ORIGINAL RESEARCH

A hospital based epidemiological study to assess the traumatic spinal injuries: An observational study

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ABSTRACT
Aim: The aim of the present study is to describe the distribution of traumatic spinal cord injury (TSCI).**Material & Methods:** All patients with acute TSI with or without SCI who were admitted in Department of Neuro Surgery, over the duration of 1 year were retrospectively selected from trauma registry for all ages and all spinal injuries. Total 100 patients with traumatic spine injury were included in study. **Results:** Out of 100, 75 were male and 25 were female. The most prevalent age group in our study was 30-39 years in 25 cases (25%) followed by 20-29 years in 20 cases (20%). In our study most common mode of injury was fall from height like unprotected roof, uncovered well, construction work, tree, electric pole in 46 cases (46%), followed by road traffic accident in 41 cases (41%). other cause of injuries were assaults in 7 cases (7%) and sports in 6 cases (6%). In our study lumber spinal column was fractured in 55 cases (55%) followed by thoracic spine in 22 cases (22%). Cervical spine injuries noted in 21 cases (21%). Sacral spine injuries noted only in 2 cases (2%) but it associated with abdominal and pelvic injuries. Most common of them was head injuries in 10 cases (10%) and extremities injuries 11 cases (11%) followed by chest injuries 5 cases (5%), abdominal injuries 3 cases (3%) and pelvic injuries 3 cases (3%). **Conclusion:** Traumatic spinal injury is major source of morbidity and mortality throughout the world. Younger age group and Male are more commonly affected as compare to older age group and female. Accidental fall and RTA are major cause if TSI. By observing the nature of spinal injuries from the above study all the spinal cord injuries requires immediate Neuro surgical intervention to fix and stabilization of spine to prevent more disabilities and neurological complications. The government should focus on enhancing the neurosurgical capabilities for the treatment and rehabilitation of catastrophic spinal cord injuries.

Key words: Epidemiology, traumatic spinal cord

INTRODUCTION

Spinal cord injury (SCI) causes significant physical and economic challenges and presents a range of issues for the patient's psychological well-being and social well-being [1]. Spinal cord injury (SCI) is widely recognized as a significant global public health issue, with varying rates of occurrence across different locations [2]. In affluent countries, the average annual occurrence of spinal cord injury (SCI) varies from 10.4 cases per million individuals to 83 cases per million individuals [3, 4]. In poor countries, Spinal Cord Injury (SCI) has a prevalence rate of 25.5 cases per million individuals annually [5]. Given the absence of efficient rehabilitation techniques for spinal cord injuries (SCI), primary prevention becomes especially crucial.

Compared to other types of traumatic injuries, traumatic spinal injuries (TSI) result in the highest levels of illness and death worldwide. Traumatic spinal injury (TSI), which refers to a damage to the

spinal column, spinal cord, or both, often results in a substantial decline in the overall well-being of individuals and their families [6]. The worldwide prevalence of TSI was 10.5 instances per 100,000 individuals, leading to an anticipated annual increase of 768,473 new cases of TSI globally. The prevalence of TSI is greater in lower- and middle-income nations, with a rate of 13.69 per 100,000 individuals, compared to higher income countries, which had a rate of 8.72 per 100,000 people [7]. Spinal fractures frequently coincide with other injuries, since studies indicate that between 30% and 55% of patients experience at least one additional injury [8, 9]. Spinal cord damage (SCI) is a serious outcome that occurs in approximately 10% to 20% of individuals with spinal injury [10, 11].

In the context of India, the epidemiological factors contributing to spinal cord injuries (SCI) differ from those in Western countries. The primary cause of SCI in India is falls. The combination of a poor socioeconomic position and a younger age group has significant financial, social, and psychological consequences, as the majority of these patients are the principal breadwinners for their families [12]. An meticulous epidemiological study can offer insights into the extent of the issue of spinal trauma and the subsequent need for medical and social resources. It can aid in identifying the risk factors and the specific mechanism of spinal injury. Additionally, it is beneficial to develop proactive strategies or plans that can alter or eliminate the circumstances that provide a risk, hence reducing the occurrence of this debilitating condition.

The objective of this study was to provide a detailed account of the occurrence of traumatic spinal cord injury (TSCI) and the associated risks of mortality. This was done by analyzing several factors such as patient characteristics, anatomical location of the injury, origin of the injury, and the type of healthcare support obtained.

MATERIAL & METHODS

Hospital based observational study. All patients with acute TSI with or without SCI who were admitted in Department of Neuro Surgery, over the duration of 1 year were retrospectively selected from trauma registry for all ages and all spinal injuries. Total 100 patients with traumatic spine injury were included in study. Patients presenting minor injuries (isolated spinous process fractures), paravertebral soft tissue injury (muscular sprains) and injuries to the lumbar transverse processes attributable to the mechanism of avulsion lesion secondary to a pelvic injury were excluded.

METHODOLOGY

Patients with congenital, metabolic, rheumatologic diseases and neoplasms such as Klippel-Feil syndrome, osteoporosis, ankylosing spondylitis, and multiple myeloma were excluded. The analysis was focused on patient-related demographic characteristics, cause and mechanism of injury, level and type of injury, neurological deficit, associated injuries (AI), management and outcome. Based on the notion of dominant lesional vector force and increasing severity of trauma, three different mechanisms of injury were used to distinguish between three types of injuries with compression:

Type A injury, distraction in either flexion or extension.

Type B injury and rotation.

Type C injury.

For the localization of spinal injuries, the spinal column was divided into 5 different segments according to anatomic and physiologic differences in each spinal segment, with upper cervical: occipital condyle (C0), atlas (C1) and axis (C2); lower cervical (C3-C7), thoracic (T1-T12), lumbar (L1-L5) and sacrococcygeal (SC) segments.

Any patient sustaining an injury at more than one of the aforementioned segments was classified as having multi-segmental injuries. For the level of injuries, we have classified spinal injuries into single level (SL) which are injuries to one vertebra and/or one intervertebral disc and multilevel injuries (injury at more than one level of the vertebral column). The later were further classified as multilevel contiguous (MLC) when $\geq$ 2 adjacent vertebrae were involved and multilevel noncontiguous (MLNC) if there was preservation of at least one uninjured vertebra between the injuries. For the type of injuries, based on diagnostic imaging studies including conventional radiographs, Computed Tomography (CT) and Magnetic Resonance Imaging (MRI), upper cervical spine injuries were classified into occipital condyle fracture, Jefferson fracture (or burst fracture of C1: When there are both anterior and posterior arch fractures), odontoid type 2 (fracture through the base of the dens), odontoid type 1(oblique fracture through the odontoid tip), odontoid type 3 (fracture through the body of C2), C2 Hangman's fracture (fracture of both pedicles or pars interarticularis of C2), C1-2 dislocations, C1-2 miscellaneous fractures (affecting the C1-C2 lamina, body, lateral mass, or spinous process). The modified Argenson classification [16] was used for lower cervical spine injuries, whereas Magerl classification [17] has been used for thoracic and lumbar spine injuries. The American Spinal Injury Association (ASIA) grading system was used to document SCI with ASIA A: Complete; B-D: Incomplete and E: Normal. Two types of SCI without radiological abnormalities (SCIWORA) were differentiated. The SCIWORA type 1 was positive neurologic findings and negative plain x-ray and CT scan but pathologic spinal cord MRI. The second type was defined as abnormal neurologic examination with normal imaging (including MRI). Any improvement or deterioration in spinal injury grade during treatment

and follow-up was documented. All the cases of death were recorded.

STATISTICAL ANALYSIS

All of the statistical calculations were performed using the Statistical Package for Social Sciences (SPSS) for macOS version 24.0 (SPSS Inc. Chicago, Illinois, US). Descriptive statistics were presented as number of cases, percentage and mean.

RESULTS

Table 1: Age-sex distribution among the study participants

Age group (Years)	Male	Female	Total
0-9	0	0	0
10-19	10	4	14
20-29	14	6	20
30-39	20	5	25
40-49	14	3	17
50-59	8	2	10
60-69	9	0	9
>70	0	5	5
Total	75	25	100

Out of 100, 75 were male and 25 were female. The most prevalent age group in our study was 30-39 years in 25 cases (25%) followed by 20-29 years in 20 cases (20%).

Table 2: Mode of injuries among the study participants

Mode of injuries	N	%
Fall from height (roof, tree, electric pole)	46	46
Road traffic accident	41	41
Fall of heavy objects or sports	6	6
Assault	7	7

In our study most common mode of injury was fall from height like unprotected roof, uncovered well, construction work, tree, electric pole in 46 cases (46%), followed by road traffic accident in 41 cases (41%). other cause of injuries were assaults in 7 cases (7%) and sports in 6 cases (6%).

Table 3: Level of spinal injuries distributions among the study participants

Level of spine/site	No of cases
Cervical	21 (21%)
Thoracic	22 (22%)
Lumbar	55 (55%)
Sacral	2 (2%)

In our study lumber spinal column was fractured in 55 cases (55%) followed by thoracic spine in 22 cases (22%). Cervical spine injuries noted in 21 cases (21%). Sacral spine injuries noted only in 2 cases (2%) but it associated with abdominal and pelvic injuries.

Table 4: Other Associated injuries among the study participants

Head	11 (11)
Chest	5 (5%)
Abdomen	3 (3%)
Pelvic	3 (3%)
Extremity	10 (10%)

Most common of them was head injuries in 10 cases (10%) and extremities injuries 11 cases (11%) followed by chest injuries 5 cases (5%), abdominal injuries 3 cases (3%) and pelvic injuries 3 cases (3%).

DISCUSSION

Over 10% of trauma patients experience spinal injury, resulting in a heightened death risk in comparison to other types of trauma [13, 14]. The prevalence of spinal fractures ranges from 16 to 64 per 100,000 individuals, depending on the specific study location and demographic being examined [15, 16]. Globally, the majority of injuries are attributed to road traffic accidents (RTAs), as well as falls from both low and high heights. Road traffic accidents and falls from heights are common causes of injury in young

patients, while low falls and osteoporosis-related injuries are more prevalent in elderly individuals. Spinal fractures frequently coincide with other injuries, since research indicates that 30% to 55% of patients experience at least one additional injury [17, 18].

Of the total 100 individuals, 75 were identified as male while the remaining 25 were identified as female. In our analysis, the age group that appeared most frequently was 30-39 years, with 25 instances (25%). This was followed by the age group of 20-29 years, which appeared in 20 cases (20%). The age distribution of patients in our investigations is similar to that of studies conducted in other regions of India and the world [19-21]. The higher prevalence of this condition in males can be attributed to an analysis of causal factors, since men are more frequently exposed to risk factors due to their greater level of occupational activity. Moreover, this is likely attributable to the presence of females in the household. The predominant cause of injury in our study was falls from elevated surfaces such as unprotected roofs, uncovered wells, construction sites, trees, and electric poles, accounting for 46 cases (46%). This was followed by road traffic accidents, which accounted for 41 cases (41%). Additionally, injuries were caused by attacks in 7 cases, accounting for 7% of the total, and by sports-related activities in 6 cases, making up 6% of the total. In the study conducted by R. Singh *et al.* [22], the most prevalent cause of injury was falling from a height, such as roofs, trees and electricity poles, accounting for 44.5% of cases. This was closely followed by motor vehicle accidents, which accounted for 34.7% of cases, a finding that aligns with our own analysis. In India, like in other developing countries, there has been a significant increase in the number of vehicles. However, this increase is not proportional to the quality of the roads. As a result, there has been a rise in road traffic accidents, particularly among younger people.

Our investigation found that the lumber spinal column was fractured in 55 instances, accounting for 55% of the total cases. The thoracic spine was fractured in 22 cases, making up 22% of the total cases. There were 21 cases (21%) of cervical spine injuries observed. Only 2 patients (2%) had sacral spine injuries, which were shown to be related with stomach and pelvic injuries. These findings were similar to those reported in the study conducted by Niemi-Nikkola V *et al*. [23] The most prevalent injuries were head injuries, which occurred in 10 cases (10%), followed by extremity injuries in 11 instances (11%). Chest injuries were reported in 5 cases (5%), while abdominal and pelvic injuries were each reported in 3 cases (3%). Spinal cord injury (SCI) has adverse effects on the patient's physical, social, and psychological well-being. In addition to its significant economic implications, SCI imposes a substantial load on healthcare systems.

CONCLUSION

Traumatic spinal injury is a significant cause of illness and death globally. The prevalence of this condition is higher among the younger male population compared to the older male and female population. Unintentional falls and road traffic accidents (RTAs) are the primary causes of traumatic spinal injuries (TSIs).By observing the nature of spinal injuries from the above study all the spinal cord injuries requires immediate Neuro surgical intervention to fix and stabilization of spine to prevent more disabilities and neurological complications. The government should focus on enhancing the neurosurgical capabilities for the treatment and rehabilitation of catastrophic spinal cord injuries.

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