

Research Article

Epidemiological study of cervical spine injury

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ABSTRACT

Background: The main purpose of this study is to provide an overview of demography, neurological level of injury, completeness of injury, incidence, prevalence, delay in the presentation of spinal injury patients to the specialized spinal trauma units, injury mechanisms as well as lethality and causes of death associated with traumatic cervical spinal cord injuries and to suggest steps to improve the quality of care of the cervical spinal trauma patients in the Indian setup. Hence, the main objective of the study is to observe the socio demographic profile, injury pattern, mechanisms, lethality and causes of death associated with cervical spinal cord injuries

Methods: This is a retrospective Study of 70 cases of colorectal carcinoma analysing incidence, clinicopathological features and outcome after different therapies including surgery, radiotherapy and chemotherapy.

Results: Mean age of our sample is 35 ± 15 years, There were 11 females (14.66%) and 64 males (85.33%), Education and socio-economic status 70% of the sample belonged to the most vulnerable lower socio-economic group. Majority 45 (60%) had fall from height and RTA 30(40%) as the cause of injury. Only 53 (70.66%) received ambulance for transport, leading to a delay in admission in 22 (29.33%) cases. Most of the injured presented with neurologically incomplete picture 65 (61.33%), ratio of incomplete and complete injuries being 6.5:1. 43 (57.33%) cases was of cervical segments 5 and 6. out of 75 patient 60(80%) patient managed conservatively and 15(20%) were operated. 27(36%) patients were improved, 14(18.6%) were died and 34 (45.3%) not-improved by treatment given to all 75 patient. Mortality-13.33% in operated patients and 20% in conservatively managed patients. Mortality was 40% in complete neurological injury and 10% in incomplete injury. Mortality was highest in C4 level injury 27% and lowest 0% in C7 injury.

Conclusions: out of total 75 patients- 27(36%) patients were improved, 14(18.6%) were died and 34 (45.3%) not-improved by treatment. Mortality was 40% in complete neurological injury and 10% in incomplete injury. This study evaluated the demographic variables of cervical spine injury for better understanding of impact that it has and further for better allocation of our health resources, distribution and planning.

Keywords: Spinal cord injury (SCI), Neurological injuries, FGS, ASIA

INTRODUCTION

Spine injury is one of the most devastating events that can occur in an individual's life, owing to which there is multisystem involvement and long term disability. By definition spinal cord injury is an acute traumatic injury to spinal cord that leads to varying degree of motor and sensory deficits.

Despite the ongoing research in the treatment of spinal cord injury (SCI) this condition is not yet amenable to complete restoration of function, which is a big obstacle in independent living of the victim. Due to the non-existence of spinal cord registries in India, no reliable data set is available, on the basis of which the demographics, economic and disability burden of the same can be ascertained.

An epidemiological data helps us to make plans for better allocation of resources directed towards preventing SCI and rehabilitating the resulting disabled individuals. This is a single hospital based study in Bhopal, MP, with a view to give a snapshot of the SCI pattern in this state.

Spinal injuries are common and their economic and social implications are a problem of great magnitude. The patient is often the earning member of the family and the consequences of these injuries can be devastating. The annual incidence of spinal cord injuries (SCI) in developed countries varies from 11.5–53.4 per million and the incidence has two peaks, one in the second and third decades of the male population and another in the elderly.¹

Most of the Western studies have shown road traffic accidents as the leading cause of spinal trauma followed by falls, diving into shallow water and sports injuries.² Males are more prone to spinal cord injury. Indian epidemiological studies in the rural regions also have shown a high preponderance of spinal trauma involving males, with the ratio of male to female ranging from 9:1–13.5:1.³

In an agricultural country like India, injuries due to fall from trees, unprotected terraces and fall into uncovered wells are common. Chacko et al gunshot wounds to the spine are comparatively rare in India.^{4,5}

About 60% of spinal injuries involve the cervical spine with the maximal incidence at C5-6 level. In the elderly, the incidence of fractures of C1 and C2 is more frequent due to the relatively high occurrence of odontoid fractures.⁶ The incidence of spinal injuries increased from 1 in 300 to 1 in 14 when seat belts are not used. The use of helmets has not been associated with an increase of spine injuries as was once thought.

The absence of national level programmes to educate the public on trauma like “THINK FIRST” is one of the reasons why the actual burden and the large economic cost of spinal injuries continue to escalate in India. The absence of city and town planning leads to a very high incidence of these injuries. Surgeons must educate the public and policy makers and push for reforms in transportation and civic infrastructure to reduce the incidence of this devastating condition.

METHODS

Patient

This study comprised all patients of traumatic cervical spine injury admitted in Department of Surgery, Gandhi Medical College, Bhopal during June 2012 to July 2013 (retrospectively) and August 2013 to May 2015 (prospectively).

Procedure

This study was carried out after obtaining necessary ethical clearance from the institutional ethical committee. A complete neurological examination was conducted on admission and regularly followed. Relevant investigation was conducted as per unit protocols. Even at the suspicion of cervical spine injury the neck was immobilized by Philadelphia cervical collar. Initial resuscitation and evaluation were carried out. After the initial general and neurological examination, Frankel's and the ASIA score are used to standardize the clinical evaluation.⁷ During the course of initial assessment, patients are kept in the supine position with rigid collar immobilization while standard ATLS protocols were followed.

Frankel Grading System (FGS)

Frankel divided spinal injuries into five gradations with decreasing neurological deficits.⁷

- *Grade A:* Complete loss of motor and sensory function below the level of lesion.
- *Grade B:* Complete motor paralysis with some sensory preservation (e.g. sacral sparing)
- *Grade C:* Retained motor function but useless
- *Grade D:* Useful motor function
- *Grade E:* Free from neurological symptoms

The American spinal injury association impairment scale (ASIA)⁷

- *ASIA A* - No motor or sensory function is preserved below the level of injury (and in the sacral segments S4-S5)
- *ASIA B* - Sensory but not motor function is preserved below the neurological level (includes the sacral segments S4-S5)
- *ASIA C* - Motor function is preserved below the neurological level, but too little to represent a practically usable function (more than half of key muscles below the neurological level have a muscle grade less than 3)
- *ASIA D* - Motor function is preserved below the neurological level, to an extent that provides practically usable function (at least half of key muscles below the neurological level have a muscle grade of 3 or more on a scale from 0-5)
- *ASIA E* - Motor and sensory functions are normal (*ASIA A* implies a complete injury, *ASIA B-D* describe incomplete injuries).

RESULTS

In the present study, mean age of our sample is 35±15 years, a significant number i.e., 45 (60%) were from the

age group of 26 to 45 years as given in Table 1 and there were 11 females (14.66%) and 64 males (85.33%), with a male to female ratio of 5.8:1 as shown in Figure 1. A significant number 42 (56.8%), were farmers and laborers, with an average monthly income of Rs. 5000. Education and socio-economic status 70% of the sample belonged to the most vulnerable lower socio-economic group.

Table 1: Age wise distribution of patients.

Age group	Number	Percentage
10-25	15	20
26-40	32	42.66
41-55	16	21.33
56-70	11	14.66
>70	01	1.33
Total	75	

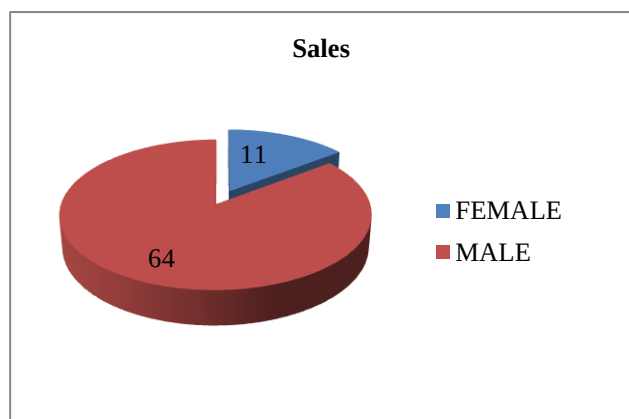


Figure 1: Sex wise distribution.

Table 2: Mode of injury.

Mechanism trauma	No. of patients	Percentage
RTA	30	40 %
Fall from height	45	60 %
A <10 f	27	
B 10-20 f	15	
C >20 f	3	
Other	0	0
Total	75	

Mechanism of trauma and mode of transport

Majority 45 (60%) had fall from height and RTA 30(40%) as the cause of injury as given in Table 2. Only 53 (70.66%) received ambulance for transport, leading to a delay in admission in 22 (29.33%) cases to a tertiary care center for more than 24 hours.

Vertebral and neurological level

Most of the injured presented with neurologically incomplete picture 65 (61.33%), ratio of incomplete and complete injuries being 6.5:1 at the time of presentation at in our hospital. Most common involvement in 43 (57.33%) cases was injuries to cervical segments 5&6.

Management

Out of 75 patient 60(80%) patient managed conservatively and 15(20%) were operated.

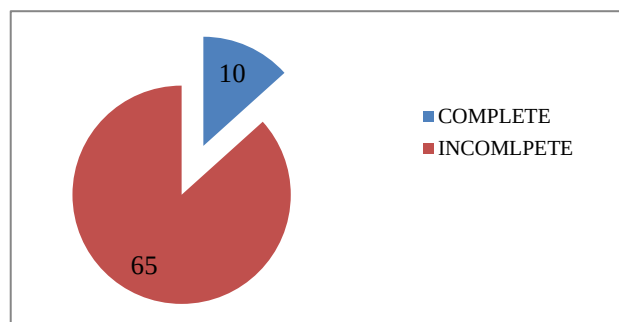


Figure 2: Complete and incomplete neurological level.

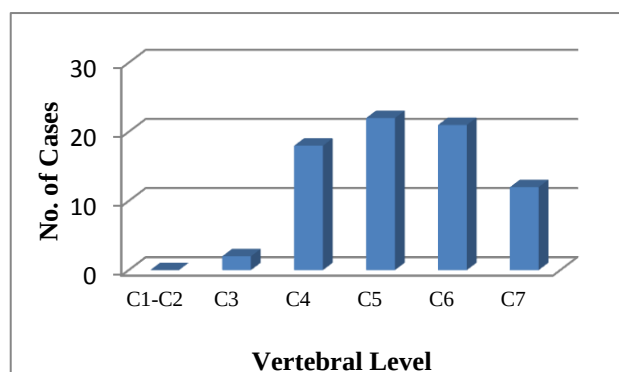


Figure 3: Distribution of cases according to vertebral level.

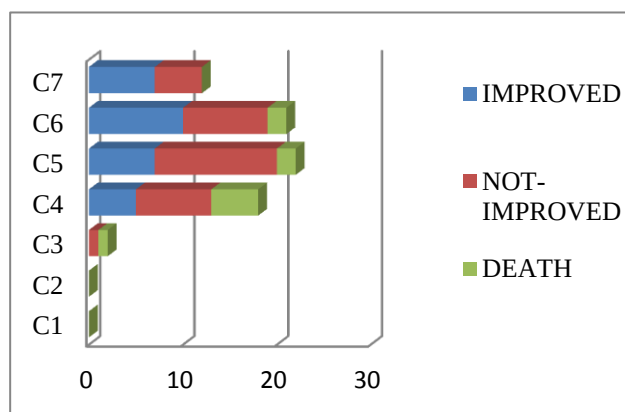
Outcome was seen in 27(36%) patients were improved, 14(18.6%) were died and 34 (45.3%) not-improved by treatment given to all 75 patient. Mortality was observed 13.33% in operated patients and 20% in conservatively managed patients. Outcome on the basis of neurological injury shows that mortality was 40% in complete neurological injury and 10% in incomplete injury.

Table 3: On the basis of outcome.

Outcome	Number of patients
Improved	27
Not improved	34
Death	14

Table 4: Outcomes on the basis of complete and incomplete.

Neurological level	Survived	Death	Mortality
Complete	6	4	66.6%
Incomplete	59	6	10.1%

**Figure 4: Outcome on the basis of vertebral level.**

Outcome on the basis neurological level shows that mortality was highest in C4 level injury 27% and lowest 0% in C7 injury. Urinary tract infection (40%) was seen as the most common complication, followed by bed sore (29.33%), DVT (6%), paralytic ileus (5.3%) and pneumonia (2.6%).

DISCUSSION

In the past two decades, India has witnessed rapid urbanization, motorization, industrialization and migration of people resulting from socio-economic growth and development. Injuries are a major public health problem in India. Road crashes and deaths have increased.

Though the real incidence of SCI is not yet known because of lack of national registry. Sekhon⁷ and Fehlings reported that the incidence of SCI varies between 15 and 40 per million each year in developed countries.⁸

The rapid and unprecedented motorization in India, with not so strong health infrastructure of our country, a poor per capita health spending (1.4% of GDP), and insufficient healthcare financing mechanisms, 66% healthcare expenditure being out of pocket, is probably increasing the burden of SCI.³

Also, looking at the startling statistics of recovery patterns with less than 36% cases showing some improvement in our study at the end of three months, it is high time to realize that prevention of occurrence of SCI is better than cure. The world over, there is a recognition that more effective preventive health programmes are the only way to reduce spiralling health costs.

Aggrawal et al reported a sex ratio of 3.6:1 and Li et al documented a sex ratio of 3.1:1.^{9,10} Sex distribution in our study is 5.8:1, which is similar to other recent studies in a sense that males are more commonly injured than females, but the gap in our study was too large which may probably reflect the difference in socio-cultural practices decreasing the women's exposure to outside world and subsequent risk of SCI.

Most common age group in our study was 26-40 yr. The prime earning age in which the individuals were rendered completely disabled, emphasizes that the focus of our strategies should be towards our work force as they are the once who are at utmost risk on account of their occupation.

Data from developed countries clearly establishes road traffic accidents as the main cause of SCI in contrast to the study of Singh et al in India that showed fall from height to be the major cause.¹¹⁻¹⁶ Most common cause in our study was fall from height, 60 percent pt. have SCI due to fall from height and 40 percent due to RTA But in urban areas most common cause was RTA.

Lack of strict implementation of 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. Lack of fencing on the terrace and guarding of the staircase make fall from height a realistic possibility. Habit of sleeping on an unprotected terrace leads to falls and use of substandard material in the construction of houses endangers the lives of people in rural areas.

Secondary injury to the cord can sometimes be much more catastrophic than the primary injury, and it occurs commonly at the time of transport from the site of trauma to specialized centre.

Despite the fact that "108" ambulance facilities have been started by our government in all cities, 53 percent of total injured in our study could arrange for an ambulance. These services have definitely improved the transportation but because of lack of awareness, trained paramedical staff, SCI evacuation equipment in the form of spinal board, collar, straps etc, this has failed to do any good to the injured.

None of the injured in our study received the primary management as per SCI protocols, well in concordance with studies of Nguyen et al and Solagberu et al.^{17,18} Only 22 percent had cervical collar when they came to casualty room.

Neurologically incomplete injuries (ASIA A) were the most common in our study also as in the developed world.^{19,20} This can be attributed to lack of observation of strict SCI extrication protocols at the site of trauma which reflects in our data, with more than 88% injured

presenting to a tertiary care centre with a delay of >8 hours and rest 39% with a mean delay of 6 days.

According to the World Bank report, nearly 39.72% of India's population in 2005 (456 million) live just above line of deprivation (<1.25\$ a day).²¹ The upper lower group is the most vulnerable to fall into the category of below poverty line as it cannot sustain health, economical, pathological or social pressure.

World Bank estimates show that 2.2 % of India's population around 24 million people goes into poverty every year because of catastrophic health expenditure that they have to make despite being treated in government hospital where most of the treatment is either free of cost or largely subsidized.²²

The government's share in the healthcare delivery market is 20 per cent while 80 percent is with the private sector. Therefore, it is imperative for the government to increase the per capita health expenditure and provide for greater number of hospitals and specialized centres where facilities for management and Rehabilitation of such chronically ill patients can be provided.

SCI management does not end with spinal instrumentation or a decision to pursue a conservative management regime. SCI rehabilitation is the only way that ensures a successful community reintegration of a SCI patient as an active member.

There is complete nonexistence of hospital and community rehabilitation in India as a whole there is only one department of physical medicine and rehabilitation with comprehensive care of inpatients and outpatients. This reflects that health planners are focusing all their resources on acute care and least substantial effort on prevention of ever increasing injuries and rehabilitation of chronically injured are being made.

Injury prevention strategies should focus towards the need for better transport facilities, provision of safer roads, greater allocation of public transport and stringent traffic rules, as wearing of safety belts, alcohol awareness in India.

In order to prevent fall from height, safety guards should be provided for workers at construction sites and negligence on the part of employers regarding safety precautions should be made a punishable offence under law.

People should be made aware of the precautions that should be taken while building their houses. It is imperative that our prevention programmes should be formulated with maximum use of local language, pictorial presentation and stage shows being included in the curriculum for better understanding by the rural, illiterate population of India.

Better ambulance facilities with medical and paramedical staff trained in management of SCI is a must. Training programmes to give an opportunity to health workers to improve their knowledge in the comprehensive management of spinal cord injured patients should be carried out on a regular basis. Hospitals managing spinal trauma must have a comprehensive spinal trauma rehabilitation team, led by rehabilitation medicine specialist.

CONCLUSION

Most of the studies in medical literature are from developed countries where the problem and presentations are different with respect to the mode of injury and other demographic variables. Though this study may not be a true representation of demography of all spinal injuries in India, as it is restricted to a single institute, it may best give a snapshot of existing scenario.

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Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. Torretti JA, Sengupta DK. Cervical spine trauma. Indian J orthop. 2007;41:255-67.
2. Tandon PN, Ramamurthi R. Textbook of Neurosurgery, Third Edition. Chapter 47, Anil k. Pande, Pradeep k. Jain. Jaypee medical publishers; 2012:533.
3. Yagi M, Ninomiya K, Kihara M, Horiuchi Y. Long term surgical outcome and risk factors in patients with cervical myelopathy and changes in signal intensity of intramedullary spinal cord on magnetic resonance imaging. J Neurosurg Spine. 2010;12(1):59-65.
4. Chacko V, Joseph B, Mohanty SP, Jacob T. Management of spinal cord injury in a general hospital in rural India. Paraplegia. 1986;24:330-5.
5. Bono CM, Vaccaro AR, Fehlings M. Measurement techniques for lower cervical spine injuries: consensus statement of the spine trauma study group. Spine. 2006;31(5):603-9.
6. Sawers A, DiPaola CP, Rehtine GR. 2nd. Suitability of the noninvasive halo for cervical spine injuries: a retrospective analysis of outcomes. Spine J. 2009;9(3):216-20.
7. Ditunno JF Jr, Young W, Donovan WH, Creasey G. The international standards booklet for neurological and functional classification of spinal cord injury. Paraplegia. 1994;32:70-80.
8. Sekhon LHS, Fehlings MG. Epidemiology, Demographics, and pathophysiology of acute spinal cord injury. Spine. 2001;26:2-12.
9. Agrawal P, Upadhyay P, Raja K. A demographic profile of traumatic and non-traumatic spinal injury

- cases: a hospital based study from India. *Spinal Cord*. 2007;45:597-602.
10. Li J, Liu G, Zheng Y. The epidemiological survey of acute traumatic spinal cord injury (ATSCI) of 2002 in Beijing municipality. *Spinal Cord*. 2011;49:777-82.
 11. Griffin MR, Optiz JL, Kurland LT, Ebersold MJ, O'Fallon WM. Traumatic spinal cord injury in Olmstead County, Minnesota, 1935-1981. *Am J Epidemiol*. 1985;121:884-95.
 12. Kraus JF, Franti CE, Riggins RS, Richards D, Borhani NO. Incidence of traumatic spinal cord lesions. *J Chronic Dis*. 1975;28:471-92.
 13. Pickett W, Simpson K, Walker J, Brison RJ. Traumatic spinal cord injury in Ontario, Canada. *J Trauma*. 2003;55(6):1070-6.
 14. Price C, Makintubee S, Herndon W, Istre GR. Epidemiology of traumatic spinal cord injury and acute hospitalization and rehabilitation charges for spinal cord injuries in Oklahoma, 1988-1990. *Am J Epidemiol*. 1994;139:37-47.
 15. Acton PA, Farley T, Freni LW, Ilegbodu VA, Snizek JE, Wohlleb JC. Traumatic spinal cord injury in Arkansas, 1980 to 1989. *Arch Phys Med Rehabil*. 1993;74:1035-40.
 16. Singh PK, Shrivastava S, Dulani R. Pre hospital care of spinal cord injury in a rural Indian setting. *Rural and Remote Health*. 2011;1760:11.
 17. Nguyen TL, Nguyen TH, Morita S, Sakamoto J. Injury and pre-hospital trauma care in Hanoi, Vietnam. *Injury*. 2008;39:1026-33.
 18. Solagberu BA, Ofoegbu CK, Abdur-Rahman LO, Adekanye AO, Udoffa US, Taiwo J. Pre-hospital care in Nigeria: a country without emergency medical services. *Nigerian J Clin Pract*. 2009;12:29-33.
 19. Chacko V, Joseph B, Mohanty SP, Jacob T. Management of spinal cord injury in a general hospital in rural India. *Paraplegia*. 1986;24:330-5.
 20. Maharaj JC. Epidemiology of spinal cord injury in Fiji: 1985-94. *Spinal Cord*. 1996;34:549-59.
 21. India new global poverty estimates. Available at www.worldbank.org.in/. MDK:21880725.

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