

# An epidemiological study from a tertiary care hospital in Asian subcontinent on Traumatic cervical injuries: How is the injury pattern and what are the implications?

Dhiraj Vithal Sonawane<sup>1</sup>, Ganesh Yeotiwad<sup>1</sup>, Ajay Chandanwale<sup>3</sup>,  
Swapnil Keny<sup>1</sup>, Abhijeet Salunke<sup>4</sup>, Ambarish Mathesul<sup>3</sup>, Eknath Pawar<sup>2</sup>

## Abstract

Study Design: Retrospective Study

Objective: The aim of the current study was to document the demographic pattern, mode of injury, level of cervical spine injury in patients so that it can be extrapolated for formulating guidelines in developing nations for proper management of this life threatening injury.

Methods: This study comprised of 275 patients of cervical spine injury admitted in a tertiary care centre from January 2006 to October 2015.

Results: The mean age was (3 to 95) and male to female ratio was 11.5: 1. Majority (30 %) of cases were of third and fourth decade. 60 % of patient fall from height as mechanism of injury. The urban to rural ratio of patients was 3:1 and 184 patients (67%) belonged to the rural areas. The most common mode of injury in the present study was fall from height, 166 cases (60%) of which most of them occurred while working and fall from tree. Dislocation at C 5-6 vertebral level was commonest and a C 5 vertebra was most commonly fractured. Incomplete cord injury of ASIA grade C scale was the commonest pattern seen in 156 cases. Head injury was commonest associated injury with cervical spine injury.

Conclusion: Identification of demographic data and mechanism of injury pattern helps to identify the preventable risk factors for controlling them. Proper education and training of paramedical staff in rural areas of initial aid and transportation of patients having spinal cord injuries can reduce the frequency and morbidity of spine injuries

Keywords: Cervical spine, Injury, Epidemiology, demographic study, Spinal cord, Mechanism of injury

## Introduction

An acute injury of cervical spine and spinal cord is a common cause of severe disability and death following trauma. 10-20% patients with head injury have associated cervical spine injury and out of which 17% of patients diagnosis of cervical spine injury is missed or delayed [1]. Cervical spine injury with neurological deficit leads to significant public health impact because of its devastating effect on personal and family level [1, 2]. Currently

there is very less data available about the epidemiological pattern and mechanism of cervical spine injuries in Indian subcontinent. In India, it is estimated that 20000 new cases of spinal cord injuries are added every year, majority of patients belong to rural background [3]. In India subcontinent cervical spine injury occurs due to fall from roofs, fall from hills and trees or road traffic accidents [4]. The social and economic impact of cervical spine injuries is extensive,

because the majority of cervical spine injuries occur in young adults [5]. An epidemiological study can provide valuable information regarding the magnitude of this problem and resultant demand on health care resources. More reliable and detailed descriptions of cervical spine injury patterns may ultimately facilitate the development of preventive measures and interventions that could enhance injury detection.

The aim of the current study was to document

<sup>1</sup>Department of Orthopaedics, Grant Medical college, & Gokuldas Tejpal Hospital, Mumbai

<sup>2</sup>Department Of Orthopaedics, Grant medical college, Mumbai.

<sup>3</sup>Sasoon Hospital & BJMC, Pune

<sup>4</sup>Gujarat Cancer Research Institute

## Address of Correspondence

Dr. Dhiraj V. Sonawane  
Grant Medical college, & Gokuldas  
Tejpal Hospital, Mumbai  
Email: dvsortho@gmail.com



Dr. Dhiraj Vithal  
Sonawane



Dr. Ganesh  
Yeotiwad



Dr. Ajay S  
Chandanwale



Dr Swapnil M  
Keny



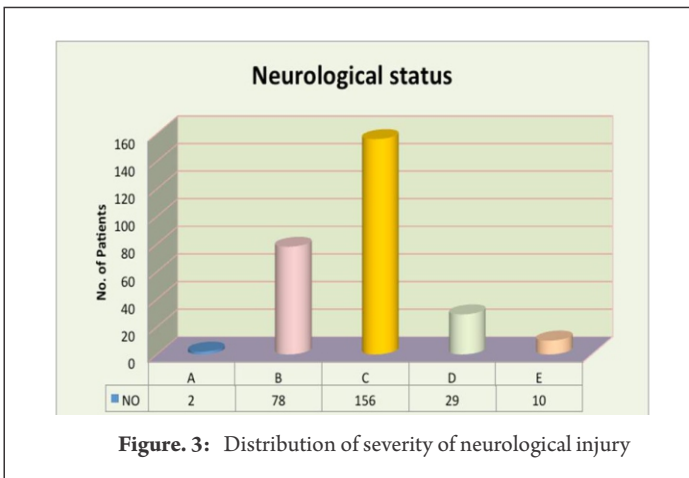
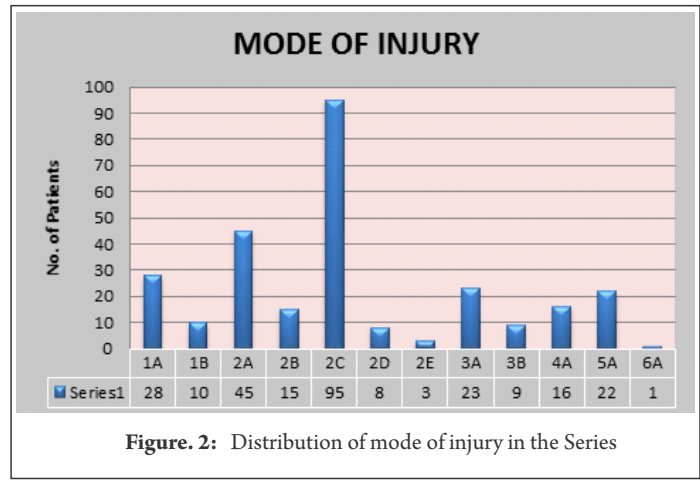
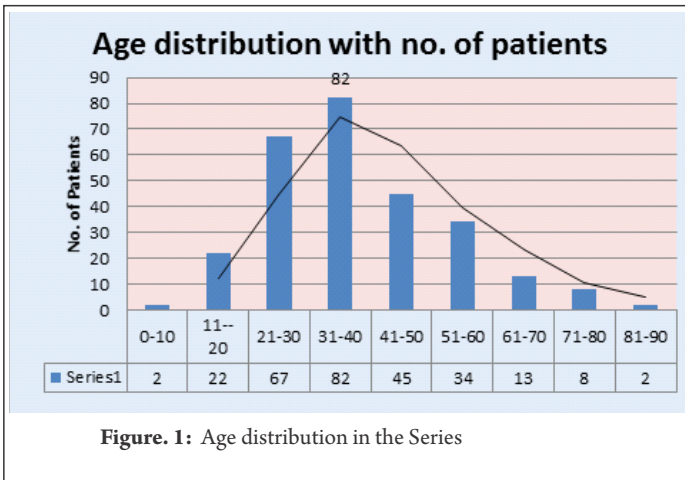
Dr Abhishek  
Salunke



Dr. Ambarish A  
Mathesul



Dr. Eknath  
Pawar



cervical spine injury admitted in a tertiary care centre from January 2006 to October 2012. Before the study was started, an approval was taken from the institutional ethics committee of the hospital. Patients with cervical spine injury i.e., occipital condyle to C7 vertebrae were included. The data analysed included the patient's age, sex, and occupation, the place of injury (rural/ urban), associated injuries, level of injury, & neurological status according to American Spinal Injury Association Scale was noted

group was 31-40 years followed by the age group 21-30 years (Fig.1). Most common mode of injury was fall from height and was observed in 166 cases (60%) (Fig.2). Most common level of injury is at C5-C6 (%) followed by C1-C2 (%) in cervical spine region (Table 1). C5 vertebral fracture was commonest amongst all cervical vertebrae (Table 2). In our study it was observed that most common neurological presentation in cervical spine fractures is grade C i.e. incomplete < 3/5 (American Spinal Injury Association Scale) except in fracture C1 is grade B i.e. incomplete 0/5 ( American Spinal Injury Association Scale) (Fig.3). Most of the patients with cervical spine injuries have associated head injury as compared to other injuries.

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**Materials & methods**

This study comprised of 275 patients of

**Results**

Male to female patient ratio was 11.5:1. The rural population was predominant with 67 % of patients. The common age

Level	No. of Patients
O-C1	2
C1-C2	41
C2-C3	8
C3-C4	5
C4-C5	25
C5-C6	77
C6-C7	20
C7-T1	0

**Table 1:** Distribution of cervical spine dislocation by levels

Level	No. of patients
C1	11
C2	10
C3	6
C4	18
C5	60
C6	43
C7	14

**Table 2:** Distribution of fractures by cervical spine level:

Site of injury	No of patients
Head	27
Extremity	4
Chest	1
Mandible	1
Pelvis	0

**Table 3:** Distribution of Associated injuries

**Discussion**

A spinal injury leads to significant functional impairment and long-term disability and morbidity. The consequences of cervical spinal injury have profound effect on the patient and family. The knowledge of epidemiology of cervical spine injury in a developing nation helps for adequate treatment, rehabilitation of the patients and proper utilization of health care resources. Majority of medical literature is from developed countries where the problem and presentations are different with respect to mode of injury, sex, and incidence. At advanced medical centre a patient with spinal injury shifted from injury site within one hour interval. In developing countries majority of the patients take medical treatment after 2-3 days, or even weeks after spine injury. Geographical distribution of cervical spine injuries is more common in rural population as compared to urban population .Higher incidence in rural areas is due to fall from

Series	M:F ratio
Chacko et al 33 (India)	13.5:1
Shanmugasundram34(India)	8.98:1
Shingu et al 36 (Japan)	4.3:1
LanC et al 38(Taiwan)	4:1
David chen (22) (India )	3.7:1
Our Study	12.5:1

**Table 4:** Ratio of cervical spine injuries in male and females

Series	Fall from height (%)	RTA (%)
Chacko et al [18] (India)	55.2	12.8
Shanmugasundram [19] (India)	66	14
Shingu et al [20] (Japan)	23.3	61.6
Dave et al [22](India)	49.4	36.5
Manjeet et al [23](India)	50	30.3
Our Study	60.3	10.1

**Table 7:** Comparison of percentage of cervical spine injuries from Fall from height and RTA with our study.

Age group	Males	Females
0-10	1	1
11-20	19	3
21-30	64	3
31-40	73	10
41-50	37	8
51-60	31	3
61-70	13	0
71-80	6	2
81-90	2	0

**Table 5:** Sex distribution according to age groups.

Cause of injury	Age									
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	
RTA	0	2	8	10	7	1	0	0	0	
Railway accident	0	1	5	1	3	0	0	0	0	
Fall from tree	1	6	14	15	4	4	1	0	0	
Fall from balcony	1	1	4	2	1	2	1	2	1	
Fall while working	0	3	14	39	21	13	2	3	0	
Fall from roof	0	0	3	3	2	0	0	0	0	
Fall from electric pole	0	1	1	0	1	0	0	0	0	
Fall of heavy object	0	1	7	5	2	6	1	1	0	
Direct impact of heavy object	0	0	2	3	1	1	2	0	0	
Sport injury	0	6	8	1	1	0	0	0	0	
Slipped in bathroom	0	0	1	3	2	7	6	2	1	
Animal related	0	1	0	0	0	0	0	0	0	

**Table 6:** Relation between Age and Mode of Injury:

height (roof, tree, pole) which is most common cause of CSI in current study .Second common mode of injury is road traffic accidents due to poor conditions of roads, improper of traffic conditions. The annual incidence of traumatic spinal cord injury (SCI) is 11.5 to 53.4 per million of population [6-10]. Deaths after admission for acute SCI ranges from 4.4% to 16.7 % [7]. In the USA, incidence of spinal cord injuries is 11000-14000 per year and annual cost of patient care is 4 billion dollars for 200,000 active patients in each year [1]. The lifetime medical costs for the partial or complete quadriplegic patient have been estimated to range from \$757000 to \$941000 in 1992 dollars and that equates to between \$7.6 billion and \$9.4 billion dollars for the life times of the 10,000 new cases every year [11]. Estimated medical costs for all individuals with cervical spine injury is approximately \$5.3 billion dollars, The common four primary etiological categories relating to cervical spinal cord injury includes transportation, recreation, fall and gun/missile related injuries [12-14,24,28-32]. Most common cervical spine injury mechanism is axial compression and results

from an accident with sudden stoppage of head while moving torso drives the neck into the base of the skull. Most of them sustain this injury by fall from unprotected roofs, trees or fall into uncovered wells, which in fact are preventable causes [23,24,28-32]. It may help to formulate preventive measures which may modify or eliminate the risk factors and may decrease the incidence of this incapacitating injury. In current study 60% had injury due to fall from height while working. 10 % patients had cervical spine injury due to road traffic accidents. Chacko et al concluded that 55 % cases of were due to fall from height, which was most commonly due to fall from trees followed by 12.8% cases due to RTA [18]. Shanmugasundaram et al recorded 66% of his patients had sustained injury due to fall from height and 14% were due to RTA [19]. The age distribution of patients is comparable with various studies and most common affected age group being 20-29 yrs [15,16]. There is higher incidence of cervical spine

injury in young, active and productive population of the society. Elderly women suffer spine injuries due to osteoporosis [17]. Studies done by Shrestha et al showed that the most vulnerable age group to be affected by cervical spine injuries to be 30-49 years [24]. Most other studies show commonly affected age group being 20-29 [3,15,16]. Cervical spine injury is relatively uncommon in paediatric age group [25,26,27]. Studies done by Manjeet et al, [23] showed most commonly affected age group is 20-30 years. In current study 32% were in the age group 31-40 years and 26% were in the age group 21-30 years. The age distribution of patients is comparable with published studies. Chacko et al showed that patients of cervical spine injury were predominantly males and were from poor socio-economic strata belonging to rural areas [18]. In the study done by Shingu et al the average age of the injury was 49.31 years old with the male and female ratio of 2:1 [20]. In the study done by Manjeet et al [23] the male (74.9%) to female (25.1%) ratio was 2.98:1. In current

study the incidence of cervical spine injuries showed a male preponderance, with 253 cases (92%). Females comprised of only 22 cases had fracture or dislocation most commonly involving the C5 vertebra. The results of current study showed concordance to the study done by Sinha et al showed majority of the patients belonging to the rural areas of the country [3]. The primary mode of occupation included field work and agriculture which exposed them to occupational risks of working at heights.

In current study 72.5% were residing in the rural areas and majority sustained injury due to fall from unprotected roofs, trees or fall into uncovered wells. In current study the relationship between the age and the level of dislocation showed the level of C5-C6 which accounted to 77 cases, of which 28 cases were in the age group of 31-40 years. In the same age group the second most common dislocation was C1-C2 level. C5-C6 dislocation was most common in the age groups: 41-50yrs, 51-60yrs and 61-70yrs. Although in the age group 11-20 years, C4-C5 dislocation was the most common site in 20 cases.

In current study, on comparing the relationship between the age group and level of fracture, it showed that C5 fracture was the most common with a total of 60 cases, of which 18 cases each were seen in the age groups 21-30 years and 31-40 years. This was followed by 43 cases of C6 fracture in total. C4 and C7 vertebrae were also involved in a fair number of patients with 18 and 14 cases respectively. No fractures were seen in our patients in the age groups 0-10 and 81-90 years. In current study, on comparing the relation between the level of dislocation and level of fracture vertebra, 20 cases showed

coexistence of both. Dislocation of C4-C5 vertebra was associated with 6 cases of fracture, of which 4 were fracture of C6 vertebra and one each of C2 and C3 vertebra. Dislocation at the C6-C7 were also associated with 5 cases of fracture involving C2 (1), C3 (1), C4 (1) and C5 (2) vertebra.

In our study, C5-C6 is the common site of cervical dislocation with associated fracture followed by C1-C2. C5 was the most common vertebra involved accounting to 60 cases (23.52%), followed by 43 cases (16.86%) of C6 vertebral fractures. The C5 fracture was most common in the age groups 21-30yrs, 31-40yrs and 41-50yrs. Both the patients in the age group 0-10 years had dislocation of C1-C2. The results of current study were in concordance with the study done by Shrestha et al ;77 patients had fracture involving both C5 and C6 vertebrae. 24 C3 vertebra was the least to be fractured, with only 6 cases.

In current study, 33 patients had other associated injuries, of which head injury was the most commonly associated injury accounting to 27 cases (81.8%). There were 4 patients with injury to the extremity and one patient each with injury to chest and mandible. Singh et al showed that prevalent injury associated with cervical spine injuries was head injury (7%) followed by extremity fractures (6.3%), chest injury (3.1%), abdominal injury (0.9%) and pelvic injury (0.7%) [4]. In the study done by Manjeet et al 75 % of the cases showed no associated trauma with CSI [23]. In the rest most prevalent associated injury was head injury, followed by extremity fractures, chest injury, abdominal injury and pelvic injury. The results of current study Our study was in concordance with available literature [4,23]. A thorough understanding of the patterns of

injury is necessary to improve the initial assessment and management of these patients and reduce the risk of inflicting further iatrogenic complications. There is tremendous lack of basic infrastructure and trained medical personnel, especially in rural areas, involved in initial management of these patients. Vast majority of people lack basic knowledge about the initial immobilization and transportation of these patients to higher centres and by the time patient reaches a general or institutional hospital; there may be an extensive damage to neurological status, which could be prevented.

Certain preventable risk factors in traumatic cervical spinal injuries (falls, vehicular accidents, improper pre-hospital care and improper transportation) need to be addressed in particular in order to reduce the frequency and morbidity of spine injuries and the burden on meagre financial and health resources of our state.

The limitation of the current study is it is a retrospective study and the sample size is small to extrapolate the injury pattern for the nationwide assessment. Though this study may not be a true representation of epidemiology of all spinal injuries in the society, as it is restricted only to one institute, it can best be taken as the trend, as we receive patients from a vast area.

We thus conclude that there is a strong need to identify the risk factors and to take steps to control them by educating the people, to train paramedical staff in rural areas about initial handling and transportation of patients having spinal cord injuries. An aggressive multidisciplinary approach can reduce the mortalities and morbidities associated with cervical spine injuries in developing nations.

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