



Original Article

## Incidence of Acute Complications Associated with Spinal Cord Injury (SCI): A Study of the Ayub Teaching Hospital, Abbottabad

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### ABSTRACT

**Objective:** The study sought to document the occurrence of acute problems as well as post-surgical improvements in individuals suffering from spinal cord injury (SCI).

**Materials and Methods:** This study was conducted retrospectively in the Department of Neurosurgery. All patients of any age and both genders were included who were admitted with spinal injuries. The patients with cervical fractures received the anterior cervical plating plus graft placement in the cervical spine, whereas the patient with thoracolumbar fractures received the transpedicular fixation in thoracolumbar spine fractures. ASIA Impairment Scale for neurological status, GCS at admission, and acute complications developed within two weeks were noted.

**Results:** 200 patients were included (mean age of 34.6 years). The common cause of SCI was a fall from an elevated position of 62.5%. On admission, 50% of patients' neurological state was Asia grade A. The most common location involved in patients (70%) was a thoracolumbar junction. 20% of patients presented with neurogenic shock. Postoperatively, the GCS scores in all patients were been improved. The commonest acute complications associated with SCI were pulmonary in 60% of patients. 17% of patients developed an infection, 5% suffered from gastrointestinal issues, and 3% suffered from renal issues. Deep vein thrombosis (DVT) was observed in 9%. After surgery, improvements in pulmonary issues were observed in 33%, DVT in 7% and infections settled in 14%.

**Conclusion:** During the early phase of hospitalization, respiratory difficulties were among the most prevalent complications encountered in those suffering from traumatic SCI. These outcomes exacerbate the eventual suffering caused by the spinal cord injury; hence, recognizing the likelihood of occurrence, early detection, exact surgical treatment, and prevention are essential.

**Keywords:** Spinal Cord Injury (SCI), Deep Venous Thrombosis, Pulmonary Complications, Anterior Cervical Plating, Graft Placement in The Cervical Spine, Thoracolumbar Spine Fractures, Transpedicular Fixation.

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## INTRODUCTION

The study's goal was to document the occurrence of acute difficulties as well as post-surgical improvements in people with spinal cord injury (SCI). Patients suffering from traumatic spinal cord injury (SCI) are more vulnerable to physiological disturbances and medical problems, which can lengthen their stay and hinder their rehabilitation.<sup>1,2</sup> Healthcare professionals should be aware of the timing, kind, and severity of each problem and take steps to recognize and avoid it as early as possible. For example, one should be aware of the increased risk of acquiring pneumonia within two weeks post spinal cord damage. As a result, the health professional might modify his or her therapeutic strategy to improve the patient's immunological function, which has been proven to be compromised following acute SCI.<sup>3</sup>

Despite recent breakthroughs in complication treatment, spinal cord injury remains a significant source of mortality and morbidity. The annual number of individuals with spinal cord damage ranges from 900 to 1200 per million people. About 45 – 60% of these patients have cervical spinal cord damage, which is associated with high rates of death and morbidity, as well as requiring a longer hospital stay, more therapy, and an increased cost.<sup>4-9</sup>

Spinal injuries are frequently followed by complications that exacerbate the patient's already-existing motor, sensory, and autonomic dysfunction. Neurological repercussions and secondary complications are the two types of issues that might occur after a spinal cord injury. Neurological effects emerge from the disruption and decentralization of the nervous system and may be considered a result of the damage itself. Secondary problems are typically caused by a loss of pulmonary function, a loss of bladder control, or a patient's morbidity.<sup>9-11</sup>

## MATERIALS & METHODS

### Study Design & Setting

This study was conducted retrospectively in the Department of Neurosurgery, Ayub Teaching Hospital Abbottabad, from January 2018 to July 2020. The patients with spinal cord injury (SCI) were included.

### Inclusion Criteria

All patients of any age and both genders were included who were admitted with spinal injuries.

### Exclusion Criteria

Patients who presented late and those who had co-morbid conditions were excluded from the study. Those patients with severe head injuries associated with spinal injuries were also not included. Patients with previously compromised neurological status who presented with spinal injuries were excluded.

### Surgical Management

The patients with cervical fractures received the anterior cervical plating plus graft placement in the cervical spine, whereas the patient with thoracolumbar fractures received the transpedicular fixation in thoracolumbar spine fractures.

### Data Collection & Analysis

The patients with spinal cord injury (SCI) were included and their data was entered in the pre-designed proforma with the causes & location of the injury and ASIA (American Spinal Cord Injury Association) Impairment Scale (AIS) at the admission, and acute complications developed within two weeks of admission. Associated injuries were also recorded. The data was entered and calculated in SPSS version 26.

## RESULTS

### Age & Gender Distribution

200 patients were included with the age ranging from 11 – 66 years with a mean age of  $34.6 \pm 17.1$  years. There were 160 male and 40 female patients.

### Causes & Mechanisms of SCI

In 62.5% (n = 125) of cases, the most prevalent cause of spinal cord injury was a fall from an elevated position, followed by motor vehicle accidents in 32% (n = 64), and assault in 5.5% (n = 11). Non-penetrations were the most prevalent mechanism of damage in 99% (n = 198), with penetrating just 1% (n = 2) (see Table 1).

### Neurological Statuses

On admission, 50% (n = 100) of patients' neurological state was Asia grade A, followed by 20% (n = 40) in Asia grade B, and 6% (n = 12), 4% (n = 8), and 20% (n = 40) in ASIA grades C, D, and E, respectively (see Table 1).

### Spine Location Involved

The most common location involved in patients was a thoracolumbar junction that is 70% (n = 140) followed by cervical at 19% (n = 38) and lumbosacral at 6% (n = 12) with the sacral spine at 1.5% (n = 3) and young patients with SCIWORA (spinal cord injury without radiographic abnormality) in 3.5% (n = 7) (see Table 1).

### The Glasgow Coma Scale (GCS)

#### Scores

20% (n = 40) of patients presented with neurogenic shock with associated bradycardia in

9% (n = 18) of patients. The GCS at the time of admission was 15 in 83% (n = 166) of patients, with 9 – 14 in 12% (n = 24) of patients and less

**Table 1:** Clinical Information of Patients with Spinal Cord Injury-SCI (n = 200).

Variables	Sub-variables	No. of Patients	Percentage
Causes of SCI	Fall from height	125	62.5%
	Road accidents	64	32%
	Assault	11	5.5%
Mechanism of SCI	Non penetration	198	99%
	Penetration	2	1%
ASIA Impairment Scale (Neurological Status)	Grade A	100	50%
	Grade B	40	20%
	Grade C	12	6%
	Grade D	8	4%
	Grade E	40	20%
Spinal Location Involved	Thoracolumbar junction	140	70%
	Cervical	38	19%
	Lumbosacral	12	6%
	Sacral Spine	3	1.5%
	SCIWORA	7	3.5%
Clinical Status	Neurological shock	40	20%
	Bradycardia	18	9%
	15	166	83%
GCS at admission	9 – 14	24	12%
	< 8	10	5%

**Table 2:** Complications Reported in SCI.

Acute Complications (During 2 Weeks of Admission)	No. of Patients	Percentage
Pulmonary	120	60%
Infection	34	17%
Gastrointestinal issues	6	3%
Cognitive deterioration	8	4%
Anemia	2	1%
Deep vein thrombosis	18	9%
Cardiac complications	2	1%
Complications (Post-surgical)	No. of Patients	Percentage
Deep vein thrombosis improvement	14	7%
Anemia reduced	1	0.5%
Renal improvement	4	2%
Infection settled	28	14%
Gastrointestinal resolved	7	3.5%
Pulmonary issues resolved	66	33%

than 8 in 5% (n=10) of patients (see Table 1). The surgery was done in most cases. Postoperatively, the GCS scores in all patients were been improved.

### Complications during Admission and Post-surgery

The commonest acute complications associated with spinal cord injury were pulmonary in 60% (n = 120) of patients with respiratory failure in 20% (n = 40), pleural effusion in 7% (n = 14), and acute lung injury in 33% (n = 66). Associated acute lung injury was common, especially in cervical and thoracic spinal injuries. 17% (n = 34) of patients developed an infection, 5% (n = 10) suffered from gastrointestinal issues, and 3% (n = 6) suffered from renal issues. Severe paralytic ileus in 5% (n = 10) and acute renal failure in 3% (n = 6). Cognitive deterioration and anemia were seen in 4% (n = 8) and 1% (n = 2), respectively. Deep vein thrombosis (DVT) was observed in 9% (n = 18) of patients and cardiac complications were seen in 1% (n = 2) of patients. After surgery, improvements in the above-mentioned complications were observed (see Table 2).



**Figure 1:** Different types of cervical and thoracolumbar fractures (scan used with the permission of the patient).

### DISCUSSION

Traumatic spinal cord injury produces long-term disability in numerous organ systems, which, along with persistent functional changes, leads to a rise in morbidity and a worse quality of life.<sup>12</sup> Pathophysiologically, alterations in spinal cord injury can be classified as either early acute (2 – 48 hours after damage), subacute (2 days to 2 weeks), or intermediate (2 weeks to 6 months).<sup>13</sup> The clinically acute phase, on the other hand, is commonly characterized as 4 to 6 weeks after spinal cord damage. The current study reported acute complications in patients presented with SCI. We reported an improvement in post-surgical GCS improvement as well as reduced complications after treatments. A total of 200 individuals with an average age of 34.6 years were included in the study. A fall from an elevated position was the most prevalent cause of spinal cord damage in 62.5% of cases. On admission, 50% of patients had Asia grade A neurological status, 20% had Asia grade B, and 6%, 4%, and 20% had ASIA grades C, D, and E, respectively. A thoracolumbar junction was the most often affected region in patients (70%). Neurogenic shock has been seen in 20% of individuals. The GCS scores of all patients improved postoperatively. In 60% of patients, the most prevalent acute problems linked with SCI were pulmonary. 17% of patients acquired an infection, 5% had gastrointestinal problems, and 3% had renal problems. Deep vein thrombosis (DVT) occurred in 9% of the patients. After surgery, 33% of patients had improved pulmonary problems, 7% had improved DVT, and 14% had infections resolved. The findings of Couris et al,<sup>14</sup> also revealed the same causes (falls and road accidents) of SCI (74%). Furlen et al,<sup>15</sup> showed in their study that 69% of their patients with SCI were in ASIA Grade A, while our results showed that 50% of patients were in Grade A, and the study done by Grasman et al, showed it to be 40%.<sup>16</sup> Tator et al,<sup>17</sup> also mentioned that the commonest level involved in SCI is a

thoracolumbar junction. Respiratory complications increase the secondary damage from the spinal cord injury, knowledge of the probability of occurrence, early detection, treatment, and prevention is necessary.

Wahman et al,<sup>18</sup> investigated the occurrence of subsequent problems following traumatic spinal cord damage in acute care. The three most prevalent consequences among the 45 people receiving acute treatment were urinary tract infections (47%), pneumonia (22%), and neuropathic pain (18%). The most prevalent problems among the 31 people who received rehabilitation were urinary tract infections (42%), neuropathic pain (42%), and stiffness (35%). A substantial relationship was discovered between the severity of the damage and the development of neuropathic pain throughout recovery. Although Sweden has a specific system for managing spinal cord injuries, subsequent problems are nonetheless prevalent. The prevalence of SCI was stated in a recent Chinese study. The major causes of SCI were shown to be motor vehicle accidents and high falls. The most prevalent traumatic SCIs were incomplete quadriplegia and AIS/A Frankel grade D. The most common type of injury was cervical-level damage. The most prevalent consequence and major cause of mortality was respiratory issues.<sup>19</sup>

Spinal cord injury (SCI) is a frequent disorder, with one million new cases reported each year and 27 million individuals living with SCI-related symptoms. SCIs impose a cost on healthcare systems and economies in the form of lost productivity and expensive healthcare expenses. SCI patients require the collaboration of several care professionals (emergency teams, anesthesiologists and intensivists, surgeons, and rehabilitation specialists). Each level of SCI patient care is crucial to improving neurological recovery. Recent advances in the understanding of this pathophysiology, as well as in the avoidance of problems and treatments, have altered the way SCI patients are handled. As a result, the French

Society of Anesthesia and Intensive Care revised the 2004 guidelines for SCI patients.<sup>20</sup> Leg spasms, constipation, back pain, pain below the level of SCI, and shoulder discomfort were the most common Secondary Health Conditions (SHC). Early prevention of these conditions should be prioritized to lessen the impairment burden of persons with SCI.<sup>21</sup> Cognitive impairment is the most common and catastrophic condition encountered in the spinal cord injury population. The likelihood of cognitive deterioration following spinal cord injury has been estimated to be 13 times greater than in healthy people.<sup>22</sup>

Spinal implants have advanced significantly during the last several decades. Non-implant decompression has given way to anterior cervical instrumented stability in combination with discectomy or decompression. Various anterior cervical plates, cages, expandable cages, zero profile anterior cervical cages with screws, and cervical artificial discs for cervical disc replacement have evolved significantly over time in terms of implant design and material, as well as to ease the surgery and change the outcome. Due to screw-back-out issues, non-locking anterior cervical plates were gradually replaced by locking anterior cervical plates. Later cervical zero profile cages with screw mechanisms have the advantage of causing less discomfort to neighboring soft tissue.<sup>23</sup> An experimental study investigated the effect of various configurations of the transpedicular fixation system on selected mechanical characteristics of the thoracolumbar spine under situations of instability. Long-segment fixator designs produce better outcomes than short-segment fixation.<sup>24</sup> The ultimate objective is spine stability, cord decompression, deficit recovery (if any), and fracture union. Preoperatively, the expectations and features of the patients should be carefully evaluated. Surgeons must also examine their own prior experiences and comfort with each procedure. Acceptance and understanding of new technologies to help in the treatment of SCI



problems is an urgent necessity.<sup>25</sup>

## CONCLUSION

Respiratory issues were among the most common, severe, and life-threatening consequences seen by persons suffering from traumatic SCI during the early period of hospitalization. These consequences enhance the subsequent harm from the spinal cord injury; therefore, understanding the likelihood of occurrence, early identification, surgical treatment, and avoidance is required. These data might be utilized to help create methods to reduce subsequent problems.

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## Additional Information

**Disclosures:** Authors report no conflict of interest.

**Ethical Review Board Approval:** The research was a retrospective study.

**Human Subjects:** Consent was obtained by all patients/participants in this study.

**Conflicts of Interest:**

In compliance with the ICMJE uniform disclosure form, all authors declare the following:

**Financial Relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

**Other Relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

## AUTHOR CONTRIBUTIONS

Sr. No.	Author's Full Name	Intellectual Contribution to Paper in Terms of
1.	Ehtisham Ahmed Khan Afridi	Study Design, Methodology, and Paper Writing.
2.	Shagufta Naeem	Data Calculation and Data Analysis.
3.	Adil Ihsan	Interpretation of Results.
4.	Sidra Maqbool	Statistical Analysis.
5.	Aqsa Shehzadi	Literature Review.
6.	Ehtisham Ahmed Khan Afridi	Literature Review and Quality Insurer.