



Epidemiology Of Pelvic Ring Fractures and Injuries: A Retrospective Study

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Abstract

BACKGROUND: Despite relatively rare occurrence in trauma victims, pelvic fractures have a high risk of mortality and morbidity.

AIM: This study was conducted to study epidemiology of patients with pelvic ring injuries in a level 1 trauma center in Kazakhstan.

METHODS: This is a descriptive cross-sectional study within a single institution. In the period of 2014–2017, we encountered 212 patients with pelvic fractures. About 92% of them had concomitant injuries due to a high-energy trauma. Measures were compared using the SPSS 20.0 program.

RESULTS: The mean age was 34.5. Pelvic fractures are more often verified in males. The most common mechanism of injury was road traffic injuries and falls from heights. The highest recovery rates were observed for type B fractures, but mortality was highest for type C fractures. The average length of hospital stay was 18.71 days. Non-surgical treatment was used in 62.3% of patients, external fixation device was imposed as an emergency intervention in 64.2% (n = 136) of patients.

CONCLUSIONS: Overall most patients with pelvic fractures had multiple injuries and the mortality rate was 7.1%. Non-surgical treatment was most commonly used. Type C fractures had significantly fatal outcome.

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Introduction

Pelvic fractures are a serious medical problem and are often associated with multiple system injuries with high mortality [1], [2], [3]. The incidence of pelvic fractures is relatively small, 16% of the total number of injuries [4]. Unstable injuries of pelvic rings, accompanied by shock and bleeding result in a significantly worse prognosis [5].

Recent publications have focused on examining the effects of injuries to the pelvic bones, providing emergency care, and various treatment methods [6], [7], [8]. A few publications are devoted to the study of the epidemiology of pelvic injuries, where the authors evaluate the sex and age structure of patients with pelvic injuries [1], [9], [10], the place and mechanism of injury, the anatomical location of injuries, and other indicators [5], [11], [12].

The aim was to study the epidemiology of patients admitted with pelvic fractures at level 1 trauma

center of the city of Nur-Sultan of the Republic of Kazakhstan.

Methods

This study is a descriptive retrospective within a single institution. This work was carried out as part of a grant-financing project of the Ministry of Education and Science of the Republic of Kazakhstan: IRNAP05135531 "Development of tools for rehabilitation of orthosurgical patients with pelvic injuries in road accidents in the Republic of Kazakhstan." The present study protocol was reviewed and approved by the Ethics Committee of Semey State Medical University dated on September 22, 2017. Informed Consent: Informed consent was obtained from patients who participated in this study.

The cross-sectional study design is used. It includes all cases of pelvic injuries (n = 212) of the

patients that were on inpatient treatment in “Nur- Sultan city Hospital No. 1” for the period from January 1, 2014, to December 31, 017. The main source of information was Form No. 027/u: “Extract from the inpatient medical record.” The following information was copied for the study: Age, gender (male/female), race (Asian/European), injury mechanism (concealment of the mechanism, road traffic injuries (passenger/driver), road traffic injuries (motorcycle), fall from own height, a fall from a height of more than 1 m, road traffic injuries (collision with a pedestrian), industrial, domestic (intentional)), place of injury (unknown/city/village/highway/house, institution, organization), date of arrival (day of the week/season), the affected ring side (right/left/both/symphysis), concomitant injuries, emergency intervention (use of an external fixation device/no intervention), Tile classification of pelvic injuries (A/B/C), treatment (non-surgical/surgical), and its outcomes (recovery/death).

All statistical analyses were performed using SPSS 20.0 program. Descriptive statistics, Chi-square test for nominal data, non-parametric Kruskal–Wallis test for independent samples, and Mann–Whitney U test were used to describe the data.

Results

The results were presented in a descriptive manner. 212 cases of pelvic injuries were analyzed, that were on inpatient treatment in level 1 trauma center for the 4-year period.

The mean age of the victims was 34.5 years (95% confidence interval [CI] Min 15, Max 80, Me 31. Range 65). The mean age of men was 32.61 years (95% CI 30.52; 34.70; Min 16, Max 71, Me 30. Range 55). The mean age of women was 37.12 years (95% CI 33.69; 40.56; Min 15, Max 80, Me 33. Range 65), $p = 0.081$.

The male to female ratio was 123/89, with males forming the majority in the study population (58%). About 84.4 % of patients ($n = 179$) were Asians and 15.6% ($n = 33$) were Europeans.

According to the seasons, cases of the pelvic bone injuries were recorded as follows: In the spring of 21.7% ($n = 46$), in the winter of 17.5% ($n = 37$), in the summer of 33.0% ($n = 70$), and in the autumn of 27.8% ($n = 59$).

The results of the distribution of pelvic injuries among the days of the week were interesting (Table 1).

On Monday 4.2% ($n = 9$), on Tuesday - 22.2% of cases ($n = 47$), on Thursday – 26.4% of cases ($n = 56$) on Friday – 8% ($n = 17$), on Saturday – 24.5% of cases ($n = 52$), and on Sunday 5.7% ($n = 12$).

Table 1: The distribution of pelvic injuries by day of the week

Day of the week	n	%
Monday	9	4.2
Tuesday	47	22.2
Wednesday	19	9.0
Thursday	56	26.4
Friday	17	8.0
Saturday	52	24.5
Sunday	12	5.7
Total	212	100.0

The distribution of injuries by the mechanism of injury is presented in Table 2.

Table 2: The distribution of injuries by the mechanism of injury

No.	Mechanism of injury	n	%
0.	Unknown (concealment of mechanism)	1	0.5
1.	Road traffic injuries (total 59.8%)		
	Passenger/driver	51	24.1
	Motorcycle	4	1.9
	Pedestrian collisions	70	33.3
	Railway	1	0.5
2.	Fall from heights (total 35.4%)		
	Fall from own height	12	5.7
	Fall from a height more than 1 m	63	29.7
3.	Occupational injury	8	3.8
4.	Domestic injury (intentional)	2	0.9
	Total	212	100.0

Regarding the mechanism of the pelvic ring injuries, we observed that in 24.1% of cases ($n = 51$) traffic accidents (passenger/driver) became the cause of pelvic injuries, in 29.7% of cases ($n = 63$) - a fall from a height of more than 1 m, and in 33.0% of cases ($n = 70$) - collisions with pedestrians.

About 56.1% (119) of the patients were injured in urban areas, 34.0% (72) - in the home/organization or institution, 9% (19) - on the highway, 0.5% (1) - in rural areas, and 0.5% (1) - concealed circumstances and place of injury.

Detailed distribution of the fractures according to the Tile/AO classification is shown in Table 3.

Table 3: Affected ring side and pelvic ring fracture/injury classification (Tile classification)

Affected ring side	n	%
Both	65	30.7
Symphysis	16	7.5
Left	64	30.2
Right	64	30.2
Others	3	1.4
Total	212	100.0
Tile/AO Classification	n	%
Type A	87	41
Type B	92	43.4
Type C	33	15.6
Total	212	100.0

Most of the fractures were Type B - 43.4% ($n = 92$), followed by Type A - 41.0% ($n = 87$).

Treatment outcomes of patients with the pelvic bone injuries, based on the Tile/AO classification, are presented in Figure 1.

The highest recovery rates were observed for type B fractures, but mortality was highest for type C fractures. $p = 0.025$.

The average length of hospital stay for men was 18.80 days (95% CI 16.12; 21.49; Min 1, Max 66, Me 15. Range 65). The average length of hospital

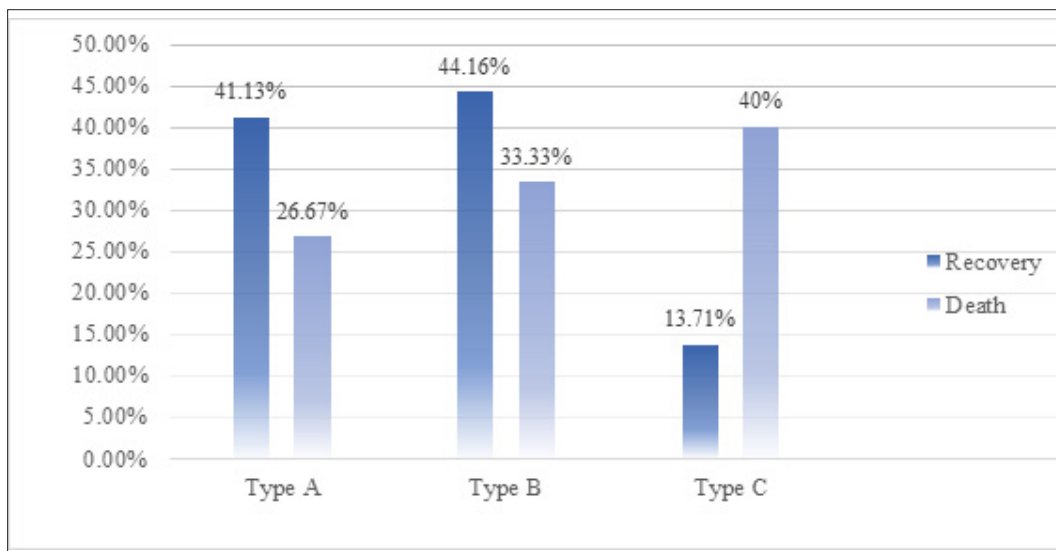


Figure 1: Treatment outcomes of patients with the pelvic fractures, according to Tile/AO classification

stay for women was 18.57 days (95% CI 14.99; 22.16; Min 1, Max 106, Me 14. Range 105) $p = 0.876$.

The average length of stay in the intensive care unit for men was 1.63 days (95% CI 0.83; 2.42; Min 0, Max 32, Me 0. Range 32). The average length of stay in the intensive care unit for women was 1.60 days (95% CI 0.29; 2.90; Min 0, Max 42, Me 14. Range 42) $p = 0.115$.

Isolated pelvic fractures were rare. According to Table 4, it is clear that 92% of patients with pelvic bone injuries had concomitant injuries. Most common non-orthopedic injuries were head, chest and limb, internal organ injuries (63 cases, 29.7%).

Table 4: Concomitant injuries

Concomitant injuries	n	%
No concomitant injuries	17	8.0
Head injuries	29	13.7
Head injuries, chest and limb injuries	56	26.4
Head injuries, chest and limb injuries, internal organ injuries	63	29.7
Head injuries, chest and limb injuries, internal organ injuries, genitourinary injuries	3	1.4
Head injuries, chest and limb injuries, genitourinary injuries	1	0.5
Head injuries, internal organ injuries	2	0.9
Head injuries, internal organ injuries, genitourinary injuries	1	0.5
Chest and limb injuries	25	11.8
Chest and limb injuries, internal organ injuries	9	4.2
Internal organ injuries	3	1.4
Internal organ injuries, genitourinary injuries	1	0.5
Genitourinary injuries	2	0.9
Total	212	100.0

On admission, an external fixation device was applied as an emergency intervention to stabilize the pelvic bones in 64.2% ($n = 136$) of patients. About 35.4% ($n = 75$) of patients were admitted without emergency intervention, and one patient (0.5%) received emergency surgical treatment of the pelvic bone injuries.

Eighty patients (37.7%) were managed surgically while 132 (62.3%) were given conservative treatment.

About 92.9% ($n = 197$) of the patients were discharged, 7.1% ($n = 15$) had a fatal outcome (did not need surgical treatment, $p = 0.001$).

Discussion

Pelvic fractures are more common in patients of the first four decades of life [11]. Thus, the average age of the patients with pelvic bone injuries in our study was 34.5, which is slightly lower than the average age indicated in retrospective study by Ruatti, aimed to identify pelvic ring anatomical lesions [5], and studies by other authors (37 years and older) [1], [13]. This can be explained by the fact that Nur-Sultan is the capital, where a lot of young people migrate from other regions in search of work.

The predominance of people of Asian ethnicity among the patients is due to the predominance of the indigenous population of the Republic of Kazakhstan. It should be noted that pelvic fractures are subject of men of economically active working age [14]. However, according to some foreign authors, the frequency of fractures among men is 2.73/10,000 (2.48–3.01), among women significantly higher – 5.82/10,000 (5.46–6.20) [9], [10]. There were no significant differences between the ages of affected men and women in our study ($p > 0.05$).

It was observed that the largest number of patients with pelvic injuries was recorded in summer and autumn. On Monday and Sunday, the frequency of damage to the pelvic bones was minimal. We associate this with the work schedule of the victims. Nonetheless, no references in the literature regarding these parameters were retrieved.

The most common mode of injury was road traffic injuries comprising 59.8% of the cases (Table 2), falls from heights were 35.4%. Similar data are presented in foreign publications [15]. According to Chueire *et al.*, traffic accidents caused pelvic injuries in 58% of cases, and high mortality due to falls from a height was observed (18%) [4], [16], [17]. Falls from a

height of more than 1 m occurred in 6% of cases in one of the studies, which is much less than in our study [13]. We believe that this is due to the active construction work in the capital. Compliance with traffic regulations as well as strict observance of safety measures in construction are the need of the hour.

It should be noted that in our study there were no significant differences between the mechanism of injury and the age of the victims ($p > 0.05$), as well as the length of stay in the intensive care unit ($p > 0.05$). However, there was a statistically significant difference between the mechanism of the pelvic bone injuries and the length of hospitalization ($*p < 0.05$). The urban zone was the most frequent place where the injuries occurred which is consistent with other studies [13].

We observed that both sides of the ring were affected equally. The rarest but most prognostically unfavorable was type C fractures (Table 3). Foreign data also indicate a higher frequency types A and B pelvic fractures according to the Tile/AO classification [11].

In our study, an external fixation device was applied to stabilize the pelvic bones in 64.2% ($n = 136$) of patients. About 35.4% ($n = 75$) of patients were admitted without emergency intervention, and one patient (0.5%) received emergency surgical treatment of the pelvic bone injuries, whereas according to Damasceno *et al.*, only 16.6% ($n = 11$) needed emergency fixation. We associate such differences with a small sample size of their study (66 people) [13].

The average length of hospital stay was 18.71 days. The average length of stay in the intensive care unit was 1.61 days, which does not contradict foreign publications [1], [10]. It should be noted that there were no statistically significant differences in the above indicators between men and women ($p = 0.876$ and $p = 0.115$, respectively).

The direct result of high-energy trauma is a high frequency of multiple lesions (92%), which affect patient prognosis. Foreign sources give us slightly fewer data. In a study by Gomes *et al.*, only 54% of patients with pelvic bone injuries had concomitant injuries [17]. At the same time, 15% of them needed exploratory laparotomy [17], whereas in our study it was performed only on 1 patient (0.5%). Pereira *et al.* indicated that 42.4% of patients with pelvic ring injuries had concomitant injuries [13].

It can be noted that a combination with a head injury (Table 4) occurred in 13.7% of cases ($n = 29$), with head, chest, and limb injuries together - in 26.4% of cases ($n = 56$), with head, chest, and limbs, and internal organ injuries - in 29.7% of cases ($n = 63$). In a similar study, Giannoudis *et al.* noted a combination of the pelvic bone injuries with a head injury in 16.9% of patients, with chest injuries in 21.2% of the patients, which does not contradict our data [18].

In the present study, fatal outcome was recorded in 7.1% of victims ($n = 15$) admitted

to hospital treatment. Type C pelvic injury was significantly more likely to cause death, as shown in Figure 1 ($*p < 0.05$). And in patients with surgical treatment of pelvic ring injury, there were no fatal outcomes ($p = 0.001$). Similar indicators were reflected in the publications of Balogh *et al.*, where hospital mortality was about 10% [19], [20]. Foreign data also confirm that type C pelvic injury is a predictor of fatal outcome [3], [4].

We believe that present study gives an idea about demographic factors and causes of pelvic fractures in Kazakhstan. Unfortunately, there is no unified trauma registry that would simplify the collection of data for retrospective studies in the Republic of Kazakhstan. For further investigation a unified trauma registry should be established.

Conclusions

Based on the results of this study, the following conclusions can be made: Pelvic injuries prevail in males; the greatest number of injuries was recorded in summer and autumn; road traffic accidents, falls from a height occupy a leading place among the causes of pelvic injuries; most injuries do not need emergency intervention; non-surgical treatment is the most common; in cases treated surgically, external fixation device was used as an emergency intervention. About 92% of patients with pelvic bone injuries had concomitant injuries. Type C pelvic injury was significantly more likely to cause fatal outcome.

Authors Contributions

Conceptualization: Zhunussov ET. Data curation: Efendiyeva EI. Formal analysis: Efendiyeva EI, Messova AM. Methodology: Efendiyeva EI., Messova AM., Myssayev AO, Zhunussov ET, Tlemissov AS, Murat Muratoglu. Validation: Efendiyeva EI. Investigation: Efendiyeva EI., Myssayev AO. Writing original draft: Efendiyeva EI. Writing-review and editing Messova AM., Zhunussov ET.

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