

Epidemiology and Clinical Features of Injuries at the Shahid Beheshti Hospital, Kashan, Iran: A Report from the National Trauma Registry of Iran

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Abstract

Background and Objectives: Trauma is a prominent reason for morbidity and death in Iran. The objective of this study was to provide epidemiological and clinical features of the injured patients admitted to one of the collaborating centers of the national trauma registry of Iran (NTRI). **Materials and Methods:** The study was carried out at the one NTRI center from March 25, 2017, to November 20, 2020. Patients who had the NTRI criteria were included in the study. Data comprised demographics, injury information, prehospital and in-hospital information, procedures, International Classification of Diseases 10 codes, diagnoses, injury severity, and outcomes. **Results:** Overall, 4043 trauma patients were included in the trauma. Of whom, 3036 (75.0%) were men. There was a statistically significant association between the cause of trauma and the severity of the injury. The *post hoc* test results demonstrated that the percentage of the injury severity score (ISS) ≥ 9 in patients with falls was higher than in patients with road traffic injuries (RTI) (26.9% vs. 16.8%, $P = 0.01$). The univariable and multiple logistic regression analyses showed statistically significant associations between age ≥ 65 , cause of trauma, years of school, and ISS ≥ 9 with intensive care units (ICU) admission. After adjusting for age and cause of trauma, the odds of ICU admission in patients with ISS ≥ 9 were 6.23 times more than in patients with ISS < 9 (odds ratio = 6.23, 95% confidence interval [4.92–7.88]). **Conclusion:** The odds of ICU admission were higher in older patients (age ≥ 65), lower educated patients, patients with falling, and severe injuries.

Keywords: Fall, injuries, injury severity score, road traffic injuries, trauma registry

INTRODUCTION

Trauma is a prominent reason for morbidity and death in Iran.^[1-4] Furthermore, traumas represent the cause of 10% of fatalities globally, and specifically, more than 90% of the global injury problem occurs in low- and middle-income countries.^[5-7] The trauma registry is one of the best tools for evaluating injuries in any community. This approach can

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be traced back to the ancient Egyptians.^[8,9] However, the modern era of trauma registries appeared in the United States of America in 1970, and its first purpose was to highlight the epidemiological factor of trauma.^[10,11] In addition, since one of the main objectives of trauma registries is to improve the care of injured patients, they provide information for medical scientists who cannot be addressed with management information systems.^[12] It has been shown that trauma systems enhance surviving levels of multi-traumatized patients and trauma registries represent an indispensable and essential part of these systems.^[13]

Until now, most hospitals in Iran have consistently documented utilizing the health information system (HIS).^[14] Still, there are significant discrepancies in the material and sources of registries.^[14] Although hospital administrative and medical records allow access to restricted data on injury patients, they often need more extensive information and necessary elements to educate continuously and potentially straight treatment and drive high-quality improvement. Concerning these conditions and regarding the trauma registry's advantages, the Ministry of Health and Medical Education of Iran supported enhancing the establishment of the national trauma registry of Iran (NTRI) in different centers.^[14] Trauma registries typically include information on individual demographics, the conditions of injury, prehospital care and transportation, and in-hospital treatments. This system can assess and create high-quality care, medical standards, and injury prevention plans. Developing local trauma platforms in the United States,^[15,16] the UK,^[17] and Norway^[18] have enhanced severe trauma monitoring in these nations.^[19]

In Iran, NTRI was developed in 2016 at the Sina Trauma and Surgery research center (STSRC), Tehran, Iran.^[14] Since then, fourteen trauma centers in various states have signed up with the NTRI project, and a couple of qualitative and measurable studies have been accomplished to examine multiple facets of the project, for example, its minimal dataset and its inclusion criteria, and to illustrate the outcomes based upon information accumulated for NTRI throughout the pilot stage at STSRC.^[14,20]

The objective of this study was to evaluate prehospital and hospital data from Shahid Beheshti Hospital in Kashan, Iran, as one of the NTRI collaborating centers.

METHODS

The NTRI is a hospital-based multicenter registry across the country. Shahid Beheshti Hospital, located in Kashan, Iran, is an NTRI collaborating center that admits injured patients. It is a government-funded teaching hospital and the biggest referral hospital in Kashan city.^[20] Kashan is a city stationed in the center part of the Islamic Republic of Iran, with inhabitants of around 500 000.^[21] The data were collected prospectively from March 25, 2017, to November 20, 2020.

Patients with one or more traumatic injuries and one of the following inclusion criteria were included in the NTRI: (1)

Hospital length of stay (HLOS) 24 h or more and (2) Patients with HLOS of <24 h that deceased after being admitted to the hospital or were transferred from intensive care units (ICU) of other hospitals to the NTRI collaborating centers.^[14]

Data collection

The data were gathered via a face-to-face interview with patients or guardians and by reviewing their medical records. It included the demographics information, different cause of trauma (road traffic injury, falling, blunt force, stab/cut), prehospital status, patients' outcomes (length of the hospital stay, ICU days, ventilator days, discharge status, any fatality after hospital arrival), and damage severity information.^[14] Two dedicated and trained nurses collected and entered data directly into the NTRI web-based portal described elsewhere.^[14] Besides, one trained supervisor (a physician) checked the entered data for completeness, accuracy, and consistency. Furthermore, the supervisor assessed the accuracy of injury severity information, including the abbreviated injury scale (AIS), AIS predot code, and injury severity score (ISS).^[21]

Ethical approval

This study has been ethically approved by the Ethics Committee of Tehran University of Medical Sciences with code number 95-02-38-259. Verbal informed consent was obtained from all patients or their legal guardians.

Statistical analysis

Frequencies and percentages were used to describe nominal and categorical variables. The association between the cause of injury and the ISS was assessed using the Chi-square test. *Post hoc* analyses were conducted using Bonferroni's test. Finally, the association between variables and ICU admission was investigated using univariable and multiple logistic regression models. $P < 0.05$ were considered statistically significant. The Stata software version 14.0 (Stata Corp, College Station, TX, USA) was used for the data analysis.

RESULTS

Overall, 4032 trauma patients were included in the trauma registry. Of these, 3036 (75.0%) were men and 996 (25.0%) were women. In general, 3488 (86.5%) of the patients had a history of trauma hospitalization. The mean age of the patients was 39.5 years (standard deviation = 22.5, range 1–98).

Most patients had primary school education levels (26.5%) [Table 1]. Use of alcohol, drugs, and sedative drugs before the injury event was reported in 13 (0.2%), 19 (0.5%), and 87 patients (2.2%), respectively [Table 1]. Most patients were transferred to the health-care facility by ambulances (64.9%), and most injuries occurred during the week (73.9%) [Table 1].

Table 2 shows the cause of trauma by the severity of injuries. There was a statistically significant association between the cause of injury and the severity of the injury ($P < 0.001$).

Table 1: Baseline characteristics of trauma patients (n=4034)

	Male (n=3036), n (%)	Female (n=998), n (%)	Total (n=4034), n (%)
Education level			
No formal education	428 (14.1)	391 (39.2)	819 (20.3)
Primary school	795 (26.2)	276 (27.7)	1071 (26.5)
Lower high school	703 (23.2)	99 (9.9)	802 (19.9)
Upper high school	145 (4.8)	20 (2.0)	165 (4.1)
Diploma	717 (23.6)	139 (13.9)	856 (21.2)
Higher education	246 (8.1)	72 (7.2)	318 (7.9)
Missing	2 (0.1)	1 (0.1)	3 (0.1)
Age			
≤15	371 (12.2)	104 (10.4)	475 (11.8)
16-44	1738 (57.2)	327 (32.8)	2065 (51.2)
45-64	587 (19.3)	259 (26.0)	846 (21.0)
≥65	332 (10.9)	299 (30.0)	631 (15.6)
Missing	8 (0.3)	9 (0.9)	17 (0.4)
Marital status			
Married	1783 (58.7)	651 (65.2)	2434 (60.3)
Single	1194 (39.3)	184 (18.4)	1378 (34.2)
Widowed/divorced	52 (1.7)	161 (16.1)	213 (5.3)
Missing	6 (0.2)	2 (0.2)	8 (0.2)
Nationality			
Iranian	2731 (90.0)	942 (94.4)	3673 (91.1)
NonIranian	305 (10.0)	56 (5.6)	361 (8.9)
Background of trauma admission			
Yes	470 (15.5)	73 (7.3)	543 (13.4)
No	2563 (84.4)	925 (92.7)	3488 (86.5)
Missing	3 (0.1)	0	3 (0.1)
Alcohol consumption			
Yes	9 (0.3)	4 (0.4)	13 (0.2)
No	3027 (99.7)	994 (99.6)	4021 (99.8)
Drug consumption^a			
Yes	15 (0.5)	4 (0.4)	19 (0.5)
No	3021 (99.5)	994 (99.6)	4015 (99.5)
Sedative consumption^b			
Yes	66 (2.2)	21 (2.1)	87 (2.2)
No	2970 (97.8)	977 (97.9)	3947 (97.8)
Injury occurrence during weekends or holidays			
Yes	794 (26.1)	256 (25.6)	1050 (26.0)
No	2240 (73.7)	742 (74.4)	2984 (73.9)
Missing	2 (0.1)	0	2 (0.1)

^aUse of drugs before the trauma occurrence, ^bUse of sedative before the trauma occurrence

Table 2: Injury severity scores by cause of trauma (n=3999)

	ISS <9, n (%)	ISS ≥9, n (%)	P	Post hoc test*
RTI	1782 (83.2)	361 (16.8)	<0.001	RTI >blunt, stab/cut
Fall	842 (73.1)	310 (26.9)		Fall >RTI, blunt, Stab/cut, others
Blunt force	379 (92.9)	29 (7.1)		Blunt=stab/cut
Stab/cut	182 (96.3)	7 (3.7)		Stab/cut<others
Others	94 (87.9)	13 (12.1)		Others=RTI Others=blunt

*Post hoc comparisons using Bonferroni's post hoc test. ISS: Injury severity score, RTI: Road traffic injury

The pairwise comparison results showed that the percentage of fall injuries with ISS ≥9 was higher than that of road traffic injuries (RTI) injuries with ISS ≥9 (26.9% vs. 16.8%, P = 0.01).

Table 3 shows the percentage of ICU admission, ventilation, and death by cause of trauma. Among the cause of trauma, the highest proportion of ICU referrals was related to falls. Besides, falling caused the highest death [Table 3].

The univariable logistic regression models showed a statistically significant association between age ≥ 65 , cause of trauma (blunt force, fall, stab/cut), years of school, and ISS ≥ 9 with ICU admission [Table 4]. According to the results, the odds of ICU admission in patients with ISS ≥ 9 were 6.28 times that in patients with ISS < 9 .

Besides, as reported in Table 5, the multiple logistic regression model showed almost the same results and a statistically significant association between age ≥ 65 , cause of trauma, years of school, and ISS ≥ 9 with ICU admission [Table 5]. For example, adjusted for ISS and cause of trauma, the odds of ICU admission in patients with age ≥ 65 were 2.11 times that in patients with age ≤ 15 (odds ratio = 2.11, 95% confidence interval = [1.38–3.22]).

DISCUSSION

This study assessed the information related to the patients with traumatic injuries admitted at the trauma center. General data showed that most of the patients were male. Besides, RTI was the leading cause of trauma, followed by falls. However, falls were more related to high injury severity, ICU admission, and death. Furthermore, previous studies in different cities in the center and northeast Iran showed that RTI and falls were the leading cause of trauma in admitted patients to trauma centers.^[14,22-25]

As the previous report showed similar outcomes^[14] relating to the cause of trauma, falls stood for a significant percentage of the injuries with ISS ≥ 9 , while RTI was the leading cause of trauma in patients with ISS < 9 . Based on the evidence, Iran has high fatalities of RTI annually.^[26,27] The age-standardized fatality rate of RTI in Iran was reported as more than twice the global standard. In addition, virtually 1.1% of Iranians seek hospital care for RTI injuries annually.^[28] On the other hand, falls were more related to more severe injuries due to a higher probability of head injury.^[29] In our study, patients with falls and RTI had a higher chance of ICU admission and death. Furthermore, this study is in line with the findings of Sharif-Alhoseini *et al.*^[14] Their study showed that RTI has a significant portion of severity score and death. In addition,

another study in Shiraz, Iran, revealed that RTI was the leading cause of trauma in patients admitted to trauma centers.^[22] Besides, Rasouli *et al.*^[30] reported that RTI was the most common cause of injury-related deaths in Iran. Nonetheless, in elderly patients, RTI and falls were reported as the most typical deadly injury mechanisms.^[14] Besides, the study by Yadollahi *et al.* in 2019 showed that RTI is the major cause of trauma and death among patients admitted to the trauma center in Shiraz, Iran.^[31]

Previous literature showed a statistically significant association between ICU admission and the cause of injuries.^[21] For instance, the study by Sharif-Alhoseini *et al.*^[14] and Naghavi *et al.*^[32] showed that fall injuries were the major cause of ICU admission. Furthermore, in our research, both univariable and multiple logistic regression models for ICU admission data showed the same results. Findings suggested that ISS ≥ 9 , age ≥ 65 , and blunt trauma were statistically significant factors for ICU admission.

Of the 4043 patients, 3036 were male (75.0%), and the average age of patients was 39.5 years, with the age range between 1 and 98 years. Our report had the same results as other research studies. Forouzanfar *et al.*^[2] reported that injuries were the leading cause of death among 15–49 years of age in Iran (23.6%) in 2010. Furthermore, different investigations showed that most admitted patients in trauma centers were men and young people.^[22,25,29,34] Moreover, the literature indicated that the distinction in the prevalence of male patients could be attributed to male domination of unsafe lines of work and social activities.^[33,35] For this reason, avoidance programs for men in the age mentioned above group, as the most at-risk people, should be highlighted.^[29]

Throughout the study, 64.9% of trauma patients were transferred by emergency medical services (EMS) ambulances which suggested the availability and coverage of EMS to some extent. In some countries like Switzerland, prehospital transports are managed mainly by physician-staffed teams.^[36] It was reported that physician-staffed teams reduce the mortality rate in pediatric and traumatic brain injuries and could relate to a better percentage of transportation to trauma centers with faster time for arrival.^[37,38] However, in many countries, ambulances are used only for transport and not as a curative vehicle,^[38,39] so it is crucial to consider this data to improve the EMS system and reduce mortality.

Table 3: Intensive care units admission, ventilation, and death by cause of trauma (n=4034)

	ICU admission		Ventilation		Death	
	Yes, n (%)	No, n (%)	Yes, n (%)	No, n (%)	Yes, n (%)	No, n (%)
RTI	188 (8.7)	1978 (91.3)	63 (2.9)	2103 (97.1)	10 (0.5)	2156 (99.5)
Fall	161 (13.5)	998 (86.1)	24 (2.1)	1135 (97.9)	19 (1.6)	1140 (98.4)
Blunt force	13 (3.2)	399 (96.8)	1 (0.2)	411 (99.8)	1 (0.2)	411 (99.8)
Stab/cut	4 (2.1)	185 (97.9)	1 (0.5)	188 (99.5)	0 (0.0)	189 (100.0)
Others	6 (5.6)	102 (94.4)	11 (10.2)	97 (89.9)	2 (1.9)	106 (98.1)

ICU: Intensive care unit, RTI: Road traffic injury

Table 4: Univariable logistic regression models of intensive care units admission, odds ratio (95% confidence interval for odds ratio) (n=3982)

	Crude OR	95% CI for OR
Years of school	0.91^a	0.89-0.94
ISS		
ISS <9	Reference	
ISS ≥9	7.86	6.28-9.86
Age		
≤15	Reference	
16-44	0.79	0.57-1.16
45-64	1.12	0.74-1.69
≥65	3.38	2.29-4.98
Cause of trauma		
Road traffic crashes	Reference	
Fall	1.70	1.35-2.12
Blunt	0.34	0.19-0.61
Stab/cut	0.23	0.08-0.62
Others	0.62	0.26-1.42

^aBold indicates $P < 0.05$. ISS: Injury severity score, OR: Odds ratio, CI: Confidence interval

Table 5: Multiple logistic regression model of intensive care unit admission, odds ratio (95% confidence interval for odds ratio) (n=3982)

	Adjusted OR	95% CI for OR
ISS		
ISS <9	Reference	
ISS ≥9	6.23^a	4.92-7.88
Age		
≤15	Reference	
16-44	0.81	0.54-1.22
45-64	1.07	0.69-1.66
≥65	2.11	1.38-3.22
Cause of trauma		
Road traffic crashes	Ref	
Fall	0.94	0.72-1.24
Blunt	0.41	0.22-0.75
Stab/cut	0.36	0.13-1.00
Others	0.68	0.28-1.61

^aBold indicates $P < 0.05$. ISS: Injury severity score, OR: Odds ratio, CI: Confidence interval

Furthermore, the outcomes of the study revealed that the major of the admitted patient were without formal education or had primary school education. Furthermore, the previous study in the northeast of Iran and Kashan showed the same result. It indicated that mass media should act better to introduce and educate people about traffic law and safety roles for increased knowledge of people to have safer driving and work.^[23,24]

A trauma registry's quality is generally challenging to measure on an unbiased scale. Black.^[13] have recently dealt with the quality of multicenter scientific data sources. The authors specified five parameters as data quality components: completeness, recruitment, freedom of observation of primary

results, use of specific definitions of variables, and extent of results validation. We considered the significant elements to ensure the data were drawn perfectly out of HIS. Meanwhile, our quality control physicians reviewed the patients' files and their severity and International Classification of Diseases codes, resulting in a better approach to enhancing data quality.

This study had some limitations. We collected the data based on a minimum dataset checklist. In addition, our patients needed to be followed up after discharge. Given extended dataset checklists in long-interval prospective projects may increase our knowledge in future studies.

CONCLUSION

This research provided an analysis of a trauma registry applied in one NTRI and showed that RTI and falls were the leading causes of trauma, with higher incidents in men. Age ≥65 and ISS ≥9 had statistically significant associations with ICU admission. More in-depth research studies can be conducted to understand different aspects of trauma burden and patient quality improvement.

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Conflicts of interest

There are no conflicts of interest.

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