Incidence of pelvic trauma and relative risk factors for mortality: a population based study in Iran

Background: Pelvic trauma (PT) constitutes one of the most devastating injuries in musculo-skeletal trauma. Early treatment and focusing on predisposing factors predicting mortality are essential. We tried to investigate distribution of demographics pelvic trauma, its various causes ,types, fracture sites, associated injuries, and risk factors for mortality on a population basis.

Methods: Of 68102 patients with pelvic trauma, 68000 patients were included for the final analysis. Information about all patients with any ICD-9-CM coded as pelvic injury was retrieved as part of a claims dataset. Based on Revised Trauma Score (RTS), Injury Severity Score (ISS) and Age, Trauma - Injury Severity Score (TRISS) was recorded as predictors of survival rate.

Results: The incidence rate PT is 13.9/100,000 person years (9.9/100,000 for male, 4/100,000 for female). The highest incidence rate PT was in the age 46-60 years group. The highest mortality rate PT happened in the age group more than75 years. The mean length of stay was 8.5 days (females, 7.4 ± 1.3 days; males, 9.2 ± 3.5 days; p<0.02). The trauma indices showed that PT had significantly higher mean AIS in the abdomen> chest> head> >multiple pelvic fracture as well as higher average ISS. They also showed lower mean RTS and lower mean probability of survival (TRISS). The most common causes of mortality of PT were massive hemorrhage (42%) and the second was multiple pelvic fractures. (39%) Also, demographic characters such as male gender (P<0.02), age >75years (P<0.03), smoking (P<0.05), automobile accident (P<0.05) set the patient at risk of mortality.

Conclusion: The overall incidence rate of pelvic trauma was higher in the older age male and in low socioeconomic level. Also, massive bleeding, multiple pelvic fractures, coagulopathy problems and injury-related abdominal injuries were stronger positive predicting factors for mortality.

Keywords: pelvic trauma, risk factor, mortality, Iran

Introduction

Pelvic fractures usually result from high energy trauma and in approximately 90% of cases there are associated injuries [1,2]. Pelvic fractures range in severity from low-energy, relatively benign injuries to life-threatening, unstable fractures. Pelvic fractures frequently cause injury to organs contained within the bony pelvis. In addition, trauma to extra pelvic organs is common. Pelvic fractures are often associated with severe hemorrhage due to the extensive blood supply to the region [3-9]. The ring formed by the fused bones of the ischium, ilium and pubis attaches to the sacrum and contains vital structures including major blood vessels and nerves and digestive and reproductive organs. Major pelvic fractures can therefore be catastrophic, mainly due to blood loss. They result from very high-energy trauma such as those generated in road traffic accidents, crush injuries or falls from height. Major pelvic injuries can be devastating and are often associated with a number of complications that may require extensive rehabilitation. Pelvic trauma deaths frequently occur as a result of associated injuries and complications rather than the pelvic injury itself [10,11]. Blunt pelvic trauma with unstable pelvic fractures and related late impairments has been reported to significantly affect morbidity as long as one year after the injury [12]. A study in the UK reported that 20% of seriously injured blunt-trauma patients associated with pelvic fracture [13]. Other studies have reported pelvic fracture mortality rates that vary from 5 up to 50% in open pelvic fracture [14-19]. In Australia, pelvic fractures have placed a growing demand on healthcare resources and costs over the past 10 years [20]. In Taiwan, the incidence

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rate of pelvic fracture was higher in females over 44 years of age. Associated injuries were stronger positive factors for the risk of mortality than gender, fracture sites, injury mechanisms [21]. However, because pelvic fracture leads to an increased health burden and the lengths of hospital stays as long as total inpatient medical costs. Epidemiological information as well as the predictors for mortality in pelvic fracture is deserved for each country. However, data about epidemiological information of pelvic fracture, such as prevalence, distribution of fracture sites and associated injuries, risk factors of mortality are not well documented in recent Asian studies. We aimed to investigate the epidemiology of pelvic fracture in west of Iran population and to look at the risk factors associated with mortality.

Methods

The study data of 220102 trauma patients were collected in trauma center department of Kermanshah University of medical sciences from May 2011 to March 2017 and prospectively reviewed. Of 68102 patients with pelvic trauma, 68000 patients were included for the final analysis. Data that were collected included: (1) the patient's demographic profile(2), mechanisms of injury (3),Type of pelvic fractures(classified according to the Tile classification)(4), Chronic comorbidities(5), associated injuries(6), injury severity (7) pelvic fracture severity (8), the presence of associated injuries (classified according to AIS)(9), interventions received (10) Socio-Economic levels(11), length of stay in the hospital (12) mortality upon one month after discharge(13) and finally risk factors of mortality (14). Patients were stratified into 6 age groups :< 15, 15-30, 31-45, 46-60, 61-75 and >75 years old. External morbidity and associated injuries were inferred from the ICD-9-CM codes declared in the same admission data file. Annual inpatient claim files with any diagnostic ICD codes in the 808 range (808.00-808.99), defined as fracture of pelvis, were included in this study. E-codes were classified into groups and represented five common injury mechanisms, such as automobile accident, motorcycle accident, Biker, Pedestrian hit by car, fall from a height. Fracture sites, such as the sacrococcygeal, pubis, ilium, ischium, acetabulum and open pelvic fracture were categorized. Also, liver, renal and endocrine diseases, cancer, diabetes, hypertension, cardiovascular diseases, osteoporosis and other chronic disease were grouped as variables chronic comorbidities. Head injuries (including neck and cervical spine), Chest injuries (including thoracic spine and diaphragm), abdominal injuries (including abdominal organs and lumbar spine), face injuries (including the facial skeleton, nose, mouth, eyes and ears) and extremities fractures were grouped as associated injuries variables. Trauma and injury severity score (TRISS), introduced in 1981, is a combination index based on Trauma Score (RTS), Injury Severity Score (ISS), and patient's age [22,23]. The revised trauma score is made up of a sum of results from three categories; Glasgow Coma Scale, Systolic blood pressure, and respiratory rate. The score ranges from 0-12. The Injury Severity Score (ISS) is an anatomical scoring system that provides an overall score for patients with multiple injuries. Each injury is assigned an Abbreviated Injury Scale (AIS) score and is allocated to one of six body regions (Head, Face, Chest, Abdomen, Extremities (including Pelvis), External). The AIS is a consensus derived, anatomically based system of grading injuries on an ordinal scale ranging from 1 (minor injury) to 6 (Lethal injury) [24]. The ISS is defined as the sum of squares of the highest AIS grade in the 3 most severely injured body regions. Six body regions are defined, as follows: The thorax, abdomen and visceral pelvis, head and neck, face, bony pelvis and extremities, and external structures. Only one injury per body region is allowed. The ISS ranges from 1-75, and an ISS of 75 is assigned to anyone with AIS of 6. Patient was clinically assessed and managed as per the ABC protocol (Airway, Breathing and Circulation). After stabilizing the patient, detailed history was recorded and general physical/systemic examination was done. The following RTS, ISS and age were determined for calculating TRISS [25]. TRISS determines the probability of survival (PS) of a patient from the ISS and RTS. Overall mortality for patients with pelvic trauma was upon 30 days after discharge. Appropriate informed consent and demographic data obtained for filling 22-item questionnaire and cooperation for serial visits after medical intervention. Also, the study was approved by faculty members of trauma center of two educational hospitals ethics committee.

Statistical analysis

All statistics were calculated with SPSS (version 16.0; SSS Inc. Chicago, II).

Descriptive statistics included means and standard deviations for continuous variables and frequencies and percentages for discrete variables. Student's t-test and $\chi 2$ test were used to look for associations between variables where appropriate. Multivariate analysis using logistic regression was performed to evaluate significant predictors (determined on univariate analysis) that were associated with mortality. A critical p value of 0.05 was used for all hypothesis testing.

Results

We reviewed the records of 68000 patients with PT who admitted during the period from May 2011 to March 2017. The incidence rate was 13.9/100,000 person years (9.9/100,000 for male, 4/100,000 for female). The comparison of the incidence of PT between gender and age groups is illustrated in **FIGURE 1**. More males [n=54800(80%)] than females [n=13200(20%)] were admitted to the hospitals. The common fractures were different between genders and ages. The acetabulum and pubis was more commonly injured in males (32%,31.5%) with age group 46-60 years old, and the Sacrococcygeal fracture and Multiple pelvic fractures in females (28%,18.5%)(P<0.05 and P<0.03 respectively) with age group 61-75 years old. (P<0.02 and P<0.03 respectively) In high BMI patients, the female (n=3315) showed more evidence of pelvic trauma than male (n=8891). (P<0.04) The male patients with non-injury-related cardiovascular disease and hypertension showed more evidence of pelvic trauma than female (P<0.04, P<0.03 respectively) and the female with non-injury-related diabetes and Osteoporosis showed more evidence of pelvic trauma than male (P<0.05, P<0.03 respectively). The average age of patients with PT was 49.5 ± 19.8 years (range, 13-79 years old), and the mean of length of stay in hospital was 8.5 days (females, 7.4 ± 1.3 days; males, 9.2 ± 3.5 days; p<0.02). The acetabulum was the most common pelvic fracture sites (30%) and the pubis was the second most common (25%). Hypertension (N=316) was the most common non-injury-related comorbidities and the diabetes was the second most common (n=280). 55983 patients had injury-related abdominal injuries (82%), 28502 patients had injury-related chest trauma(42%) and 19182 patients had injury-related head (except for simple brain concussion) trauma (28%) that were the first, second and third most common pelvic fracture-related injuries, respectively. Patient demographics, associated injuries, and correlated information, including mortality rate are illustrated in **TABLE 1**. Patient stratified in six groups mentioned above. The highest incidence rate of PT was found in the 46-60 years group (8.39/100,000 population), and the highest mortality rate was in male (P<0.02) in age group more than 75 years old. (P<0.03) The patients with low socioeconomic level showed a higher mortality (25%) than in low socioeconomic level respectively (p<0.42). Automobile accident injuries were the most common cause of PT(37%), followed by injuries to Motorcycle accident (28%). Biker was the lowest mechanism of pelvic injury (1%). The highest mortality was happened in patients with automobile accident injuries. (P<0.05)1661(2.5%) patients had active and massive hemorrhage that was the most risk factor of PT mortality (P<0.00). 10272(15%) patients had active and multiple pelvic fracture that was the second risk factor of PT mortality (P<0.00). There were 1043(1.5%) patients with coagulopathy problems such as DIC and emboli that showed one of the essential predicting factor of PT mortality (P<0.05). The relationship

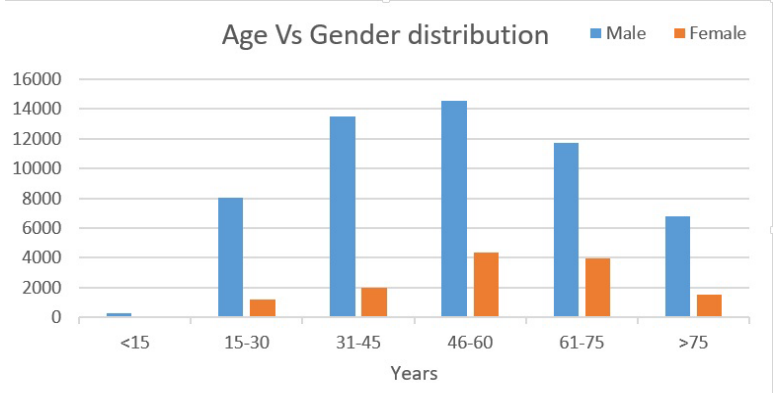

FIGURE 1. Age vs. gender distribution. Comparison of the incidence of pelvic fracture between gender and age groups.

Table 1. Patient demographics, associated injuries, and correlated information, including mortality rate.

	Age groups(Years)							
Parameters	< 15	15-30	31-45	46-60	61-75	>75	Total	Mortality Rate
Gender								
Male	262	8015	13465	14555	11692	6811	54800(80%)	9992(67%)
Female	112	1222	1996	4331	3980	1559	13200(20%)	4359(33%)
BMI								
<25	328	6555	12329	15491	13992	6099	54794(80%)	8720(54%)
≥ 25	46	2682	3132	3395	1680	2271	12206(20%)	5631(46%)
Smoking								
Smoker	0	2056	4924	5692	2895	1268	16835(25%)	9803(68%)
No smoker	374	7181	10537	13194	12777	7102	51165(75%)	4546(32%)
Site of fracture								
Sacrcoccygeal fracture	15	211	706	601	962	337	2832(4.2%)	79(2.7%)
Open pelvic fracture	34	491	1749	3677	2628	1294	9873(16%)	2815(29%)
Acetabulum	101	3409	4115	5999	4558	2402	20584(30%)	5278(26%)
Ischium	24	970	1883	1934	1702	774	7287(11%)	156(2%)
Ilium	19	273	760	1295	991	433	3771(5.5%)	289(8%)
Pubis	77	2339	3983	4333	4022	2202	16956(25%)	1561(9%)
Multiple pelvic fractures	108	1524	2265	2547	2900	928	10272(15%)	4038(39%)
Mechanism of injury								
Automobile accident	201	3064	5629	7001	5480	3743	25118(37%)	5734(40%)
Motorcycle accident	69	2611	3306	5901	4291	2958	19136(28%)	3896(27%)
Biker	6	122	391	59	32	12	622(1%)	2(0.0%)
Pedestrian hit by car	59	1930	3221	2870	3277	1002	12359(18%)	3412(24%)
Fall from a height	39	2010	2871	3055	2592	655	11222(16%)	3001(21%)
Non-injury-related comorbidities								
Liver disease	1	11	22	27	32	29	122(0.2%)	10(8%)
Renal disease	5	7	16	25	23	11	87(0.1%)	8(9%)
Endocrine disease	1	5	12	11	9	8	46(0.07%)	4(9%)
Cardiovascular disease	2	8	18	42	79	37	186(0.3%)	35(19%)
Diabetes	1	13	42	110	66	48	280(0.4%)	54(25%)
Hypertension	0	12	39	142	68	55	316(0.5%)	68(21%)
Osteoporosis	0	2	22	71	47	33	175(0.25%)	32(18%)
Cancer	1	14	26	34	28	14	117(0.17%)	19(16%)
Others	3	6	9	9	5	10	42(0.06%)	8(19%)

Mean of Associated injuries								
Massive hemorrhage	49	277	359	454	331	191	1661	69(42%)
Coagulopathy problems	11	89	510	122	183	128	1043	341(33%)
Multiple organ failure	33	136	229	566	141	133	1238	328(26%)
AIS head injury (neck and cervical spine)	1.48 ± 1.9	1.62 ± 1.5	1.48 ± 1.6	1.77 ± 1.8	1.39 ± 1.3	1.41 ± 1.8	19182(28%)	4361(23%)
AIS Chest injuries(thoracic spine and diaphragm)	1.38 ± 1.7	1.49 ± 1.3	1.55 ± 1.9	1.82 ± 2.2	1.61 ± 1.7	1.98 ± 2.4	28502(42%)	5572(19.5%)
AIS abdominal injury (including abdominal organs and lumbar spine)	1.59 ± 1.7	1.61 ± 1.8	2.88 ± 2.8	2.67 ± 2.6	2.89 ± 2.4	3.88 ± 1.5	55983(82%)	14891(27%)
AIS face injuries(including the facial skeleton, nose, mouth, eyes and ears)	0.32 ± 0.9	0.38 ± 0.9	0.23 ± 0.3	0.37 ± 0.7	0.29 ± 0.3	0.19 ± 0.7	14753(22%)	2849(19%)
AIS multiple pelvic bone fractures	2.45 ± 1.8	3.62 ± 1.5	3.82 ± 2.1	3.79 ± 2.3	3.82 ± 3.51	3.94 ± 2.6	10272(15%)	4038(39%)
AIS extrimities fractures	1.52 ± 2.7	1.59 ± 1.7	1.87 ± 2.5	2.61 ± 1.6	2.95 ± 2.4	2.99 ± 3.4	55766(82%)	2863(5%)
ISS	24.6 ± 13.7	27.3 ± 11.5	29.6 ± 22.5	29.9 ± 26.4	29.7 ± 21.3	31.1 ± 24.5		
RTS	4.57 ± 2.7	5.48 ± 2.9	5.98 ± 2.6	5.99 ± 2.8	5.99 ± 3.6	6.33 ± 3.1		
TRISS	0.77 ± 0.44	0.79 ± 0.61	0.81 ± 0.53	0.81 ± 0.79	0.82 ± 0.11	0.86 ± 0.71		
Socio-Economic levels								
Inadequate(low)	34	102	138	119	89	91	573(1%)	142(25%)
Adequate(acceptable)	340	9135	15323	18767	15583	8279	67427(99%)	14209(21%)
Medical intervention								
Fluid resuscitation and pelvic binder	67	1984	4034	4598	3486	235	14407(21%)	5(0.03%)
Blood transfusion<4 bags and pelvic binder	102	4417	8743	6610	7663	2904	30439(45%)	111(0.4%)
Transfusion≥4 bags and pelvic binder	205	2836	2684	4004	4523	5231	19483(29%)	431(2.2%)
Thoracotomy	34	655	1139	3674	2045	3576	11123(16%)	202(1.8%)
Arteriography	59	1989	2945	3779	3003	5673	17448(26%)	544(3.1%)
Diagnostic laparotomy	42	2303	3597	5473	2557	2198	16170(24%)	16(0.1%)
Therapeutic Laparotomy	32	1201	3211	6547	4909	1264	17164(25%)	293(1.7%)
External Pelvic fixation	46	1122	2467	3278	2287	1732	10932(16%)	167(1.5%)
ORIF	156	5115	8092	10608	12821	5823	42615(63%)	275(0.6%)
Hospital length of stay								
<5 days	155	3043	5823	6022	4571	2117	21731(32%)	3039(21%)
5-10days	209	5734	8965	11987	9320	5745	41960(62%)	7693(54%)
>10days	10	460	673	877	1781	508	4309(6%)	3619(25%)
Mortality	38(10.2%)	1068(11.5%)	2059(13.5%)	3002(16%)	2485(16.5%)	1699(20%)	14351(15%)	

between mortality risk and all these factors were analyzed by using logistic regression, and the results are listed in **TABLE 2**. The most common leading cause of death within 6 hours was massive hemorrhage; 6 to 24 hours head injury, and greater than 24 hours multiple organ failure.

On arrival to the emergency department, the orthopedic trauma surgeon performed direct assessment and management. Almost, all patients that faced to hemodynamic instability. 68000 patients had pelvic fractures, and 19483 patients (29%) were transfused with more than four units of blood. Following chest trauma, 11123 patients (16%) received thoracotomy had hemothorax. Following injury-related abdominal injuries, 16170 patients (24%) received diagnostic laparotomy had hemoperitoneum. 17164 patients (25%) had therapeutic laparotomy. 5107 patients (9%) received peritoneal lavage and 33429 patients (60%) received abdominal operations. 17448(26%) who continued to be unstable hemodynamically, taken arterial angiography and embolization. After the patient was hemodynamically stabilized, full imaging (including inlet, outlet, Judet, and CT scan) performed. 43547 patients with unstable pelvic fracture (Tile B or C) who operated using open reduction and internal fixation(63%) or external fixator or a pelvic C-clamp (16%) (if posterior instability exists) **(TABLE 1).** The overall mortality rate was 15% (n = 14351). The average hospital long of stay for mortality cases was 6.1 ± 2.2 days, which was shorter than the total average hospital long of stay of patients (8.3 ± 3.7 days). There were no significant differences between the numbers of patients in each year during of these 6 years (p>0.65). **(FIGURE 2)** One-way analysis of variance (ANOVA) showed a significant difference in the spring and summer incidence of pelvic fracture with a higher incidence rate in the fall and winter (p<0.04) **(FIGURE 3).**

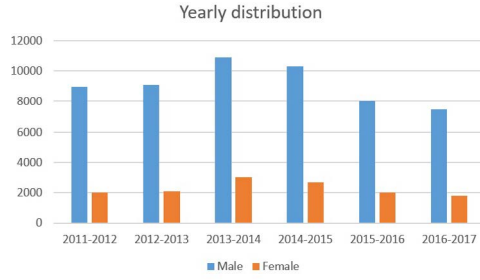

FIGURE 2. Yearly distribution of pelvic fracture..

Table 2: Logistic Regression for Predictors of Mortality among Patients with Pelvic Ring Fractures .(CI: confidence interval)

Variables	Odds ratio (95.0% CI)	P value
Male	2.814 (21.749-2.880)	0.02
BMI ≥25	1.135 (1.090-1.181)	0.42
smoking	0.169 (0.160-1.678)	0.05
46-60years	0.986 (0.961-1.012)	0.08
61-75years	1.158 (1.125-1.192)	0.06
>75years	2.281 (2.145-2.426)	0.03
Sacrococcygeal	0.189 (0.160-0.618)	0.82
pubis	2.40 (2.195-2.286)	0.67
Acetabulum	1.059 (1.033-2.185)	0.05
Open pelvic fracture	2.230 (1.923-2.920)	0.03
Multiple pelvic fractures	2.151 (2.115-2.189)	0.00
Cardiovascular disease	1.127 (1.090-1.166)	0.03
Diabetes	0.924 (0.911-1.738)	0.04
Hypertension	1.603 (1.583-1.617)	0.01
Osteoporosis	0.917 (0.870-0.976)	0.02
Multiple organ failure	2.820 (2.723-2.920)	0.00
Head injury (neck and cervical spine)	3.073 (3.048-3.098)	0.00
Chest injuries(thoracic spine and diaphragm)	2.850 (2.831-2.870)	0.01
Abdominal injury (including abdominal organs and lumbar spine)	4.801 (4.770-4.832)	0.00
face injury	1.727 (1.790-2.126)	0.04
Massive bleeding	3.276 (3.260-3.292)	0.00
Coagulopathy	1.959 (1.933-2.185)	0.05
Low Socio-Economic levels	0.092 (0.052-0.133)	0.42
Hospital LoS	0.289 (0.260-1.318)	0.34
Cause of pelvic trauma(Automobile accident)	1.279 (1.260-1.299)	0.05

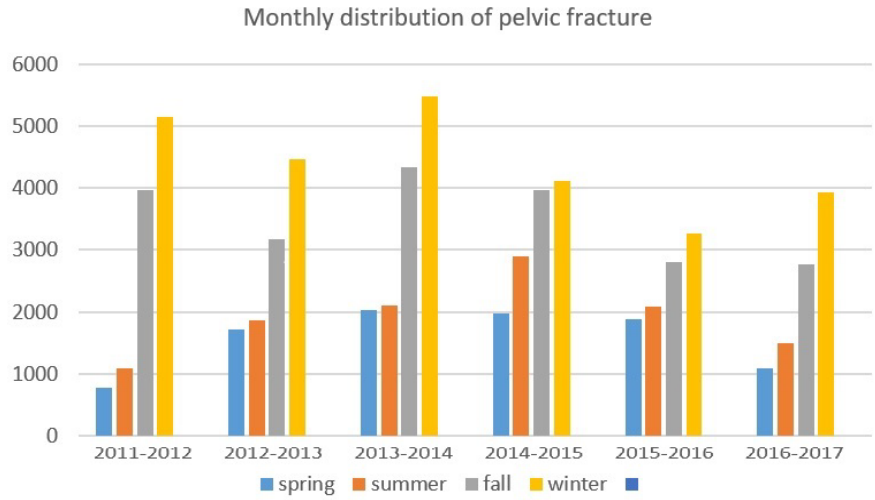

FIGURE 3. Monthly distribution of pelvic fracture

Discussion

The growing use of motor vehicles and the increasing size of the elderly population, osteoporosis-related fractures will increase pelvic fracture. Therefore, pelvic fracture will become more prevalent and a more burdensome national healthcare problem [13,21,25,26]. Because patients with pelvic fractures who are in shock at presentation have high mortality. However, measuring the incidence of pelvic fracture and the risk factors of associated mortality are deserved. Pelvic fractures represent approximately 3 percent of skeletal injuries [27]. Open pelvic fractures are rare and represent only 2-4% of all pelvic fractures [28]. Of all pelvic ring fractures, approximately 55% are stable, whereas 25% have rotational instability, and 20% have rotational and vertical instability. Approximately 16% of patients have associated acetabular fractures [29]. Overall mortality from pelvic fractures ranges from 5 to 16 percent, with the rate for unstable pelvic fractures approximately 8 percent [30,31]. The mortality rate associated with acetabular fractures is 3 percent [8,32], while open pelvic fractures, which comprise 2 to 4 percent of all pelvic fractures, are associated with a mortality rate of up to 45 percent [33,34]. Most fatalities stem from associated internal injuries; deaths attributed solely to pelvic fractures range from 0.4 to 0.8 percent of trauma fatalities [31,34]. Patients aged greater than 65 with pelvic fractures have a mortality rate of approximately 20 percent [35]. Overall, pelvic fractures are associated with an increased risk of death among trauma patients [36,37]. An Australian study of pelvic ring fractures demonstrated an incidence of 23 per 100,000 persons per year, while a British study found the incidence of acetabular fractures to be 3 per 100,000 persons per year [38,39]. A study of a large patient database in the United States found that around 70% of patients sustaining pelvic ring fractures are female [40]. A trauma registry review from New South Wales, Australia, revealed that most patients sustaining high-energy pelvic ring fractures, such as from a motor vehicle crash, were male, whereas females predominated in low-energy injuries [41]. Males also sustain associated genitourinary injuries more commonly than females [42]. Our study showed that most patients sustaining high-energy pelvic ring fractures, such as automobile accident that were male aged more than 46 years old. Also sustain associated head; chest and abdominal injuries more commonly happened in males. In the United States, a large patient database review found that the mean age of patients sustaining a pelvic ring fracture is about 65 years. The average age actually increased significantly over the 17-year study period, which may represent an increase in low-energy pelvic fractures [40]. A study showed an increasing incidence of severe pelvic fracture in motor vehicle collisions in Ontario, Canada, from 3.9 to 7.5% in 10 years [25]. One study in Taiwan reported that the incidence rate of pelvic fracture was higher in females over 44 years of age. Associated injuries were stronger positive factors for the risk of mortality than gender, fracture sites, injury mechanisms, and the characteristics of the treating hospitals [43]. In an 11-year retrospective study [44],

236 (30.4%) sacral fractures were identified among 776 pelvic injuries. Reviews of two large trauma registries found the incidence of pelvic ring fractures among admitted trauma patients to be 8 and 9.3 percent, respectively [17,44]. Risk factors for pelvic fractures include low bone mass, smoking, hysterectomy, older age, and a propensity to fall [45]. We reported the incidence, the distribution of pelvic fracture sites and types and the differences between genders. We found a high incidence of pelvic fracture for the elderly male. Also we also illustrated that more than the patients were between 46 to 60 years old. A predominance of female population among those with pelvic fracture has been reported since the 1980s [45,46]. We found that more female patients were among the age groups over 46 years old. A probable explanation is that osteoporosis is more severe in older women than in men in general [47].

We also reported that our female patients had higher BMI, more sacrococcygeal and multiple pelvic fractures, more noninjury-related osteoporosis and diabetic disease. Also, female patients showed shorter LOS than male patients. Additionally, we found a higher incidence rate of pelvic fracture admissions at our trauma center in the colder season. One study of the literature showed substantial annual variation [48] but some studies reported that seasonal variations didn't effect on admissions of pelvic trauma patients significantly [49-51]. Automobile accident was a significant factor for the risk of death. In Taiwan population, none of the mechanisms mentioned above was a significant factor for the risk of death [43] but one study showed that automobile accidents increased the risk of mortality and reported that the cause of death in most trauma mortalities with pelvic fractures was primarily associated injuries, not pelvic fractures alone [34]. Our study showed that the most causes of mortality with pelvic trauma were massive uncontrolled bleeding and multiple pelvic fractures.

Our study showed that Pelvic trauma related head injuries, such as skull fracture and intracranial hemorrhage, significantly increased the risk of death in patients with pelvic fracture. Furthermore, our results also revealed that associated face, chest and abdominal injuries significantly increased the mortality risk. Patients who had open pelvic fractures, acetabulum and multiple pelvic fractures or received a blood transfusion of more than four units were also at a greater risk of death. However, our study revealed that coagulopathy problem such as emboli or DIC and some noninjury-related comorbidity like cardiovascular and diabetic diseases and hypertension put our patients in risk of mortality significantly. The limitation of this study was patients who died at home during at one month after discharge based on a traditional idea that dying patients should be taken home to die. However, for this reason, some dying patients didn't record in our study.

Conclusion

This national survey is essential to understanding the epidemiology and incidence of pelvic trauma in Iran and other developmental societies. The analysis of mortality risk factors should give healthcare providers important information on which to base their decisions. All information should be taken when facing to patients with pelvic trauma. However, more detailed studies are needed.

Conflicts of interest

No potential conflicts of interest relevant to this article were reported.

Disclosure

No potential conflicts of interest relevant to this article were reported.

Ethics statement

Appropriate informed consent and demographic data obtained for filling 22-item questionnaire and cooperation for serial visits after medical intervention. Also, the study was approved by faculty members of trauma center of two educational hospitals ethics committee.

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