Original Article

Surgical Management of Traumatic Spinal Cord Injuries — An Outcome Analysis

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Md Abdul Hye Manik[1*], Rukun Uddin Chowdhury[2], Ahmed Ul Morsalin Chowdhury[2], Md Al Amin Salek[2], Md Amir Ali[2]

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Sheikh Sayera Khatun Medical College (SSKMC), Gopalganj, Bangladesh

*Corresponding Author

ABSTRACT

Introduction: *Surgical management of traumatic spinal cord injuries (TSCI) is crucial for stabilizing the spine, decompressing neural elements, and promoting recovery. These injuries, caused by accidents, falls, sports, and violence, often lead to significant morbidity and disability. This study aimed to evaluate the surgical management of traumatic spinal cord injuries.* ***Methods & Materials:*** *This prospective cross-sectional study was conducted in the Combined Military Hospital, Dhaka, Bangladesh from January 2020 to December 2021. The study included a total of 57 patients who presented with traumatic spinal cord injuries (TSCI) and underwent surgical stabilization, selected using a purposive sampling technique. Data analysis was conducted using MS Office tools.* ***Results:*** *In this study, at the 24-month follow-up, 7.0% of cases were grade A, 5.3% grade B, 7.0% grade C, 22.8% grade D, and 52.6% grade E, with 5.3% mortality. Bladder emptying improved in 33% of cases, while bowel emptying improved in 20%. In the cervical group, 29.8% had static outcomes, 24.6% in the thoracic group, and 45.6% in the lumbar group. Relative recovery was seen in 24.6% of cervical, 28.6% of thoracic, and 23.1% of lumbar cases. Complete recovery occurred in 45.6% of cervical, 28.6% of thoracic, and 42.3% of lumbar cases. One individual in each group died.* ***Conclusion:*** *Since the baseline status of participants is a key predictor of prognosis, preventing motor vehicle accidents is crucial for reducing the disease burden. Additionally, focusing on patients with cervical SCI during hospitalization and follow-up can lower mortality rates from respiratory issues like pneumonia.*

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1. *Associate Professor, Department of Neurosurgery, Momenshahi Combined Military Hospital, Mymensingh, Bangladesh*
2. *Professor, Department of Neurosurgery, Combined Military Hospital, Dhaka, Bangladesh*

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INTRODUCTION

Spinal cord injury (SCI) is prevalent, occurring thousands of times daily on a global scale. The worldwide incidence rate of traumatic spinal cord injury (TSCI) is approximately 10.5 cases per 100,000 individuals[1]. The severe complications associated with TSCI can pose long-term challenges for both patients and their families[2,3]. However, advancements in medical care have significantly increased the life expectancy of individuals with TSCI in recent decades[4]. The foremost principle in treating patients with traumatic spinal cord injury (TSCI) is to initiate treatment promptly to maximize recovery in the shortest possible time[5]. Despite substantial advancements in spine surgery over recent decades, it remains one of the most challenging surgical fields. TSCI primarily results from mechanical damage incurred during the accident, known as primary injury. Secondary damage mechanisms contribute to further injury over time, exacerbating the initial harm. The primary objectives of surgery for traumatic spinal cord injury (TSCI) are to decompress the spinal canal, realign the spine, and enable early patient mobilization [6]. Rath et al. (2017), in their study "Spinal cord injury – the role of surgical treatment for nerve healing," found that performing surgery within 24 hours post-injury is both safer and more effective in preventing secondary SCI compared to delayed intervention[7]. While most research has concentrated on the acute phase of SCI and its immediate treatment, it is also essential to focus on the long-term condition and recovery of patients in the months following the injury and surgical intervention. For patients with TSCI, the SCI literature often cites mortality rates two to three times higher than in the general population[8]. Unfortunately, despite advancements in medical technology and rehabilitation, many studies have shown limited or no improvement in long-term mortality[9,10]. In a 2017 study, Savic et al. identified respiratory diseases (including infections), cardiovascular diseases, and neoplasms as the leading causes of death among those who survived at least one year after injury[11]. Patient mortality rates post-surgery present a notable factor that may introduce bias in studies with extended follow-up periods. A systematic review from 2018 revealed that approximately 12.8% of patients with thoracolumbar injuries succumb after roughly 4.5 years. This figure escalates to over 20% after a decade of follow-up[12]. Consequently, prolonged observation of patients could yield outcomes that are not reflective of reality. The objective of this study was to evaluate the surgical management of traumatic spinal cord injuries.

METHODS & MATERIALS

This was a prospective cross-sectional study that was conducted in the Combined Military Hospital, Dhaka, Bangladesh from January 2020 to Dec 2021. The study enrolled a total of 57 patients presenting with traumatic spine injuries who underwent surgical stabilization, selected through purposive sampling. Written consent was appropriately obtained from all participants before data collection. Following the study's inclusion criteria, all patients with traumatic spinal cord injury

(TSCI) resulting from spinal fractures referred to the specified hospital were included. Conversely, individuals who were unwilling to cooperate had incomplete information or had underlying bone-affecting diseases such as osteomyelitis, thyroid disease, and parathyroid disease were excluded based on the study's exclusion criteria. Each patient underwent a comprehensive examination, and their American Spinal Injury Association (ASIA) score was recorded [13]. At the end of the 24th month, the follow-up data were collected for outcome analysis. Data analysis was conducted using MS Office tools.

RESULT

The socio-demographic data of participants revealed a mean age of 35.24±14.69 years. Gender distribution showed 26.3% female and 73.7% male participants. The primary mechanism of injury was motor vehicle accidents (63.2%), followed by falls (24.6%) and other causes (12.2%). ASIA grade classification included 15.8% grade A, 1.8% grade B, 40.4% grade C, 28.1% grade D, and 14.0% grade E. Types of injury comprised 63.2% burst injuries, 24.6% injury/dislocation, and 12.3% compressed injuries. The location of injury varied, with 33.3% in the thoracic spine, 28.1% in the lumbar spine, and 24.6% in the sub-axial cervical spine. Sphincter dysfunction included 26.3% with urinary sphincter dysfunction and 22.8% with anal sphincter dysfunction. At the 24-month follow-up, participants were categorized into different ASIA grades. Among the cases, 7.0% were classified as grade A, 5.3% as grade B, 7.0% as grade C, 22.8% as grade D, and 52.6% as grade E. Additionally, mortality was observed in 5.3% of cases. After the 24-month follow-up (n=33), urinary and anal sphincter function was assessed. Bladder emptying showed improvement in 33% of cases while 66.7% did not show improvement. Similarly, bowel emptying improved in 20.0% of cases, with 80.0% showing no improvement. Outcomes were evaluated among individuals with cervical, thoracic, and lumbar cord injuries. In the cervical group, 29.8% experienced static outcomes, 24.6% in the thoracic group, and 45.6% in the lumbar group. Relative recovery was observed in 24.6% of cervical cases, 28.6% of thoracic cases, and 23.1% of lumbar cases. Complete recovery occurred in 45.6% of cervical cases, 28.6% of thoracic cases, and 42.3% of lumbar cases. Additionally, 1 individual in each group died.

Table I: Socio-demographic data

Parameter	*n*	%
Age (Mean ±SD)	35.24±14.69	
Gender distribution		
Female	15	26.3%
Male	42	73.7%
Occupational status		
Serving soldiers	30	52.6%
Relative entitled	12	21.1%
Retired individuals	9	15.8%
Others	6	10.5%
Mechanism of injury		
Motor vehicle accident	36	63.2%
Fall	14	24.6%
Other	7	12.2%
ASIA grade		
A	9	15.8%
B	1	1.8%
C	23	40.4%
D	16	28.1%
E	8	14.0%

Type of injury		
Burst injury	36	63.2%
Injury /dislocation	14	24.6%
Compressed injury	7	12.3%
Location of injury		
Thoracic spine	19	33.3%
Lumbar	16	28.1%
Sub-axial cervical spine	14	24.6%
Thoracolumbar	7	12.3%
Axial cervical spine	1	1.8%
Sphincter dysfunction		
Urinary sphincter dysfunction	15	26.3%
Anal sphincter dysfunction	13	22.8%

Table II: ASIA grades at 24-month follow-up

Status	**ASIA grades**					
	A	**C**	**D**	**E**	***n***	**%**
A	4	0	0	0	4	7.0%
B	3	0	0	0	3	5.3%
C	0	4	0	0	4	7.0%
D	0	11	2	0	13	22.8%
E	0	7	15	8	30	52.6%
Mortality	2	1	0	0	3	5.3%

Table III: Urinary/anal sphincter function after 24-month follow-up (*n*=33)

Function	**Not improved**		**Improved**	
	n	**%**	***n***	**%**
Bladder emptying	12	66.7%	6	33%
Bowel emptying	12	80.0%	3	20.0%

Table IV: Outcomes in cervical, thoracic, and lumbar cord injuries

Location	**Static**	**Relative recovery**	**Complete**	**Died**	**Total**	
	n	***n***	***n***	***n***	***n***	**%**
Cervical	5	4	7	1	17	29.8%
Thoracic	5	4	4	1	14	24.6%
Lumbar	8	6	11	1	26	45.6%
Total	18	14	22	3	57	100%

DISCUSSION

The mean age of our participants was 35.24±14.69 years; 73.7% were male. The primary mechanism of injury was motor vehicle accidents (63.2%), followed by falls (24.6%) and other causes (12.2%). ASIA grade classification included 15.8% grade A, 1.8% grade B, 40.4% grade C, 28.1% grade D, and 14.0% grade E. All these findings were comparable with a previous study[13]. Several studies have focused on the initial ASIA grade and its impact on outcomes. Coleman and Geisler suggested that the severity of SCI is the primary predictor of patient outcomes[14]. They also reported that patients with ASIA grades C and D experienced significantly better recovery compared to those with ASIA grade B, and patients with grade B had better outcomes than those with grade

A[15]. Most of our patients were younger adults. Similarly, the mean age of the participants of another recent study series was 35.92 ± 9.68 years[16]. Motor vehicle accident was the most frequent mechanism of injury (63%) in our study. Traffic accidents are the primary cause of injuries in developing countries, while falls are the leading cause of injuries in developed countries[17,18]. In our study, at the 24-month follow-up, participants were categorized into ASIA grades: 7.0% as grade A, 5.3% as grade B, 7.0% as grade C, 22.8% as grade D, and 52.6% as grade E, with a 5.3% mortality rate. Urinary function improved in 33%, and bowel function improved in 20% of cases, while the rest showed no improvement. Nearly similar findings were observed in a previous study[13]. In this study, static outcomes were seen in 29.8% of cervical, 24.6% of thoracic, and 45.6% of lumbar cases. Relative recovery occurred in 24.6% of cervical, 28.6% of thoracic, and 23.1% of lumbar cases. Complete recovery was noted in 45.6% of cervical, 28.6% of thoracic, and 42.3% of lumbar cases. Additionally, one individual in each group died. All these findings were comparable with the findings of some other studies[13,19]. All the findings of this current study may be beneficial for future similar research.

Limitation of the study:

This was a single-centered study with a small sample size, conducted over a very short period. Therefore, the findings may not accurately represent the situation across the entire country.

Conclusion:

Given that the baseline status of participants is the most crucial predictor of patient prognosis, motor vehicle accident prevention emerges as a key strategy in reducing the burden of disease on individuals and society. Preventive measures, such as enforcing traffic laws, promoting road safety education, and improving vehicle safety standards, can significantly decrease the incidence of spinal cord injuries (SCI) and other severe injuries resulting from accidents. Additionally, heightened attention to patients with cervical SCI during hospitalization and follow-up care is essential. By focusing on comprehensive respiratory management, including proactive measures to prevent pneumonia and other respiratory complications, healthcare providers can substantially reduce the mortality rate associated with these conditions. This dual approach—emphasizing both accident prevention and meticulous patient care—can lead to better outcomes for individuals and alleviate the overall impact on public health systems.

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