ORIGINAL ARTICLE

# FREQUENCY OF SPASTICITY AND ITS ASSOCIATION WITH GENDER, MECHANISM, LEVEL AND TYPE OF INJURY IN CHRONIC TRAUMATIC SCI PATIENTS

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ABSTRACT

**Background**: Spinal cord injury is known as a "disconnection syndrome" which leads to loss of ability of the spinal cord to correspond ascending and descending impulses and thus results in loss of motor, sensory and autonomic functions below the level of spinal cord injury. Spasticity is considered as a major secondary complication after SCI leading to various physical, psychological, social and medical complications causing increased functional dependence and low quality of life. The objective of this study was to determine the frequency of spasticity and its association with gender, mechanism, level and type of injury in chronic traumatic SCI patients.

**Methods**: A cross-sectional study was conducted on patients with spinal cord injury admitted to the Paraplegic Centre Peshawar. A total of 60 participants who met the inclusion criteria were selected using convenient sampling. Demographic information was collected, followed by assessment of the type and level of spinal cord injury using the American Spinal Injury Association (ASIA) scale. Spasticity was evaluated and graded using the Modified Ashworth Scale (MAS).

**Results**: This study showed that 51 % of the patients had spasticity after SCI. The mean age of the study participants was 30.5±11.4 years (12Minimum - Maximum 68) with 50 males: 10 females. Spasticity showed strong association with cervical cord lesions and with incomplete injuries. No association was present between mechanism of injury and gender of participants.

**Conclusion**: This study concludes that Spasticity is a common and debilitating secondary complication in patients with spinal cord injury. It is strongly associated with the level and severity of the lesion, with cervical cord injuries and incomplete lesions showing a significantly higher likelihood of spasticity.

**Key Words**: ASIA Scale, Modified Ashworth Scale, Spasticity, Spinal Cord Injuries

**Authors' Declaration**: The authors declared no conflict of interest and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors contributed substantially to the planning of research, question designing, data collection, data analysis and write-up of the article.

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**This article may be cited as**: Faiz N, Gul S, Khan M, Syed S, Durrani ZB. Frequency of spasticity and its association with gender, mechanism, level and type of injury in chronic traumatic SCI patients. Rehman J Health Sci. 2025;7(1). 12-17

Submitted: Aug 05, 2022 Revisions Submitted: Oct 11, 2024 Accepted: Dec 24, 2024

## Introduction

Spinal cord injury is known as a "disconnection syndrome" which leads to loss of ability of the spinal cord to correspond ascending and descending impulses and thus results in loss of motor, sensory and autonomic functions below the level of spinal cord injury.[1] The incidence of SCI is approximately 30 to 80 cases per million

globally.[2] In Pakistan the incidence of SCI is almost 11000 new cases annually.[3] Males at higher risk than females 2:1.[4] Following spinal cord injury majority of the patients may develop serious respiratory complications, deep venous thrombosis, bowel and bladder complications, sexual dysfunction, pressure ulcers, spasticity, contractures, bone fractures, depression and neuropathic pain.[5]

Spasticity is an upper motor neuron disorder (UMN) in which there is velocity dependent increase in muscle tone due to increase in tonic stretch reflexes with increased tendon jerks. There is increased muscle tone, involuntary jerky movement, hyper reflexia, clonus and painful muscle spasms. In general, it is defined as abnormal increase in stretch reflex secondary to exaggeration of spinal reflex.

Symptoms of spasticity vary from person to person, some will have

(i) Increase resistance to passive movement,
(ii) Exaggerated tendon reflexes,
(iii) Uncontrolled involuntary muscle jerking,
(iv) Clonus it is the rapid involuntary repeated movement commonly in ankle or foot.[6]

Spasticity limit's Functional ability and greatly affects quality of life and community reintegration. The literature has shown that higher is the level of injury, greater will be the chances of spasticity development.[7]

Spasticity is a prevalent and disabling secondary complication of spinal cord injury, significantly affecting patients' rehabilitation outcomes, quality of life, and reintegration into the community. there is a significant lack of region-specific data, particularly in Pakistan. To date, only one survey has investigated spasticity among spinal cord injury patients in Pakistan, and it was limited to those injured during the 2005 earthquake. Given this gap, there is a pressing need to explore the frequency and characteristics of spasticity in individuals with traumatic spinal cord injury in Pakistan. This study aims to provide updated data on spasticity prevalence in relation to the level and type of injury in patients attending the Paraplegic Centre Peshawar, thereby contributing valuable insights for clinical management and policy planning.

## Methods

This cross-sectional study was conducted at the Paraplegic Centre Peshawar on patients with chronic traumatic spinal cord injury during November 2018. The study duration was from 18th November to 2nd December 2018. After ethical approval of research proposal, permission was taken from chief executive of Paraplegic Center. A total of 77 patients during the study period were screened. Using a census sampling technique, all patients meeting the inclusion criteria were included in the study. The inclusion criteria involved male and female patients aged 2 to 60 years with traumatic spinal cord injury caused by road traffic accidents, falls from height, firearm injuries, coal mine accidents, diving accidents, or being hit by a falling object, with injury duration of more than six months. Patients were excluded if they had acute spinal cord injury (less than six months), spina bifida, poliomyelitis, caries spine, transverse myelitis, spinal tumors, central canal stenosis, cauda equina syndrome, or had undergone spinal surgery. After applying inclusion and exclusion criteria 7 patients were excluded and the final sample size was 60. The purpose of study was explained to all patients and informed consent was obtained. After obtaining demographic data, American Spinal Cord Injury scale (ASIA scale) was used to find out the type and level of spinal cord injury. Modified Ashworth scale (MAS) was used to measure and grade spasticity. SPSS version 20 was used for data analysis. descriptive statistics were applied to explore trends, patterns and important characteristics within the data.

## Results

A total of 60 patients with spinal cord injuries were included in this study. The study participants showed the following baseline characteristics (Table I). Out of the total, 29 patients showed no spasticity (48.3%) while 4

patients showed grade 1 spasticity (6.6%), 11 patients showed grade 1+ spasticity (18.3%), 8 patients showed grade 2 spasticity (13.3%), 3 patients showed grade 3 spasticity (5%) and 5 patients showed grade 4 spasticity (8.3%). (Figure I). Out of 38 males (63%) 23 had spasticity with frequency of 33.3 % and out of 22 females (37.7%) 8 had spasticity with frequency of 31.3%. (Table II). Total of 7 patients had cervical cord lesion (11.66 %) all had spasticity with frequency of 22.58% while 39 patients had thoracic cord lesion (65%), out of which only 15 had spasticity with frequency of 48.38% and total of 14 patients had lumbosacral cord lesion (23.33%) out of which only 9 had spasticity with frequency of 29%. Odds ratio (9.8) showed that spasticity has great association with cervical cord lesion. Given in (Table III). Out of 60 patients 52 patients had complete cord lesion (86.6%) in which only 25 had spasticity (80%).8 out of 60 had incomplete cord lesion (13.3%) in which only 7 had spasticity (22.5%) and Odds ratio of (2.5) showed that spasticity is associated more with incomplete cord lesion than complete cord lesions (Table IV). Data showed that the most common cause of SCI injury in SCI is Fall from height injuries (42%), FAI is the second most common cause (32%), RTA is the third most common cause of SCI (14%), Hit by falling object is the fourth common cause of SCI (11%), Coal mine accident is the Least common cause of SCI (1%) and Odds ratio show that there is no association between mechanism of injury and spasticity. (Table V)

Table I: Baseline Characteristics

| Distribution of Age & Gender | | Participants Gender | | |
|---|---|---|---|---|
| | | Male | Female | Total |
| Mean Age | <20 | 8 | 2 | 10 |
| 32.5±11.4years | 20-30 | 14 | 10 | 24 |
| | 31 -40 | 10 | 5 | 15 |
| | 41 - 50 | 4 | 2 | 6 |
| | 50+ | 2 | 3 | 5 |
| | | 38 | 22 | 60 |

| SCI level | Level | no. of subjects | male | female |
|---|---|---|---|---|
| | C5-C7 | 7 | 6 | 1 |
| | T1-T6 | 10 | 9 | 1 |
| | T7-T12 | 29 | 22 | 7 |
| | L1-S5 | 14 | 10 | 4 |

Table II: Association of spasticity with gender

| Gender | Number (n=60) | Percentage | Frequency of Spasticity | Odds Ratio |
|---|---|---|---|---|
| MALE | 38 | 63.3% | 23(33.3%) | 1.1 |
| FEMALES | 22 | 37.7 | 8(31.3%) | 0.90 |

Odds ratio (1.1 and 0.9) show that spasticity has no association with gender of patients.

Table III: Association of spasticity with level of injury

| Level of injury | Frequency n=60 | Percentage | Frequency of Spasticity | Odds Ratio |
|---|---|---|---|---|
| Cervical | 7 | 11.66% | 7 (22.58 %) | 9.8 |
| Thoracic | 39 | 65% | 15 (48.38%) | 0.87 |
| Lumbosacral | 14 | 23.33% | 9 (29.0%) | 0.90 |

Table IV: Association of spasticity with severity of the injury

| Severity of injury | Frequency | Percentage | Frequency of Spasticity | Odds Ratio |
|---|---|---|---|---|
| Complete | 52 | 86.6% | 25 (80%) | 0.4 |
| Incomplete | 8 | 13.3% | 7 (22.5%) | 2.5 |

Table V: Association of spasticity with mechanism of injury

| Mechanism of Injury | Frequency n=60 | Percentage | Frequency of Spasticity | Odds Ratio |
|---|---|---|---|---|
| Fall from height | 27 | 45% | 14 (45%) | 1.2 |
| RTA | 9 | 15% | 3 (9.6%) | 0.6 |
| Hit by falling object | 7 | 11% | 4 (12.9%) | 0.90 |
| Firearm injury | 16 | 26% | 10 (32%) | 1.1 |
| Coal mine accident | 1 | 1.6% | 0 (0%) | 0 |

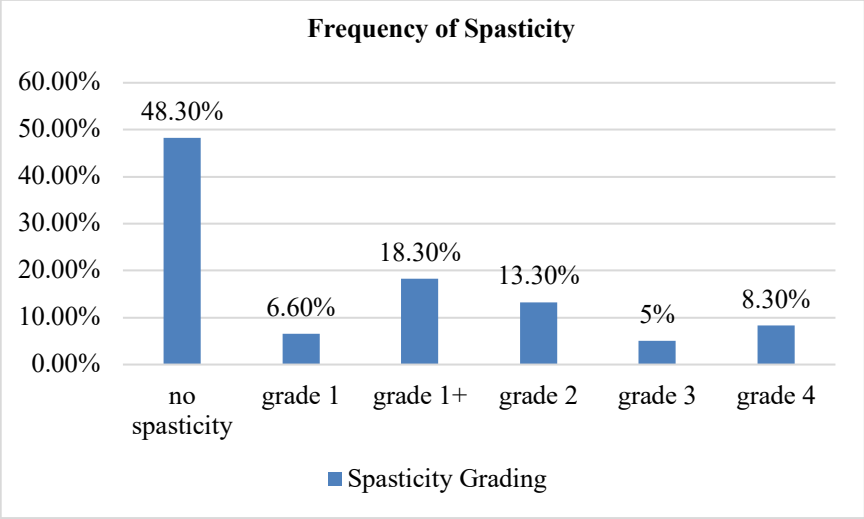


Figure I: Frequency of Spasticity in SCI Patients using Modified Ashworth Scale

## Discussion

In this study, we found that spasticity was seen in 51.6% SCI patients. It was more common in incomplete injuries, (Odds ratio 2.5), strong association was seen between cervical cord lesion and frequency of spasticity (odds ratio 9.8) There was no correlation of spasticity with mechanism of injury and gender of the patients (odds ratio less than 1). There are different views about the relationship of spasticity with gender, post injury period, level of injury, mechanism of injury, cause of injury, severity of injury and with associated complications. Research study by McKinley et al. reported that 30.2% of their Spinal cord injury patients developed spasticity during first year of injury.[8] In a study done by Skold et al. it was found that 69% patients by discharge developed spasticity and 75% showed spasticity in follow up out of which 37% received pharmacological interventions.[9] An Indian research study found out that the frequency of spasticity was 69.5% in chronic cases of SCI.[10] while findings of our study showed that spasticity is seen in 51.6% SCI patients. According to Griffin M et al. prevalence of spasticity is 20% in traumatic and non-traumatic SCI patients with no significant relevance to cause of injury[11] but results of this study showed spasticity has no correlation with traumatic, non-traumatic SCI and cause of injury (odds ratio less than 1). William et al. reported that spasticity is associated with gender and is common in males than females.[12] Another study done by Canadian association of spinal cord injury find out that spasticity has great association with gender of the patients and has weak association with level of injury, body mass index, severity of injury and smoking history[13] but findings of this study show that there is no correlation of spasticity with gender of patients (odds ratio less than 1) and has high association with level of injury (odds ratio 9.8). Another study done by Skold et al.[9] found out that problematic spasticity can be correlated with cervical incomplete injuries than complete injuries. The literature has shown that higher is the level of injury, greater will be the chances of spasticity development e.g the incidence of spasticity is 93% in individuals with complete cervical SCI, and 78% in cervical incomplete patients ,In thoracic complete SCI the prevalence is 72% and 73% in incomplete thoracic SCI.[9] According to this study spasticity is more common in incomplete injuries, (Odds ratio 2.5) and strong association was seen between cervical cord lesion and frequency of spasticity (odds ratio 9.8)

According to a research study, there was no significant relationship between severity of spasticity and presence of pressure ulcers.[14] however in contrast an Indian study found that pressure ulcers management, proper physical therapy and urinary tract infections directly control the severity of spasticity.[15]

Result of study done by Naveed et al. showed that 38% patients developed spasticity in acute phase of injury and strong association exist between level of injury and severity of injury while no association of spasticity with pressure ulcers, gender and age was noted.[16] According to this study spasticity is more common in incomplete injuries, and strong association was seen between cervical cord lesion and frequency of spasticity however this study did not measure the relationship between spasticity, pressure ulcers , UTI and physical therapy.

A study done by Gorgy et al. showed evidence about the effect of spasticity on bone composition and muscle mass find out that spasticity has desirable effects on body composition, bone density, muscle mass and strength. The results of a cross-section survey done by D Westerkam on Spastic SCI population showed that nearly 45% of the SCI patients claim that spasticity has positive impact on their life.[17]

Krause et al. reported in his study that risk factors for spasticity include pregnancy, abnormal posture, cold, pressure sore, bowel and bladder problems, menstrual cycle, depression, limb movement and tight clothing. While factors like osteophytes, hemorrhoids, hemorrhoids, DVT, temperature, and sleep disturbance did not increase spasticity.[18]

**Limitations:**

1) The sample size in this study was limited, which restricts the generalizability of the findings to a broader population.

2) The study was conducted at a single spinal cord injury rehabilitation center.

**Recommendations:**

Including multiple tertiary care hospitals in future research could enhance the diversity and applicability of the results.

Future studies should explore the association of spasticity with other secondary complications in individuals with spinal cord injury to provide a more comprehensive understanding.

**Conclusion**

This study concludes that spasticity is a frequently occurring and debilitating secondary complication, affecting 51.6% of spinal cord injury (SCI) patients at the Paraplegic Centre Peshawar. It is strongly associated with the level and severity of the injury, with cervical cord lesions and incomplete injuries showing a significantly higher likelihood of spasticity (odds ratios of 9.8 and 2.5, respectively). However, no significant association was found between spasticity and the patient's gender or the mechanism of injury (odds ratio < 1).

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