

Research Paper: Different Traumatic Spinal Column Fractures and Traumatic Spinal Cord Injury: An Epidemiologic Study



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ABSTRACT

Background: Trauma and traumatic injuries are the most common causes of disabilities among the young population in developing countries. Besides morbidity and mortality, traumatic injuries can significantly decrease the quality of life and life expectancy of the victims.

Objectives: Traumatic Spinal Cord Injury (TSCI) is an acute, traumatic lesion of the spinal cord. It usually produces economic problems that can emotionally and psychologically affect the patients. This study aims to evaluate spinal column fractures and TSCI in Iran.

Methods: In this study, we evaluated all of the cases diagnosed with TSCIs between 2012 and 2018. A total of 1014 patients were included in our study. Prevalence of spinal column fractures was evaluated and the percentage of each type of fractures was extracted. The need for surgery and the percentage of TSCI were also evaluated.

Results: The most common cause of trauma was vehicle and road accidents (83.4%) followed by falling (12.7%). A total of 21 patients (2.1%) died due to injuries. The incidence of TSCI among patients with traumatic spinal column fractures were 62 cases (6.1%). Also, 67.7% of patients with TSCI underwent surgery. Furthermore, we found that the lumbar area received the highest incidence of TSCI (38.3% of all TSCIs) followed by thoracic spine fractures (27.4% of all TSCIs). Also thoracic and cervical spine fractures were mostly associated with mortality compared with other sites of spine fractures (47.6% and 38.1% of all mortalities, respectively).

Conclusion: In our study, most cases (83.4%) were injured by road accidents which indicates the low safety of vehicles and roads in Iran. Epidemiological features of spinal column injuries and TSCI vary among different societies due to different causes. So far, this study is the first one to evaluate different spine fractures and TSCI and other associated factors in the Iranian population. The results indicate a high incidence of thoracic and lumbar fractures and a higher mortality rate in thoracic and cervical fractures.

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1. Introduction

Trauma is the most common cause of disabilities among the young population in developing countries [1]. Aside from morbidity and mortality, traumatic injuries can significantly decrease the quality of life and life expectancy of the victims. Traumatic injuries are most common in the younger working population but they are also high among the older population [2]. Spinal column injuries are rare, but they can cause high mortality and morbidity rates with heavy burdens and lifelong social, financial, and personal problems and even permanent disabilities [3]. Traumatic spinal column injuries are also high in low socio-economic areas due to frequent use of motorcycles, lack of sufficient immunity, and absence of adequate infrastructures.

Traumatic Spinal Cord Injury (TSCI) can occur after spinal column injury [4]. TSCI is an acute, traumatic lesion of the spinal cord with its consequent economic problems and can emotionally and psychologically affect the patients. It can affect different systems and organs of the body and cause motor or sensory impairment or dysfunction of urinary, gastrointestinal, or reproductive systems [5]. TSCI in pediatric or young population is a catastrophic event that can alter the child's life forever. Different studies had surveys about the incidence of TSCI around the world and this incidence ranges from 3.6 to 195.4 patients per million around the world [6].

Studies indicate that TSCI is mostly caused by vehicle accidents, falling, and violence. Age distribution for TSCI also showed a higher incidence in 15-29 and over 65 years old people [7]. These data indicate the importance of TSCI because it affects mostly younger working population causing heavy socio-economic burden and older population in whom serious complications are observed. TSCI can permanently damage different organs but they may be rehabilitated by the means of physiotherapies or occupational therapies [8]. Evidence shows that early surgical intervention in cases that require immediate surgery could be a great help in further prognosis [9]. Different studies surveyed the epidemiology of TSCI and evaluated age and sex distributions and related factors. This study aims to evaluate spinal column fractures based on anatomical position, percentage of TSCI, and need for surgery in Iran. This information can enrich our knowledge of spinal cord trauma and safety considerations at the scene of the accident.

2. Methods

This is a retrospective study of cases with traumatic spinal column fractures referring to Al-Zahra Hospital, one of the most important trauma centers of Isfahan City, Iran. We evaluated all cases diagnosed with traumatic spinal column fractures between 2012 and 2018. A total of 1014 patients were included in our study. The exclusion criteria were lacking clear spine radiology images or patients with severe brain injury. The study was approved by the Ethics Committee of Isfahan University of Medical Sciences. All medical records of patients were reviewed and anatomical locations of spine fractures were evaluated. Patients with spinal cord injuries were also detected based on documented history and MRI findings. The need for surgery and the percentage of TSCI were also evaluated. The obtained data were analyzed in SPSS.

3. Results

In this study, 1014 patients with traumatic spinal column fractures were included. The most common causes of trauma were vehicle and road accidents (83.4%) followed by falling (12.7%). Sex distribution indicated that 717 cases (70.7%) were male and 297 (29.3%) female. Furthermore, 7.1% of male patients had spinal injuries while only 3.7% of females had spinal injuries and this difference was statistically significant ($P=0.024$). A total of 21 patients (2.1%) died due to injuries. Statistics showed that 85.7% of mortalities occurred in males and 14.3% in females and as a result, male patients with traumatic spine injuries had higher mortalities. The frequency of TSCI among patients with traumatic spinal column fractures were 62 patients (6.1%). Further analysis also indicated that 311 of all patients (30.7%) underwent surgical procedures while the other 703 patients (69.3%) required no surgery (Table 1).

The frequency of each type of fracture was also evaluated. The single-level fracture was found in 92.3% of patients, comprising cervical spine fractures in 16.0% (74.1% in males and 25.9% in females), thoracic spine fractures in 27.4% (76.3% in males and 23.7% in females), lumbar spine fractures in 38.3% (67.8% in males and 32.2% in females), sacrum and coccyx fractures in 10.7% (59.3% in males and 40.7% in females). The multiple fractures were seen in 7.7% of patients (74.4% in males and 25.6% in females). These results indicate that lumbar spine fractures especially in men are the most common fractures in traumatic spinal fractures.

Sex distribution for TSCI indicated that 7.1% of all male patients with spinal column fractures had TSCI

Table 1. Demographic characteristics of the study patients

Variables		No. (%)
Patients	Male	717 (70.7)
	Female	297 (29.3)
	Total	1014 (100)
Mortality	No	993 (97.9)
	Yes	21 (2.1)
TSCI	No	952 (93.9)
	Yes	62 (6.1)
Location of fracture	Cervical	162 (16.0)
	Thoracic	278 (27.4)
	Lumbar	388 (38.3)
	Sacrum and Coccyx	108 (10.7)
	Multiple fractures	78 (7.7)
Need for surgery	No	703 (69.3)
	Yes	311 (30.7)

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Table 2. Sex-specific distribution of spine injury

Variables	Spine Injury		Total	
	No	Yes		
Male	Count	666	51	717
	% within sex	92.9	7.1	100.0
	% of total	65.7	5.0	70.7
Female	Count	286	11	297
	% within sex	96.3	3.7	100.0
	% of total	28.2	1.1	29.3

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while for female patients this rate was 3.7% (Table 2). Our data also indicated that 67.7% of patients with TSCI underwent surgery. Analysis for distribution of spinal injuries among different sites of spinal column fractures indicated that cervical spines had the highest incidence of TSCI (43.5% of all TSCIs) followed by thoracic spines fractures (29% of all TSCIs). For lumbar spines fractures, 24.2% of patients faced TSCI and sacral fractures associated with no TSCI. The percentage of TSCI among patients with multiple site fractures was 3.2% (Table 3).

Furthermore, we found that thoracic and cervical spine fractures were mostly associated with high mortality compared with other sites of spine fractures (47.6% and 38.1% of all mortalities, respectively). It should also be noted that lumbar spine fractures were associated with no mortality among all fractures (Table 4). Age analysis for fractures of the spinal column indicated that the Mean±SD age for cervical spine fractures is 39.86±17.43 years. For thoracic spine fractures, this figure is 39.68±18.54 years. The Mean±SD age for lum-

Table 3. Distribution of spine injuries among different sites of spinal column fractures

Variables	Spine Injury		Total		
	No	Yes			
Location of fracture	Cervical	Count	135	27	162
		% within spine injury	14.2	43.5	16.0
	Thoracic	Count	260	18	278
		% within spine injury	27.3	29.0	27.4
	Lumbar	Count	373	15	388
		% within spine injury	39.2	24.2	38.3
	Sacrum and coccyx	Count	108	0	108
		% within spine injury	11.3	0.0	10.7
	Multiple fractures	Count	76	2	78
		% within spine injury	8.0	3.2	7.7
	Total % within spine injury	Count	952	62	1014
			100.0	100.0	100.0

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Table 4. Distribution of mortalities among different sites of spinal column fractures

Variables	Mortality		Total		
	No	Yes			
Location of fracture	Cervical	Count	154	8	162
		% within mortality	15.5	38.1	16.0
	Thoracic	Count	268	10	278
		% within mortality	27.0	47.6	27.4
	Lumbar	Count	388	0	388
		% within mortality	39.1	0.0	38.3
	Sacrum and coccyx	Count	106	2	108
		% within mortality	10.7	9.5	10.7
	Multiple fractures	Count	77	1	78
		% within mortality	7.8	4.8	7.7
	Total % within mortality	Count	993	21	1014
			100.0	100.0	100.0

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bar spine fractures is 40.02 ± 16.61 years. For sacrum and coccyx fractures, it is 36.91 ± 17.42 years and for multiple fractures 38.60 ± 17.42 years. Thus, patients with sacrum and coccyx fractures have the lowest mean age and those with lumbar fractures have the highest mean age.

4. Discussion

The results of our study indicated a prevalence of 6.1% for TSCI among patients with spinal column fractures. The mortality rate of our patients was 2.1% and the most common fractures were lumbar and thoracic spine fractures. About 67.7% of our patients with TSCI required surgical treatments. Furthermore, we found that lumbar spine fractures had the highest incidence of TSCI while thoracic and cervical spine fractures were associated with the highest mortality rate. Our analysis also indicated that mortality rates are higher among male patients with cervical fractures with the Mean \pm SD age of 39.86 ± 17.43 years.

Falavigna et al. had recently surveyed the epidemiology of fractures and TSCI among patients younger than 18 years [10]. Their results indicated that TSCI occurred in 52.6% of patients. Most injured sites of the spinal column were lower thoracic levels and they also indicated that 73.9% of patients underwent surgical procedures. However, the percentage of TSCI in our study was 6.1% and the most common injured site was lumbar vertebrae. We also showed that 30.7% of our cases needed surgical treatments. These differences in data are possibly due to age and other epidemiological differences. The most common causes of spinal injuries in the Falavigna's study was falling while our patients were mostly injured by vehicle and road accidents.

Hagen reported that higher thoracic spine injuries are associated with greater complications [11]. This finding is in line with our data showing a higher mortality rate in patients with thoracic and cervical spine injuries. Majdan et al. also conducted an epidemiological study on patients with TSCI [7]. They reported that cervical trauma was the most common injured region (52%). They also reported that TSCI has a higher incidence in patients older than 65 years who face spinal injuries. In most studies, which were performed in developed countries, the main cause of the spinal column accident is falling [12, 13] but in our study, most cases (83.4%) were injured by road accidents which indicate the poor vehicle and road safety in Iran. The differences between our data and other studies could be mostly due to this factor.

In this study, the mortality rate of patients was 2.1% of all cases and we found that thoracic and cervical

spine fractures were mostly associated with high mortality compared with other sites of spine fractures. Löfvenmark et al. also surveyed the epidemiologic features of TSCI and reported a 20% mortality rate [14]. They also reported that the most common cause of TSCI was road-traffic accidents. These data are in line with our study but we reported a lower rate of mortality which might be due to lower intensity of trauma and TSCI. Investigating a long-term follow-up of patients with TSCI, Savic et al. published a report indicating an improved life expectancy of patients with TSCI [5]. They also had a survey on risk factors for mortality among these patients. Gender, current age, time since injury, and neurological grouping were the most important risks for long term mortality among patients with TSCI. The limitations of this study were lack of sufficient personal resources and incomplete documents of some patients, so our research team had to check some cases in person.

5. Conclusion

Taken together, we found that the epidemiological features of spinal column injuries and TSCI vary among different societies due to different causes. So far, this study is the first study to evaluate different spine fractures and TSCI and other associated factors in the Iranian population. Our results indicate a high incidence of thoracic and lumbar spine fractures and higher mortality rates in thoracic and cervical spine fractures.

Ethical Considerations

Compliance with ethical guidelines

The review board approved this research of our institute under the (Code: 397094). The written consent was obtained from the patients before their participation in the study.

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Authors' contributions

Conceptualization: Hossein Akbari Aghdam, Ali Andalib; Methodology, investigation: All authors; Writing-Original Draft Preparation: Emran Ahmadi, Hossein Akbari Aghdam; Writing review and editing : All authors.

Conflict of interest

The authors declared no conflict of interest.

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