ORIGINAL ARTICLE

LEVEL OF PRE-TERTIARY CARE HOSPITAL MANAGEMENT OF TRAUMATIC SPINAL CORD INJURED PATIENTS; WHERE DO WE STAND?

Shahbaz Ali Khan, Shah Khalid, Abdul Aziz Khan, Zanib Javed, Jawwad Hussain[2], Ehtisham Ahmed Khan Afridi, Muhammad Zeeshan Haroon[3], Ahsan Aurangzeb

Department of Neurosurgery, Neurology[2], [3]Community Medicine, Ayub Medical College Abbottabad-Pakistan

Background: Traumatic spinal cord injury is a debilitating condition that may cause long term disabilities with tremendous socioeconomic impact on affected individuals and their families. Secondary injuries can best prevent or minimized by appropriate pre hospital management and proper referral and transfer. This study was conducted to assess the clinical profile of traumatic spinal cord injuries and level of pre-hospital care provided to patients either at the site of injury or at other healthcare facilities. **Methods:** This prospective study was conducted in the Department of Neurosurgery Ayub Teaching Hospital Abbottabad, from January 2012 to January 2017. All patients with suspected spinal injury were included in the study. Age, gender, mode of injuries and the pre-tertiary care provided were recorded. **Results:** Out of 4464 patients with suspected spinal cord injury, 3685 (82.5%) were male, 779 (17.4%) were female. Age ranged from 10–70 years. 1685 (37.8%) were diagnosed as having spinal injury. Cervical spine was the most common affected level 743 (44.09%), followed by thoracic spine 135 (8.01%). 1441 (85.5%) were incomplete while 224(14.5%) were complete spinal cord injuries. Road traffic accident was the most common mechanism of injury 884 (52.4%). Only 4 (0.23%) patients directly received in our unit were properly transported, 66 (3.91%) were brought after proper spinal immobilization, intravenous line was maintained in 584 (34.66%) patients, 410 (24.3%) patients received some fluid resuscitation, parenteral analgesia was given to 441 (26.17%) patients while urinary catheterization was done in 195 (11.75%) patients. Those received from other healthcare facilities only 4 (0.23%) were brought by properly equipped ambulance, intravenous access was maintained in 438 (25.99%),320 (18.99%) received some fluid resuscitation, urinary catheterization was done in 229(13.59%) while proper parenteral analgesia was given to 988 (58.63%) patients. **Conclusion:** There is a complete lack of proper transport and referral of trauma patients in our area which reflects almost non-existent emergency medical (rescue) services, deficient health care facilities.

Keywords: Spinal Injury; Spinal trauma; Prehospital management; Trauma; Emergency services

Citation: Khalid S. Level of pre-tertiary care hospital management of traumatic spinal cord injured patients; Where do we stand? J Ayub Med Coll Abbottabad 2021;33(2):305–10.

INTRODUCTION

Spinal cord injury (SCI) is traumatic lesion of nervous tissue of spinal canal which includes spinal cord and cauda equina.[1] It can give rise to multiple neurological problems either temporary or permanent such as motor or sensory deficits, neuropathic pains, autonomic dysreflexia, bladder and bowel dysfunction.[1,2] A global-incident rate is estimated at 23 SCI cases per million (179,312 cases per annum)[3] with 13.7 to 52.2 per million in developed versus12.7 to 29.7 per million in developing countries[1] with higher male to female ratio and peak age incidence in third decade.[1,4,5] The most frequent causes of SCI in adults are motor vehicle accidents (40%), falls (21%) especially in elderly, acts of violence (15%) and sports-related injuries (13%). In children SCIs are mostly due to sports (24%) and water recreational activities.[1,4,5] Cervical spine is most common site reported recently contributing to approximately 55% SCIs of all.[1,6]

Spinal cord injury involves primary and secondary injury mechanisms. The primary mechanism is irreversible and is related to the initial mechanical damage at the time of injury. The secondary mechanism applied to destructive and self-propagating biological changes in cells and tissues that lead to their dysfunction or death over hours to weeks after the initial insult. secondary injuries can be exacerbated by extrinsic factors such as spinal instability, systemic hypoxia, hypotension and metabolic derangement that further injure the already compromised neural tissues resulting in further neurologic deterioration. Historically, it is estimated that 3 to 25% of SCI may be aggravated after the initial insult, either during transport or early in the course of treatment.[7,8] Secondary injuries can be potentially avoided with early appropriate pre-tertiary

care, either pre-hospital or at other health care facilities before referral to a tertiary care hospital for definitive management.

Pre-hospital/ pre-tertiary management includes patient assessment, spinal immobilization, airway management, cardiovascular support, blood glucose levels within the normal range and transportation to health care facility.[5] A combination of a rigid cervical collar and supportive blocks on a backboard with straps is effective in limiting motion of the cervical spine and is recommended. Spinal immobilization in patients with penetrating trauma is not recommended because of increased mortality from delayed resuscitation.[8-10] National Emergency X-Radiography Utilization Study (NEXUS)[11] and the *Canadian* C-Spine Rule Study (CCSR)[12] developed criteria for selective immobilization. NEXUS recommends 5 low risk criteria, immobilization of trauma patients who are awake, alert, and are not intoxicated; who are without neck pain or tenderness; abnormal motor or sensory examination; and who do not have any significant associated injury that might detract from their general evaluation is not recommended.[8,11]In case of sports injury, hard cervical collars should be used in non-helmeted athlete, for helmeted athlete manual in line stabilization is better.[13] In case of SCI, helmets and shoulder pads of athletes should not beremovedinprehospitalsettings.[13,14] Airway management in SCI may require endotracheal intubation with a rapid induction sequence and manual in line stabilization MILS of the spine. MILS is more effective and easier than cervical collar for stabilization while intubation.[2,5,10] Hemodynamic instability in SCI can be due to neurogenic shock or associated haemorrhage. To re-establish the circulation in neural tissue during shock the patient should be in the Trendelenburg position and receive intravenous fluids, vasopressors and chronotropic agents depending on requirement.[2,6,15] AANS and CNS guidelines recommend mean arterial pressure (MAP) >85 mm Hg and avoidance of systolic blood pressure < 90 mm Hg for the first 5–7 days after SCI.[16]AANS/CNS guidelines recommend early and safe transport of patients with spinal cord injuries to a specialized care center.[8,17] Patients transported within 24 hours to health facility have better outcome.[10] The High Arm In Endangered Spine (HAINES)or modified HAINES technique is currently more widely recommended than the classical log-roll procedure during transport or exploration, since it causes less mobilization of the spine.[18]

The guidelines for early essential care and management of traumatic spinal cord injuries are difficult to implement in developing countries due to many reasons including deficient health care staff and health care facilities, lack of knowledge by the health care provider about ATLS guideline, lack of rescue medical services and unawareness by generational population regarding minimal possible care of spinal trauma victims. The aim our study was to assess the clinical profile of spinal cord injuries and to evaluate the level of pre-tertiary hospital care provided either at the site of injury or at other health care facilities.

MATERIAL AND METHODS

This prospective study was conducted in the Department of Neurosurgery, Ayub teaching hospital, Abbottabad from January 2012 to January 2017. The study was approved by the Hospital Ethical Review Committee. All trauma victims brought to Neurosurgery department of Ayub Medical Teaching Institute, either directly from site of injury by rescue team or by attendants or those referred from other primary or secondary health care facilities. with complaints of back and/or neck pain, spinal tenderness on palpation, any palpable spinal deformity, patients with neurologic deficit (lower limbs and/or upper limbs paresis or paralysis) and patients with altered level of consciousness in whom neurologic examination was either difficult or inconclusive were included in the study. In patients with suspected spinal injury based on history or initial neurological evaluation radiologic assessment of spine was done by X-rays, CT scan and MRI to confirm the diagnosis and level of spinal cord injury. Demographic data, mode of trauma and important aspect of pre-tertiary care like spine immobilization, intravenous line, fluid resuscitation, analgesia, urinary catheterization and method of transportation to hospital were recorded at the time of initial evaluation on a predesigned *pro forma.*

RESULTS

During the study period 4464 patients with suspected spinal injury were brought to neurosurgical unit of Ayub Teaching Hospital. These patients were received either directly or indirectly through other healthcare facilities like BHU, RHC or district head quarter hospitals. Their age ranged was 10–70 years. Out of 4464 patients with suspected spinal injuries 3685 (82.5%) were male and 779 (17.4%) were female. After further clinical evaluation and spine imaging, 1685 (37.8%) were diagnosed as having spinal injuries.

Out of 1685 (37.8%) diagnosed spinal injuries, 743 (44.09%) were isolated cervical spine, 135(8.01) were isolated dorsal spine and 645 (38.27%) were isolated lumbar spine injuries. combined dorsolumbar, cervicodorsal and cervicolumbar spinal injuries were found in 69(4.09%), 64 (3.79%) and 29 (1.72%) patients respectively (Figure-1). In patients with diagnosed spinal injuries, 1441 (85.5%) had incomplete while 224 (14.5%) have complete spinal cord injury. Complete spinal cord injury was more common in patients with cervical spine injuries. In patients with isolated cervical spine injury 723 (97.3%) were complete and 20 (2.69%) were incomplete spinal cord injuries. In isolated dorsal spine injuries 126 (93.33%) were complete and 9(6.66%) were incomplete, while in isolated lumbar spine 446 (69.14%) were complete and 199 (30.85%) were incomplete spinal injuries in combined dorsolumbar, cervicodorsal and cervicolumbar spinal injuries, 58 (84.66%),63 (91.3%) and 25(86.2) were complete spinal injuries while 11 (15.94%),6 (8.69) and 4 (13.8%) respectively were incomplete spinal cord injuries (Table-1). Mode of injury in majority of cases was road traffic accident 884 (52.46%), followed by fall from height 716 (42.5%) and physical assault 83 (4.93%) (Figure-2).

Essential Pre-hospital care provision was inadequate. Out of the patients received directly to our hospital, only 4 (0.23%) were brought through a well-equipped ambulance, 66 (3.91%) were brought after proper spinal immobilization, intravenous line was maintained in 584 (34.66%) patients, 410 (24.3%) patients received some fluid resuscitation, parenteral analgesia was given to 441(26.17%) patients while urinary catheterization was done in 195(11.75%) patients (Table-2). Patients received from other healthcare facilities only 4 (0.23%) were brought by properly equipped ambulance, intravenous access was maintained in 438 (25.99%),320 (18.99%) received some fluid resuscitation, urinary catheterization was done in 229 (13.59%), proper parenteral analgesia was given to 988(58.63%) patients while spine immobilization was maintained in only 4 (0.23%) (Table-3).

Out of total 1685 patients with spinal injury, 1007 (59.76%) patients reported a decline in neurology in terms of power during the transport from the site of injury to the tertiary care hospital.

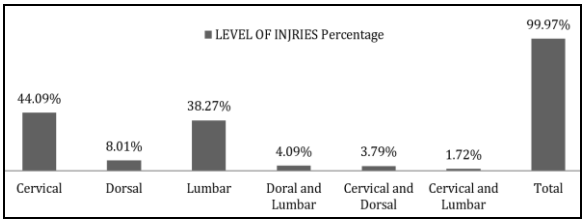

Figure-1: Level of injuries

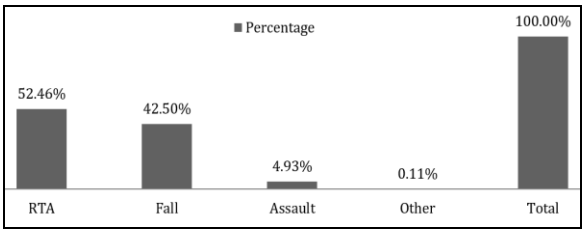

Figure-2: Mode of injuries

Table-1: Percentage of complete and incomplete spinal cord injury with each level

Level of Injury	Type of Injury	Number	Percentage
Cervical	Complete	723	97.3
	Incomplete	20	2.69
Dorsal	Complete	126	93.33
	Incomplete	9	6.66
Lumbar	Complete	446	69.14
	Incomplete	199	30.85
Dorsal and Lumbar	Complete	58	84.06
	Incomplete	11	15.94
Cervical and Dorsal	Complete	63	91.3
	Incomplete	6	8.69
Cervical and Lumbar	Complete	25	86.2
	Incomplete	4	13.8

Table-4: pre-hospital care given to patients received directly

Pre-hospital Care	Number	Percentage
Spinal Immobilization	66	3.91
Intravenous access	584	34.66
Fluid resuscitation	410	24.33
Urinary Catheterization	195	11.57
Analgesia	441	26.17
Proper Transport	4	0.23

Table-5: Pre-hospital care given to patients shifted from other health care facilities

Pre-hospital Care	Number	Percentage
Spinal Immobilization	4	0.23
Intravenous access	438	25.99
Fluid resuscitation	320	18.99
Urinary Catheterization	229	13.59
Analgesia	988	58.3
Proper Transport	4	0.23

DISCUSSION

Traumatic spinal cord injury is a devastating condition that may cause permanent disability and increase burden on health care facilities. Functional outcome and survival depend on the severity of primary insult and magnitude of secondary injuries that occur during transportation to hospital. Much of the secondary injuries can be minimized or prevented by adequate pre hospital/pre tertiary care like spine immobilization, appropriate fluid resuscitation and proper transportation to the site of definitive treatment.

Our study showed that traumatic spinal injuries usually affect individuals between 10–70 years of age with much high male to female ratio (82.5% vs 17.4%). This high figure in male population is due to fact that majority of traumatic spinal injuries are related to road traffic accident especially motor bike (52.46%), followed by fall from height (42.5%) and direct physical assault (4.93%). Males' greater exposure to road traffic accident account for greater number of traumatic spinal cord injuries. World Health Organization in his report published in The Express tribune in November 2020 postulated that more than 50% of reported accidents in Pakistan involve motorbikes. Motor bike is a major source of transport in developing countries including Pakistan. Furthermore, young individuals, carelessness on road, over speeding and noncompliance with helmet contribute to such a high prevalence.[19] These results resemble the usual pattern seen globally as well as to a study done in Armed Forces Institute of Rehabilitation Medicine Rawalpindi, showed motorbike accident as a major cause of traumatic spinal cord injury (40%).[20] However these results are inconsistent with studies done in other developing countries like India, Afghanistan and Bangladesh where fall from height is the major cause of traumatic spinal injuries followed by motor bike accident and gunshot or stab injuries.[21]

Our study showed that isolated cervical spine is most commonly involved in traumatic spinal injuries (44.09%), followed by isolated lumbar (38.27%) and dorsal spine (8.01%), with the combine cervical and lumbar spine being least likely affected (1.72%). These findings are similar with publications from other Authors.[22] However few studies reported lumbar spine as the most commonly affected level (59.4%).[23] Anatomically, the mobile cervical spine is relatively unprotected, and its high position in the body makes it prone to injury. Moreover, the level of involvement depends on the mode of injury. The relation between level of involvement and mode of injury was not assessed by our study. It seems that such a high incidence of cervical spine involvement is motorbike accident especially if the Rider was un helmeted. Helmeted motorcyclists have significantly lower risk of cervical spine injuries.[24]

Out of 1685 (37.8%) diagnosed spinal injury cases, 85.5% patients have incomplete while 14.5% have complete spinal injury. Risk of complete spinal injury was highest in cervical spine injury (97.3%) followed by dorsal spine (93.3). Risk of complete spinal injury in lumbar spine was significantly lower than cervical and dorsal spine (69.14%). These results are consistent with previous studies where the incidence of incomplete spinal injury is much higher than complete spinal injury.[25] Inadequate pre hospital care may result in further spinal cord damage with conversion of an incomplete spinal injury into complete spinal cord injury. When comparing the risk of complete spinal cord injury with level of involvement these results are much different to previously done studies where the risk of complete spinal cord injury in Dorsal spine is higher than in cervical spine injury (69.4% vs65.4%).[26] It seems that High prevalence of complete spinal cord injury in cervical spine trauma is due to fact, that majority of patients presented to our unit even with significant cervical tenderness and neurologic deficit, does not have proper cervical spine immobilization.

One of the main purposes of our study is to assess the degree of pre-tertiary hospital care provided to victims of traumatic spinal cord injury before their arrival to our emergency or neurosurgical department. Proper pre hospital care can only be achieved by following ATLS Guidelines. Minimum pre tertiary care assessed in our study include spine immobilization, maintenance of intravenous line, fluid resuscitation, urinary catheterization, appropriate analgesia, and proper transport to the site of definitive treatment. Pre tertiary care is important to minimize or prevent secondary injury to spinal

cord. Adequate pre tertiary care and prompt transfer to the site of definitive care has been associated with improved neurologic outcome.[27] Patients in our study were either shifted directly from site of injury or referred from other health care facilities to our emergency department and then shifted to our unit for further assessment and management. Those shifted directly, only 3.91% (66) patients were properly immobilized on spine board while only 0.23% (4) patients referred from other hospital were properly immobilized on spine board during their transport to the site of definitive care. Traumatic spine with or without neurologic deficit may be unstable. Further movement of an unstable spine during transport may cause neurologic deficit in patients with intact neurology or may convert incomplete into complete spinal cord injury.[28] A study was done in Iran to investigate the epidemiology of trauma and the quality of limb and spine immobilization in patients with multiple traumas transferred to a medical center via emergency medical services, spinal immobilization was observed in 95% of patients. Keeping in view the above results and comparing it with previous studies, may reflect lack of emergency medical services, inability of our healthcare professionals or lack of facilities including spine board and hard cervical collars. Maintaining airway, intravenous access with prompt fluid resuscitation, urinary catheterization, adequate parenteral analgesia and proper transportation to hospital are other important components of pre tertiary care. In our study intravenous line was maintained in 34.66% (584) patients received directly and in 24.53% (410) patients referred from other health care facilities. Patients with spinal injury may present with or develop hemodynamic instability, either due to neurogenic shock or associated haemorrhage, which further compromise spinal cord perfusion. Incidence of neurogenic shock in cervical and thoracic spine is 19.3% and 7% respectively Guly HR *et al.*[29] Though the management of shock depends on its aetiology but fluid resuscitation is necessary initially to achieve minimum hemodynamic stability. These results either show incompetency of our healthcare professionals, or lack of adequate knowledge of ATLS guidelines. One of the basic principles of pre tertiary care is safe, rapid and careful transport of spinal injury patients to health care facility for definitive care. Early careful transport to a specialized center is associated with fewer complications and better neurologic outcome.[30] In our results proper transport through a well-equipped ambulance was observed in only 0.23% (4) cases. This may be due lack of rescue services or insufficient resources in health care facilities. And this might have resulted in the deterioration of neurological status of the patients in over 59% cases of our study.

In one of the previous studies conducted at our unit the mass disaster of earthquake of 2005, the prehospital management was even better than that a decade after that.[31] This shows that there has been no improvement rather a decline and almost non-existent proper referral and transport of trauma patients. There is a dire need of improvement. Government needs to look into this so as to save the neurology in economically active age group that is prone to spinal injuries.

CONCLUSION

Road traffic accident is the most common cause of traumatic spinal cord injury. Cervical spine is the most commonly affected level. Risk of complete spinal cord injury is highest in cervical spine injuries. Inadequate pre-tertiary hospital care reflects lack of emergency medical (rescue) services, deficient primary health care facilities were identified in this study. Strong measures need to be initiated at primary and secondary level to improve the outcome of patients with spinal injury.

AUTHORS' CONTRIBUTION

SAK: Conceived the idea, data collection, write up, data analysis SK, AAK, ZJ, MZH: Write-up, literature review. JH, EAKA: Data Collection, literature search, write-up. AA: Supervised the study, proof read the manuscript.

REFERENCES

1. Ala'a OO, Smith K, Jennings PA, Stoelwinder JU. The prehospital management of suspected spinal cord injury: an update. Prehosp Disaster Med 2014;29(4):399–402.
2. Galeiras Vázquez R, Ferreiro Velasco ME, Mourelo Fariña M, Montoto Marqués A, Salvador de la Barrera S. Update on traumatic acute spinal cord injury. Part 1. Med Intensiva 2017;41(4):237–47.
3. Lee BB, Cripps RA, Fitzharris M, Wing PC. The global map for traumatic spinal cord injury epidemiology: update 2011, global incidence rate. Spinal Cord 2014;52(2):110–6.
4. Singh A, Tetreault L, Kalsi-Ryan S, Nouri A, Fehlings MG. Global prevalence and incidence of traumatic spinal cord injury. Clin Epidemiol 2014;6:309–31.
5. Bernhard M, Gries A, Kremer P, Böttiger BW. Spinal cord injury (SCI)—prehospital management. Resuscitation 2005;66(2):127–39.
6. Pickett W, Simpson K, Walker J, Brison RJ. Traumatic spinal cord injury in Ontario, Canada. J Trauma 2003;55(6):1070–6.
7. Hadly MN. The Section on Disorders of the Spine and peripheral nerves of the American Association of Neurological Surgeons and the Congress of Neurological Surgeons. Guidelines for management of acute cervical spinal injuries. Neurosurgery 2002;50(Suppl):S7–17
8. Theodore N, Hadley MN, Aarabi B, Dhall SS, Gelb DE, Hurlbert RJ, *et al*. Prehospital cervical spinal immobilization after trauma. Neurosurgery 2013;72(Suppl_3):22–34.
9. Hadley MN, Walters BC. Introduction to the guidelines for the management of acute cervical spine and spinal cord injuries. Neurosurgery 2013;72(Suppl_3):5–16.

10. Ahn H, Singh J, Nathens A, MacDonald RD, Travers A, Tallon J, *et al*. Pre-hospital care management of a potential spinal cord injured patient: a systematic review of the literature and evidence-based guidelines. J Neurotrauma 2011;28(8):1341–61.
11. Hoffman JR, Mower WR, Wolfson AB, Todd KH, Zucker MI. Validity of a set of clinical criteria to rule out injury to thecervical spine in patients with blunt trauma. National Emer-gency X-Radiography Utilization Study Group. N Engl J Med 2000;343:94–9.
12. Stiell IG, Wells GA, Vandemheen KL, Clement CM, Lesiuk H, De Maio VJ, *et al*. The Canadian C-spine rule for radiography in alert and stable trauma patients. JAMA 2001;286(15):1841–8.
13. Sanchez AR, Sugalski MT, LaPrade RF. Field-side and prehospital management of the spine-injured athlete. Curr Sports Med Rep 2005;4(1):50–5.
14. Waninger KN, Swartz EE. Cervical spine injury management in the helmeted athlete. Curr Sports Med Rep 2011;10(1):45–9.
15. Yue JK, Winkler EA, Rick JW, Deng H, Partow CP, Upadhyayula PS, *et al*. Update on critical care for acute spinal cord injury in the setting of polytrauma. Neurosurg Focus 2017;43(5):E19.
16. Catapano JS, John Hawryluk GW, Whetstone W, Saigal R, Ferguson A, Talbott J, *et al*. Higher mean arterial pressure values correlate with neurologic improvement in patients with initially complete spinal cord injuries. World Neurosurg 2016;96:72–9.
17. Theodore N, Aarabi B, Dhall SS, Gelb DE, Hurlbert RJ, Rozzelle CJ, *et al*. Ryken TC, Walters BC, Hadley MN. Transportation of patients with acute traumatic cervical spine injuries. Neurosurgery 2013;72(Suppl_3):35–9.
18. Blake WE, Stillman BC, Eizenberg N, Briggs C, McMeeken JM. The position of the spine in the recovery position--an experimental comparison between the lateral recovery position and the modified HAINES position. Resuscitation 2002;53(3):289–97.
19. Khan KM, Jamil M, Memon IA, Idrees Z. Pattern of injuries in motorbike accident. J Pak Orthop Assoc 2018;30(3);123–7.
20. Gill ZA, Ahmed N, Akhtar N, Hanif S, Butt AW. Pattern of traumatic spinal cord injuries in Pakistan Armed Forces. Med Chan 2012:18(1);77–9.
21. Rahimi-Movaghar V, Sayyah MK, Akbari H, Khorramirouz R, Rasouli MR, Moradi-Lakeh M, *et al*. Epidemiology of traumatic spinal cord injury in developing countries: a systematic review. Neuroepidemiology 2013;41(2):65–85.
22. Oliveira TAB de, Andrade SM dos S, Prado GO, Fernandes RB, Gusmão MS, Gomes EGF, *et al*. Epidemiology of spine fractures in motorcycle accident victims. Coluna/Columna 2016;15(1):65–7.
23. Obalum DC, Giwa SO, Adekoya-Cole TO, Enweluzo GO. Profile of spinal injuries in Lagos, Nigeria. Spinal Cord 2009;47(2):134–7.
24. Page PS, Wei Z, Brooks NP. Motorcycle helmets and cervical spine injuries: a 5-year experience at a Level 1 trauma center. J Neurosurg Spine 2018;28(6):607–11.
25. Bárbara-Bataller E, Méndez-Suárez JL, Alemán-Sánchez C, Sánchez-Enríquez J, Sosa-Henríquez M. Change in the profile of traumatic spinal cord injury over 15 years in spain. Scand J Trauma Resusc Emerg Med 2018;26(1):27.
26. Ter Wengel PV, De Haan Y, Feller RE, Oner FC, Vandertop WP. Complete traumatic spinal cord injury: current insights regarding timing of surgry and level of injury. Global Spine J 2020;10(3):324–31.
27. Ahidjo KA, Olayinka SA, Ayokunle O, Mustapha AF, Sulaiman GA, Gbolahan AT. Prehospital transport of spinal cord-injured patients in Nigeria. S Afr J Surg 2012;50(1):3–5.
28. Connor D, Greaves I, Porter k, Bloch M. Pre-hospital spinal immobilization: an initial consensus statement. Trauma 2013;30(12):1067–9.
29. Guly HR, Bouamra O, Lecky FE. The incidence of neurogenic shock in patients with isolated spinal cord injury in the emergency department. Resuscitation 2008;76(1):57–62.
30. Theodore N, Aarabi B, Dhall SS, Gelb DE, Hurlbert RJ, Rozzelle CJ, *et al.* Transportation of patients with acute traumatic cervical spine injuries. Neurosurgery.2013;72(Suppl 2):35–9.
31. Lodhi A, Khan SA, Ahmed E, Fatima S, Fatima F, Pasha T, *et al*. Pre-hospital management of spinal injuries in a natural disaster. J Ayub Med Coll Abbottabad 23(4):10–2.

Submitted: February 7, 2021	*Revised: March 10, 2021*	*Accepted: April 4, 2021*

Address for Correspondence:

Muhammad Zeeshan Haroon, Department f Community Medicine, Ayub Medical College, Abbottabad-Pakistan
Email: zeeshanharoon@yahoo.com