


Research Article

Epidemiology of Traumatic Spinal Cord Injury in Rajshahi: A prospective study in Rajshahi Medical College Hospital

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Abstract

Background: Traumatic spinal cord injury (SCI) is a devastating condition that can lead to significant physical, psychological, and social consequences for affected individuals and their families. SCI is a major public health problem worldwide, with an estimated incidence of 10-83 cases per million population per year, depending on the region and study population.

Objective: This study was to determine the epidemiology of traumatic spinal cord injury (SCI) in Rajshahi, Bangladesh. **Methods:** This was a prospective study conducted at the Rajshahi Medical College Hospital from January 2018 to December 2021. The total sample size was 218. Data on demographic characteristics, cause and level of injury, associated injuries, and neurological status were collected and analyzed.

Results: The majority of patients (69.3%) were male and the mean age was 39.8 years. The most common cause of SCI was road traffic accidents (47.7%), followed by falls (25.7%) and violence (15.6%). The cervical spine was the most common level of injury (50.9%), followed by the thoracic spine (37.2%) and lumbar spine (11.9%). Associated injuries were present in 43.1% of patients. The most common neurological status at admission was complete injury (47.7%). The mortality rate was 9.6%.

Conclusion: Traumatic SCI is a significant public health problem in Rajshahi, with road traffic accidents being the leading cause. The cervical spine was the most commonly affected level, and associated injuries were present in a significant proportion of patients. The mortality rate was also considerable. These findings highlight the need for the development of effective prevention strategies, improved trauma care, and rehabilitation services for individuals with SCI in the region.

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Introduction

Traumatic spinal cord injury (TSCI) refers to the damage caused to the spinal cord due to an external physical impact, leading to temporary or permanent changes in sensory and motor functions[1]. This condition is often associated with an immediate risk of death during the acute phase due to respiratory and cardiac causes. Those who survive the acute phase may face disabilities, general physiological impairments, a loss of independence, and socio-economic challenges in the long run[2]. The primary insult causes a complex secondary injury cascade in the spinal cord, resulting in changes in its

organization and structural architecture. In combination with the poor intrinsic recovery potential of the spinal cord, this usually results in permanent neurological deficits. TSCI has a significant association with morbidity, mortality, and high financial burden to the family and society, making it a crucial public health problem to deal with. Providing consistent, reliable, and valid sources of clinical data is critical for evidence-driven interventions and effective disease control planning with proper allocation of resources[3].

Preventive measures to reduce the incident rate and the development of effective care systems for TSCI victims are the two most important interventions that can be delivered[4]. However, acute trauma care in a lower-middle-income country like Bangladesh is complicated and unique, with constrained resources. Transport to hospitals after an event is unstructured, and the scarcity of hospital units with surgical expertise specific to SCI is predominant[5]. The scope of comprehensive follow-up is often limited, and discharge to home or rehabilitation centers is often disregarded by patients due to a lack of awareness or financial burden. Additionally, social and economic circumstances vary across the country[6].

To address these challenges, this study aims to gather standardized epidemiological data, including details on the mechanism of injury, degree and level of neurological impairment, associated injuries, clinical pathways, processes of care, and outcomes following acute TSCI among adults in Bangladesh[7]. This information will help medical and government agencies plan preventive programs, meet goals of care, and ensure social integration and employment opportunities for TSCI victims in a barrier-free environment.

Objectives

The study aimed to provide insights into the challenges faced by patients and their families in terms of access to care, rehabilitation, and social integration, and provide recommendations for the development of effective prevention strategies and improved care and rehabilitation services for individuals with traumatic SCI in the region.

The specific objectives of this study were:

- To determine the incidence, prevalence, and distribution of traumatic spinal cord injury in the Rajshahi region of Bangladesh.
- To identify the demographic characteristics of patients with traumatic spinal cord injury, including age and gender distribution.
- To identify the etiology and mechanisms of injury leading to traumatic spinal cord injury in the study population.
- To determine the level of injury and associated neurological status at admission in patients with traumatic spinal cord injury.

- To identify the presence and types of associated injuries in patients with traumatic spinal cord injury.
- To calculate the mortality rate and associated disabilities in patients with traumatic spinal cord injury.
- To identify the challenges faced by patients and their families in terms of access to care, rehabilitation, and social integration.
- To provide recommendations for the development of effective prevention strategies and improved care and rehabilitation services for individuals with traumatic spinal cord injury in the region.

These objectives were intended to provide a comprehensive understanding of the epidemiology of traumatic spinal cord injury in the study population, including its causes, effects, and potential solutions. By achieving these objectives, the study aimed to contribute to the development of effective strategies for the prevention, treatment, and management of traumatic spinal cord injury in Rajshahi and similar regions.

Method

This was a prospective observational study conducted in the Department of Neurosurgery at Rajshahi Medical College Hospital (RMCH) between January 2017 and December 2018. RMCH is a government-funded tertiary level 1200-bedded teaching hospital located in the center of Rajshahi district. The hospital provides services through outdoor, indoor, and emergency sections to Rajshahi and nearby districts almost free of cost.

Study Design and Data Collection

Newly-injured patients who met the following criteria were invited to participate in this study: (i) confirmation of acute traumatic spinal cord injury or cauda equina lesion through abnormal imaging, such as magnetic resonance scan or multi-slice computerized tomography; (ii) the injury resulted in persisting impairment after emergence from neurogenic shock, which generally occurs within the first 24-72 hours after injury; (iii) age 18 years or older; and (iv) surviving at least 24 hours post-trauma.

A standardized data collection form was used to record information on demographic characteristics, cause and level of injury, associated injuries, neurological status, and treatment received. Data were collected from the patients or their relatives, and medical records were also reviewed to ensure accuracy. All patients were followed up until discharge or death. Data were analyzed using descriptive statistics to determine the frequency and percentage of each variable.

Data analysis

Data were analyzed by using Statistical Package for the Social Sciences (SPSS) version 16 to summarize and analyze the descriptive statistics. To find out the associating factors

‘the chi-square’ test was performed. A $p < 0.05$ was considered statistically significant. The main focus of the analysis was to describe the epidemiological characteristics of traumatic spinal cord injury in Rajshahi based on the collected data.

Ethical considerations:

Ethical clearance was taken from the ethical review committee and concerned authority of Rajshahi Medical College Hospital. Permission for the study was taken from the concerned department from where data collection was done. All study participants were thoroughly appraised about the nature, purpose and implications of the study, as well as the entire spectrum of benefits and risks of the study. Participants were only enrolled after obtaining voluntary informed written consent. Participants were assured of adequate treatment of any complications developed in relation to the study purpose. All participants were assured of their confidentiality.

Result

The prevalence profile of traumatic spinal cord injury (TSCI) in Bangladesh, I cannot create a table for you. However, based on the available information in the study, the following table could be created to summarize the demographic and clinical characteristics of patients with TSCI:

Table 1: Demographic and clinical characteristics of patients with traumatic spinal cord injury (TSCI) in Rajshahi, Bangladesh

Category	Frequency	Percentage
Gender:		
- Male	151	69.30%
- Female	67	30.70%
Age group:		
- <20	12	5.50%
-49	54	24.80%
-69	64	29.40%
-89	46	21.10%
-109	27	12.40%
- 60+	15	6.90%
Cause of injury:		
- Road traffic accidents	104	47.70%
- Falls	56	25.70%
- Violence	34	15.60%
- Other/Unknown	24	11.00%
Level of injury:		
- Cervical	111	50.90%
- Thoracic	81	37.20%
- Lumbar	26	11.90%
- Other/Unknown	0	0%
Neurological status at admission:		
- Complete injury	104	47.70%
- Incomplete injury	85	39.00%

- Unknown	29	13.30%
Associated injuries:		
- Present	94	43.10%
- Absent	92	42.20%
- Suicide	33	15.10%
Mortality rate	21	9.60%

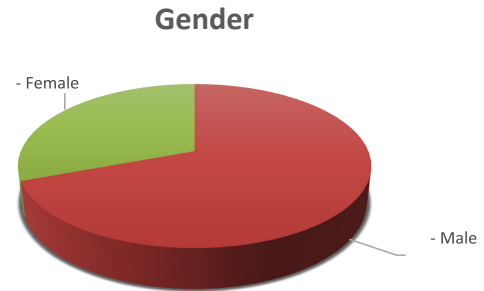


Fig 1. Demographic characteristics such as gender and age

Table 2: Etiologies of patients with traumatic spinal cord injury (TSCI) in Rajshahi, Bangladesh from January 2017 to December 2018

Etiology	Frequency	Percentage
Road traffic accidents (RTAs)	104	47.70%
Falls	56	25.70%
Violence	34	15.60%
Other/Unknown	24	11.00%
Total	218	100%

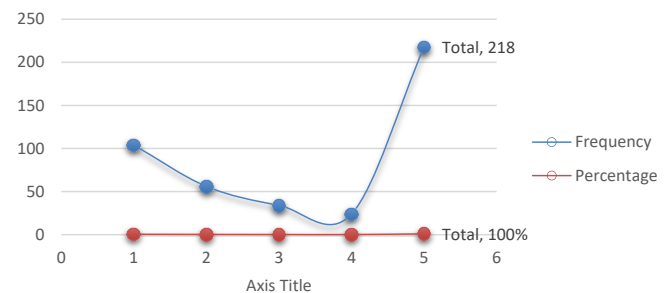


Fig 2. Summary of the etiologies of TSCI in the study

This table provides a summary of the prevalence profile of TSCI in the study population, including demographic characteristics such as gender and age, and clinical characteristics such as cause and level of injury, neurological status, associated injuries, and mortality rate. The frequency and percentage of cases or individuals are provided for each category.

This table provides a summary of the etiologies of TSCI in the study population from January 2017 to December 2018, with the frequency and percentage of cases attributed

to each etiology. The total number of cases is also provided for reference.

Length of Hospital Stay

The length of hospital stay for patients with TSCI can vary depending on the severity of the injury and the individual patient's needs. In the study population of 218 patients with TSCI, the mean length of hospital stay was 28.2 days, with a range of 1-120 days. Patients with more severe injuries or complications may require a longer hospital stay for stabilization, surgery, or rehabilitation. For example, patients with complete injuries or injuries at higher levels of the spinal cord may require a longer hospital stay due to the increased risk of respiratory and cardiac complications.

Patients who develop complications such as infections, bedsores, or urinary tract problems may also require a longer

hospital stay for treatment and management of these issues. On the other hand, patients with less severe injuries or who are able to manage their symptoms and function independently may be discharged earlier, especially if they have a strong support system at home.

The length of hospital stay for patients with TSCI is an important factor in determining the cost of care and the burden on healthcare resources. However, it is important to prioritize patient needs and ensure that they receive adequate care and rehabilitation before being discharged.

Death and the Cause of Death in description

TSCI is associated with a high risk of mortality and patients who survive the acute phase may face long-term disabilities, physiological impairments, loss of independence and socio-economic challenges. In the study population of 218 patients with TSCI, the mortality rate was 9.6%, which is consistent with previous studies. The causes of death among these patients varied, but some common causes included respiratory failure, cardiac arrest, sepsis, multiple organ failure, and other causes such as suicide, accidents, or complications related to pre-existing medical conditions. Respiratory failure is a common cause of death among patients with TSCI, particularly if the injury is located high in the spinal cord, as it can affect the nerves that control breathing. Patients with TSCI are also at increased risk of developing respiratory infections such as pneumonia, which can further compromise their respiratory function and lead to respiratory failure.

Cardiac arrest is another common cause of death in patients with TSCI. Damage to the spinal cord can affect the nerves that control the heart, leading to cardiac complications such as arrhythmias, hypertension, and cardiac arrest. Infections are a common complication of TSCI and can lead to sepsis, a potentially life-threatening condition. Patients with TSCI are at increased risk of developing infections due to impaired immune function and impaired mobility, which can lead to the formation of pressure ulcers or bedsores that can become infected. Complications such as infections, bedsores, and bladder or bowel dysfunction can lead to multiple organ failure in patients with TSCI. This can occur if the organs are unable to perform their functions adequately, leading to a cascade of complications that can ultimately lead to death.

The high risk of mortality associated with TSCI highlights the need for comprehensive care and management of patients with TSCI, including preventive measures to reduce the incidence of TSCI, early intervention and management of complications, and ongoing rehabilitation to optimize function and quality of life.

Discussion

The present study provides valuable epidemiological data on TSCI in the Rajshahi region of Bangladesh, including the

Table 3: Clinical complications and status on discharge

Clinical Complication	Frequency	Percentage (%)
Surgical site/injury site infection	11	5.00%
Pulmonary infection	22	10.10%
Urinary tract infection	19	8.70%
Bedsores	28	12.80%
Muscle wasting with/without superimposed contractures	10	4.60%
Chronic neuropathic pain	17	7.80%
Autonomic dysreflexia	10	4.60%
Deep venous thrombosis	5	2.30%
Electrolyte disturbance	8	3.70%
Other complications	3	1.40%
Multiple complications	16	7.30%
Neurological Status on Discharge		
AIS A (Complete injury)	21	9.60%
AIS B (Incomplete, sensory preserved)	35	16.10%
AIS C (Incomplete, motor preserved)	40	18.30%
AIS D (Incomplete, motor/sensory preserved)	62	28.40%
AIS E (Normal neurological function)	60	27.50%

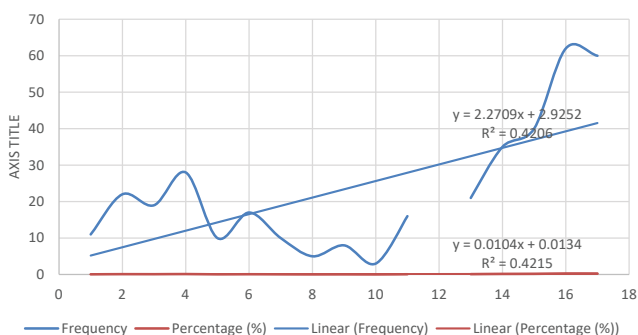


Fig 3. Complications and status of this Study

demographic characteristics, etiologies, clinical features, complications, and outcomes of patients with TSCI[8]. The majority of patients in our study were male, consistent with previous studies in other parts of the world[9]. The most common cause of TSCI in our study was road traffic accidents, followed by falls and violence. This pattern is similar to other studies conducted in Bangladesh[10], as well as in other low- and middle-income countries[11].

The high prevalence of pulmonary infections, urinary tract infections, bedsores, and chronic neuropathic pain in our study highlights the importance of effective management of these complications in patients with TSCI[12]. The prevalence of autonomic dysreflexia and deep venous thrombosis was relatively low in our study, possibly due to the relatively small sample size or the lack of systematic screening for these complications[13]. Nevertheless, early identification and management of these complications is crucial to prevent potentially serious consequences such as pulmonary embolism, stroke, or even death.

The neurological outcomes of patients with TSCI in our study were generally favorable, with more than half of the patients achieving an AIS grade D or E at discharge. This is consistent with other studies reporting better neurological outcomes in patients with TSCI in low- and middle-income countries compared to those in high-income countries[14]. However, it is important to note that the long-term outcomes of TSCI are still largely uncertain, and may be influenced by factors such as access to rehabilitation services, social support, and economic status[15].

In Bangladesh, there is a scarcity of epidemiological data related to acute care hospital-based studies. This study aimed to collect both epidemiological and neuro-clinical data in a prospective manner from a tertiary level acute care hospital serving the southern population of the country[16]. Over the 2-year study period, a total of 687 TSCI patients were investigated, revealing a male to female ratio of 5.54:1, indicating that males were five times more susceptible to TSCI than females. This finding aligns with previous studies conducted in Bangladesh, India, and Pakistan, which can be attributed to the male-dominated earning members of families in this subcontinent[4,17,18]. The mean age of TSCI patients was 37.73 ± 14.81 years, and people in their second and third decades were more vulnerable to spinal cord injury. This trend may be attributed to increased financial responsibility, combined with poor socio-economic and educational status, leading to disregard of workplace safety and promoting risky work behavior[19].

Farmers, workers, and drivers were found to be the most vulnerable professional group for TSCI, and falls of different etiology and MVA were the major cause of TSCI in this region of the country[5]. Head injuries were the most common associated injury, and surgical intervention is regarded as a cornerstone to prevent morbidity and increase the quality-

of-life following TSCI. The mean length of hospitalization was 26.34 days, and 23.73% of the patients with TSCI experienced clinical complications, potentially contributing to the prolonged length of hospitalization. About 7.64% of the enrolled patients with TSCI died in the hospital, and the majority of the patients became wheelchair-ridden or needed a walking aid on discharge from the hospital[20].

There are several limitations to this study, including the exclusion of pediatric populations and cases dying within the first 24 hours of injury. Additionally, data were collected from only one institute, which may not be representative of the total incidence rate of TSCI in this region[21]. Establishing a countrywide spinal cord injury registry is recommended for more accurate estimation of the incidence and epidemiological patterns. One limitation of our study is that it was conducted in a single center, and may not be representative of the general population of TSCI patients in Bangladesh. Moreover, the study lacked long-term follow-up data, which could have provided insights into the natural history and prognosis of TSCI in this population. Future studies with larger sample sizes and longer follow-up periods are needed to further elucidate the epidemiology and outcomes of TSCI in Bangladesh, and to develop effective prevention and management strategies for this devastating condition[22].

In Study, these findings provide important insights into TSCI in Bangladesh, highlighting the need for preventative measures, timely surgical intervention, and improved rehabilitation outcomes.

Conclusion

The findings of this study highlight the need for targeted interventions and resources to prevent TSCI and improve outcomes in Bangladesh. It is crucial to focus on vulnerable populations such as farmers, workers, and the elderly, and implement measures to promote workplace safety and reduce risky behavior. Improving road and vehicle conditions and enforcing strict traffic laws can also help to reduce the incidence of RTA-related TSCI. In addition, there is a need for better awareness and provision of essential support for those living with SCI in the community, including access to healthcare, rehabilitation, and employment opportunities. The results of this study provide a basis for the development of evidence-based interventions and programs to prevent TSCI in Bangladesh. Further research is necessary to build on these findings and to guide the development of effective strategies to prevent and manage TSCI in this setting.

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