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Research Paper:

Epidemiology of Spine Trauma and Spinal Cord Injuries in the North of Iran

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ABSTRACT

Background and Aim: Traumatic Spinal Cord Injury (SCI) is one of the most traumatic events threatening patients' well-being and places a financial burden on health care system. The first step in determination of the exact impact of SCI is to estimate the pattern of traumatic injuries in a population and also the type of frequently occurred co-injuries. Hence, this study was conducted to assess the frequency of anatomy, type of spine injuries, and associated co-injuries in patients with trauma in Poursina Hospital of Guilan province in Iran.

Methods and Materials/Patients: A descriptive cross-sectional study was carried out on traumatic spine patients admitted to the Poursina hospital of Rasht, a referral therapeutic center for trauma in north of Iran, in Rasht during 2015 to 2019. Data were extracted from the SCI registry of Poursina Hospital, Rasht, Guilan, Iran.

Results: A total of 274 records were reviewed. Seventy-six patients were females and 198 patients were males. Mean±SD of age of the patients was 42.27±16.83 years. Based on this survey, most of the patients (43.8%) had SCI in lumbar region. Locked facet was seen in 12 patients. Fifty-seven patients (20.8%) complained about having pain. The median of VAS score was 6 (range=6). Co-existence of associated injuries (e.g. limb fractures, TBI, Internal bleeding, etc.) was found in 27.4% of the patients. According to ASIA (The American Spinal Injury Association) impairment scale, three patients (2.9%) had score A, and 100 patients (97.1%) had score E neurological defects.

Conclusion: The most telling reiteration to be drawn is that men mostly suffered from spine trauma. Lumbar region was the most susceptible location of SCI. Moreover, most of the patients experienced score E (normal neurological charcteristics) according to ASIA.

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Highlights

- Men mostly suffered from spine trauma, compared with women.
- Lumbar region was the most susceptible location of spinal cord injury.
- Most of the patients had score E neurological defects according to the American Spinal Injury Association.

Plain Language Summary

Traumatic Spinal Cord Injury (SCI) is one of the most traumatic events threatening patients' health and causes a financial burden on the health care system. The first step in determination of the exact impact of SCI is to estimate the pattern of traumatic injuries in a population as well as the type of frequently occurred co-injuries. In this regard, this study was conducted to assess the frequency of anatomy, type of spine injuries, and associated co-injuries in patients with traumatic SCI in Poursina Hospital of Rasht, Iran during 2015 to 2019. Data were extracted from the SCI registry of the Hospital. A total of 274 records were reviewed. Seventy-six patients were females and 198 patients were males. The mean age of patients was 42.27 years. Based on this survey, most of the patients (43.8%) had SCI in lumbar region, and 47 patients (20.8%) complained about having pain. Coexistence of associated injuries (e.g. limb fractures, traumatic brain injury, internal bleeding, etc.) was found in 27.4% of the patients. Men mostly suffered from spine trauma. Lumbar region was the most susceptible location of SCI. Moreover, most of the patients experienced normal neurological characteristics according to the American Spinal Injury Association.

1. Introduction

Spinal Cord Injury (SCI) is defined as a direct damage to the spinal cord, causing temporary or permanent damage to its performance. SCI can be divided into two main categories: traumatic and non-traumatic [1, 2]. Traumatic SCI occurs due to automobile crash, falling down, sports, etc., while the non-traumatic SCI is secondary to other complications, as tumors, infections, and degenerative disc disease. Chronologically, patients with SCI form four subgroups: i) acute phase patients; who got injured within last 48 hours, ii) subacute phase patients; who got injured between 48 hours to 14 days ago, iii) intermediate phase patients; who got injured between 14 days to 6 months ago, and iv) chronic phase patients; who injury occurred to them 6 months ago and earlier. SCI includes two steps. Primary injury arises from a mechanical force to the nervous tissue resulting in direct damage and a secondary insult which deteriorates the condition [3].

Neuron and glial cell deaths occur directly following SCI, or as a result of the liked ischemia and infection. These changes and associated glial scar compromise internal architecture of the spinal cord, and accompanying with the slow rate of axonal regeneration and remyelination, are factors determining the weak potential of spinal cord for self-regeneration [4]. Hence, it can be expected that regardless of the injury mechanism, SCI is almost always associated with permanent neurological damage.

The cost of care of a patient bearing SCI is estimated to be approximately 1.1 to 6.4 million dollars during his/her lifetime, highlighting the necessity of placing the prevention before the treatment. It has been reported that men have a higher chance (79.8%) to suffer from SCI, compared with women (20.9%) [5] and the risk for morbidity and mortality is higher when the site of the injury is close to the head. Traumatic SCI occurs mostly in the cervical spinal cord (60%) and the risk for its occurrence in thoracic and lumbosacral spinal cord is rather low (32% and 6%, respectively) [5].

Elderly, multi-system trauma, and accident severity are other factors correlated with morbidity and mortality [6, 7]. Although today with advances that have been made in medical sciences the survival rate in SCI patients seems to be promising, these patients still experience a shorter lifespan when compared to age-matched healthy individuals [8]. During hospital stay, the mortality rate in SCI patients has been estimated to be 4-14%. After being discharged, the mortality rate for the patients was estimated to be 3.8% in the first year and 1.6% in the second year following the accident [9].

Depending on the mechanism and type of the injury, traumatic damage to the spine can cause SCI at cervical, thoracic, or lumbosacral spinal levels in spinal cord, which are almost always detectable by one of the medical imaging techniques. SCI includes fractures, tensions, dislocations, etc., which most of the times are accompanied by Traumatic Brain Injury (TBI), burning, fractures of the limbs, and internal organs damage. Damage to the spinal cord could result in complete or incomplete SCI in different levels. International standards for neurological classification of spinal cord injuries, mostly referred to as the ASIA Impairment Scale (AIS), is a scale classifying spinal cord injuries according to motor and sensory functions and the severity of the injury [10].

Regarding the physical, mental, emotional, social, and economic impacts on the patient, her/his family, and the health system, it is necessary to put prevention as the first line treatment for SCI. But in some cases that it is impossible to prevent the injury, providing efficient health care in the shortest possible time frame is of the utmost importance as it turned out to be correlated with successful outcome [9].

The differences in culture and climate and also urban texture can have a direct impact on the incidence of SCI and even their types and levels. Due to the existence of various gardens and building sites, the risk of falling down is high in Guilan province. Additionally, its mild climate attracts passengers from all over the country in holidays such as Nowrouz and summer holidays, making it a province with a somehow custom-built traffic pattern with increased risk of car accidents. There are studies on the traumatic SCI in Guilan province, but either their focuses are on the regions of the spinal cord involved in the injury or they are assessing results in a short period of time. Thus, this study was aimed to investigate not only the anatomical site of the SCIs, but also the types and levels of these injuries and the associated injuries in patients admitted to the Guilan trauma center.

2. Methods & Materials/ Patients

Study design

The present cross-sectional study was based on a survey carried out on patients with spine trauma admitted to the Poursina hospital trauma center in Rasht and registered to Guilan trauma center spinal cord injuries' registry during 2015 to 2019. Medical records of patients with confirmed CT-scan and/or MRI signs of SCI were enrolled in the study. Demographic information including age, sex, anatomical site of the injury, type of the injury, type of the injury to the C1-C2 vertebrae, type of the associated injuries, presence of locked facet, and neurological defects ASIA (The American Spinal Injury Association) impairment scale [10] were extracted from the registry.

Statistical analyses

Absolute and relative percentage abundance of the variables were calculated via SPSS statistical software V. 22 (IBM Corp, Armonk, NY, USA).

3. Results

A total of 274 medical records of patients were reviewed. Seventy-six patients were females (27.7%) and 198 patients were males (72.3%). The Mean±SD of patients' age was 42.27±16.83 years. All patients had non-penetrating traumatic injuries. Based on this survey, 120 patients (43.8%) suffered from SCI in lumbar region of the spinal cord, 76 patients (27.7%) had cervical SCI, and 50 patients (18.2%) had thoracic SCI. Also, 14 patients (5.1%) were reported with both thoracic and lumbar injuries, 10 patients (3.6%) with both thoracic and cervical injuries, 1 patient (0.4%) with both lumbar and sacral injuries, 2 patients (0.7%) with both lumbar and cervical injuries, and 1 patient (0.4%) with cervical and thoracic and lumbar injuries. Tables 1, 2, and 3 represent a summary on the type of fractures and/or displacements in the cervical, thoracic and lumbar regions of the spine, respectively. Locked facet was reported in 12 patients (4.4%).

Accompanying injuries was reported in 75 patients (27.4%) of which 55 patients (73.3%) had limb fractures, 11 patients (14.7%) had TBI, 4 patients (5.3%) represented with internal bleeding, and 5 patients (6.7%) suffered from both TBI and limb fractures. Fifty-seven patients (20.8%) complained about having pain. Table 4 summarizes Visual Analogue Scores (VAS score) [11], assessed in conscious patients who had accompanying injuries, as well as spine trauma. The median of VAS score was 6 (range=6). Of the 103 patients with SCI, according to ASIA impairment scale, 3 patients (2.9%) had score A, and 100 patients (97.1%) had score E neurological defects. Twenty-eight patients (10.2%) were not able to control their urine and 24 of them (8.8%) had no control over excretion.

4. Discussion

In the present study, most of the patients showed normal neurological characteristics (E) according to ASIA. Locked facet was not a frequently observed event in the patients with spine trauma. Limb fracture was the most important associated disease in these patients, in contrast to pain. Safaei et al. studied 174 patients with

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Table 1. Types of injuries in the cervical region of the spinal cord

Types of the Injuries	Frequency	Percentage
A0-no bony or minor injuries	17	25.4
A1-compression fracture	7	10.4
A2-coronal Split or pincer fractures	3	4.5
A3-burst fracture	3	4.5
A4-burst fracture or sagittal split injury	6	9.0
C-translational injury	13	19.4
F1-nondisplaced facet fracture	2	3.0
F2-facet fracture with displaced	4	6.0
F4-pathologic subluxation or perched/ dislocated facet	1	1.5
A0-no bony or minor injuries & A3- burst fracture	1	1.5
A3-burst fracture & C-translational injury	2	3.0
A0-no bony or minor injuries & A1-compression fracture	1	1.5
A0-no bony or minor injuries & A1-compression fracture	3	4.5
C-translational injury & F1-nondisplaced facet fracture	1	1.5
A4-burst fracture or sagittal split injury & C-translational injury	1	1.5
A2-coronal split or pincer fractures & C-translational injury	1	1.5
A2-coronal split or pincer fractures & C-translational injury	1	1.5

Table 2. Types of injuries involving thoracic region of the spinal cord

Type of the Injuries	Frequency	Percentage
A0-minor injuries	7	9.3
A1-wedge compression	16	21.3
A2-split	4	5.3
A3-incomplete burst	17	22.7
A4-complete burst	30	40.0
A1-wedge compression & C-translation/displacement	1	1.3

Table 3. Types of injuries involving lumbar region of the spinal cord

Type of the Injuries	Frequency	Percentage
A0-minor injuries	3	2.2
A1-wedge compression	24	17.4
A2-split	3	2.2
A3-incomplete burst	49	35.5
C-translation/displacement	1	0.7
A4-complete burst	55	39.9
B1-monosegmental bony posterior tension band injury / chance fracture	1	0.7
B2-posterior tension band disruption	1	0.7
A3-incomplete burst & A1-wedge compression	1	0.7

Table 4. VAS Score in patients with traumatic spine injuries

VAS Score	Frequency	Percentage
Score 2	1	1.8
Score 3	4	7.0
Score 4	4	7.0
Score 5	11	19.3
Score 6	26	45.6
Score 7	9	15.8
Score 8	2	3.5

spine injury in our hospital between 2001 and 2003 and reported that 71.8 % of the patients were male with an average age of 40.75±15.55 years [12]. Moreover, lumbar (L1), thoracic (T12), and cervical (C7) spine injuries of spine were found in 54.6, 33.9, and 11.5 percent of the patients with spine injury.

In our study, we observed that 198 patients (72.3%) were males. The mean of patients' age was 42.27 years. One hundred-twenty patients (43.8%) suffered from SCI in lumbar region of the spinal cord, 76 patients (27.7%) had cervical SCI, and 50 patients (18.2%) had thoracic SCI. Furthure, 14 patients (5.1%) were reported with both thoracic and lumbar injuries, 10 patients (3.6%) with both thoracic and cervical injuries, 1 patient (0.4%) with both lumbar and sacral injuries, 2 patients (0.7%) with both lumbar and cervical injuries, and 1 patient (0.4%) with cervical and thoracic and lumbar injuries.

In 2015, Yousefzadeh et al. investigated 74 patients with spine injury and found that 88.2 of the patients were male [13]. Moreover, 34 patients (44.7%) experienced cervical spine injury. Thoracolumbar injuries resulted in SCI in 23 patients (30.3%). 29.7% of the patients had paraplegia and 10.8% of the patients suffered quadriplegia. Complete SCI was reported in 25 patients (38.5%).

In our study, of the 103 patients with SCI, according to ASIA impairment scale, 3 patients (2.9%) had score A, and 100 patients (97.1%) had score E neurological defects. Ramezani et al. [14] carried out a cross-sectional investigation on all 15-80 years old patients with trauma in Poursina Hospital of Guilan Province from 2015 to 2017 and reported that 70% of all the patients with spinal fractures were male and 30% were female. In addition, the mean age of patients with spinal fractures was 40.2. Lumbar (47.64%), cervical (30.58%) thoracic (21.76%) spine fractures were found to be the most prevalent.

An Icelandic retrospective study assessed hospital admissions owing to traumatic spinal fracture during a 5-year period [15]. The authors reported a total of 487 patients were diagnosed with a spinal fracture in which the mean age was 56 years Of these patients 9% developed SCI. A Spanish observational study on 282 traumatic SCI patients in the Canary Islands between 2001 and 2015 showed that 80.1% of the patients were males [16]. Additionally, the most frequently affected level was the cervical spine (50.9%), and incomplete tetraplegia (29.8%) was the most prevalent group.

5. Conclusion

The most telling reiteration is that men mostly had spine trauma. Lumbar region was the most susceptible place of SCI. Moreover, most of the patients experienced score E (normal neurological defects) according to ASIA.

Ethical Considerations

Compliance with ethical guidelines

The study was approved by institutional ethics committee (Code: IR.GUMS.REC.1397.517).

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Authors contributions

Sasan Andalib and Zahra Mohtasham Amiri (co-first authors) contributed equally to the paper. All authors met ICMJE criteria.

Conflict of interest

Authors declare no conflict of interest.

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