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Research Article

An Epidemiological Study of Traumatic Spinal Injuries in Iranian Patients from 2007 to 2017

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Abstract

Background: Traumatic spinal cord injuries (TSCIs) cause numerous adverse effects on spinal cord and neural tissues. These injuries may have negative effects on physical and psychological health during lifetime.

Objectives: The present study aimed to investigate the epidemiology of TSCI in patients with trauma admitted to Beasat hospital of Hamadan between 2007 and 2017.

Methods: This cross-sectional study was conducted on 3219 patients with traumatic spinal injuries admitted to Beasat Hospital of Hamadan between 2007 and 2017. Data were collected from hospital information system. Data analysis was performed using SPSS. Quantitative data were expressed as mean, standard deviation, and frequency; and qualitative data were analyzed using chi-square and Fisher's exact tests. The significance level was considered to be less than 0.05.

Results: Mortality was significantly associated with gender ($P=0.001$), age ($P=0.051$), external causes ($P=0.001$), and type of injury ($P=0.001$). Length of hospital stay was significantly associated with type of injury ($P=0.001$) and external causes ($P=0.001$), whereas there was no significant relationship between length of hospital stay and gender, age, and surgery ($P>0.0.05$).

Conclusion: Mortality rates were highest at the age of 55 years and over compared with other age groups. Thus, effective intervention and programs should be implemented for this age group.

Keywords: Epidemiology, Spinal injuries, Trauma, Hamadan

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Background

Traumatic spinal cord injuries (TSCIs) lead to numerous unpleasant impacts on spinal cord and neural tissues, and may adversely affect physical and psychological health during lifetime. Some degree of neurological deficit occurs in 10%-20% of all patients at the level of spine injury; 40% at the cervical spine level, and 15%-20% in the thoracolumbar level. In spite of advances in emergency ward services in pre-hospital settings, TSCI is still a major cause of global mortality and morbidity. These complications have adverse impacts on the patient's life as well as his/her family members' lives and the society (1, 2). Over the past two decades, the death from TSCI in trauma patients has shown a steady trend, and been reported 17% (3). The prevalence of TSCI varies in different regions depending on economic, social, political, and cultural contexts. The prevalence of these complications varies from 12.1-57.8 per 1 000 000 population in developed countries, and 17.7-29.7 per 1000 000 population in developing countries (4,5). In addition, the reported annual incidence rate of traumatic spinal fractures varies between 19 and 88 per 100,000 population, and that of spinal injuries between 14 and 53 per 100 000 population (6,8).

Given that the data on the epidemiology of spinal fractures with or without spinal cord injury is different and even in some sources, it has been combined with spinal cord injuries, and that spinal fractures are common in the injured people involved in various accidents, the present study was conducted to investigate

the epidemiology of spinal cord injuries in trauma patients admitted to Beasat hospital in Hamadan from 2007 to 2017.

Objectives

Given the high prevalence of spinal cord fractures in various types of injuries and inconsistent epidemiological data on spinal cord fractures with or without spinal injuries, the present study was aimed to investigate the epidemiology of TSCI in patients with trauma admitted to Beasat hospital of Hamadan between 2007 and 2017.

Methods

This cross-sectional study was conducted on 3219 patients with TSCI admitted to Beasat hospital of Hamadan between 2007 and 2017. Beasat hospital is the largest and the most sophisticated hospital in western Iran. Data were collected from the hospital information system. The inclusion criteria were fulfilling the definition of trauma, and the ICD-10 coding conventions, and head and cervical spine trauma codes (9). Patients with more than two incomplete demographic items (30% or higher), non-traumatic head injury, and TSCI false positivity were excluded from the study. The ICD-10 codes for TSCI included T09.5 (spinal cord injury with nonspecific level), S12.90 (cervical fracture with nonspecific level), S14.1 (other unknown cervical spinal cord injuries), S22 (the fracture of the rib, chest and thoracic spinal cord), and S32 (fractures of lumbar spine and pelvis). Data were collected using a checklist including items on gender (male or female), age (e.g., 15 years or higher, 15-24 years, 25-34 years, 35-44 years, 45-54 years, 55-64 years, and 65 years or older), type of injury (spinal cord or cervical spinal cord injuries, cervical fracture, lumbar or pelvic fractures, fractures of the ribs, and thoracic spinal cord injuries), external causes of injury (pedestrian, motor vehicle crashes, falls, etc.), surveillance (recovery or death), and length of hospital stay (7 days or lower, 7 days or higher).

Data analysis was performed using SPSS, version 23. Quantitative data were expressed as mean, standard deviation, and frequency; and qualitative data were analyzed using chi-squire and Fisher's exact tests. The significance level was considered to be less than 0.05.

Results

The average age of the participants was 41.7±17.07 years, and 22.6% aged between 25 and 34 years (n=729). About 66% (n=2148) of the subjects were male. The frequency of death was 4.9% (n=158) among our participants. The most common cause of TSCI was motor vehicle accidents (45.9%), followed by falls (43%) (Figure 1 and Table 1). TSCI at all age groups was significantly more prevalent among men compared with women (P=0.001, Table 2). The epidemiological investigation of TSCI showed an increasing trend between 2007 and 2012, and a decreasing trend between 2012 and 2013. The observed decrease in Figure 2 is due to Trauma II Center in Hamadan province. Since then, TSCI showed an increasing trend between 2013 and 2016 (Figure 2).

Discussion

Trauma is one of the leading causes of disability-adjusted life-disability (DALY) in productive and active groups in society. Due to the irreversible consequences of failing to care for injured patients and given that most traumatic events (especially in children) are preventable, it is essential to figure out the pattern and distribution of fatal traumas such as spinal and spinal cord trauma in different geographic areas for health policy making so

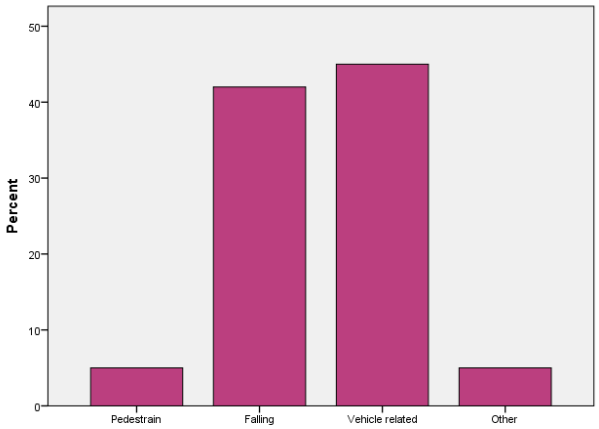

Figure 1. External Causes of Morbidity and Mortality Among Patients With Traumatic Spinal Cord Injury In Hamadan Province, Iran

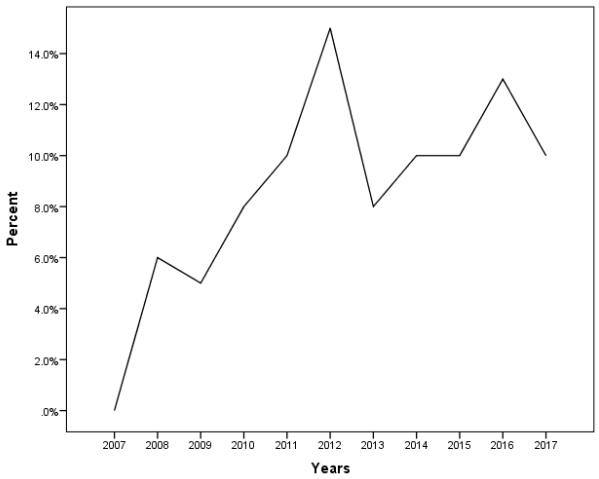

Figure 2. Trend of Spinal Cord Injury Among Patients With Traumatic Spinal Cord Injury Hospitalized Between 2007 and 2017.

Table 1. The Factors Associated With Mortality and Length of Hospital Stay in Patients With Traumatic Spinal Cord Injury in Hamadan Province, Iran

	Total No. (%)	Mortality		*P* Value	Length of Hospital Stays		*P* Value
		Non-survived	Survived		≤7	>7	
Gender							
Male	2148 (66)	125 (5)	2018 (96)	0.001	1559 (72)	589 (27)	0.001
Female	1071 (34)	33 (3.1)	1037 (96.9)		759 (70)	312 (30)	
Age (y)							
≤15	81 (2.5)	2 (2)	79 (98)	0.051	56 (69)	25 (31)	0.001
15-24	456 (14.2)	16 (3)	440 (97)		329 (72)	127 (27)	
25-34	729 (22.6)	27 (3)	699 (97)		526 (72)	203 (27)	
35-44	594 (18.5)	31 (5)	562 (95)		418 (70)	176 (30)	
45-54	583 (18.1)	28 (4)	554 (96)		420 (72)	163 (28)	
55-64	439 (13.6)	32 (7)	406 (93)		332 (75)	107 (25)	
≥65	337 (10.5)	22 (6)	315 (94)		237 (70)	100 (30)	
Mechanism							
Pedestrian	188 (5.8)	41 (25.9)	141 (4.6)	0.001	116 (5)	72 (8)	0.001
Vehicle related	1383 (43)	0 (0)	1383 (45.3)		1051 (45.3)	332 (36.8)	
Falling	1476 (45.9)	117 (74.1)	1359 (44.5)		1036 (44.7)	440 (48.8)	
Other	172 (5.3)	0 (0)	172 (5.6)		115 (5)	57 (6.3)	
Surgery							
Yes	1784 (55)	67 (4)	1362 (96)	0.001	489 (27)	1295 (73)	0.001
No	1435 (45)	91 (6)	1693 (94)		412 (28)	1023 (72)	
Type of injury							
Cervical spinal cord	559 (17)	70 (12)	489 (88)	0.001	446 (78)	119 (22)	0.001
Cervical fracture	342 (10)	0 (0)	342 (100)		191 (55)	151 (45)	
Spinal cord fracture	1351 (42)	88 (6)	1263 (94)		1034 (76)	317 (24)	
fractures of the ribs, and thoracic spine	961 (29)	0 (0)	961 (100)		647 (67)	314 (32)	

Table 2. Age Versus Gender Distribution of Patients With Traumatic Spinal Cord Injuries in Hamadan Province, Iran

Age (years)	Male No. (%)	Female No. (%)	Total No. (%)	*P* Value
≤15	36 (1.1)	45 (1.4)	81 (2.5)	0.001
15-24	329 (10.2)	127 (3.9)	456 (14.2)	
25-34	518 (16.1)	211 (6.6)	729 (22.6)	
35-44	412 (12.8)	182 (5.7)	594 (18.5)	
45-54	395 (12.3)	188 (5.8)	583 (18.1)	
55-64	280 (8.7)	159 (4.9)	439 (13.6)	
≥65	178 (5.5)	159 (4.9)	337 (10.5)	

that preventive measures could be taken.

The results of the present study showed that TSCI was significantly more prevalent among men at all age groups compared with women. Hasler and colleagues reported the prevalence of TSCI as being 65% in men and 35% in women (8). In addition, Thietje and colleagues showed that 94% of patients with TSCI were male (10), which is in agreement with our study. The prevalence of TSCI showed an increasing trend between 2007 and 2012, and a decreasing trend between 2012 and 2013, and since then, TSCI showed an increasing trend between 2013 and 2016, which is due to the establishment of another trauma center in the studied region.

Majdan and colleagues conducted a study in Australia and found that TSCI-related mortality rate increased from 3.1 per 1 million population in 2002 to 6.2 per 1 million population in 2012. In addition, the prevalence of RTAs increased from 27% in 2002 to 55% in 2012 (11). Because motor vehicle crashes were the most frequent accidents in this study, it can be concluded that TSCI trend is associated with use of motor vehicles, as increased use of motor vehicles and the public's ignorance of traffic and safety rules increased the prevalence of TSCIs. Moreover, findings regarding factors associated with TSCI-related mortality reveal that TSCI-related mortality rate is significantly higher in men than in women. Singh and colleagues reported that higher TSCI-related mortality in men was attributed to motor vehicle trauma, which is consistent with our study (12). However, some studies have shown that women and individuals under 40 years have lower life

expectancy in traffic crashes (13,14). Furthermore, studies conducted in Scandinavian countries have shown higher RTA-related mortality rates (14-16). Sabre and colleagues used Cox proportional-hazards model and demonstrated no significant relationship between gender and RTA-related mortality rate (13), which is inconsistent with the present study. In the present study, the number of female patients was lower than that of male patients, and therefore RTA-related mortality rate was reported to be lower in women (17).

The TSCIs-related mortality rate was reported higher in the age range of 25-34 and 55-64 years, with a statistically significant difference. A study by Ghaem and colleagues showed that trauma-related mortality was higher in patients older than 55 years (18). Besides, Majdan and colleagues argued that TSCI-related mortality rate was higher in patients older than 65 years (19), which is in agreement with our study. Interestingly, the prevalence of TSCI is significantly higher among young adults, and differences between age groups may be due to differences in methodology, socioeconomic status, culture, and area of living. Besides that, according to the findings of the present paper, elderly people do not have satisfactory physical endurance to cope with illnesses and accidents due to the weakness of the body, special health conditions and comorbidities.

Mortality rate was significantly higher in trauma patients with motor vehicle collisions. Thietje and colleagues investigated mortality among patients with spinal cord injuries, and found that motor vehicle crashes were the most common cause of TSCI in trauma patients, which is in accordance with our study (10). Singh et al reported that 52% of death was attributed to road traffic accidents (RTAs), Sharma et al (20) reported a death rate of 57%, and Sidhu et al reported the RTAs-related mortality as being 45% (21), which are in agreement with the current study. High prevalence of RTAs can be attributed to multi-polar vehicles on the road, high speed, and ignorance of pedestrians and the public of different road safety rules. Moreover, results showed that mortality rate was significantly higher in patients with cervical spine and spinal cord injuries. Majdan and colleagues reported that the most common cause of death in trauma patients was cervical injuries (66% in males vs. 55% in females), followed by lumbar injuries (19% in males vs. 26% in females) (19). A study by Majdan and colleagues in Australia showed that the most common level of injury was cervical damage, which was in compliance with our study. The length of hospital stay in TSCI patients was significantly higher in men than in women, which was inconsistent with Wu et al reporting no significant difference in length of hospital stay between men and women (22). The length of hospital stay was not significantly different between male and female patients in different age groups, which was inconsistent with the studies of Wu and colleagues (22), and Jang and colleagues (23). The length of hospital stay was significantly higher in patients with motor vehicle injuries and cervical fracture. However, Wu and colleagues found no significant relationship between length of hospital stay and level of injury (22). Some studies have revealed that length of hospital stay is considerably longer in trauma patients than in other patients (24, 25). Since trauma patients are in need of extra medical care for recovery, the length of hospital stay is quite longer among them (26).

According to the findings of the current study, mortality rates and length of hospital stay were not significantly different between patients who underwent surgery and patients with did not, which is not consistent with the results of other studies (22,27). These studies have argued that surgery increases the length of hospital stay for full recovery in trauma patients (22).

Our results showed that mortality rates were highest at the age of 55 years and higher compared with other age groups. Thus, effective intervention and programs should be implemented for this age group. Our study was a prospective cross-sectional study, and the reliability of our findings depends mainly on the precise records and reviews of data drawn from the hospital information system. The study population was an appropriate representative of the general population of Hamadan, and therefore the results can be generalized to the whole population of the city. Besides, application of similar ICD-10 codes during the study duration confirmed the validity of our results.

Authors' Contribution

Study concept and design: MS; Acquisition of data: SS; Analysis and interpretation of data: EM; Drafting of the manuscript: YM, MS, AA; Critical revision of the manuscript for important intellectual content: EM, NK, AA; Statistical analysis: EM; Administrative, technical, and material support: NK; Study supervision: MS.

Conflict of interests

The authors declare that they have no conflicts of interests.

Ethical Approval

The Institutional Review Board of the Modeling of Non-Communicable Diseases Research Center of Hamedan University of Medical Sciences approved the project (IR.UMSHA.REC.1397.239).

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The Medical Record Center of Beasat Hospital provided the database. The Institutional Review Board of the Modeling of Non-Communicable Diseases Research Center of Hamedan University of Medical Sciences approved the project.

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