

# A Comprehensive Study of Deaths due to Cervical Spine Injuries in Various Cases Reported at a Tertiary Care Hospital Mortuary during the Period of January to December 2015

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## ABSTRACT

**Introduction:** The cervical spine is made up of the first 7 vertebrae, referred to as C1-7. It functions to provide mobility and stability to the head while connecting it to the relatively immobile thoracic spine. A cervical spinal injury makes a person morbid and it is the most crippling disease and the most common cause of spinal cord injuries are motor vehicle accidents. Hence, the aim of the present study was to assess the anatomical distribution of cervical spine injuries and draw a parallel with mortality and to study cervical spine injuries in relation to variety of trauma.

**Material and methods:** The present study was conducted among 93 cases which were obtained from sample size comprised of all cases with cervical spine injury autopsied at medico legal center between January to December 2015. The cases for study included wherever the cervical spine was traumatically injured alone or in combination with other injuries.

**Results:** A total of 5240 cases were autopsied at medico legal centre of which 93 cases had clear demonstrable cervical spine injuries. Of the 93 cases 68 cases are identified bodies and 25 are unknown. Total number of cases is 93 out of which 87 were males and 6 were females.

**Conclusion:** It was found that the mortality due to cervical spine injury comprised 1.77% of all cases. Majority of victims were males with female ratio 87:6. Common age group involved in the study was 31-40 years. Accidental cases comprised 74% of all cases and the rest 26% were suicidal cases.

**Keywords:** Cervical Spine Injury, Tertiary Care Hospital, Accidents, Death

## INTRODUCTION

The cervical and thoracic regions are the most common areas of spinal injury. Spinal Cord Injury is truly a devastating injury with profound consequences to the individual, his family and society. WHO recognized it as a major musculoskeletal condition that presents a serious disease burden among the population. After a skull fracture the severity of disability is estimated at 43%. Following Spinal cord injury, it is 72% as per the statistical data compiled in Rehabilitation council of India Publications.<sup>1</sup>

A cervical spinal injury makes a person morbid and it is the most crippling disease that cripples the thought process too. The most common causes of spinal cord injuries in the United States as per a series published in Mayo clinic are motor vehicle accidents in which auto and motorcycle accidents are the leading cause of spinal cord injuries, accounting for

more than 35 percent of new spinal cord injuries each year followed by falls in which spinal cord injury after age 65 is most often caused by a fall.<sup>2</sup>

Overall, falls cause more than one-quarter of spinal cord injuries, acts of violence in which around 15 percent of spinal cord injuries result from violent encounters, often involving gunshot and knife wounds, according to the National Spinal Cord Injury Statistical Center and Sports and recreation injuries under which athletic activities, such as impact sports and diving in shallow water, causes about 9 percent of spinal cord injuries with alcohol as a factor in which about 1 out of every 4 spinal cord injuries takes place.<sup>3</sup>

Diseases such as cancer, arthritis, osteoporosis and inflammation of the spinal cord also can cause spinal cord injuries. The common causes of cervical spinal injury as per rehabilitation council of India data are fall from height: trees, construction sites, road traffic accidents (RTA); especially involving two wheelers, sporting injuries: diving and kabaddi, assault: such as gunshot injury and stabbing followed by non-traumatic causes such as tubercular spondylitis.<sup>4</sup>

The causes and prevention of cervical spine injury in our Telangana region are not studied in detail till date. The present study makes an effort to study them. A preliminary assessment of data makes it clear that automobile accidents account for majority of cervical soft tissue and spinal injuries in our area.<sup>5</sup>

Leaving aside the grave mortality of cervical spine injury, it is very important to note that anyone who survives the first 24 hours of a spinal injury are still alive 10 years later without any sequelae. This makes it clear about the steady improvisation of trauma care and emergency management.<sup>6</sup> Most damage to the spinal cord arises from intrusion of some part of the spinal column into the canal, be it bony

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fragments or displacement, ligamentum flavum, disc annulus or extruded nucleus pulposus. There may be bleeding into the space outside the spinal dura causing a space-occupying lesion in the canal that can compress the cord or bleeding may occur within the dura, either from ruptured vessels or from haemorrhage in the cord itself.

Damage to the cord may also occur in the absence of any apparent intrusion into the canal, in a manner similar to that seen in the brain in closed head injuries without a fracture.<sup>7,8</sup> The health and economic aspects of morbidity are yet to be studied with emphasis. Speaking on the mortality side the most common cause of death is respiratory failure.<sup>9</sup> Therefore, the present study made an attempt to devise a checklist of safety guidelines for prevention of cervical spine injury with the aim to assess the anatomical distribution of cervical spine injuries and draw a parallel with mortality and to study cervical spine injuries in relation to variety of trauma.

## MATERIAL AND METHODS

The present study was conducted in the Department of Forensic Medicine and Toxicology, of Osmania, General Hospital, Hyderabad, Telangana. Sample size comprised of all cases with cervical spine injury autopsied at our medico legal center between January to December 2015. The cases for study included wherever the cervical spine was traumatically injured alone or in combination with other injuries.

Anterior approach for spinal dissection was undertaken considering the advantages of less disfigurement and less learning curve. Waiver of informed consent was obtained from the Institutional Ethical Committee. A semi-structured proforma with all necessary parameters was used to generate data for statistical analysis. The description of some cases brought to the hospital is as follows:

A 25-30 year old unknown male was hit and run by a four wheeler and died on the same day. The body was subjected to post-mortem examination. He sustained fracture dislocation of 6 and 7 cervical vertebrae associated with diffuse subdural and subarachnoid haemorrhage all over the brain, antero-lateral fracture of all ribs on right side, whole thickness laceration of liver and rupture of posterior wall of stomach. The cause of death was due to head injury, cervical spine injury and blunt injury chest and abdomen.

A laborer patient 40 year old sustained cervical spinal injury as he slipped while carrying rice sacks on his back wherein he expired and his body was subjected to post mortem examination. 5th and 6th cervical vertebrae fracture and dislocation was the primary injury on examination associated with rib cage fractures antero-laterally with corresponding penetrating injury of lungs with 2 litres of partially clotted blood in pleural cavity. The cause of the death was due to cervical spine injury.

A 42 year old farmer fell from a tree wherein he expired after two days of hospital treatment. The surgeon's diagnosis was subluxation at the level of 4 and 5 cervical vertebrae with bilateral lower limb fractures. Cervical plating was done in the course of management. The corpse was subjected to

autopsy. Cervical spine fracture and subluxation was noted at 5 and 6 vertebrae associated with both lower limb fractures. The cause of the death was due to cervical spine injury and other related injuries.

An 18 year old student was riding a two wheeler without a helmet, was under the influence of alcohol after a late night party lost control of his vehicle speedily hit the divider and sustained a forceful fall followed by death after 2 days. On post mortem examination, it was found that cervical spine fractured at the level of C4 and C5 associated with fracture skull and underlying diffuse sub arachnoid hemorrhage all over the brain and fracture right femur.

A 30 year old driver was riding his four wheeler under the influence of alcohol, unrestrained by seat belt sustained a sudden deceleration injury by hitting a tree and died on the spot. The body was subjected to post mortem and his viscera was preserved and sent to Forensic Sciences Laboratory for toxicological analysis. Cervical spine injury was damaged at fifth level, on receipt of Forensic Sciences Laboratory the final opinion. The reason for death was found to be cervical spine injury and the deceased was under the influence of ethyl alcohol at the time of death.

Similarly, a 35 year old male who was an electrician by profession fell down accidentally from an electrical pole while performing his duty. He was taken to hospital but declared as brought dead. Body was brought in mortuary for autopsy. On post mortem examination, cervical spine was fractured at the level of C5 and C6 associated with fracture in right leg. The reason for death was found to be cervical spine injury associated with fracture lower limb.

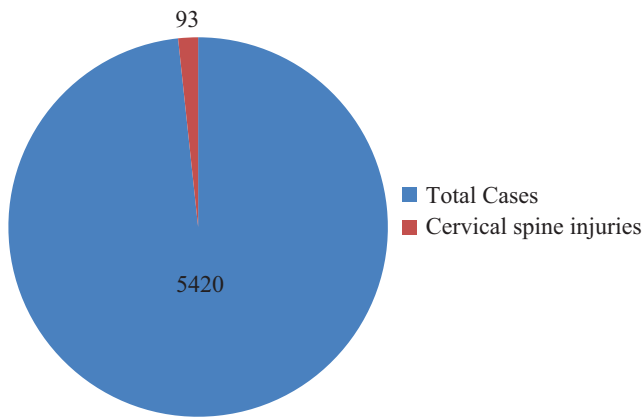
## STATISTICAL ANALYSIS

The data was entered into the excel sheet and was analyzed for descriptive statistics with the help of statistical software SPSS version 21.

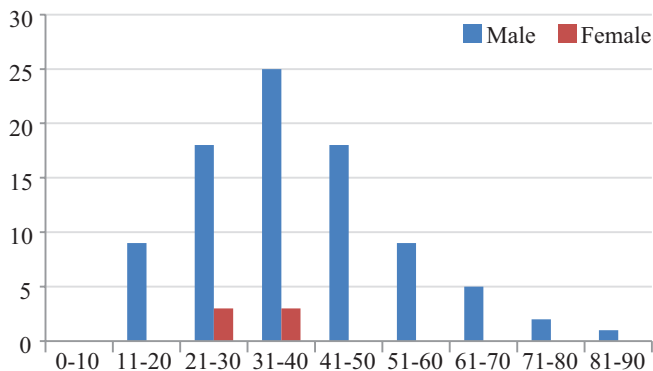
## RESULTS

A total of 5240 cases were autopsied at medico legal centre of which 93 cases had clear demonstrable cervical spine injuries. Of the 93 cases 68 cases are identified bodies and 25 are unknown. Total number of cases is 93 out of which 87 were males and 6 were females. The age distribution of victims is as follows, between 11-20 years, about 9 males are involved, in 21-30 years, 18 males and 3 female members are involved, in 31-40 years, 25 members were males and 3 were females, in 41-50 years, 18 members were males, in 51-60 years, 9 members were males, in 61-70 years about 5 members were males, in 71-80 years, 2 members were males, only 1 case was male member in 81-90 years age group (Graph 1 and 2).

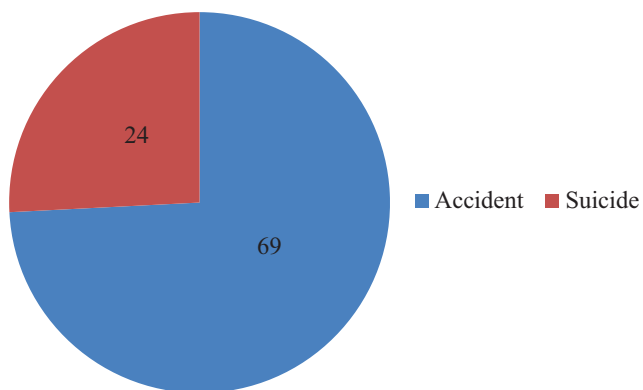
Total 69 cases were accidental and 24 were suicidal. About 45 cases suffered from road traffic accidents, 10 cases with falls and 14 cases from railway accidents. Among the 6 four wheeler accidents none used seat belt for protection. In the present study among the 13 two wheeler riders 9 were under the influence of alcohol. Among 8 pillion riders only one was under the influence of alcohol. Spot deaths accounted for 74



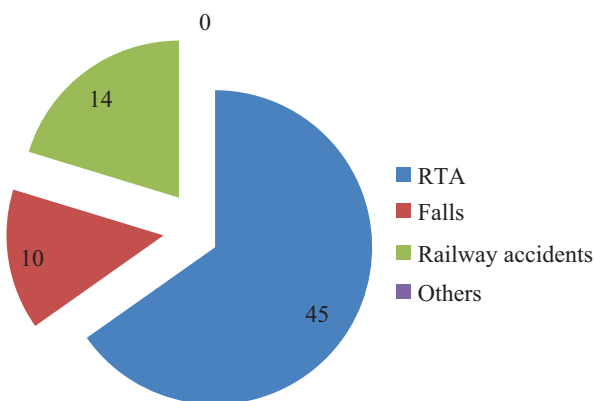
**Graph-1:** Shows the distribution of data based on cervical spine injuries among all autopsies



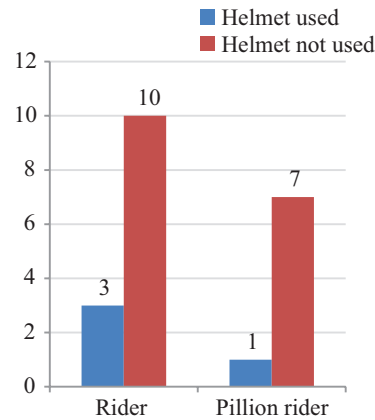
**Graph-2:** Shows the distribution of data based on age and gender in cervical spine injuries



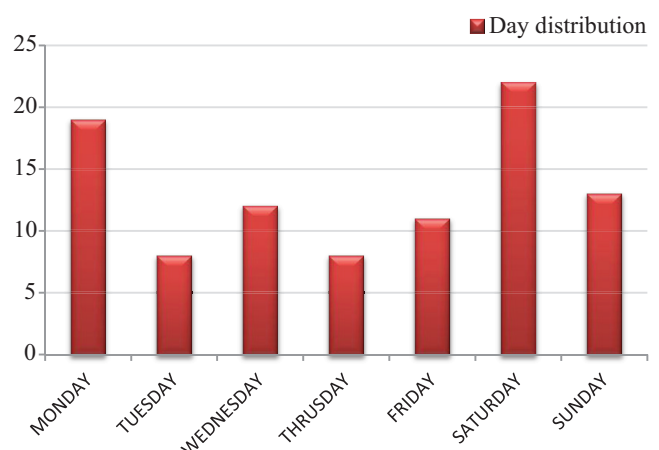
**Graph-3:** Shows the distribution of data based on manner of deaths in cervical spine injuries



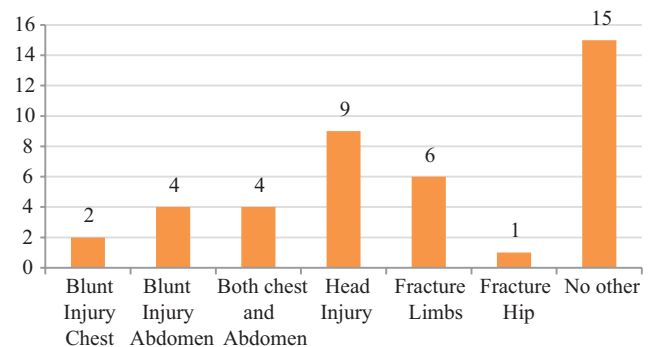
**Graph-4:** Shows the distribution of data based on various types of accidents involved in cervical spine injuries



**Graph-5:** Shows the distribution of data based on use of helmet in deaths in two wheeler cervical spine injuries



**Graph-6:** Shows the data based on day-wise distribution of all the cases



**Graph-7:** Shows the associated fatal injuries with railway deaths due to cervical spine injury

of 93 cases, 16 were hospital deaths, three deaths happened while transit to hospital. Among the hospital deaths 5 survived for a day, 7 survived for 2 days and the remaining four died in first week. Surgical management was done in 8 cases and 8 cases were conservatively managed for the reason of poor prognosis (Graph 3, 4 and 5).

In our study, 36 cases had only cervical spine injury without any other fatal injury, in 27 cases cervical spine injury was associated with head injury, associated with blunt injury chest and abdomen in 6 cases, associated with only blunt injury chest in 8 cases, associated with only blunt injury abdomen in 6 cases, associated with fatal long bone fractures

Place of death	No	Occupancy	Number
Spot Death	33	Driver/rider	10
		Pillion rider	4
		Front seater	1
		Rear seater	2
		Pedestrian	16
Hospital	10	Driver	4
		Pillion rider	4
		Rear occupant	1
		Pedestrian	1
Transit	2	Rider	1
		Rear occupant	1

**Table-1:** Shows the place of death and occupancy of deceased in the vehicle in RTA

Vehicle	Total cases	Number of cases in which alcohol is detected
Two wheeler	21	10 (9 rider, 1 pillion rider)
Three wheeler	1	0
Four wheeler	6	2 (2 driver)
Pedestrian	17	1
Total	45	13

**Table-2:** Shows the influence of alcohol in road traffic accidents

	Total cases	Alcohol influence	No Alcohol influence
Suicide	24	3	21
Accident	14	1	13
Total	38	4	34

**Table-3:** Shows the Influence of alcohol in railway deaths due to cervical spine injury

in 12 cases (Graph 6).

The day wise distribution is 22 cases reported on Saturdays, 19 cases on Mondays, 13 cases on Sundays, 12 cases on Wednesdays, 11 cases on Fridays, 8 each in Thursday and Tuesday (Graph 7). The cause of injury showed the following patterns. Fall accounted to reason in 10 individuals, train accidents in 38 cases, road traffic accidents in 45 cases. Among the road traffic accident cases two wheeler mishaps occurred in 21 individuals. Rider sustained injury in 13 cases and pillion rider in 8 cases.

A total of 6 deaths due to cervical spine injury occurred in four wheeler accidents. Among those one was driving the vehicle, two were front occupants, and three were rear occupants (Table 1, 2).

A total of 17 pedestrians on road succumbed to cervical spine injuries. Among all cases of fall, 7 are fall from height, one was a fall from tree, one was fall from steps and other was fall while still standing. The manner of death was accidental in 14 cases and suicidal in 24 cases. No homicidal injury to cervical spine region was reported during the study period (Table 3).

## DISCUSSION

Indian transport systems play an important role in

development of economic activities by promoting fair distribution of produced goods and services. The share of transport sector in Gross Domestic Product (GDP) of India is steadily growing. It is one of the key indicators in assessment of socioeconomic development of the country. Hence it is of paramount importance to understand the trends and patterns of traffic accidents. Traffic Accidents in the country have marginally increased by 1.3% during 2014 compared to 2013. A total of 4,81,805 traffic accidents comprising of 4,50,898 road accidents, 28,360 railway accidents and 2,547 railway crossing accidents were reported, these accidents caused 1,41,526, 25,006 and 2,575 deaths respectively during 2014. Maximum 'Traffic Accidents' were reported in the month of May, accounting for 9.2% (44,106 out of 4,81,805) of total traffic accidents during the year 2014.<sup>10,11</sup>

The results of our study are in concordance with ever increasing accidental deaths in this part of the country. From the previous literature, it was revealed that the same tertiary care hospital in 2004, 85 cases cervical spine deaths were reported among 3872 in that year. The share of cervical spine deaths in our study population is more or less nearly equal.<sup>12</sup> Age distribution wise deaths are common in 31-40 years group. Similar results were obtained in An Epidemiological Survey of Fatal road traffic accidents and their relationship with head injuries. This age group is the most active phase of life, physically and socially, and hence outnumbers the other road users.<sup>13</sup>

It was found from the literature that majority of injuries were in 21-35 years group with another peak at the 61 to 65 age groups (10%). The reason for more accidents during weekends in case of road accidents is alcohol consumption, late night parties after which they took on the roads. Similar results were obtained in a study done by Mehta SP et al. However there is no consistent trend in this pattern as contradicting to our results are obtained in a study conducted by Arvind Kumar et al.<sup>14,15,16</sup>

The probable explanation for the trends of deaths due to cervical spine injury between 6 pm and 6 am is majority of suicides are planned in the early hours of the day, poor visibility in winter months causing accidents and alcohol consumption. In a study done by Arvind Kumar et al it was found that about 53.20% of fatal accidents occurred between 6 pm and 6 am.<sup>16</sup>

Though it is undoubted that helmet protects from head injury, our study proved that helmet has a protective element in preventing cervical spine injury also and these findings were in concordance with the study done by the Myth Joseph G Crompton et al. Alcohol was significantly responsible for many accidents in our study and these findings are consistent with the study done by Gjerde H et al.<sup>17,18</sup>

Failure to use seat belt was responsible for fatal cervical spine injuries in four wheeler accidents as reported by Koji Mizuno et al. Homicides, bullet injuries, diving, hanging and strangulation, sport injuries and pathological fractures were not reported in this study as was seen in many studies among the subjects.<sup>19</sup>

Cervical spine injury cannot be the attributed the whole

importance in the presence of other associated fatal injuries. The spatial and temporal distribution of study should be borne in mind while generalizing the findings. Because the time limit of study and restriction of jurisdiction, all types of cases did not fall within the study group.

Modern imaging techniques like computerised tomography were not employed for precise location of injury prior to post-mortem. Survival period post injury could not be accurately determined from our study. Role of using mobile phone during accidents was not a part of this study, which could have a significant impact in accidents according to many studies.

## CONCLUSION

Mortality due to cervical spine injury comprised 1.77% of all cases. Chest and abdomen injuries were the most commonly associated with cervical spine injury in suicidal deaths. Road traffic accidents were major cause of accidental spinal cord injuries in this study. Lack of helmet protection was responsible for cervical spine injury in two wheeler accidents. Fracture limbs were the most common associated injury with cervical spine injury due to fall from height.

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