



ASSOCIATION OF NEUROLOGICAL LEVEL OF INJURY AND PRESSURE ULCER DEVELOPMENT IN PATIENTS WITH SPINAL CORD INJURY- A RETROSPECTIVE STUDY

Physical Medicine & Rehabilitation

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ABSTRACT

Study Design: Retrospective Study **Setting:** Department of Physical Medicine and Rehabilitation (PMR), Regional Institute of Medical Sciences, Imphal. **Study Period:** 1st January 2020 to 31st December 2022. **Aim and object:** To find out the association between neurological level of injury and pressure ulcer development in patients with spinal cord injury. **Materials and Methods:** Hospital files of traumatic SCI patients admitted in the Department of Physical Medicine and Rehabilitation, RIMS, Imphal were studied retrospectively. Demographics, neurological level of injury (NLI), American Spinal Injury Association (ASIA) Impairment Scale and complications including pressure were recorded. **Result:** Among 64 patients, pressure ulcer was present in 18 (28.1%) cases. There were 8 cases of pressure ulcer (50%) in ASIA A, 4 (25%) each in ASIA B and ASIA C. Eight patients (44.4%) with cervical level of injury and 8 patients (44.4%) in upper thoracic level of injury had pressure ulcer. One patient each with lower thoracic and lumbar level of injury had pressure ulcer. **Conclusion:** Higher level of injury was associated with higher percentage of pressure ulcer. Patients with higher level of injury had more than two times higher risk of developing pressure ulcer compared to lower level of injury.

KEYWORDS

Spinal cord injury, American Spinal Injury Association, Neurological level of injury, Pressure ulcer

INTRODUCTION

Spinal cord injury (SCI) is a serious neurologic condition that has significant functional, economic, psychological, and societal consequences.¹ Secondary consequences common among spinal cord injured patients include pressure ulcers, urinary issues, sexual dysfunctions, and bowel bladder problems. These consequences cause significant impairment, morbidity, dependency, and mortality. Respiratory system disorders are the primary cause of death among people with spinal cord injuries. Heart disease is ranked second, followed by septicaemia, which is typically accompanied by a pressure ulcer, urinary tract infection, or pneumonia.² Pressure ulcers are the second most common secondary complication of spinal cord injuries. Pressure ulcers have an impact on quality of life, length of hospital stay, and increased mortality and morbidity rates.³ There hasn't been consistent reporting on the association between the level of SCI and the development of pressure ulcers. This study attempted to find out if there was any association between the neurological level of injury and pressure ulcer development in patients with spinal cord injury.

Aims and Objectives

To find out the association between neurological level of injury and pressure ulcer development in patients with spinal cord injury.

Materials and Methods

Data were collected and reviewed retrospectively from the hospital files of traumatic SCI patients admitted in the Department of Physical Medicine and Rehabilitation, RIMS, Imphal between 1st January 2020 and 31st December 2022. Only the data of first admission were included in the study. Demographics, neurological level of injury (NLI), American Spinal Injury Association (ASIA) Impairment Scale, and complications were recorded. Data were entered in Microsoft excel and checked for any discrepancy in data. Statistical analysis was done using SPSS version 21. Frequencies, percentage and means were calculated. Odd ratio and Crammer's V were used to find out the association between different neurological level of injuries and the pressure ulcer development.

RESULTS

Demographics and neurological characteristics are shown in Table 1.

Table 1. Demographic and Neurological Characteristics

Profile	Value
Age in years (mean±SD)	45.25±14.17

Sex(male:female)	60:4
Duration of injury in months (mean±SD)	23.38±18.77
Complete:Incomplete	20:44
Tetraplegic:paraplegic	32:32
Motor Score (mean±SD)	65.81±27.77
Sensory score (mean±SD)	57.00±28.45
ASIA	
A	20 (31.3%)
B	8 (12.5%)
C	8 (12.5%)
D	24 (37.5%)
E	4 (6.3%)
NLI	
Cervical	32 (50%)
Upper Thoracic	10 (31.3%)
Lower Thoracic	8 (12.5%)
Lumbar	4 (6.3%)
Sacral	0 (0%)
Level of Injury	
Higher Level of Injury (T6 and above)	52 (81.3%)
Lower level of injury (Below T6)	12 (18.8%)
Hemoglobin in g/dL (mean±SD)	
Higher Level of Injury (T6 and above)	12.41±2.40
Lower level of injury (Below T6)	13.53±1.65

A total of 64 patients with mean age of 45.25±14.17 years were included. Mean duration since injury was 23.38±18.77 months. Majority of them were male (93.75%). Cervical level injury was the most common level accounting 50% of the total cases, followed by upper thoracic (31.3%), lower thoracic (12.5%) and lumbar (6.3%). Mean motor and sensory scores were 65.81±27.77 and 57.00±28.45 respectively. Out of 64, 52(81.3%) cases had higher level of injury (T6 and above) whereas 12(18.8%) had lower level of injury. Patients with higher level of injury had lower hemoglobin level (12.41±2.40g/dL) compared to patients with lower level of injury (13.53±1.65g/dL).

Table 2. Pressure Ulcer Distribution in Different Profiles

	Pressure ulcer Number (%)
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ASIA Impairment Scale	A	9 (50%)
	B	4 (22.2%)
	C	4 (22.2%)
	D	1 (5.6%)
	E	0
NLI	Cervical	8 (44.4%)
	Upper thoracic	8 (44.4%)
	Lower thoracic	1 (5.6%)
	Lumbar	1 (5.6%)
Site	Sacral	10 (55.6%)
	Trochanteric	4 (22.2%)
	Sacral-Trochanteric	4 (22.2%)
Grade	Grade 1	4 (25%)
	Grade 2	4 (25%)
	Grade 3	6 (37.5%)
	Grade 4	2 (12.5%)

Table 2 showed the distribution of pressure ulcer among the different ASIA Impairment Scales, neurological level of injuries, different sites and grading. There were 9 cases (50%) with ASIA A, 4 (22.2%) each with ASIA B and ASIA C. Cervical and upper thoracic level of injuries had 8 cases (44.4%) each. Lower thoracic and lumbar level of injuries had 1 case each (5.6%). The most common site for pressure ulcer was found to be sacral area (55.6%). Grade 3 pressure ulcer was the most common among all the grades.

Table 3. Association Between Neurological Level of Injury and Pressure Ulcer

	Pressure Ulcer	p-value
Neurological level of Injury	0.199*	0.469

*Crammer's V

Crammer's V value was found to be 0.199 indicating weak association between the different level of injuries and the pressure ulcer.

Table 4. Odd Ratio

	Odd Ratio (OR)	95% CI	
		Upper	Lower
Odds Ratio for Higher Level of Injury /Lower Level of Injury	2.22	0.436	11.324

Odd ratio was found to be 2.22 (95% CI) indicating higher chance of developing pressure among the patients with higher level of injuries compared to patients with lower level of injuries.

DISCUSSION

The current study showed a mean age of 45.25±14.17 years. Similar findings were reported by other studies too. Chacko V et al¹ found most of the patients were in their 3rd or 4th decade of life. Goel et al⁵, in their studies, found the mean age to be 46.65±16 years among the spinal cord injury patients. The current study found male patients (93.8%) were affected more than females (6.3%). Similar findings were reported by Jackson AB et al.⁶

Out of the 64 patients, 18 patients had pressure ulcer accounting 28.1% of the total study population. The incidence of pressure has been found to vary widely in different studies. Brienza D et al⁷ found pressure ulcers in 37.5% of acute care hospitalizations and inpatient rehabilitation. Similar findings were also reported by Nogueira et al.⁸ They reported 42.5% of the patients had pressure ulcer which was higher than the current study. Pressure ulcer developed during the acute phase when most of the patients are immobilized. The lower incidence of pressure ulcer in the current study can be attributed to the fact that most of the patients were admitted after the acute phase.

Verschueren JHM et al⁹ observed the most common site for pressure ulcer was sacral area. In their study, sacral pressure ulcer constituted 43% of all pressure ulcer. In our study, 50% of the pressure ulcer was present in sacral area, followed by sacral-trochanter (25%) and trochanteric area (25%). Different studies had reported varied frequencies of pressure ulcer grades among the SCI patients. In the study conducted by Verschueren JHM et al⁹, most of the pressure ulcers were in either grade 1 or 2. Whereas, Salzberg et al¹⁰, in their study of a population of chronic SCI patients living in the community, found that most patients had grade 3 or 4 ulcers. In our study, grade 3 pressure ulcer had the maximum frequency (37.5%). This may be because of the fact that, most of the patients in our study were of chronic SCI which was in accordance with findings of Salzberg et al.¹⁰

Scheel-Sailer A et al¹¹ found that pressure ulcer was more common among the patients with ASIA A compared to other incomplete injuries. Similar findings were observed in our study too. In our study, 4 out of 10 patients (40%) with ASIA A developed pressure ulcer. Whereas, among the 22 patients with incomplete injury (ASIA B and ASIA C), only 4 (18.18%) developed pressure ulcer.

The level of SCI and the ensuing motor impairments may have an impact on how pressure ulcers initially manifest in SCI patients. Brienza D et al⁷ reported higher percentage of pressure ulcer (49%) among cervical level of injury. Similar finding was observed in our study too. Among the patients with pressure ulcer, 44% of pressure ulcer was observed in cervical level (C2-C7) and another 44% in injuries at upper thoracic level (T1-T6). One patient (5.6%) each in lower thoracic and lumbosacral region developed pressure ulcer.

Grigorian A et al¹² found the risk of pressure ulcer development in upper SCI to be nearly three-fold greater than in patients with lower SCI. In our study too, patients with higher level of injury were found to have more than two times higher chance of developing pressure ulcer than those with lower level of injury (OR=2.22, 95% CI). This could be because of the mobility issues with higher level of injury. Additionally, patients with higher level of injury were found have lower level of hemoglobin compared to patients with lower level of injury. Low hemoglobin level can increase the risk of developing pressure ulcers as lower hemoglobin leads to reduced oxygen delivery to tissues, making them more vulnerable to damage from pressure and other causes.¹³

We tried to find out if there was any statistically significant association between the different levels of spinal cord injuries and the development of pressure ulcer. Crammer's V value was found to be 0.199 indicating weak association but the p value was more than 0.05. In the systemic review by Gelis A et al¹⁴, the level of spinal cord injury was not found to be a risk factor for the development of pressure ulcer in acute stage. This can be explained by the fact that most of the patients were immobilized in the acute stage irrespective of the level of injury. In our study, most of the patients were admitted at the later stage that may explain current findings.

Limitations of the Study

One of the study's major limitations was the small sample size. We were unable to conduct a detailed analysis of the various factors that contribute to the development of pressure ulcers because this study was retrospective in nature. Prognostic markers such as the Braden scale and pressure-relieving devices were not taken into account.

CONCLUSION

Pressure ulcer was present in 28.1% of the total population who were admitted for rehabilitation program. The most common site for pressure ulcer was found to be sacral area, and grade 3 was the most common grade. Higher level of injury had more than two times higher risk of developing of pressure ulcer compared to lower level of spinal cord injuries. Future studies with bigger sample size that take into account all significant risk factors and inclusion of interface pressure monitoring devices will enhance the planning of pressure ulcer management in patients with spinal cord injury.

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