

Respiratory Morbidity and Mortality of Traumatic Cervical Spinal Injury

Nabin Pokhrel,¹ Aastha Neupane,² Nabin Thapa,³ Rupesh Yadav,¹ Pawan Kumar Hamal,¹ Pragya Malla⁴

¹National Academy of Medical Science, Kathmandu, Nepal, ²Nobel College, Kathmandu Nepal, ³Karnali Academy of Health Science, Karnali, Nepal, ⁴Nepalgunj Medical College, Nepalgunj Nepal.

ABSTRACT

Background: Traumatic cervical spinal injuries can severely affect respiratory function and cause significant morbidity and mortality. The typical respiratory morbidity in cervical spine injury is Atelectasis, Ventilator-associated pneumonia, acute respiratory distress syndrome and delayed weaning, etc. The study aims to see the prevalence of respiratory morbidity as well as mortality associated with cervical spine injury.

Methods: Cross sectional study based on retrospective data was conducted on the X Sciences with the existing hospital record during the period of 3 years to find out the prevalence respiratory morbidity like Ventilatory Associated Pneumonia, delayed weaning, ARDS, atelectasis of traumatic cervical spine injury, determine the prevalence, type, and impact of respiratory morbidity and mortality in this population.

Results: Total no 76 patients data meeting the inclusion criteria included in study. Male patients were more prone to develop traumatic cervical spinal injuries (SCI). The prevalence of respiratory morbidity in term of VAP(57.89), delayed weaning(46.05) and Atelectasis(22.36) was high. Patients with Asia A Neurology has higher association for VAP and delayed weaning, while Asia E Neurology patients had no respiratory morbidity. The study found a significant positive association between respiratory morbidity with hospital stay, and ventilator days (p-value: 0.019 and 0.048). A total of 15 patients died, 28.95% were discharged on request and 40.8% leaving the hospital against medical advice.

Conclusions: The prevalence of respiratory morbidity higher in cervical spine injury. Furthermore, it has associated with prolonged ICU and ventilator days and increase in mortality.

Keywords: ARDS; atelectasis; delayed weaning; respiratory morbidity; traumatic SCI.

INTRODUCTION

Traumatic cervical spinal cord injury presents a unique challenge due to its potential to impair respiratory function. The respiratory system impacts motor control and sensation below the level of injury, leading to a range of pulmonary complications.¹ The common respiratory morbidity in cervical spine injury is Atelectasis, Ventilator-associated pneumonia, ARDS, delayed weaning, etc. An increase in complications and delays in management may worsen the.^{2,3} The increased incidence of SCI possibly increases respiratory compromise. Despite the increasing incidence of SCI, there is a paucity of research specifically focused on respiratory mortality and morbidity.^{3,4} This study aims to find out the incidence of respiratory morbidity and mortality in patients with traumatic cervical spine

injury and its associated with the total days of ICU days and ventilator stay.

METHODS

A cross-sectional study using retrospective data was conducted at the X Science. All the cases of any age group and both genders, with a confirmed diagnosis of traumatic cervical spinal cord injury based on clinical and radiological evaluations during the period of 2077 Baisakh to 2080 Baisakh, were included in the study. Those patients with a head injury or polytrauma, patients not admitted to the ICU (Intensive Care Unit), patients with incomplete and missing medical records, and patients not discharged during the study period were excluded. A structured proforma was created, and based on that questionnaire, data collection was done.

Correspondence: Dr Nabin Pokhrel, National Academy of Medical Science, Kathmandu, Email: nepalkonabin@gmail.com, Phone: +9779851131121.

Only the data needed for the objective of the research was collected. ASIA (American Spine Injury Association) was used to assess the severity of cervical spinal cord injury. It was determined from available radiological investigations (anteroposterior and lateral radiographs or computerized tomography, or magnetic resonance imaging). Information regarding age, gender, duration of ventilation, duration of ICU, other respiratory complications like VAP, atelectasis, ARDS, and hospital stay was obtained from medical records. The primary outcome will be respiratory morbidity in term of VAP, delayed weaning, ARDS and outcome like discharge, death, LAMA as well as secondary outcome like days of ICU stay and ventilator days and its association with respiratory complication. Confidentiality of the patient information was maintained during the collection of the data. Data was analysed using SPSS (Statistical Package for Social Sciences) Version 2020.

RESULTS

A retrospective study was conducted with 76 patient's medical records that met the inclusion criteria. The mean age of the patients in the study was found to be 46.11 years. The incidence of traumatic cervical spinal was found to be higher in males, i.e., 77.6% of male patients were admitted to ICU with a diagnosis of traumatic SCI. Out of 76 medical records included in the study, 43 (56.6%) were classified as Asia A Neurology. Only one patient with Asia E Neurology was admitted to the ICU throughout the study period.

Table 1. shows the demographic data of the patients admitted with Traumatic SCI.

Variables			
Mean Age		46.11±17.01	
		Frequency	Percentage
Sex	Male	59	77.6%
	Female	17	22.4%
ASIA Grading	A	43	56.6%
	B	17	22.4%
	C	13	17.1%
	D	2	2.6%
	E	1	1.3%

The study finding reveals VAP as the most common respiratory morbidity seen as 57.89% of them developed VAP, followed by delayed weaning, atelectasis, and ARDS with 46.05%,22.36%, and 6.57%, respectively. These findings suggest the presence of multiple respiratory morbidities in single patients with traumatic SCI. VAP and

Delayed weaning is found to be more common in patients with ASIA A Neurology. No respiratory complications are seen in patients with Asia E Neurology.

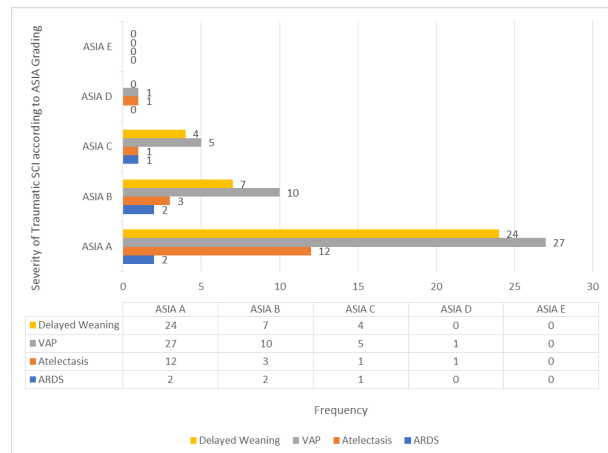


Figure 1. shows the incidence and types of respiratory morbidity experienced by patients with Traumatic Cervical Spinal Injury classified according to ASIA Neurology.

In cases with respiratory morbidity, the mean length of hospital stays and days in ventilators is 17.81 plus or minus 26.49 days and 14.81 plus or minus 18.94, respectively. A significant positive association exists between respiratory morbidity and length of hospital stay and days in a Ventilator (p-value: 0.019 and 0.048, respectively). The mean ICU stay days and ventilator days of patients without any respiratory complications are 9.53±7.5 and 9.53±7.93 respectively.

Table 2. shows the association between morbidity, length of hospital stays, days in ventilator stay, and respiratory morbidity.

Variable	Occurrence of Respiratory Complications	Mean Days Stay	P-Value
Days Of ICU stay	Presence	17.81±26.49	0.019*
	Absence	9.53±7.5	
Days of Ventilator	Presence	14.81±18.94	0.048
	Absence	9.53±7.93	

Fifteen patients died, with a mortality rate of 19.7%. Around 28.95% of the patients were discharged after the recovery, whereas 40.8% left the hospital against the medical advice.

Table 3. shows the clinical outcomes of the patients admitted with Traumatic Cervical Spinal Injury.

Variable	Frequency	Percentage
Outcomes		
Death	15	19.7 %
DOR	2	2.6%
LAMA	31	40.8%
Recovered	22	28.95%
Referred	6	7.9%

DISCUSSION

This study aimed to investigate the significant issue of respiratory morbidity and mortality associated with traumatic cervical spinal injuries, specifically focusing on cases treated at a tertiary trauma center in Nepal. The mean age of this study review was 46 years, where male patients were prone to traumatic cervical injury. The risk factors for traumatic SCI were found to be age (31 to 45 years), male sex, fall injury, and traumatic C5 and C6 vertebra fractures from a study conducted in China.⁵ This finding may be possible as males are exposed more to outdoor work and trauma in comparison to females.

The study findings revealed that patients with Asia A Neurology have highly developed respiratory morbidities. The level of injury increases the risk of respiratory failure. The ability to breathe deeply and cough forcefully is impaired depending on the severity and extent of the SCI, with higher injury levels resulting in more dysfunction.⁶ The incidence of VAP is higher in patients with traumatic SCI, which is followed by delayed weaning and atelectasis. Evidence from studies showed pneumonia as a clinically relevant complication that arises in patients with traumatic cervical injury. The increased risk of pneumonia depends on factors such as the severity of the injury, the clinical setting, total days of ICU stay, and mechanical ventilation. Prevention strategies should be developed and implemented in ICU settings.⁷

In this study the mean day of ICU stay, and Ventilator days who developed respiratory morbidity were 17.81 ± 26.49 and 14.81 ± 18.94 respectively. A survey conducted in India revealed that the primary cause of respiratory morbidity and mortality in the acute phase of SCI is the long duration of mechanical ventilation. AIS-A score, ventilator days length, and ICU and hospital stay prolongation were associated with mortality and

morbidity.⁸ This study found that the mortality rate of patients with respiratory complications after traumatic cervical spine injury was 19.7%. 40.8% of the patients went home, and 2.6% left on DOR. However, in a poor and developing country like Nepal, clinical outcomes and survival rates of traumatic cervical injury are significantly low. So, the patients who went home on LAMA and DOR are at higher risk of mortality. Another survey conducted in Nepal found that the mortality rate during hospital stay was 1.98%, while the rate was 24.32% after rehabilitation.³ Different studies found that respiratory problems are widespread after cervical spinal cord injury and are the primary cause of morbidity and death.^{9,10}

This study include limited no of sample size so the reproducibility might be difficult as well as limit generalizability to other populations

CONCLUSIONS

The prevalence of respiratory morbidity higher in cervical spine injury. The severity of the cervical injury has higher incidence of complications as well as associated with prolonged ICU stay and ventilator days. Furthermore, it has associated with prolonged ICU and ventilator days and increase in mortality. There is a need to implement appropriate and cost-effective treatment plans and modalities to reduce the burden of respiratory complications in patients with traumatic cervical injury.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

1. Anam A, Muhammad DY, Muhammad FD, Jalilah I, Angela MHN, Amaramalar SN, et al. Spinal Cord Injury: Pathophysiology, Multimolecular Interactions, and Underlying Recovery Mechanisms. *Int J Mol Sci* [Internet]. (13 October 2020). doi: 10.3390/ijms21207533
2. Hendershot KA, O'Phelan KH. Respiratory Complications and Weaning Considerations for Patients with Spinal Cord Injuries: A Narrative Review. *J Pers Med*. 2022 Dec. doi: 10.3390/jpm13010097
3. Parajuli B, Acharya K, Shrestha D. Epidemiology of traumatic spinal cord injury in Nepal: A systematic review. *ASIAN J Med Sci*. 2020

Jan;11(6):121-8. doi: [10.3126/ajms.v11i6.30151](https://doi.org/10.3126/ajms.v11i6.30151)

4. Shah G, Dhakal GR, Hamal PK, Dhungana S, Poudel S. Outcome of cervical spine trauma patients admitted to the intensive care unit at a tertiary government referral trauma center in Nepal. *Glob Spine J.* 2022 Sep;12(7):1388-91. doi: [10.1177/2192568220980703](https://doi.org/10.1177/2192568220980703)
5. Wang H, Xiang Q, Li C, Zhou Y. Epidemiology of Traumatic Cervical Spinal Fractures and Risk Factors for Traumatic Cervical Spinal Cord Injury in China. *J Spinal Disord Tech.* 2013 Dec;26(8):E306-13. doi: [10.1097/BSD.0b013e3182886db9](https://doi.org/10.1097/BSD.0b013e3182886db9)
6. Berlowitz DJ, Wadsworth B, Ross J. Respiratory problems and management in people with spinal cord injury. 2016 Dec;12(Breathe):328-40. doi: [10.1183/20734735.012616](https://doi.org/10.1183/20734735.012616)
7. Raab AM, Mueller G, Elsig S, Gandevia SC, Zwahlen M, Hopman MTE, et al. Systematic Review of Incidence Studies of Pneumonia in Persons with Spinal Cord Injury. *J Clin Med.* 2021 Dec 31;11(1):211. doi: [10.3390/jcm11010211](https://doi.org/10.3390/jcm11010211)
8. Sengupta D, Bindra A, Kumar N, Goyal K, Singh PK, Chaturvedi A, et al. Respiratory morbidity and mortality of traumatic cervical spinal cord injury at a level I trauma center in India. *Spinal Cord Ser Cases.* 2021 May 13;7(1):36. doi: [10.1038/s41394-020-00371-5](https://doi.org/10.1038/s41394-020-00371-5)
9. Arora S, Flower O, Murray NPS, Lee BB. Respiratory care of patients with cervical spinal cord injury: a review. *Crit Care Resusc J Australas Acad Crit Care Med.* 2012 Mar;14(1):64-73. PMID: 22404065
10. Adigun T, Sanusi A, Idowu O. Outcome of Traumatic Cervical Spinal Cord Injury in a General ICU: A 5-Year Review. *Arch Med.* 2020 Jun 24;12(4):15. doi: [10.36648/1989-5216.12.3.316](https://doi.org/10.36648/1989-5216.12.3.316)