated in **Figure 3**. The elderly proportion accounted for 15.2% of total cases in the first 5 years, which significantly increased to 27.9% in the subsequent 5-year period.

The annual mean age of pelvic fracture patients over the decade is shown in **Figure 4**. Overall, the mean age demonstrated a progressive increasing trend with some fluctuations, observed in both the overall patient population and the elderly subgroup. Additionally, the mean age in the latter 5-year period was significantly higher than that in the first 5 years (48.5±18.2 years vs 41.5±16.4 years, *P*<0.001) (**Table 1**).

The temporal trend in sex distribution (female-to-male ratio) among pelvic fracture patients over the decade is shown in

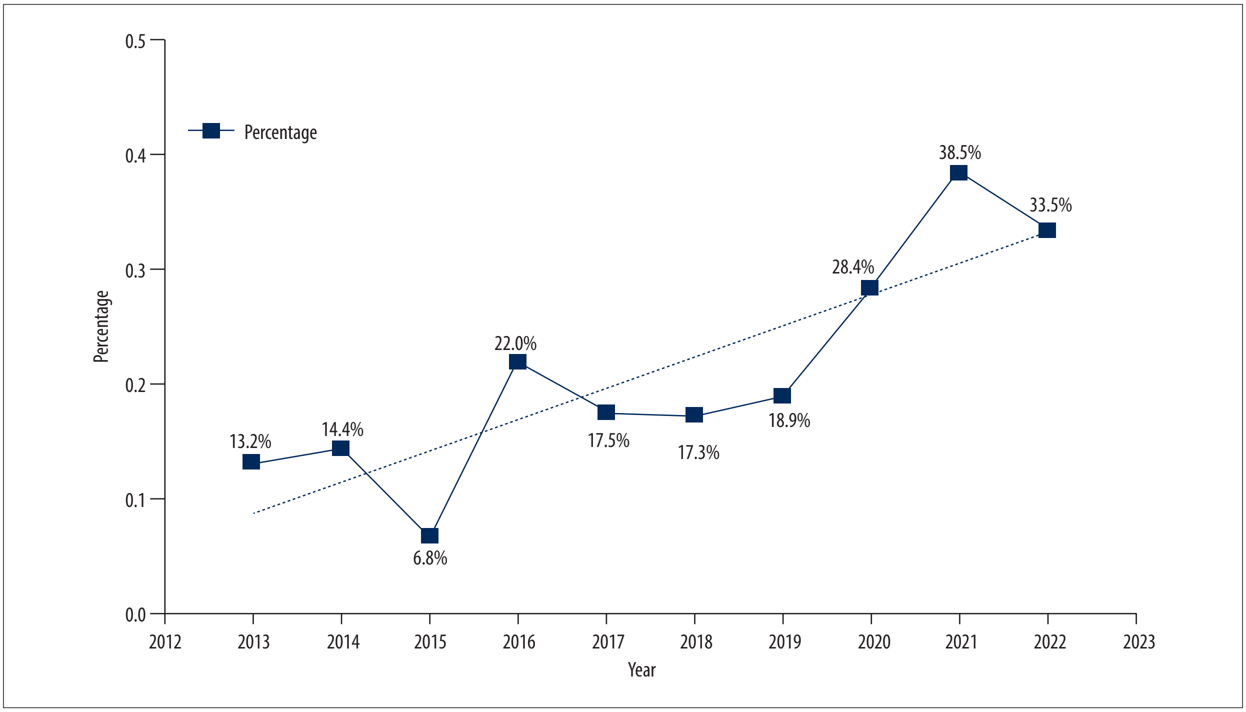

Figure 3. Proportion of elderly pelvic fracture change over years. (*GraphPad Prism, version 9.5.0.730, GraphPad*).

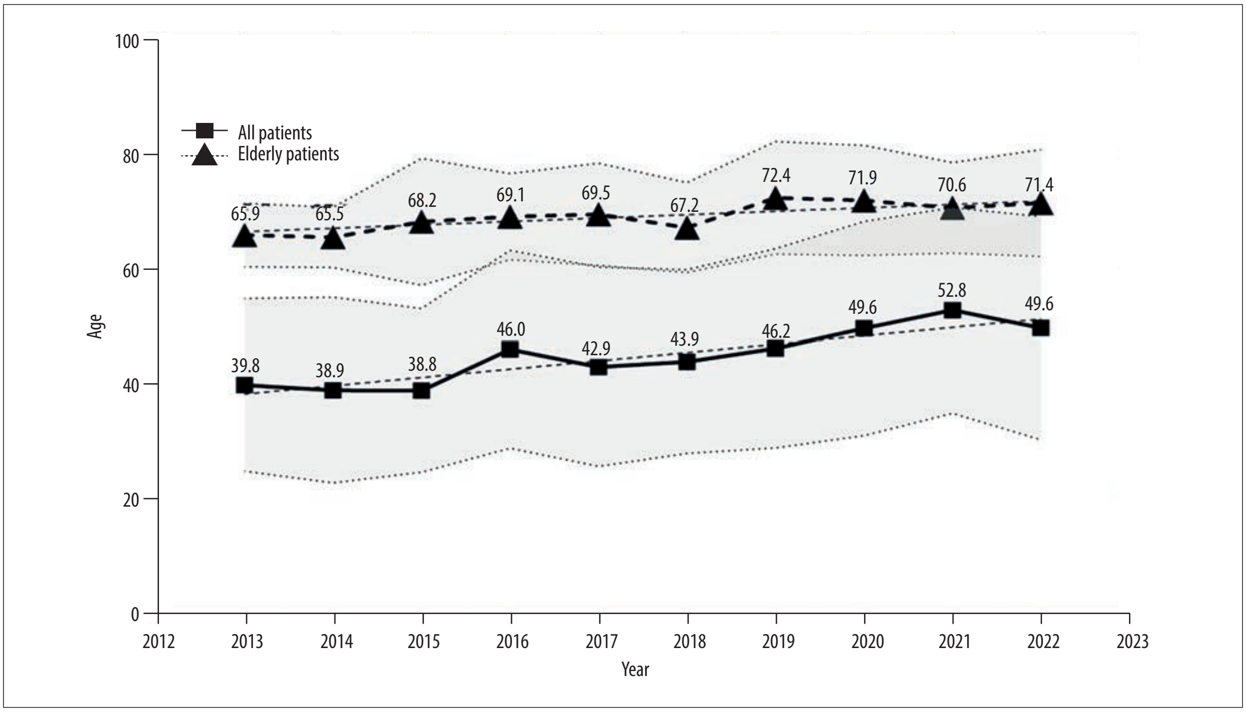

Figure 4. Trend charts of mean age over years. (*GraphPad Prism, version 9.5.0.730, GraphPad*).

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Table 1. Comparison of patient and fracture characteristics between different admission time group.

Variables	Total (n=1037)	2013-2017 (n=460)	2018-2022 (n=577)	P-value
Age of injury, years, Mean±SD	45.4±17.7	41.5±16.4	48.5±18.2	<0.001
Sex, n (%)				0.162
Male	578 (55.7)	268 (58.3)	310 (53.7)	
Female	459 (44.3)	192 (41.7)	267 (46.3)	
Comorbidity, n (%)				
Diabetes	55 (5.3)	20 (4.3)	35 (6.1)	0.277
Hypertension	96 (9.3)	29 (6.3)	67 (11.6)	0.005
CHD	23 (2.2)	7 (1.5)	16 (2.8)	0.251
Associated injuries, n (%)				
Urethra	54 (5.2)	23 (5.0)	31 (5.4)	0.898
Urinary bladder	27 (2.6)	16 (3.5)	11 (1.9)	0.167
Spinal	318 (30.7)	137 (29.8)	181 (31.4)	0.629
Craniocerebral	87 (8.39)	42 (9.13)	45 (7.80)	0.512
Thoracic	346 (33.4)	147 (32.0)	199 (34.5)	0.428
Abdominal	165 (15.9)	80 (17.4)	85 (14.7)	0.281
Upper limb fractures	251 (24.2)	108 (23.5)	143 (24.8)	0.679
Lower limb fractures	356 (34.3)	174 (37.8)	182 (31.5)	0.040
Young-Burgess classification, n (%)				0.068
APC-1	53 (5.1)	29 (6.3)	24 (4.2)	
APC-26	73 (7.0)	34 (7.4)	39 (6.8)	
APC-3	31 (3.0)	19 (4.1)	12 (2.1)	
LC-1	332 (32.0)	141 (30.7)	191 (33.1)	
LC-2	168 (16.2)	72 (15.7)	96 (16.6)	
LC-3	38 (3.7)	17 (3.7)	21 (3.6)	
VS	47 (4.5)	13 (2.8)	34 (5.9)	
CM	110 (10.6)	44 (9.6)	66 (11.4)	
Unable to classify*	185 (17.8)	91 (19.8)	94 (16.3)	
AO/OTA classification#, n (%)				0.121
A1	9 (0.9)	4 (0.9)	5 (0.9)	
A2	210 (20.3)	108 (23.5)	102 (17.7)	
B1	165 (15.9)	75 (16.3)	90 (15.6)	
B2	381 (36.7)	159 (34.6)	222 (38.5)	
B3	75 (7.2)	34 (7.4)	41 (7.1)	

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Table 1 continued. Comparison of patient and fracture characteristics between different admission time group.

Variables	Total (n=1037)	2013-2017 (n=460)	2018-2022 (n=577)	P-value
C1	147 (14.2)	54 (11.7)	93 (16.1)	
C2	37 (3.6)	21 (4.6)	16 (2.8)	
C3	13 (1.3)	5 (1.1)	8 (1.4)	
Underwent surgery for pelvic fracture, n (%)	535 (51.6)	207 (45.0)	328 (56.8)	<0.001

* Avulsion fractures or isolated pubic/ischial remus fractures of pelvic ring were unable to be classified by Young-Burgess classification system; # Transverse undisplaced sacral body fractures (61A3) were not included in this study as these cases were specifically diagnosed and managed as sacral fractures rather than pelvic fractures in our institution. CHD – coronary heart disease; DVT – deep venous thrombosis; APC – anterior posterior compression; LC – lateral compression; VS – vertical sheer; CM – combined mechanism; AO/OTA – Arbeitsgemeinschaft für Osteosynthesefragen/Orthopaedic Trauma Association.

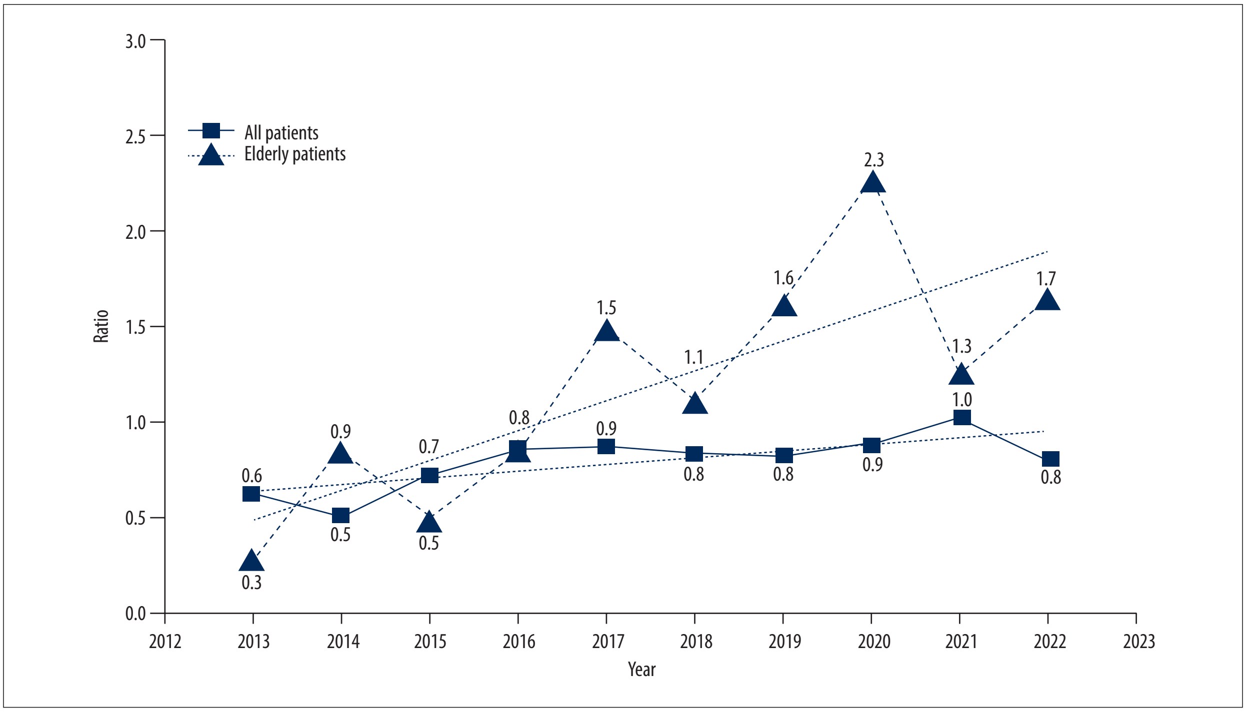

Figure 5. Trend charts of sex ratio over years. (*GraphPad Prism, version 9.5.0.730, GraphPad*).

Figure 5. There were more male patients in the overall patient population, with female patients showing a slight but non-significant increasing trend (female patients 41.7% in the first 5 years vs 46.3% in the subsequent 5 years, *P*>0.05, **Table 1**). However, a markedly different pattern emerged in the elderly subgroup, where the female-to-male ratio increased significantly from 0.3 in 2012 to 1.7 in 2022 (female patients 45.7% in the first 5 years vs 60.2% in the subsequent 5 years, *P*=0.041), resulting in female patients outnumbering male patients in recent years within this age group.

Figure 6 illustrates the age distribution of pelvic fracture patients and sex proportions within each age group. The age distribution showed a unimodal pattern, with the highest incidence observed in people aged 40-50 years old, while most cases were in those aged 20-70 years. The sex distribution demonstrated distinct characteristics across different age groups: the 14-20 year age group showed nearly equal sex proportions; there were more male patients in the 20-30 year age group, accounting for 62.6% of cases; the 20-60 year age range maintained an approximate 3: 2 male-to-female ratio; and in patients aged over 60 years, the proportion of female patients progressively increased with advancing age, while male proportions showed a corresponding decline, leading to more female than male patients in the over 70 years age group.

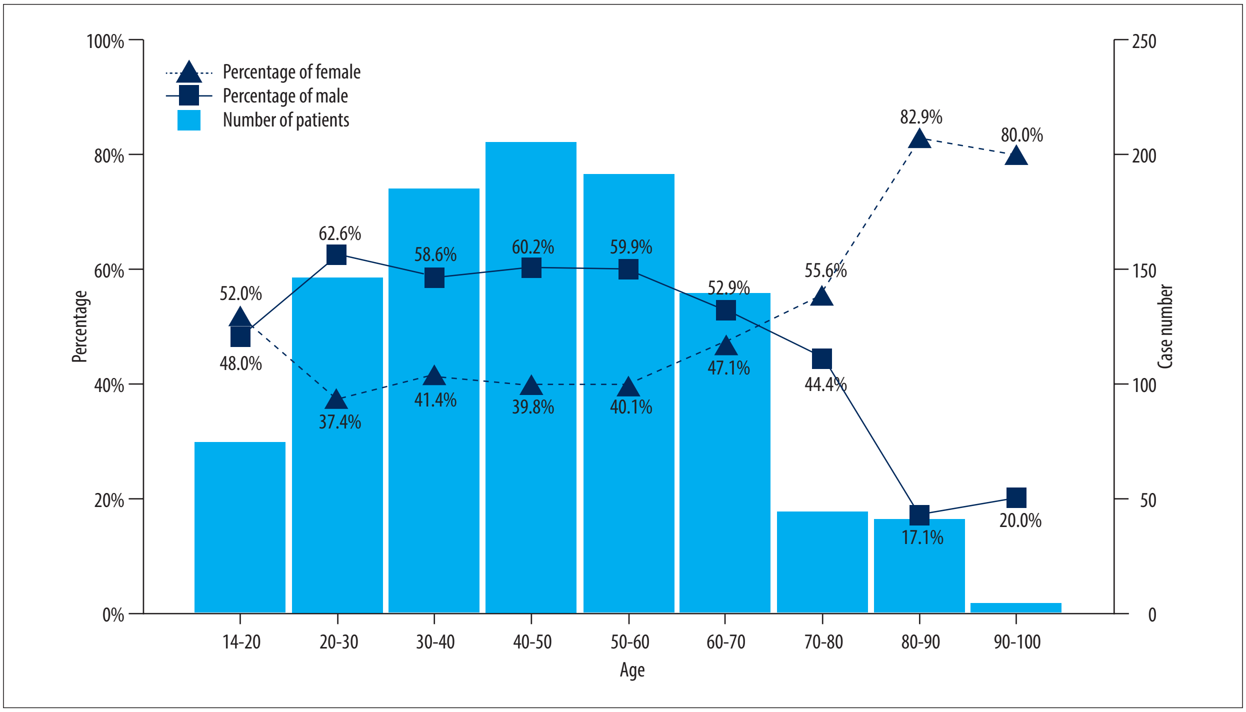

Figure 6. Trend chart of sex ratio by age group. (*GraphPad Prism, version 9.5.0.730, GraphPad*).

Table 2. Comparison of fracture characteristics between different age groups.

Variables	Total (n=1037)	<60 years (n=806)	≥60 years (n=231)	P-value
Age of injury, years, Mean±SD	45.4±17.7	38.4±12.6	70.0±8.7	<0.001
Sex, n (%)				<0.001
Male	578 (55.7)	476 (59.1)	102 (44.2)	
Female	459 (44.3)	330 (40.9)	129 (55.8)	
Comorbidity, n (%)				
Diabetes	55 (5.3)	24 (3.0)	31 (13.4)	<0.001
Hypertension	96 (9.3)	35 (4.3)	61 (26.4)	<0.001
CHD	23 (2.2)	3 (0.4)	20 (8.7)	<0.001
Associated injuries, n (%)				
Urethra	54 (5.2)	48 (6.0)	6 (2.6)	0.043
Urinary bladder	27 (2.6)	25 (3.1)	2 (0.9)	0.060
Spinal	318 (30.7)	269 (33.4)	49 (21.2)	<0.001
Craniocerebral	87 (8.4)	71 (8.8)	16 (6.9)	0.363
Thoracic	346 (33.4)	274 (34.0)	72 (31.2)	0.422
Abdominal	165 (15.9)	148 (18.4)	17 (7.4)	<0.001
Upper limb fractures	251 (24.2)	202 (25.1)	49 (21.2)	0.228
Lower limb fractures	356 (34.4)	272 (33.7)	84 (36.4)	0.460

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Table 2 continued. Comparison of fracture characteristics between different age groups.

Variables	Total (n=1037)	<60 years (n=806)	≥60 years (n=231)	P-value
Young-Burgess classification, n (%)				<0.001
APC-1	53 (5.1)	41 (5.1)	12 (5.2)	
APC-26	73 (7.0)	69 (8.6)	4 (1.7)	
APC-3	31 (3.0)	29 (3.6)	2 (0.9)	
LC-1	332 (32.0)	270 (33.5)	62 (26.8)	
LC-2	168 (16.2)	126 (15.6)	42 (18.2)	
LC-3	38 (3.7)	30 (3.7)	8 (3.5)	
VS	47 (4.5)	43 (5.3)	4 (1.7)	
CM	110 (10.6)	88 (10.9)	22 (9.5)	
Unable to classify*	185 (17.8)	110 (13.6)	75 (32.5)	
AO/OTA classification#, n (%)				<0.001
A1	9 (0.9)	8 (1.0)	1 (0.4)	
A2	210 (20.3)	129 (16.0)	81 (35.1)	
B1	165 (15.9)	129 (16.0)	36 (15.6)	
B2	381 (36.7)	305 (37.8)	76 (32.9)	
B3	75 (7.2)	69 (8.6)	6 (2.6)	
C1	147 (14.2)	121 (15.0)	26 (11.3)	
C2	37 (3.6)	36 (4.5)	1 (0.4)	
C3	13 (1.3)	9 (1.1)	4 (1.7)	
Underwent surgery for pelvic fracture, n (%)	535 (51.6)	443 (55.0)	92 (39.8)	<0.001

* Avulsion fractures or isolated pubic/ischial remus fractures of pelvic ring were unable to be classified by Young-Burgess classification system. # Transverse undisplaced sacral body fractures (61A3) were not included in this study as these cases were specifically diagnosed and managed as sacral fractures rather than pelvic fractures in our institution. APC – anterior posterior compression; LC – lateral compression; VS – vertical sheer; CM – combined mechanism; AO/OTA – Arbeitsgemeinschaft für Osteosynthesefragen/ Orthopaedic Trauma Association.

Table 1 shows a comprehensive comparison of demographic and fracture patterns between pelvic fracture patients in the first (2013-2017) and latter (2018-2022) 5-year periods. Regarding comorbidities, hypertension prevalence showed a significant increase in the latter period (P<0.05), whereas no significant differences were observed in diabetes or coronary heart disease (CHD) prevalence (P>0.05). The incidence of concomitant lower-limb fractures decreased significantly (P<0.05), with no significant changes in other associated injuries (P>0.05). Fracture pattern analysis revealed similar distributions between both periods (P>0.05). According to the Young-Burgess classification, LC-1 type fractures were most prevalent (32.0%), followed by LC-2 type fractures (16.2%), while 17.8% of cases were unclassifiable. Based on the AO/OTA classification, B2 type fractures were the most common (36.7%), followed by A2 type (20.3%), B1 type (15.9%), and C1 type (14.2%) fractures. Additionally, the surgical intervention rates increased significantly from 45.0% to 56.8% between the 2 5-year periods (P<0.001).

Table 2 presents a comprehensive comparison of demographic characteristics and fracture patterns between younger and elderly pelvic fracture patients. Younger patients had a mean age of 38.4±12.6 years, significantly lower than that of elderly patients (70.0±8.7 years, P<0.001). There were more male patients among the younger patients (59.1%), while female

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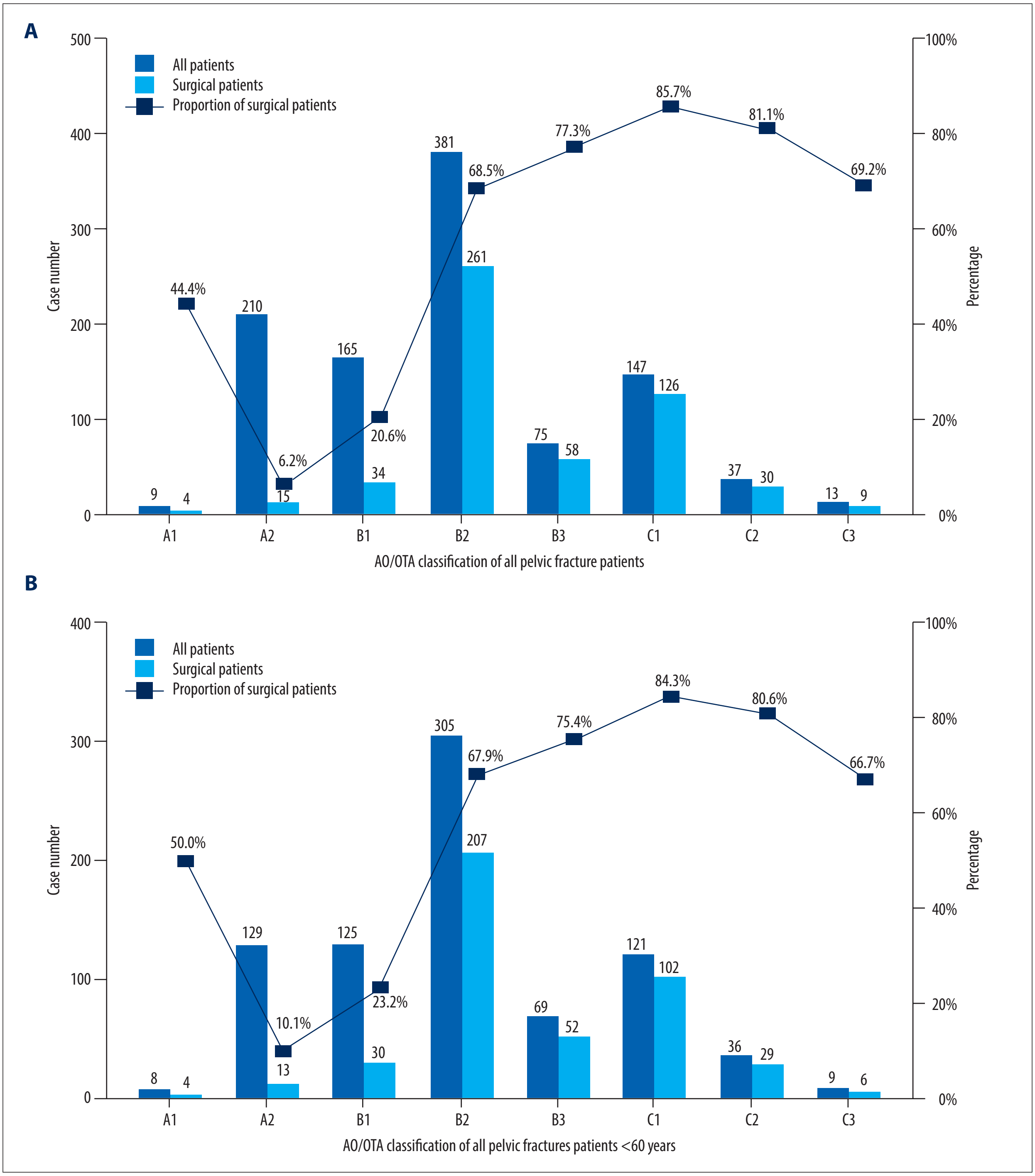
patients constituted the majority in the elderly group (55.8%), with this sex distribution difference reaching statistical significance (*P*<0.001). Regarding comorbidities, elderly patients demonstrated significantly higher prevalence rates of hypertension, diabetes mellitus, and coronary heart disease compared to younger patients (*P*<0.001). Analysis of associated injuries revealed that elderly patients had significantly lower rates of urethral, spinal, and abdominal injuries (*P*<0.05), while no significant differences were observed in other associated injuries (*P*>0.05). Fracture pattern analysis using the Young-Burgess classification showed that LC-1, LC-2, CM, and unclassifiable fractures were most common in both groups. However, significant distribution differences were observed (*P*<0.001): younger patients had higher proportions of APC-2, APC-3, LC-1, and VS types, while elderly patients showed increased prevalence of unclassifiable fractures (32.5% vs 13.6%). According



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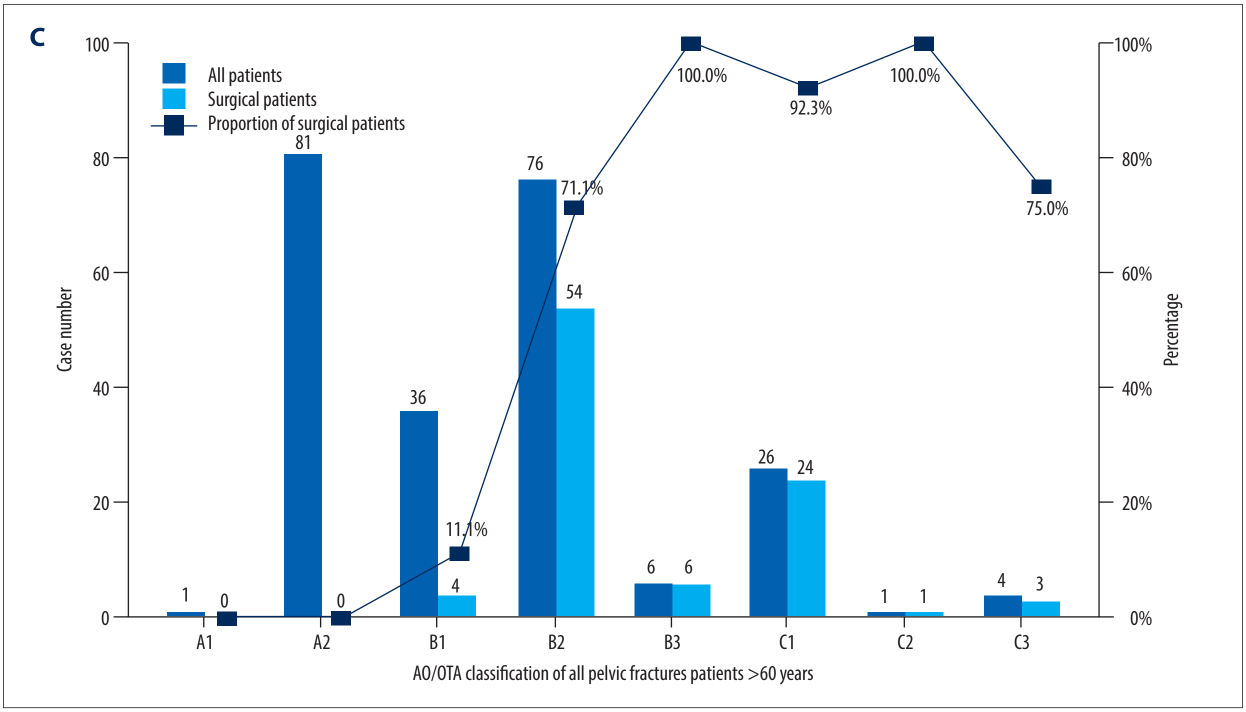

Figure 7. (**A**) Distribution of fracture types in all pelvic fracture patients treated with surgery. (**B**) Distribution of fracture types in young pelvic fracture patients treated with surgery. (**C**) Distribution of fracture types in elderly pelvic fracture patients treated with surgery. (*GraphPad Prism, version 9.5.0.730, GraphPad*).

to the AO/OTA classification, A2, B1, B2, and C1 types were most prevalent in both groups, with significant distribution differences ($P<0.001$): elderly patients had higher proportions of A2 type fractures (35.1% vs 16.0%), whereas younger patients showed increased prevalence of B2, B3, C1, and C2 type fractures. Moreover, surgical intervention rates were significantly higher in younger patients compared to their elderly counterparts ($P<0.001$).

Figure 7 illustrates the number and proportion of surgically treated cases among pelvic fracture patients, categorized according to the AO/OTA classification. B2, C1, and B3 type fractures accounted for most surgical cases in both younger and elderly patient groups. From a proportional perspective, B2-type and more complex fractures demonstrated the high surgical intervention rates in both age cohorts. Notably, while surgical treatment was occasionally performed for A1 and A2 type fractures in younger patients, no surgical interventions were recorded for these fracture types in the elderly population.

Discussion

In this study, we performed a comprehensive retrospective analysis using our institution's pelvic fracture registry database, examining 10-year epidemiological trends from multiple perspectives. Our findings provide substantial evidence that the epidemiology of pelvic fractures is undergoing significant transformations in the context of population aging.

Transverse undisplaced sacral body fractures (61A3) were not included in this study because these cases were specifically diagnosed and managed as sacral fractures rather than pelvic fractures in our institution.

Our findings revealed significant epidemiological shifts in pelvic fractures, with increasing case numbers, rising mean age of patients, and growing numbers and proportions of elderly patients. These epidemiological patterns are consistent with findings reported in previous studies [2-6], suggesting that these changes represent a global phenomenon rather than isolated observations. These trends may be attributed to several interrelated factors. First, population aging has increased the proportion of elderly individuals who are more susceptible to pelvic fractures due to age-related osteoporosis and higher fall risk [8]. Second, improved diagnostic capabilities, particularly the increased use of CT scans, have enhanced detection of pelvic fractures that might have been missed previously [9,10]. The expansion of trauma center networks and increased public awareness of fracture management may have contributed to higher case reporting rates [11]. Additionally, our study revealed a unimodal age distribution of pelvic fracture patients, with the most patients observed in the 40-50 year age group. This pattern is consistent with findings from another epidemiological study on pelvic fractures in China [12], further validating the age distribution of pelvic fractures in the China. In **Figure 2**, we observed a significant decrease in the number of pelvic fracture patients in 2020, but not in elderly patients. This may be related to the COVID-19 pandemic, as China's epidemic prevention and control measures may have reduced the occurrence of high-energy injury accidents, but did not prevent the occurrence of low-energy injury accidents that lead to pelvic fractures in the elderly.

Regarding sex distribution, our study demonstrated male predominance in the overall Chinese patient population, consistent with previous study [12]. However, studies by Elias et al [2] and Natalie et al [3] reported a female predominance, possibly due to more advanced population aging in France and Sweden, where the mean age of pelvic fracture patients was 74.6 and 76 years, respectively, compared to 45.4 years in our study. Notably, our findings revealed an increasing proportion of female patients among the elderly population, with females outnumbering males in patients over 70 years old. This trend aligns with observations by Elias et a.[2] and Natalie et al [3], supporting the global pattern of sex distribution shifts in elderly pelvic fracture patients.

Regarding comorbidities, our study found significantly higher prevalence of hypertension, diabetes, and coronary heart disease among elderly pelvic fracture patients compared to their younger counterparts, reflecting the age-related nature of these conditions. Furthermore, the increasing proportion of patients with hypertension may correlate with both the aging trend of pelvic fracture patients and advances in Chinese medical services.

Regarding associated injuries, elderly pelvic fracture patients showed significantly lower rates of urethral, spinal, and abdominal injuries compared to younger patients, potentially due to lower-energy trauma mechanisms in the elderly population [6,8,13,14]. Additionally, the study revealed a decreasing trend in concomitant lower-extremity fractures over time, which may be also attributed to the growing proportion of elderly patients who typically experience lower-energy trauma, resulting in fewer associated injuries.

In this study, according to the Young-Burgess classification, LC-1 type fractures were most prevalent, followed by LC-2, with 17.8% of cases unclassifiable, consistent with previous studies [15,16]. The AO/OTA classification analysis revealed B2-type and A2-type fractures as most common, followed by B1 and C1 types, showing partial agreement with international studies [16] but notable discrepancies from another Chinese study [15]. Of particular interest, Zhang et al [15] demonstrated C3-type fractures as the most common, which may be related to their institution's admission criteria and the known inter-observer variability in AO/OTA classification [15,17,18].

Our study revealed significant differences in fracture patterns between younger and elderly patients. Younger patients showed higher proportions of APC-2, APC-3, and VS types according to the Young-Burgess classification, along with more B2, B3, C1, and C2 types in the AO/OTA system, reflecting their association with high-energy trauma mechanisms [8,13,14]. In contrast, elderly patients had a higher prevalence of fractures unclassifiable by the Young-Burgess system and more A2 type fractures in the AO/OTA classification. This pattern likely results from the incidence of low-energy mechanisms in elderly patients, often resulting in isolated pubic and ischial rami fractures [6,19,20]. The Young-Burgess classification's inability to categorize these common elderly fractures is a notable limitation of this system, while the AO/OTA classification includes A2 type fractures for such injuries [21,22]. In the context of increasing elderly pelvic fracture cases, there is a pressing need for a novel classification system specifically tailored to the unique characteristics of pelvic fractures in the elderly population.

In 2013, Rommens proposed a novel classification system for pelvic fractures in the elderly, focusing on the degree of instability, which has addressed the limitations of traditional classification systems in characterizing fragility fractures [23]. Recently, a series of clinical studies based on this Fragility Fractures of the Pelvis (FFP) classification have been conducted, establishing evidence-based treatment strategies for different fracture types and gaining widespread clinical acceptance [24]. Given its superior applicability to elderly patients and proven clinical utility, we will use the FFP classification for summarizing and analyzing elderly pelvic fracture cases in our database in future studies.

In terms of surgical management, our study found significantly higher surgical rates in younger patients compared to elderly patients, consistent with previous reports [2]. This disparity may be attributed to several factors: younger patients typically sustain high-energy injuries resulting in more complex fracture patterns [8,13,14], while elderly patients often present with multiple comorbidities that increase surgical risks [25]. Additionally, cultural hesitancy toward invasive procedures, reduced functional demands, and financial burden among elder pelvic fracture patients may also contribute to this trend. The overall surgical rate markedly increased during the latter 5-year period, likely reflecting improved healthcare resources and subsequent advances in pelvic fracture management philosophy in mainland China. At our institution, the maturation of robot-assisted sacroiliac screw fixation techniques and the development of pelvic fracture reduction robots have significantly improved surgical outcomes, enabling surgical management for many patients [26-29]. Since 2022, our center has pioneered and implemented robot-assisted reduction and internal fixation for displaced and unstable pelvic fractures in elderly

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patients, achieving excellent clinical outcomes [30]. Compared to the substantial intraoperative trauma and bleeding associated with traditional open surgery for pelvic fracture [31,32], robot-assisted techniques – with their minimally invasive approach, intelligent navigation capabilities, and proven efficacy – provide a promising solution to address the clinical challenges of the increasing rates of elderly pelvic fractures in aging populations.

Among surgically treated cases, B2, C1, and B3 type fractures predominated, consistent with established surgical indications [25,33]. It is important to note that no A1 or A2 type fractures in elderly patients were treated surgically. This is in accordance with current clinical practice guidelines, which state that isolated anterior pelvic ring fractures in elderly patients usually require conservative management [23,25]. The surgical rate of pelvic fractures varies with different types of fractures, which guides clinicians to adopt different treatment strategies for different types of pelvic fractures. When the fracture type is AO/OTA B2 or above, surgical treatment should be performed. In addition, we have observed that there is still a significant proportion of C3 fractures that have not received surgical treatment, and the reasons for this need further investigation to improve the efficacy of treatment of severe pelvic fractures.

This study is the first comprehensive analysis of pelvic fracture epidemiology in China, utilizing our institution's pelvic fracture registry database – the first such registry established in China and across Asia – to reveal significant epidemiological shifts through multi-dimensional analysis in the context of population aging. However, several limitations should be acknowledged. First, the retrospective design hindered accurate collection of injury mechanism data and differentiation between high- and low-energy trauma, along with a lack of osteoporosis-related data. Second, the single-center design with a relatively small sample size may have led to regional bias. These findings need validation through larger-scale, multicenter, prospective studies in the future.

Conclusions

We found significant epidemiological transformations in pelvic fractures in China from 2013 to 2022, characterized by a substantial increase in elderly patients. Furthermore, the analysis demonstrates marked differences in fracture patterns and treatment approaches between younger and older populations, highlighting the profound impact of population aging on pelvic fracture epidemiology.

Declaration of Figures' Authenticity

All figures submitted have been created by the authors, who confirm that the images are original with no duplication and have not been previously published in whole or in part.

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