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Original Research Article

A Retrospective Study Assessing the Incidence of Traumatic Spinal Cord Injury (TSCI) and Mortality Risks: An Observational Study

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Abstract

Aim: The aim of the present study was to describe the incidence of traumatic spinal cord injury (TSCI) and mortality risks, based on the characteristics of the patient, anatomical level of the lesion, setting/cause of the injury, and type of healthcare support received within the regional trauma network.

Material & Methods: All patients with acute TSI with or without SCI who were admitted in Department of General Surgery, over the duration of 2 years were retrospectively selected from trauma registry for all ages and all spinal injuries. Total 200 patients with traumatic spine injury were included in study.

Results: Out of 200, 140 were male and 60 were female. The most prevalent age group in our study was 30-39 years in 50 cases (25%) followed by 20-29 years in 40 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 90 cases (45%), followed by road traffic accident in 84 cases (42%). other cause of injuries were assaults in 16 cases (8%) and sports in 10 cases (5%). In our study lumber spinal column was fractured in 108 cases (54%) followed by thoracic spine in 46 cases (23%). Cervical spine injuries noted in 40 cases (20%). Sacral spine injuries noted only in 6 cases (3%) but it associated with abdominal and pelvic injuries. Out of 200 cases of traumatic Spinal Injuries 64 cases (32%) found to be had other associated injuries. Most common of them was head injuries in 20 cases (10%) and extremities injuries 20 cases (10%) followed by chest injuries 12 cases (6%), abdominal injuries 6 cases (3%) and pelvic injuries 6 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. Prevention remains the most effective way to reduce the burden of the traumatic spinal cord injuries. Government should work to strength the neurosurgical capacities for traumatic spinal cord management and rehabilitation.

Keywords: Epidemiology, traumatic spinal cord, Bihar

Introduction

As compare to other traumatic injuries traumatic spinal injuries (TSI) cause greatest amount of morbidity and mortality throughout the world. Traumatic spinal injury (TSI, injury to spinal column, spinal cord, or both) commonly leads to significant impairment in the quality of personal and family life. [1] These injuries are often caused by heavy injuries, traffic accidents, falling accidents, etc. and are centered in the labor age population and elderly population. [2,3] The overall global incidence of TSI was 10.5 cases per 100000 people resulting in an estimated 768473 new cases of TSI increase annually worldwide. Incidence of TSI is higher in lower and middle-income countries (13.69 per 100000 people) as compared to higher income countries (8.72 per 100000 people). [4] Spinal fractures are often associated with other injuries as 30% to 55% of patients are reported to have at least one associated injury. [5,6] Spinal cord injury (SCI) is one of the severe consequences coexisting in

one-tenth to one-fifth of those with spinal injury. [7,8]

Epidemiological factors of SCI in Indian scenario are different from Western countries, with the major cause being fall. The low socioeconomic status and younger age group have a major financial, social, and psychological impact as majority of the patients are the primary earning members of the family. [9]

Despite the economic differences between countries or regions, this traumatic disease has caused a large loss of the working population, imposing a serious economic burden on patients and families, which leads to high health expenditure and economic losses. [10,11]

With the limited resources in low-income countries, healthcare cost is one of the main barriers affecting the quality of life of people with SCI. [12] Furthermore, clinical symptoms of depression were seen in 20-30% of people with SCI. [13] Because there is no cure for SCI, primary and secondary prevention strategies are vital. [14] Epidemiological evidences will help to plan and implement future preventive measures. In the Indian setup, as in most developing countries, very little is known about the exact incidence of SCIs. Since there is no curative treatment for SCI, prevention of SCI is paramount. Investigating the epidemiological pattern of SCI is the first step in planning for preventive strategies. [15]

A careful epidemiological study can provide information regarding magnitude of the problem of spinal trauma and resultant demand of medical and social resources. It can help to identify the risk factors involved and actual mode of spinal injuries. It also helps to formulate preventive measures / planning's which may modify or eliminate the risk factors and may decrease the incidence of this incapacitating injury.

Material & Methods

All patients with acute TSI with or without SCI who were admitted in Department of General Surgery, Narayan Medical college and Hospital, Sasaram, Bihar , India over the duration of 2 years were retrospectively selected from trauma registry for all ages and all spinal injuries. Total 200 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 also 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 ≥ 2 adjacent vertebrae were involved and multilevel non-contiguous (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). Values for p $p<0.05$ were regarded as statistically significant and all confidence intervals (CI) were expressed at 95%.

Descriptive statistics were presented as number of cases, percentage and mean. Statistical analyses were conducted using the student t-test and nonparametric tests including the Mann-Whitney U-test and the Kruskal-Walli's test. The Pearson's Chi-square ($\chi 2$) testing of frequency data was performed where appropriate. Analysis of variance (ANOVA), odd ratio (OR) of associated injuries (AI) was calculated using forward stepwise regressions.

Results

Table 1: Age-sex distribution

Age group (Years)	Male	Female	Total
0-9	0	0	0
10-19	13	3	28
20-29	23	7	40
30-39	34	10	50
40-49	20	9	35
50-59	10	5	20
60-69	8	8	18
>70	0	8	9
Total	140	60	158

Out of 200, 140 were male and 60 were female. The most prevalent age group in our study was 30-39 years in 50 cases (25%) followed by 20-29 years in 40 cases (20%).

Table 2: Mode of injuries

Mode of injuries	N	%
Fall from height (roof, tree, electric pole)	90	45
Road traffic accident	84	42
Fall of heavy objects or sports	10	5
Assault	16	8

In our study most common mode of injury was fall from height like unprotected roof, uncovered well, construction work, tree, electric pole in 90 cases (45%), followed by road traffic accident in 84 cases (42%). other cause of injuries was assaults in 16 cases (8%) and sports in 10 cases (5%).

Table 3: Level of spinal injuries distributions

Level of spine/site	No of cases
Cervical	40 (20%)
Thoracic	46 (23%)
Lumbar	108 (54%)
Sacral	6 (3%)

In our study lumber spinal column was fractured in 108 cases (54%) followed by thoracic spine in 46 cases (23%). Cervical spine injuries noted in 40 cases (20%). Sacral spine injuries noted only in 6 cases (3%) but it associated with abdominal and pelvic injuries.

Table 4: Other Associated injury

Head	20 (10)
Chest	12 (6%)
Abdomen	6 (3%)
Pelvic	6 (3%)
Extremity	20 (10%)

Out of 200 cases of traumatic Spinal Injuries 64 cases (32%) found to be had other associated injuries. Most common of them was head injuries in 20 cases (10%) and extremities injuries 20 cases (10%) followed by chest injuries 12 cases (6%), abdominal injuries 6 cases (3%) and pelvic injuries 6 cases (3%).

Discussion

More than 10% of trauma patients sustain spinal injury and they have a higher mortality rate compared to other traumas. [18,19] The incidence of spinal fractures is reported to vary between 16 and 64/100,000 depending on the study area and population concerned. [20,21] Internationally, most of the injuries are caused by road traffic accidents (RTAs), together with low and high falls. Road traffic and high fall accidents are typical etiology in young patients, whereas the role of low falls and associated osteoporosis increases trauma in older population. Spinal fractures are often associated with other injuries as 30% to 55% of patients are reported to have at least one associated injury. [22,23]

Out of 200, 140 were male and 60 were female. The most prevalent age group in our study was 30-39 years in 50 cases (25%) followed by 20-29 years in 40 cases (20%). The age distribution of patients of our studies is comparable with studies from the other parts of the India and World. [24-26] Higher incidence in males can be explained by examination of etiological factors, with men being more exposed to risk factors since they are more active on account of occupations. Furthermore, this is probably due to household stay of females. In our study most common mode of injury was fall from height like unprotected roof, uncovered well, construction work, tree, electric pole in 90 cases (45%), followed by road traffic accident in 84 cases (42%). other cause of injuries were assaults in 16 cases (8%) and sports in 10 cases (5%). In study of R. Singh et al [27] also most common cause of injury was fall from height including roof, trees, electricity pole (44.5%) followed by motor vehicle accidents (34.7%) that was almost similar to our study. Like other developing countries there is tremendously increase in number of vehicle which is not proportion to quality of road in India further raises the incident in of road- traffic accident in younger group of people.

In our study lumber spinal column was fractured in 108 cases (54%) followed by thoracic spine in 46 cases (23%). Cervical spine injuries noted in 40 cases (20%). Sacral spine injuries noted only in 6 cases (3%) but it associated with abdominal and pelvic injuries which were comparable to the study by Niemi-Nikkola V et al. [28] Out of 200 cases of traumatic Spinal Injuries 64 cases (32%) found to be had other associated injuries. Most common of them was head injuries in 20 cases (10%) and extremities injuries 20 cases (10%) followed by chest injuries 12 cases (6%), abdominal injuries 6 cases (3%) and pelvic injuries 6 cases (3%). Spinal cord injury (SCI) negatively affects the patient's physical, social and psychological well-beings. Besides its paramount economic costs, SCI places profound burden on healthcare systems.

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. Prevention remains the most effective way to reduce the burden of the traumatic spinal cord injuries. Government should work to strength the neurosurgical capacities for traumatic spinal cord management and rehabilitation.

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