

# Incidence of Spinal Cord Injury in Traumatic Patients Admitted to a Trauma Referral Center in Guilan

Shahrokh Yousefzadeh-Chabok<sup>1</sup>, Hamid Behzadnia<sup>1</sup>, Leila Kouchakinejad-Eramsadati<sup>1</sup>, Marieh Hosseinpour<sup>1</sup>, Babak Alijani<sup>\*</sup>, Omid Taghinejadi<sup>1</sup>

<sup>1</sup> Guilan Road Trauma Research Center, Guilan University of Medical Sciences, Rasht, Guilan, Iran.

\*Corresponding Author: Guilan Road Trauma Research Center, Poursina Hospital, Guilan University of Medical Sciences, Rasht, Guilan,

Iran. Tel: +98133368773, Fax: +98133368773, E-mail: info@gtrc.com

Article Type: Research Article

Received: February 22, 2015, Last Revised: March 14, 2015, Accepted: March 14, 2015

## Abstract

**Background & Aim:** Patients with spinal cord injury (SCI) impose a heavy burden on health care system. Awareness on prevalence and incidence of SCI is important because this would show the necessity of prevention. This study aimed to investigate the epidemiology and types of traumatic spinal cord injuries in a trauma referral center in Guilan.

**Methods & Materials/Patients:** This is a descriptive study which was conducted on patients with spinal cord trauma using a questionnaire during one year. The questionnaire included demographic information, injured spinal cord area, mechanism of injury, and type of neural damage based on ASIA scale. The data were analyzed using SPSS18 and descriptive statistics.

**Results:** Out of 76 study patients, 68 (88.2%) were men with mean age of  $35.2 \pm 1.45$  years. The most common cause of SCI was motor vehicle accidents (MVA) (48.7%). 34 patients (44.7%) had cervical spine injury and in 23 patients (30.3%), thoraco-lumbar injuries caused SCI. 29.7% of patients suffered from paraplegia and 10.8% quadriplegia. 25 patients (38.5%) had complete SCI. 7 patients with SCI (9.2%) died during hospitalization. In this study, increased age was identified as a risk factor for death. In 4 of these patients (57.1%) cervical SCI was the underlying cause of death.

**Conclusion:** Young men were the group at highest risk and the most mechanism leading to SCI was motor vehicle accidents. Many of these accidents are preventable; thus, more attention should be devoted to safety policies based on needs of the vulnerable groups. Besides, comprehensive education program with clear and practical goals should be developed.

**Keywords:** Epidemiology; Spinal injuries; Trauma

Please cite this paper as: Yousefzadeh-Chabok Sh, Behzadnia H, Kouchakinejad-Eramsadati L, Hosseinpour M, Alijani B, Taghinejadi O. Incidence of Spinal Cord Injury in Traumatic Patients Admitted to a Trauma Referral Center in Guilan. *IrJNS*. 2015;1(1):39-42.

## Introduction

Traumatic spinal cord injury (TSCI) is a very burdensome incidence which occurs unexpectedly. It can be really destructive and costly (1) since usually causes long-term and lifelong morbidity and many a time changes the life conditions of the injured one's and his/her family (2). In this type of injury, the spine structure is damaged and its function are impaired. This leads to disorder in motor skills, sense, sphincters, and autonomic nerves below the damaged area (3). The cause of traumatic spinal cord injuries can be either traumatic or non-traumatic (NTSCI), which includes various degrees based

on nerve damage (4). According to international standards of American Spinal Injury Association (ASIA), the severity of an injury can be classified into two types, complete and incomplete. Complete injury is defined as absence of sensory and motor function in lowest parts of sacral segment (3) while in incomplete injury, sensory or motor function below the injured plane including the lowest sacral segments is maintained. The prevalence of traumatic SCI is different based on economic, social, political and cultural structure of each region (5). The incidence rate of spinal injuries in developed countries varies from 12.1 to 57.8 cases per million population and in developing

countries from 12.7 to 29.7 (6). In US, the annual incidence of SCI is about 40 cases per million population (7). There are scarce reports on incidence of SCI in Iran (8). The most SCI cases are young men in age range of 21 to 30 years old (3). Moreover, the studies revealed that within two previous decades, motor vehicle accidents, violence and falling in the elderly have been the most leading-to-death mechanisms in youths (9). Patients with SCI put a burden on health care system because their condition necessitates much more care and higher costs not only in the acute phase but also in early years after injury due to secondary physical and mental outcomes (10)(11). With regard to the abovementioned points, knowing the prevalence and incidence of SCI is of high importance since the statistics have shown the necessity of prevention (10). Considering the importance of topic and the fact that various life styles, socio-economic class and time of study lead to different epidemiologic statistics (12), much more research should be performed in this field in Iran in order to discover the groups at risk and preventive strategies. As a matter of fact, in prior studies, there has been no emphasis on types of spinal injuries. Therefore, the high importance of this topic in recent years and people's different lifestyles made us to conduct our study in a trauma referral center in Guilan province on epidemiology and types of traumatic spinal injuries.

**Methods & Materials**

This is a descriptive study which was performed by census method on patients with spine trauma who had referred to Emergency Department of Poursina Hospital. Over this period, data of 76 patients were collected prospectively using a questionnaire consisting of demographic characteristics and the injured spine area, injury mechanism, type of neural injury based on ASIA scale and clinical examinations and records and para-clinical findings. Data were analyzed using SPSS (version 18) and descriptive statistics.

**Results**

In this study, 68 of 76 patients admitted with neurologic disorder due to spine trauma were men (88.2%). The male-to-female ratio was 7.4:1. The mean age of men was 35.2±1.45 years and 80% of them were under 45 years. Mean age of women was 47.1±1.16 years (Figure 1). MVA (48.7%) and falling (42.1%) were the most common causes of SCI in this study, respectively. Causes of SCI based on age are shown in figure 2.

43 patients (56.6%) with SCI had burst fracture and 17 patients (22.3%) of these fractures had facet dislocation (type B3 and C1 to 3 in Magerl classification). The unusual fractures like Odontoid and posterior element fracture were the least types. 10 SCI patients (31.1%) had no fracture in spinal column. One of them had SCI in C1-C2 due to stab wound which caused Brown-Sequard. One of the patients had SCI due to gun shut but had no pellet in spinal cord. 8 patients (10.5%) had central cord syndrome due to the previous degenerative canal narrowing. Results of this study indicated that 29.7% of patients had Paraplegia and 10.8% Quadriplegia.

In 34 patients (44.7%), cervical spine trauma and in 23 patients

(30.3%) lumbar trauma led to SCI. No sacral trauma in these patients led to SCI. 25 patients (38.5%) had complete SCI (A in ASIA categorization). Figure 3 shows spine lesion in different levels.

7 patients with SCI (9.2%) died during hospitalization. Mean age of dead patients was 49.42±1.32 years. In this study, increased age was assigned as a risk factor for death. In 4 of these patients (57.1%) cervical SCI led to death. 3 of deaths were due to organ injuries such as brain or sepsis. Falling was the mechanism of trauma due to SCI in 3 deaths (75%).

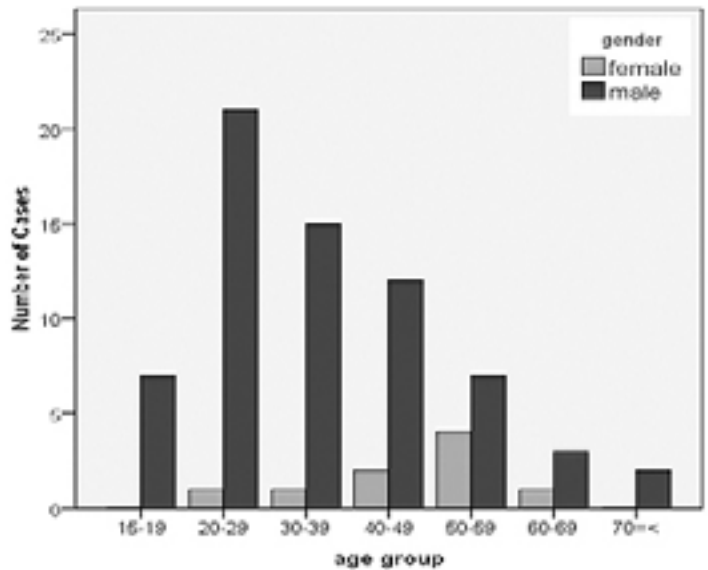


Figure 1. Age profile by Gender

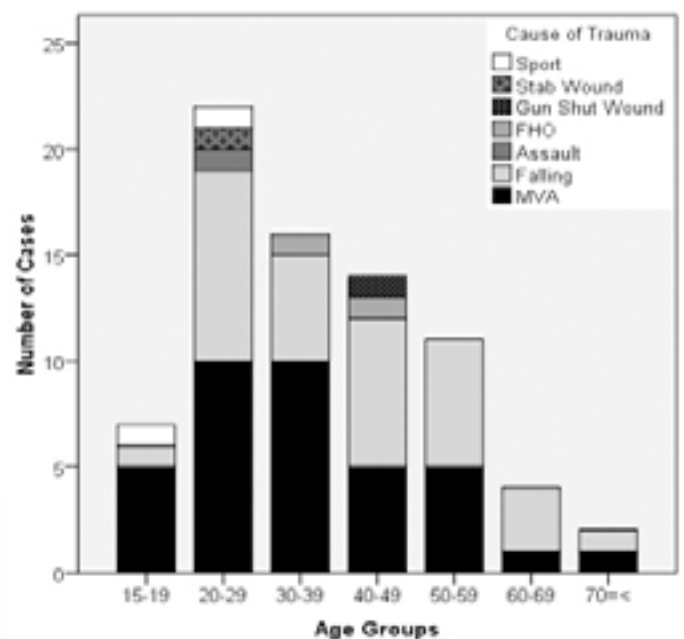


Figure 2: Cause of SCI classified by Age Groups

Downloaded from irjns.org at 13:00 +0430 on Friday June 23rd 2017

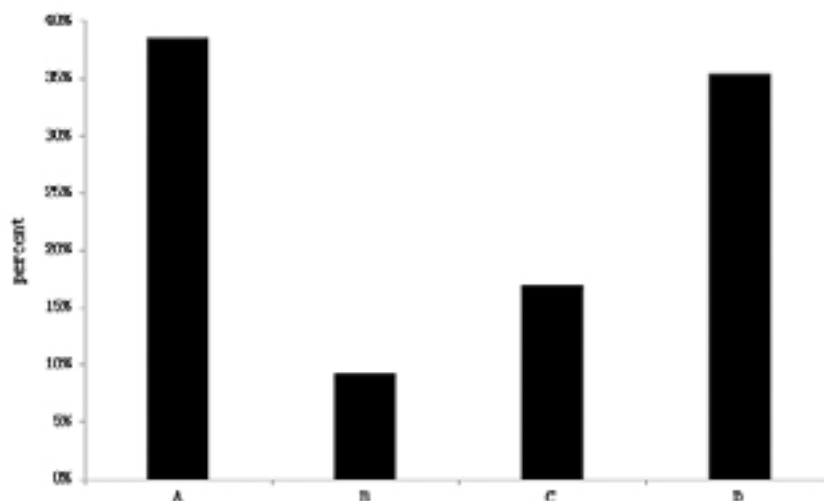


Figure 3. Incidence of Spinal Injury in ASIA

## Discussion

Mean age of patients in this study was  $36.64 \pm 14.61$  years. In similar studies in Canada and America, the mean age of patients was 35 (13) and over 33 years, respectively (12). Asian papers have reported mean age of SCI patients in range of 26.8 to 56.6 years. This estimation was similar to world statistics which displays that most SCI traumatic incidences occur to adult individuals since they are the most active members of society (14). In Iran, a similar study was performed in Tehran in which the mean age of patients with traumatic SCI victims was  $31 \pm 7$  years (8). In our project, 88% of subjects under study were men. In another study by Dryden et al. 71.6% of patients were men (13). Brojeni et al. had 18 men (90%) and 2 women (10%) of 20 subjects in their study (15). In a research by Jackson et al. the number of SCI men was four times more in men than women (12), based on a report by Ning et al, men were more at risk of SCI than women (14). These findings emphasize the fact that younger men are more involved in works and activities in open environments while most women work at home or perform less riskful activities (3)(14). In this effort, the most common cause of SCI was motor vehicle accidents (48.7%) followed by falling (42.1%). In parallel studies, it was suggested that MVC (Motor Vehicle Collision) and falling were the causes leading to SCI, respectively (12)(13)(14). In a study in Iran, traffic accidents (54.11%) and falling (42.35%) were the most common causes of SCI (16). In ongoing study, 44.7% of patients had traumatic spine in cervical area and 30.3% in the thoracolumbar area. In a research by Dryden et al. 61.5% of patients in cervical and 17.3% in thoracic, 17.1% lumbosacral area suffered trauma (13). Broojeni et al. reported the anatomical area of injury as follows; cervical in 8 cases (40%), thoracic in 7 cases (35%), and lumbar in 5 cases (25%) (15) whereas in a study by Erdoğan and colleagues, the most prevalent injury location was attributed to lumbar (48%) followed by thoracic (29.3%) (17). All in all, severity of traumatic SCI is often assessed by the neurologic level of injury (tetraplegia) or extent of injury (complete or incomplete) (14). In a study by Jackson, 54.1% of patients had tetraplegia who occupied a higher number compared to paraplegia (12). In this study, 38.5% of patients had complete

SCI (A grade in ASIA), 9.2% B, 16.9% C, 35.4% D. A study by Feng et al. suggested 32.6% A, 12.1% B, 16.3% C, and 38.9% D (5). In another study, Jackson et al. cited 55.6% A level injury (complete injuries) which was more than incomplete (44.4%) (12). Furthermore, Ning et al. who worked on traumatic SCI epidemiology in Asia concluded that in most countries, most patients were at A level of AIS/A-Frankel (except China & Japan), B level comprised 10 to 30% of patients. A similar number were at C (14) in our project, 7 patients (9.2%) died during hospitalization. In most patients with cervical SCI death was the direct cause of death. Our study revealed that the most causes of death in patients with SCI was injury in cervical area (5) while in a study conducted by Dryden et al. 32% of dead victims had SCI in cervical area, and 68% of them had SCI and injury in other areas (13).

## Conclusion

According to this study, men were more at risk and the most injury mechanism leading to SCI was MVA. In fact, these victims are source of income in family and human resource in society. As a result, these injuries lead to serious damages in diverse dimensions. In most cases, they make patients unable to accomplish their personal matters. Often these traffic accidents are preventable; thus, we suggest more attention be paid to education on safety issues considering at risk groups. Governments and organizations in charge should devise comprehensive plans with clear aims to increase safety.

## Acknowledgment

Hereby, the authors would like to thank Clinical Research Development Unit of Poursina Hospital, Guilan University of Medical Sciences.

## Funding

None declared

## Conflicts of Interest

The authors have no conflict of interest.

## References

- 1) Lee BB, Cripps RA, Fitzharris M, et al. The global map for traumatic spinal cord injury epidemiology: update 2011, global incidence rate. *Spinal Cord*. 2014 Feb;52(2):110-6.
- 2) Pickett GE, Campos Benitez M, Keller JL, et al. Epidemiology of traumatic spinal cord injury in Canada. *Spine (Phila Pa 1976)*. 2006; 31(7):799-805.
- 3) Yang R, Guo L, Wang P, et al. Epidemiology of spinal cord injuries and risk factors for complete injuries in Guangdong, China: a retrospective study. *PLoS One*. 2014; 9(1):e84733.
- 4) McCammon JR, Ethans K. Spinal cord injury in Manitoba: a provincial epidemiological study. *J Spinal Cord Med*. 2011;34(1):6-10.
- 5) Feng HY, Ning GZ, Feng SQ, et al. Epidemiological profile of 239 traumatic spinal cord injury cases over a period of 12 years in Tianjin, China. *J Spinal Cord Med*. 2011;34(4):388-94.
- 6) Pérez K, Novoa AM, Santamaría-Rubio E, et al. Incidence trends of traumatic spinal cord injury and traumatic brain injury in Spain, 2000-2009. *Accid Anal Prev*. 2012; 46:37-44.
- 7) Ji Cheol Sh, Dae Hyun K, Su Jin Y, et al. Epidemiologic Change of Patients With Spinal Cord Injury. *Ann Rehabil Med*. 2013; 37(1): 50–56.
- 8) Rahimi-Movaghar V, Saadat S, R. Rasouli M, et al. Prevalence of Spinal Cord Injury in Tehran, Iran. *The Journal of Spinal Cord Medicine*. 2009; 32(4): 428-431.
- 9) Furlan JC, Fehlings MG. Blood alcohol concentration as a determinant of outcomes after traumatic spinal cord injury. *Eur J Neurol*. 2013;20(7):1101-6.
- 10) Wyndaele M, Wyndaele JJ. Incidence, prevalence and epidemiology of spinal cord injury: what learns a worldwide literature survey?. *Spinal Cord*. 2006; 44(9):523-9.
- 11) Wyndaele M, Wyndaele JJ. Incidence, prevalence and epidemiology of spinal cord injury: what learns a worldwide literature survey?. *Spinal Cord*. 2006; 44(9):523-9.
- 12) Jackson AB, Dijkers M, Devivo MJ, et al. A demographic profile of new traumatic spinal cord injuries: change and stability over 30 years. *Arch Phys Med Rehabil*. 2004; 85(11):1740-8.
- 13) Dryden DM, Saunders LD, Rowe BH, et al. The epidemiology of traumatic spinal cord injury in Alberta, Canada. *Can J Neurol Sci*. 2003; 30(2):113-21.
- 14) Ning GZ, Wu Q, Li YL, et al. Epidemiology of traumatic spinal cord injury in Asia: a systematic review. *J Spinal Cord Med*. 2012; 35(4):229-39.
- 15) Saeedi-Broojeni H, Ghavimi L, Fakheri T, et al. Penetrating spinal injuries by sharp objects; report of

20 cases in Neurosurgery Ward of Taleghani Hospital. *Forensic Medicine*. 2003; 9(30): 61-64.

16) Taghipour M, Sherafat Kazemzadeh E. Traumatic Vertebral Column and Spinal Cord in Shiraz Nemazi Hospital, an Epidemiological Study. *ARMAGHANE DANESH*. 2005; 10(40): 55-62.

17) Erdoğan MÖ, Anlaş Demir S, Koşargelir M, et al. Local differences in the epidemiology of traumatic spinal injuries. *Ulus Travma Acil Cerrahi Derg*. 2013; 19(1):49-52.

## Comments

Shahrokh Yousefzadeh-Chabok and colleagues reported 76 traumatic spinal cord injured (TSCI) patients admitted to Emergency Department of Poursina Hospital which is a trauma referral center in Guilan. They described the age, sex, causes of injury, complete versus incomplete, paraplegic versus tetraplegic patients and in-hospital mortality rate of the patients.

This report is an addition to the literature of TSCI in Iran and in the world. However, there are few concerns: First, incidence defines the rate at which a certain event occurs, as the number of new cases of a specific disease occurring during a certain period in a population at risk (2). Problematically, there is no defined period of time and no defined population at risk, and we do not know how many TSCI occurs, as there is unknown number of patients who die before arrival at hospital. Even a simple question such as what is the population at risk is difficult to answer as the population of the Guilan province, changes yearly, and some there are always patients that will be referred to other provinces? In a hospital based study, we have shown that almost half of the TSCI patients hospitalized in Tehran had been injured in other provinces (3). In addition, we estimated the mean annual incidence of hospitalized TSCI patients of Tehran was 10.5/1,000,000/year (95% confidence interval: 9-12). However, this was much less than population based estimated incidence of SCI in Tehran which was 98.4/1,000,000/year for males and 46.5/1,000,000/year for females (4).

The incidence of SCI in developing countries has been published in a paper from Spain. However, we performed a systematic review and estimated 25.5/million/year (95% CI: 21.7–29.4/million/year) and ranges from 2.1 to 130.7/million/year (5).

There are other concerns with the incidence reported in the existing literature due to the retrospective design and possibility of missed data or other data entry errors. Examples of

these limitations can be seen in two examples

1. One group of authors wrote that there were 76 TSCI patients identified including 34 cervical and 23 thoraco-lumbar injuries, but 34+23=57; what about the other 19 patients? 2. Similarly, the authors wrote “10 SCI patients (31.1%) had no fracture in spinal column.” However, 10 SCI out of 76 patients is 13.1%.

Finally, we would recommend to insert the following title for the study: A case series of 76 traumatic spinal cord injured patients admitted to Poursina hospital, Guilan, Iran (time period: from this to this).

*Vafa Rahimi-Movaghar, MD, Professor of Neurosurgery, Sina Trauma and Surgery Research Center, Tehran University of Medical Sciences, Tehran, Iran*

*Alexander R Vaccaro, MD, PhD, Professor of Orthopedics, The Rothman Institute at Thomas Jefferson University, Philadelphia, PA, USA*

## References:

1. Yousefzadeh-Chabok Sh, Behzadnia H, Kouchakinejad-Eramsadati L, Hosseinpour M, Alijani B, Taghinejadi O. Incidence of Spinal Cord Injury in Traumatic Patients Admitted to a Trauma Referral Center in Guilan. *IrJNS*. 2015;1(1):39-42.
2. Dorland's Medical Dictionary for Health Consumers. © 2007 by Saunders, an imprint of Elsevier, Inc.
3. Sharif-Alhoseini M, Rahimi-Movaghar V. Hospital-based incidence of traumatic spinal cord injury in Tehran, Iran. *Iran J Public Health*. 2014;43(3):331-41.
4. Rahimi-Movaghar V, Moradi-Lakeh M, Rasouli MR, Vaccaro AR. Burden of spinal cord injury in Tehran, Iran. *Spinal Cord*. 2010;48(6):492-7.
5. Rahimi-Movaghar V1, Sayyah MK, Akbari H, Khorramirouz R, Rasouli MR, Moradi-Lakeh M, Shokraneh F, Vaccaro AR. Epidemiology of traumatic spinal cord injury in developing countries: a systematic review. *Neuroepidemiology*. 2013;41(2):65-85.