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Type of study: Original

Epidemiological profile of incomplete and complete spinal cord injury in tertiary care hospital in Himalayan region of north India, Himachal Pradesh

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Abstract

Introduction: Spinal Cord Injury (SCI) affects many facets of an individual's life. The physical, personal, financial and social impact of spinal cord injury is such that most patients are lost in follow-up or succumb to life-threatening complications associated with spinal cord injury. More than half of the survivors from injury cannot return back to normal life. **Methodology:** It was a cross-sectional analytical study conducted in a tertiary care hospital of Himachal Pradesh for duration of one year i.e. from 1st July 2016 through June 2017. All patients of Traumatic SCI were included in the study. **Results:** There were 274 patients who presented with TSCI and out of them 61 had complete and 213 had incomplete spinal injury with male predominance (201;73.3%). The most common cause for TSCI was fall in (178) 65% of the patients.

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Conclusion: SCI has a major effect not only on individual but also on family and society by psychological and economical manner. Prevention is possible by better upkeep and management of roads and other legislative measures.

Keywords: Epidemiology, Traumatic spinal cord injury, Public health, road side accident, health systems strengthening .

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Background:

Accidents are a major public health problem. Traumatic spinal cord injury (TSCI) is a kind of injury having great impact on patients and their families. As Sir Ludwig Guttmann, the great pioneer in the field of spinal cord injury (SCI) rehabilitation, pointed out in the year1976, severe SCI is undoubtedly one of the greatest disasters to human beings[1]. TSCI not only leads to possible serious disability but may also cause dysfunctions of many organs, including the respiratory, gastrointestinal, urinary, and autonomic nervous system, as well as skin, bone, and joints. The involvement of multiple organ systems may lead to movement disorders, serious complications, and a high mortality rate during both acute and chronic stages. Additionally, research indicated that 22.8% of the caregivers had depression with regard to their stress from taking care of these patients[2].

The main cause of TSCI in all developed countries is traffic accidents (TAs) with the prevalence of TAs ranging from 35% to 53.8% [3,4]. The second most common cause of TSCI is falls, which range from 22.6%26 to 37%[5]. Conversely, falls are the primary cause in most of the developing countries. The rates vary from 37.9%25 to 63% [6]. Epidemiological factors of SCI in Indian scenario are different from Western countries, with the major cause being falls. 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[7].

Additionally, significant variation in the prevalence of TSCI exists among geographic regions. As is well known, Shimla is the capital city and one of the largeest and most populous districts of Himachal Pradesh, India However, at present, very little is known and reported about the prevalence of TSCI in Himachal Pradesh. The goals of the present study were to explore the epidemiological features of patients with TSCI in Shimla and to help establish the best allocation of medical resources, in order to ease financial and social burdens.

Methods

This cross-sectional analytical study was conducted during 2016-2017 over the period of one year at Department of Surgery and Department of Neuro-surgery, India Gandhi Medical College (IGMC), Shimla, Himachal Pradesh. 274 patients with TSCI were included in the study. All patients with traumatic spinal cord injury were included in the study. Patients with non-traumatic

spinal cord injury were excluded. The detailed history was taken which included the mode of injury, delay from time of accident to time of admission, first aid given, mode of transport and associated injuries. These details were recorded as per the proforma. After clinical assessment and stabilizing for acute symptoms all patients presenting in OPD / Emergency Department with TSCI underwent hematological and radiological investigations.

Complete and incomplete TSCI were evaluated using ASIA impairment scale. ASIA impairment scale defines TSCI in to 5 grades. Grade A is termed as complete injury while Grade B to E are termed as incomplete.

Results:

Demographic profile

On the basis of ASIA impairment scale, out of 274 patients, 61 patients had complete injury while 213 patients had incomplete injury. Age was comparable between both the groups (p value= 0.72). 83.3% of patients with complete injury were males. Males were significantly more prone to have complete injury (81.9% vs 65.3% in incomplete injury). 84.3% of all the patients received adequate treatment before reaching the institute under study. The prior treatment was not associated with type of TSCI. 27.7% of all the patients had alcohol intake prior to injury. Alcohol consumption was not associated with complete TSCI (table 1).

Table 1: Demographic profile of patients

Variables		**Complete Injury (n=61)**	**Incomplete Injury (n=213)**	**P Value**
Sex	Male:Female	50:11	151:62	0.008
Age group	Mean±SD	42.967±18.14	42.103±16.63	0.72
Alcohol intake prior to injury	Yes:No	18:43	58:155	0.85

Etiology:

Fall was the most common cause of TSCI in 65% (n=178) of the patients. The mean height of fall in patients with complete injury was 33.56±28.15 feet while in incomplete injury the mean height reported was 18.63±18.37 feet with statistically significant difference (p value <0.001). Road traffic accident was the second most common cause of TSCI in 32.5% (n=89) patients but the evidence of association with the type of injury could not be generated. Out of 89 patients with road traffic accident, 89.88% (n=80) patients met with accident on vehicle while remaining 10.11% (n=9) patients were travelling as pedestrian at the time of injury. Overall, collision was the most common type of vehicular injury in 39 (48.75%) patients followed by rolldown in 38 (47.5%) patients. 66 out of 80 patients (82.5%) were driving four wheelers at the time of injury while 4 patients were using public transport. Out of 178 patients with fall, 107 (60.11%) patients had domestic fall while and remaining 71 (39.8%) patients had outdoor fall. (Table 2)

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Table 2: Mode of injury in patients with complete and incomplete injury

		Complete (n=61)	Incomplete (n=213)	P Value
Mode of injury	Assault	1 (2%)	4 (2%)	0.78
	Fall	41 (67%)	137 (64%)	
	Occupational	1 (2%)	1 (1%)	
	RSA	18 (30%)	71 (33%)	
Height from fall (feet) (Mean±SD)		33.56±28.15 (n=41)	18.63±18.37 (n=137)	<0.001
Type of RSA	Pedestrian	2 (12%)	7 (9%)	0.67
	Vehicle	15 (88%)	65 (91%)	
Vehicular injury	Collision	5 (33%)	34 (52%)	0.388
	Collision & rolldown	0	1 (2%)	
	Rolldown	10 (67%)	28 (43%)	
	Rollover	0	2 (3%)	

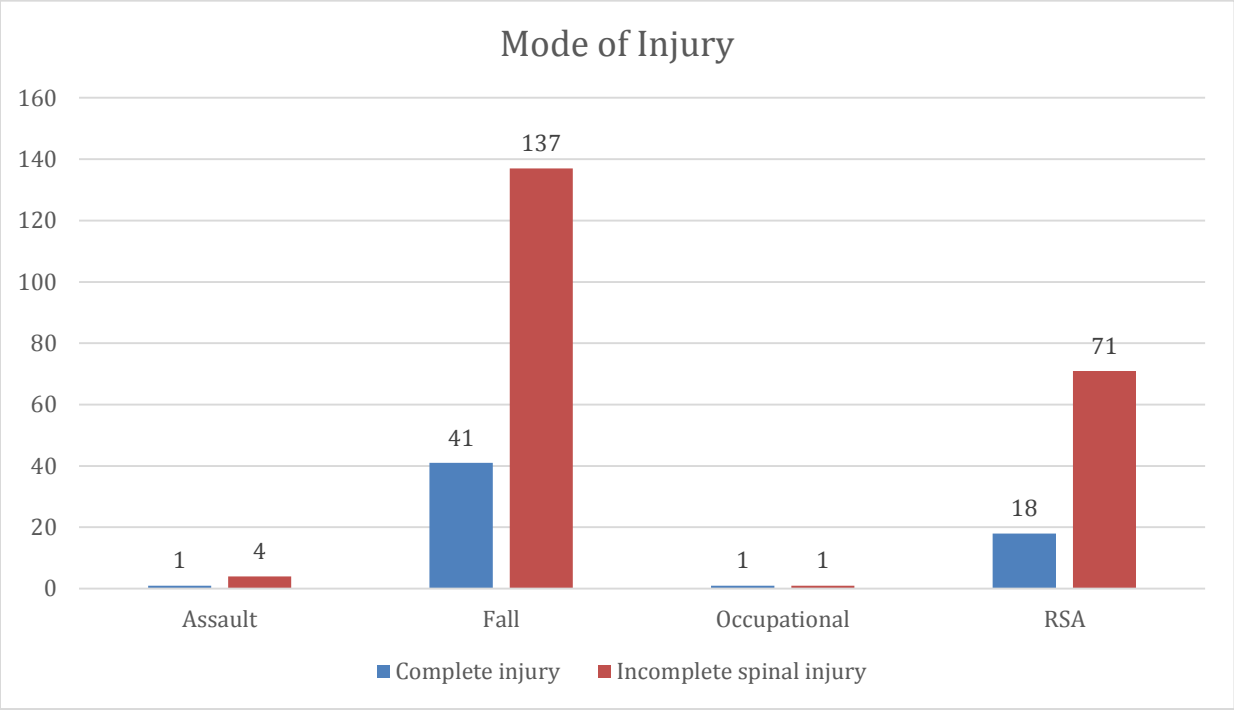

Figure 1: Mode of injury in patients with complete and incomplete TSCI.

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Table 3: Mean time duration of arrival in hospital and stay at hospital

		Complete (n=61)	Incomplete (n=213)	P Value
Mode of transport	Ambulance	38 (62%)	141 (66%)	0.572
	Private	23 (38%)	72 (34%)	
Time to reach nearest hospital (hours)		5.04±9.94 (n=51)	3.89±11.13 (n=158)	0.511
Time to reach IGMC (hours)		16.7±19.04 (n=60)	10.24±15.41 (n=213)	**0.007**
Mean hospital stay (days)		13.83±9.45 (n=60)	10.58±8.13 (n=207)	**0.009**

The time from the point of trauma to being admitted in the tertiary care hospital ranged between 10-16 hours. During this period, some patients might have received treatment in their local hospitals, and others might have been in an ambulance on the way to the hospital. Even worse, some patients might not have paid full attention to their trauma conditions and even stayed at home during this period. Out of the 61 patients with complete injury, 38 (62.29%) patients were transported in ambulance and rest 23 were transported in private vehicles while in those with incomplete injury, 141 (66.19%) were transported in ambulance and 72 in private vehicle. 35% of all patients were transported in private vehicles with no trained personnel accompanying them who were supposed to know how to handle patients with SCI.

It was observed that mean time taken to reach nearest hospital was more in patients with complete injury (5.04±9.94 hours) while in incomplete injury, the mean time observed was (3.89±11.13 hours) with no significant difference. In a similar way, time taken to reach IGMC Shimla was also more in patients with complete injury (16.7±19.04) hours than that observed in patients with incomplete injury (10.24±15.41) with statistically significant difference (p value = 0.007). The mean stay of patients in hospital was also more in complete injury patients (13.83±9.45 days) than that of patients with incomplete injury (10.58±8.13 days) with statistically significant difference (p value = 0.009). (Table 3)

Discussion

Spinal cord injury (SCI) is a devastating condition which occurs with an annual incidence of 12.1-57.8 cases per million[8]. SCI is associated with permanent disability and decreased life expectancy[9]. There is some data to indicate that the majority of TBI cases (60%) are as a result of RTA, followed by falls (20-30%), and violence (10%)[10].

In the current study, males were found to be more prone for spinal cord injury in our study, which is similar to findings in other studies[11]. The major reason of male predominance could be due to the fact that the most of drivers, labourers, farmers and other workers are males who could be injured during the course of work and males have an increased risk-taking behavior as compared to females.

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The present study also reflects the adult population being the most susceptible for spinal injuries. Adult people are the active age group of any community, which makes them more susceptible for spinal cord injuries considering the mode of work they do to earn their livelihood. The mean age of patients of SCI reported is from 30.9 years - 38.9 years from various series [12,13].

In our study the most common cause for spinal injuries was fall from height followed by road traffic accidents. Most of the Indian houses in rural and urban areas lack essential safety precautions like fencing of the terrace and guarding of the staircase, thereby making fall from height a realistic possibility. Moreover, habits of sleeping on an unprotected terrace especially during summer season can lead to fall from the terrace while sleeping. Use of substandard material in the construction of rural houses (most often mud is used to construct walls of houses) endangers the lives of the people living in them. Lack of strict implementation of traffic rules in various non-metropolitan cities of India along with lack of awareness among the general population regarding adherence to traffic rules still prevails as an important cause of road traffic accident and spinal trauma.

The mean time of transfer of patient from injury to tertiary care hospital in our study was between 10-16 hours. Ideally, patients should arrive at tertiary care centers within 2 h of injury[14]. This increased transfer time in our study can be due to the rough hilly terrain of Himachal Pradesh and the fact that many villages here are not connected by motorable roads. Another possible reason could be the time taken to stabilize in the first referral units before reaching the study hospital. Birua GJS, in their study in Sikkim, a north-eastern state of India with hilly terrain, observed the mean transfer time of 15.35 hours[15] similar to our observed value. In an study, Singh *et al*. in 2003 found 81% of patients have access to health-care facilities within 6 h and 90.3% within 24 h of SCI[16]. In a comparative study between New Delhi and Charlottesville, USA, 50% reached the hospital in <1 h and 88% within < 3 h in USA[17], compared to 7% and 39% in New Delhi[18].

The shift from trauma site to tertiary center is a major reason for the delay in giving appropriate and timely treatment to the patients with acute spinal cord injury. It happens mainly to the patients who are shifted from rural areas with poor road connectivity. This delay can range between 12 and 72 hours [19] leading to increased morbidity and mortality.

There were certain limitations in our study. Since it was a cross sectional study the data was extracted from the patients at one point of time. Their follow up on survival and morbidity could not be gathered due to time and logistics constraints. Second, the details of management done at the first referral units could not be taken that would have allowed the health staff to be prepared with necessary prerequisites of management. Hence it is recommended that the communication between the first referral unit and the emergency team of the tertiary care hospitals may be strengthened through continued medical education and supportive supervision.

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Conclusion

SCI is a public health issue, and has a major effect not only on individual but also on family and society by psychological and economical manner. Prevention is possible by better upkeep and management of roads and other legislative measures. Incidence of RTAs can be decreased by implementing strict traffic rules; and drink and drive has to be banned strictly. All buildings, balconies, workplaces should have mandatory safety railings to prevent fall which is a major cause of Neurosurgical Trauma.

Considering the enormity of the problem of Neurosurgical Trauma in our state there is an urgent need for the provision of proper transportation facilities of these patients quickly to the nearest hospitals and tertiary care centers in well-equipped ambulances with well trained medical personnel. Further, ATLS course should ideally be provided for the doctors serving in the periphery for better management of TSCI patients and there should be strict adherence to ATLS protocols.

References

1. Institute of Occupational Safety and Health. http://www.iosh.gov.tw/date/f2/sp42-1.htm. Accessed September 9, 2019.

2. Lin HJ, Su JY, Liao MC, Chiou CJ. Factors related to long-term care information needs toward hospitalized disable-patients' caregivers. J Long Term Care. 2004;8:236-250.

3. Pickett GE, Campos-Benitez M, Keller JL, Dug gal N. Epidemiology of traumatic spinal cord injury in Canada. Spine. 2006;31:799-805

4. Pagliacci MC, Celani MG, Zampolini M, et al. An Italian survey of traumatic spinal cord injury: the Gruppo Italiano Studio Epidemiologico Mielolesioni study. Arch Phys Med Rehabil. 2003;84: 1266-1275

5. Jackson AB, Dijkers M, Devivo MJ, Poczatek RB. A demographic profile of new traumatic spinal cord injuries: change and stability over 30 years. Arch Phys Med Rehabil. 2004;85:1740-1748

6. Hoque MF, Grangeon C, Reed K. Spinal cord lesions in Bangladesh: an epidemiological study 1994-1995. Spinal Cord. 1999;37:858-861.

7. Mathur N, Jain S, Kumar N, Srivastava A, Purohit N, Patni A, et al. Spinal cord injury: Scenario in an Indian state. Spinal Cord. 2015;53:349–52.

8. van den Berg MEL, Castellote JM, Mahillo-Fernandez I, de Pedro-Cuesta J. Incidence of Spinal Cord Injury Worldwide: A Systematic Review. Neuroepidemiology. 2010;34(3):184-192.

9. Hartkopp A, Brønnum-Hansen H, Seidenschnur AM, Biering-Sørensen F. Survival and cause of death after traumatic spinal cord injury. A long-term epidemiological survey from Denmark. Spinal Cord. 1997;35(2):76-85.

10. Gururaj G. An Epidemiological Approach to Prevention-Prehospital Care and Rehabilitation in Neurotrauma. Neurol India. 1995;43(3):95-105.

11. Pandey V, Nigam V, Goyal TD, Chhabra H. Care of post-traumatic spinal cord injury patients in India: An analysis. Indian J Orthop. 2007;41:295–299.

ISSN: 2515-8260, Volume 10, Issue 01, 2023

12. Kishan S, Vives MJ, Reiter MF. Timing of surgery following spinal cord injury. J Spinal Cord Med. 2005;28:11–9
13. Surkin J, Gilbert J, Harkey HL, 3rd, Sniezek J, Currier M. Spinal cord injury in Mississippi. Findings and evaluation, 1992-1994. Spine. 2000;25:716–21
14. World Health Organization. Guidelines for Essential Trauma Care. World Health Organization. Available from: https://www.who.int/violence_injury_prevention/publications/. [Last accessed on 2020 Jan 10]
15. Birua GJS, Munda VS, Murmu NN.Epidemiology of Spinal Injury in North East India: A Retrospective Study. Asian J Neurosurg. 2018; 13(4): 1084–1086
16. Singh R, Sharma SC, Mittal R, Sharma A. Traumatic spinal cord injuries in Haryana: An epidemiological study. Indian J Community Med 2003;28:184-6
17. Herman J, Ameratunga S, Jackson R. Burden of road traffic injuries and related risk factors in low and middle-income Pacific Island countries and territories: a systematic review of the scientific literature (TRIP 5). BMC Public Health. 2012;12:479.
18. Sahdev P, Lacqua MJ, Singh B, Dogra TD. Road traffic fatalities in Delhi: causes, injury patterns, and incidence of preventable deaths. Accid Anal Prev. 1994;26(3):377-384.
19. Srinivasan US. Acute spinal cord injury: managing at the site of impact and addressing reality gap. J Assoc Physicians India. 2012;60 Suppl:7-9.