# The Prevalence of Traumatic Spinal Cord Injury in Khyber Pakhtunkhwa from 2008 to 2017: A Cross Sectional Study

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**Abstract**

**Background:** Spinal Cord Injury (SCI) is an event that impacts an individual physically, psychologically, socially and become a financial burden upon the family, society and health care system.

**Objective**: To describe the prevalence of Traumatic Spinal Cord Injury (TSCI) in Khyber Pukhtunkhwa from 2008 to 2017.

**Materials and Method:** It is a retrospective descriptive study. The data was collected from the three main spinal cord injury rehabilitation hospitals i.e. Paraplegic Center Hayatabad, Rafsan Rehabilitation Hospital (Peshawar) and Helping Hand Rehabilitation Hospital (Mansehra) of Khyber Pukhtunkhwa, Pakistan. Descriptive statistics was used to analyze the data to describe the prevalence of TSCI.

**Results:** The current study consists of 2098 patients with a mean prevalence of 5.74 cases per million populations per year. The leading cause was the Road Traffic Accidents (RTAs) (33.1 %) and the mean age was 33.31 years. The most commonly injured level was the thoracic spine (56.2 %). In the current study 2016 was the most devastating year for SCI in Khyber Pakhtunkhwa with highest number of cases reported (14.4 %).

**Conclusion:** The prevalence of traumatic SCI in Khyber Pakhtunkhwa was 5.74 per million people per year.

**Index Terms:** Prevalence, Traumatic SCI, Complete SCI, Incomplete SCI, Single Neurological Level (NLI), Level of SCI, Khyber Pakhtunkhwa.



## INTRODUCTION

Spinal cord - the division of the central nervous system transmitting signals to and from the main component of the central nervous system i.e. to and from the brain to the rest of the body parts. Spinal cord is surrounded by vertebral column divided into five different regions like cervical the neck region, thoracic the upper back region, lumbar the lower back region, sacral the pelvic region and coccyx the tail (1). Spinal cord injury is an event that impacts an individual physically, psychologically, socially and become a financial burden upon family, society and the health care system (2). According to International Standards

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for Neurological Classification of Spinal Cord Injury (ISNCSCI), the elements of American Spinal Cord Injury Assocciation (ASIA) impairment scale are: Severity of spinal cord injury, sensory and motor level, completeness of spinal cord injury, left and right, Single Neurological Level (NLI) and the zone of partial preservation (3). A study reported the highest prevalence of SCI 870 cases per million populations in United States of America.(4). A study conducted in Iceland, the crude prevalence rate calculated was 526 cases per million population (5). Another study conducted in Birmingham, UK reported that the main causes of TSCI in 2015 were the vehicular accidents (39.08%), falls (29.54%) and acts of violence (14.41%) (6). A similar study conducted in Cambodia, revealed that the most common cause of TSCI was Fall From Height (FFH) (53%) including falls from the trees (45%) and falls from the houses (24%) (7).

The traumatic SCI predominantly impacts the male as compare to female because of several reasons including motor vehicle accidents, sports, falls and violence (8). According to a study males mostly the young adults of age 18 to 32 years were highly exposed in both the developed and developing countries (10). The Activities of Daily Livings (ADLs) of a patient with SCI are greatly depending upon the level of the injury (Cervical, Thoracic or Lumbar) and the severity (Complete or Incomplete) of the injury. Higher the level of injury, greater the help will be required for the patients in ADLs and transportation. The injury to the cervical region especially C1 to C5 cause tetraplegia i.e. paralysis of all four limbs. And if it's the injury to C6 to C8 level, patients will need extra care in bowl and bladder. The injury at or below the T1, cause paraplegia which means the impairment of just the lower limbs and the patient is somehow independent in their self care (11). As cervical spine has conspicuous mobility due to which cervical spine was damaged commonly followed by thoracolumbar region (12). According to a study, the cervical spine injury (10%) was more common than thoracic spine injury (6%) (13). The treatment course and recovery is highly dependent upon the level and severity of the injury (14). A study reported that the Complete SCI accounts for 56.5% was more common than Incomplete SCI having 43% (15).

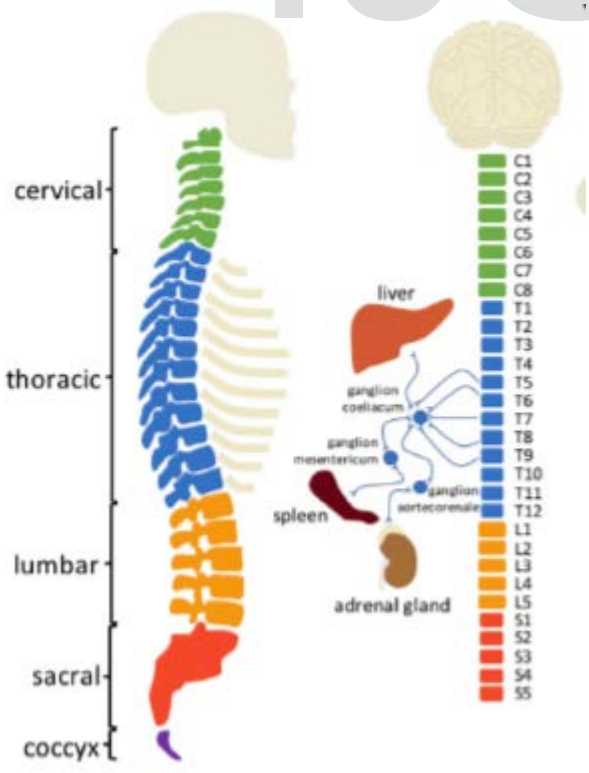


***Figure 1 (a). Vertebral Column (b). Spinal Cord*** (9)

According to Spain Health Ministry in 2014, the mortality rate was 1.4% after initial admission to hospital (16). The mortality rate in the pre-hospital phase and in acute phase of the patients with spinal cord injury is highly dependent upon the level and degree of the injury despite of the fact, modern medical management is available (17). A study reported in 2006 that the survival of the patients with SCI is improving such as the average life expectancy of the patients with SCI having age from 25 to 34 was expected to be 38 years and among 43% patients, the minimum survival time was 40 years, which showed a five years increase in the survival time as compared to a study conducted on the same population i.e. SCI patients in 1983 (18). The main cause that lower the life expectancy of the patients with SCI are the secondary health conditions including loss of bowel and bladder control, pressure

sores, spasticity, cardiovascular and respiratory disorders (19).

## Materials and Methods

It was a cross sectional study.

**Data collection:**

This study was conducted in the three main rehabilitation centers of Khyber Pakhtunkhwa, Pakistan including Paraplegic Center Hayatabad, Peshawar, Rafsan Rehabilitation Center, Peshawar and Helping Hand Rehabilitation Center, Mansehra. All the traumatically injured patients admitted between January 2008 and December 2017 with radiographically confirmed injuries to the spinal vertebrae and neural components of the spine, with neurological deficit whether complete, incomplete and normal ASIA E were included in the study. A customized template for data collection was developed and the patient's information was collected from the medical record of these mentioned rehabilitation centers.

The study was approved by the research committee of the NCS University System, Peshawar and an ethical approval was obtained from the administration of these mentioned rehabilitation hospitals.

The data was compiled and was analyzed using Statistical Package for Social Sciences (SPSS) version 22.0.

## Results:

The patients registered to these rehabilitation hospitals from 2008 to 2017 were 2098. The mean age was 33.31 years ranges from 2 to 98 years. The mean prevalence was 5.74 per million populations per year. Most of the patients were male 1667 (79.5 %) while female were 431 (20.5 %). Patients with complete SCI were 1632 (77.8 %), with incomplete SCI were 557 (21.8 %) and with normal ASIA-E were only 9 (0.4 %).

The leading cause of traumatic SCI was RTA 653 cases (33.1 %) while other causes were falls (22.3%) including fall from height 446 cases (21.3%) and ground fall 21 cases (1.0%), Fire Arm Injury (FAI) 459 cases (21.9 %), natural disaster 171 cases (8.2%), object fall 159 (7.6%) and coal mine accidents 37 cases (1.8%). Majority of the patients with SCI were from district Peshawar 427 (20.4%). Among 2098, thoracic region was the most common region injured 1180 cases (56.2%). Patients with cervical injury were 481 (22.9%) and with lumber region injury were 436 (20.8%) and for sacral region only one case was reported. The literacy rate in our study sample was (52.6%).

## Discussion:

The current study is the first in its nature reporting prevalence of such a high number of patients with traumatic spinal cord injury in whole province of Khyber Pakhtunkhwa in the country. In the current study the mean prevalence of TSCI was 5.74 cases per million population/ year. A study in Tianjin, China scantly support the results of the current study as they reported the prevalence of SCI 18 cases per million populations which was higher as compare to our study (20). Similarly, the prevalence of SCI in Canada was estimated to be 1289 cases per million populations, the highest ever reported (21).

In the current study, the author calculated the mean age of 33.31 years and the common age range affected was 21-30 years which mean that the spinal cord injury was common in younger adults. MJ DeVivo in USA conducted a study supported the current study in which he reported that mean age of the patients with traumatic SCI was 36.9 years in 2010 (21). While in contrast to our study results Henry Ahn et al. reported in a study in 2011 that the mean age of patients with Spinal cord injury in Canada was 54.6 years (22). In the current study the ratio of male to female was 4:1, the potential reason for the low proportion of females in the current study could be the more exposure of the male gender to the risk factors of traumatic SCI like RTA- the common cause of SCI almost everywhere in the world., fire arm injury and fall from height as compare to female gender. Another study conducted by Haidar Darain et al. in Pakistan also reported almost similar to the results of the current study in which 76 % were male patients and 24 % were female patients (23). A study in USA by Christine Richard et al. males were more likely to experience SCI than fe-

males at a ratio of 2.25:1 and were projected to account for 80 % of all TSCI (24). Most of the cases reported in the current study were patients with

| | | Count | Column N % |
|---|---|---|---|
| **Gender** | Male | 1667 | 79.5% |
| | Female | 431 | 20.5% |
| **Education** | Literate | 1104 | 52.6% |
| | Illiterate | 994 | 47.4% |
| **Age** | Less than 21 years | 350 | 16.7% |
| | 21 to 40 years | 1155 | 55.1% |
| | 41 to 60 years | 458 | 21.8% |
| | More than 60 years | 135 | 6.4% |

**Table 1. Baseline characteristics of the participants**

| Years 2008 | Population (KPK) | Frequency (TSCI) | Prevalence Per million |
|---|---|---|---|
| 2008 | 21.335,625 | 204 | 9.5 |
| 2009 | 22.201,483 | 165 | 7.4 |
| 2010 | 23,104.480 | 189 | 8.1 |
| 2011 | 24,042,123 | 186 | 7.7 |
| 2012 | 25,017,818 | 186 | 7.4 |
| 2013 | 26,033,109 | 259 | 9.9 |
| 2014 | 27,089,604 | 221 | 8.1 |
| 2015 | 28,188,974 | 177 | 6.2 |
| 2016 | 29,332,960 | 302 | 10.2 |
| 2017 | 30,523,371 | 209 | 6.8 |
| Total | | 2098 | |

**Table 2. Prevalence of Traumatic SCI**



| Causes | Frequency | Percentage |
|---|---|---|
| Road Traffic Accident | 653 | 33.1 |
| Fire Arm Injury | 459 | 21.9 |
| Height Fall | 446 | 21.3 |
| Natural Disaster | 171 | 8.2 |
| Object Fall | 159 | 7.6 |
| Sports Injury | 91 | 4.3 |
| Coal Mine Injury | 37 | 1.8 |
| Diving in Shallow Water | 32 | 1.5 |
| Ground Fall | 21 | 1.0 |
| Bomb Blast Injury | 18 | 0.9 |
| Animal Hit Injury | 8 | 0.4 |
| Crush Machine | 3 | 0.1 |
| Total | 2098 | 100 |

**Table 3. Causes of Traumatic Spinal Cord Injury**

complete SCI (77.8 %). Incomplete SCI were 21.8 % while patients with Normal ASIA - E were 0.4 %. Knotsdottir et al. conducted a study in Iceland didn't supported the study reporting complete SCI 61%, incomplete SCI 39 % (25). Another study conducted by Gwynedd E. Pickett et al. in Canada also went in contrast to the current study reported that 35 % of cases were the complete SCI while the remaining were incomplete SCI and most of the incomplete SCI were having ASIA – D classification (26). The most com-

mon level of injury affected was the thoracic level (56.2 %) followed by cervical spine (22.9 %) and lumbar spine (20.8 %) while only one case of sacral region was reported. Rathore et al. reported that thoracic was the most common level injured in Pakistan (27). In the current study the RTA (31.1 %) was the leading cause of the traumatic SCI in Khyber Pukhtunkhwa from 2008 to 2017. RTA was the cause of almost one third of the total injuries to spinal cord. Fall was the second leading cause (22.3%) of traumatic SCI collectively including the fall from height and ground fall. This is because the northern districts of Khyber Pakhtunkhwa like Swat, Dir Upper, Dir Lower and Shangla etc are hilly and most of the time people slipped of the hills and as these mountains are high that's why the prevalence of spinal cord injury was high because of fall from height. The third common cause was the fire arm injury (21.9 %). A study conducted by Velmahos et al. in South Africa reported that fire arm injury (35 %) was the leading cause of spinal cord injury followed by motor vehicle accidents (30 %) (28). According to a study by Donna M. Dryden et al in Canada the motor vehicle accidents were the leading cause of SCI (56.4 %) followed by fall from height (19.1 %) while the third leading cause was sports and recreational activities (11.3 %) (29). According to another study conducted in Spain, the most frequent causes of TSCI were falls (54.2%) followed by road traffic accidents (37%) while the other causes were sports or leisure-related accidents (3.5%) (30).

The secondary health problems including loss of bowel and bladder control, pressure ulcers, spasticity, cardiovascular and respiratory disorders are the causes of lower life expectancy in the patients with SCI. So it become the responsibility of the administration of the tertiary care hospitals to refer such patients for rehabilitation centers after seeking the emergency treatment for their better and independent life.

**Conclusion:**

A significant decrease of four people per year per million populations was recorded in the study. Due to the security situation in the recent past of Khyber Pakhtunkhwa, the FAI contributed a large number of patients. The minimum numbers of cases were reported in 2009.

The common age affected was the young adults. Even there were some pediatric and geriatric cases also registered. Male gender was affected the most, four times greater than females. Thoracic region was the most common and frequently injured region. Most of these injuries were the complete SCI round about four times greater than incomplete SCI with a very few number of ASIA – E.

More than half of the patients were literate which is a good move to educate and for the rehabilitation of such patients. In the current study the road traffic accidents, was the leading cause of SCI. Fire arm injuries and diving in shallow water were also one of the causes of TSCI. Most of patients in the current study were from the northern districts - the hilly side of Khyber Pakhtunkhwa.

## Limitation:

The only limitation of this study was there might be some duplicated cases because the authors were totally depended upon the health record of these mentioned rehabilitation hospitals. Though probabilistic matching was performed and these duplicated cases were eliminated.

## Recommendation:

To void the duplication of cases and proper record maintenance, the establishment of National Spinal Cord Injury (SCI) Data Base is much needed in Pakistan like the other developing countries of the globe.

The current study was conducted in Khyber Pakhtunkhwa similarly such studies should be conducted at national level.

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## Conflict of interest:

The authors declare no conflict of interest.

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