Original Article

Nepal Journal of Neuroscience 2025;22(1): 23-28

Pattern of Cervical Spine Injuries in Karnali Province of Nepal: A Cross-Sectional Study

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Date of Submission: 7th October 2024 Date of Acceptance: 05th May 2025 Date of Publication: 15th May 2025

Abstract

Introduction: Cervical spine injury is a common occurrence in trauma patients.

Materials and Methods: This is a descriptive cross sectional study performed over a period of 6 months in Province Hospital, Surkhet. This study describes the incidence, presentation, management of cervical spine injury in Province Hospital Surkhet over a 6 month period.

Results: A total of 29 patients with cervical spine injury were admitted in Province Hospital, Surkhet over a 6 month period. Most commonly injuries occurred in the second and third decades with male predominance. Diagnosis was done using computed tomography and magnetic resonance imaging. Ten cases underwent surgery and the other cases were managed conservatively.

Conclusion: Cervical spine injury is a common presentation after trauma. It can be dealt with efficiently if a protocol based management is done.

Key words: Cervical spine injury, surgery, Karnali province

Introduction

Karnali province is one of the most remote regions of Nepal. Due to the poor road conditions and challenging geographical terrain, road traffic accidents, fall are a frequent occurrence. Cases of cervical spine injury either isolated or associated with polytrauma frequently present to the emergency department. This study describes the authors' experience with diagnosis and management of cervical spine injury in Surkhet Provincial Hospital, Karnali, Nepal.

There are seven cervical vertebrae in human body C1 to C7. The first cervical vertebra (atlas), second cervical vertebra (axis) and the seventh cervical vertebra are atypical. The third to sixth cervical vertebrae are typical. The prevalence of cervical spine injury in all trauma patients is around 3.7 %. (Milby et al). Milby et al. also showed that the prevalence of CSI in alert patients is 2.8 % compared to 7.7% in patients in whom clinical evaluation isn't possible.[1] Cervical spine injury is commonly seen in the second and third decades with another peak in people more than 65. Males have a higher incidence of cervical spine injury as compared to females.[2] Road traffic accidents, fall from height, sports related injuries, physical assault are the most common causes of cervical spine injury. In elderly trivial injuries can cause fractures.[3] The C5/C6 and C6/C7 are the most frequently injured cervical vertebrae following trauma, followed by the C1/C2 vertebrae. The common mechanisms of injury are axial compression causing Jefferson-type fractures in C1 vertebrae, occipito-condylar fractures or burst fractures in other vertebrae; hyper-flexion, hyper-extension, and rotational-type injuries.[4]

Management of patients with suspected cervical spine injury begins in the field. Excessive movements can cause secondary cervical spine injury.[5] Triad of a cervical collar, a spine board, and head immobilization between a pair of sandbags or foam wedges is used. This enables full in-line spinal immobilization and adequately minimizes head motion or rotation during the transfer of patients in the pre-hospital setting and during initial assessment in hospital. But patients should be immediately transferred to softer mattress as soon as possible to prevent pressure ulcers.[6,7] All patients should have a neurologic assessment using the International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) impairment

The principles of treatment of a spinal injured patient are to decompress neurological structures, prevent or correct segmental collapse and deformity, restore normal spinal mechanics, avoid and manage complications, facilitate early ambulation and rehabilitation. Indications for surgical management of SCI are

Access this article online

Website: https://www.nepjol.info/index.php/NJN

DOI: https://10.3126/njn.v22i1.70701

HOW TO CITE
Jha P, Khadka N. Pattern of Cervical Spine Injuries in Karnali Province Of Nepal- A Cross Sectional Study. NJNS. 2025;22(1):23-28

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ISSN: 1813-1948 (Print), 1813-1956 (Online)

unstable injuries, progressive neurological deterioration, for early mobilization in neurologically compromised patient, in patients with a high incidence of late complications. Surgical options for treating scale, pre-transfer, post-transfer, and pre- and post-operatively.[8] A CT scan of the cervical spine is the gold standard imaging modality for patients with a suspected cervical spine injury.[9] MRI is more sensitive to soft tissue injuries and can detect disruptions of the discoligamentous complex. MRI scans can provide clinically useful information in 48% of cases with change in management in 39 % and a decision for surgery in patients in 24 % previously assumed to be non- operative.[10]

The principles of treatment of a spinal injured patient are to decompress neurological structures, prevent or correct segmental collapse and deformity, restore normal spinal mechanics, avoid and manage complications, facilitate early ambulation and rehabilitation. Indications for surgical management of SCI are unstable injuries, progressive neurological deterioration, for early mobilization in neurologically compromised patient, in patients with a high incidence of late complications. Surgical options for treating subaxial cervical injuries include anterior decompression (discectomy/corpectomy) and fusion, posterior stabilization with or without decompression and a circumferential approach to the spine that combines both anterior and posterior approaches.[11] The Surgical Timing in Acute Spinal Cord Injury Study (STASCIS), a multicentre international study that recruited patients between the age of 16 to 80 with a cervical SCI, showed a 19.8% ≥2 ASIA grade improvement in patients who had early surgery (14.2±5.2 hours) compared to an 8.8% rate of improvement in patients who had late surgery (48.3 ± 29.3 hours).[12]

This study describes the demographics, diagnosis, management and rehabilitation of patients with cervical spine injury at Province Hospital, Surkhet, Nepal.

Materials and Methods

This is a cross sectional study describing the pattern of cervical spine injuries in Karnali Province of Nepal. Province hospital Surkhet is one of the two major hospitals serving the ten districts of Karnali province and the adjacent hilly districts of Sudurpaschim province.

The study describes the cervical spine injury cases presenting to the out patient clinic and emergency of the hospital. This is a descriptive study which aims to present the pre hospital scenario, the demographics, emergency diagnosis and management, in patient care, pre operative care, intra operative details, conservative measures, post operative care of patients with cervical spine injury.

Cases presenting over a period of six months from September 2023 to February 2024 have been included. All cases have been managed by two neurosurgeons one of whom is a dedicated spine neurosurgeon and the other a consultant neurosurgeon. The team includes medical officers, dedicated neuro intensive care unit nurses, dedicated operation theatre nurses. All cases were operated in a modular operation theatre with the assistance of fluorosocopy. Spinal table isn't available at the center. Mayfield head holder was used. Consultant anaesthesiologist with anaesthesia assistant were present in all cases.

RESULTS

A total of 29 patients were admitted with traumatic CSI over the period of six months from September 2023 to February 2024. Out of 29 patients 24 were admitted from emergency and 5 were admitted from outpatient clinic. This constituted 42 % of the total 68 spine injury cases, 9.2 % of total 312 traumatic head and spinal injury cases and 7.1 % of total 405 neurosurgical cases admitted within six months. All patients admitted from outpatient clinic were either late presenters or missed injuries during the initial evaluation. Out of these 29 cases 13 cases had operative indications. (Table 1) Ten cases were operated and two cases were discharged on request. One case expired preoperatively. Rest of the cases were managed conservatively.

The mean age of patients presenting with CSI was 36 (6-68 years). There were 19 (65.5 %) males and 10 (34.5 %) females. All the cases presenting to the hospital were from Karnali province and far west province. The time to reach the hospital varied based upon the district. Due to difficult geographical terrain and harsh driving conditions, in some cases with no access to roads, transport of patients was difficult.

The major cause of injury was fall in 16 (55.17 %) cases followed by road traffic accident in 11 (37.9 %) cases. Two cases had history of trivial injury.

Advanced trauma life support (ATLS) protocol was followed in the initial clinical assessment of patients with suspected CSI presenting in the emergency department. Initial neck immobilization was done using hard collar and sand bag. Patients were then transferred in a spinal board for computed tomography (CT)

C spine and other investigations. Isolated cervical spine injury was present in twenty two (75.8 %) cases. Polytrauma was present in 7 (24.2 %) cases.

The cases presenting in the outpatient clinic had only done x ray C spine anteroposterior and lateral views in the emergency. They presented with features of cervical myelopathy and neck pain. On further investigation with a CT C spine, the injuries were detected. The average time of presentation to the out patient clinic from the time of injury was 35 days (13-42 days). The cases were further evaluated using Magnetic Resonance Imaging (MRI) C spine. For all cases planned for surgery, CT vertebral angiography was done. Preoperative neuroradiology discussion was done along with calculation of screw lengths and trajectory. Complete neurological examination was done preoperatively at admission, after spinal shock recovery and post operatively. The ASIA grade was recorded and improvement assessed. [Table 2 and 3] Three patients with high cervical injuries presented with respiratory distress and were intubated in emergency. All patients had skull traction after emergency admission. Two patients underwent anterior cervical corpectomy with fusion. Out of these two patients one was extubated successfully but the other one expired due to acute respiratory distress syndrome. One patient couldn't be operated and died in intensive care unit.

The cost of treatment was covered by the Government of Nepal which provides provides Nepalese Rupees (NPR) 100,000 under

Improvised Citizen Treatment Fund (ICTF), started in 2013 AD for all patients with spinal injury. If the cost of treatment was more than NPR 100,000 it was covered by the patient.[13]

Intraoperatively the team consisted of two neurosurgeons, anaesthesiologist, anaesthesia assistant, scrub nurse, OT technician. Spinal table wasn't available. For anterior procedures, patients were placed on Mayfield horse shoe with neck extended and shoulders pulled down. For posterior procedures, patients were placed in prone position on Mayfield horseshoe/three pin. Intraoperative fluoroscopy was available in all the cases.

Preoperative skull traction under fluoroscopy guidance was done under local anaesthesia in all awake co operative patients. The polyaxial screws, rod and plate used were all made of titanium and MRI compatible. Cage for ACDF were polyetheretherketone cages. Vertebral artery injury occurred in one case which was managed with packing and compression. CSF leak occurred in one case which was managed with suturing. Mortality occurred in one case of high cervical cord injury after ACCF.
The average length of hospital stay was 13 days. (6-33 days). Post operative physiotherapy was done in hospital.

Table 1 Diagnosis and management of Cervical spine injury patients

Odontoid fracture type 2	Number of patients	Procedure
C1/c2 rotatory subluxation with fracture	1	C1 lateral mass C2 pedicle screw fixation (Figure 1)
Hangman fracture type 2	1	Occipito cervical fixation
Traumatic disc prolapse C4-C5	1	Counseled for Halo brace immobilization but refused so managed with hard collar only
Subaxial burst fracture	1	Managed with anterior cervical discectomy and fusion with fixation
C7-T1 subluxation	4	Two cases underwent anterior cervical corpectomy and fusion.
Spinous process/laminae fracture	2	One case expired in ICU after skull traction placement.
Spinal cord contusion without bony injury likely whiplash injury	16	One case discharged on request (Figure 2)
C4-C5 subluxation	2	360 degree fusion
Anterior cervical discectomy and fusion plus posterior lateral mass/ pedicle screw fixation (Figure 3)	1	Anterior cervical discectomy and fusion plus posterior lateral mass/pedicle screw fixation (Figure 3)
Spinous process/laminae fracture	16	Conservative management with hard collar
Spinal cord contusion without bony injury likely whiplash injury	2	Decompressive laminectomy
C4-C5 subluxation	1	Managed with lateral mass fixation (Figure 4)

Table 2 ASIA score

Score	Number of patients
A	4 (13.7%)
B	2 (6.8 %)
C	6 (20.6 %)
D	2 (6.8 %)
E	15 (51.7 %)

CASE	Pre-operative	Post-operative	Day of presentation	Pre operative respiratory support (BIPAP/ Intubation)	Spinal shock at presentation	Vaso-pressor support preoperatively	SLIC score	Time of surgery	Intra operative complication	Post operative complication	Length of ICU stay	Length of hospital stay
Occipitocervical fixation for Rotatory C1-C2 subluxation	C	D	42	NONE	NONE	NONE	NA		NONE	NONE		
C1 lateral mass C2 pedicle screw fixation for type 2 odontoid fracture	E	E	3	None	None	None		7	None	None		
C4-C5 laminectomy for cervical cord contusion	B	C	1	Intubation	Yes	Yes	3	3	None	None		
C3-C4 laminectomy for cervical cord contusion	A	B	1	None	Yes	Yes	4	4	None	None		
ACCF for C5 burst fracture	A	A	1	INTUBATION	YES	YES	7					
ACCF for C6 burst fracture	C	D	2	NONE	NONE	NONE						
Lateral mass fixation for C5-C6 subluxation	D	E	2	NONE	NONE	NONE						
ACDF with posterior lateral mass/pedicle screw fixation for C7-T1 subluxation	C	D	30									
ACF with iliac crest graft with posterior lateral mass/pedicle screw fixation for C7-T1 subluxation	A	A										
Skull traction for C5 burst fracture												
C6-C7 subluxation												

Figure 1 C1-C2 fixation for Type 2 odontoid fracture

Figure 2 ACCF for C5 burst fracture

Figure 3 360 degree fusion with fixation for C7-T1 subluxation

Figure 4 Lateral mass fixation for C4-C5 subluxation

DISCUSSION

The prevalence of cervical spine injury in all trauma patients is around 3.7 %. (Milby et al). This study also showed that the prevalence of CSI in alert patients is 2.8 % compared to 7.7% in patients in whom clinical evaluation isn't possible. [1] In our study the prevalence was 9 % of all trauma patients. The higher incidence may be due to our hospital being the only referral center in the entire region.

Cervical spine injury is commonly seen in the second and third decades with another peak in people more than 65. Males have a higher incidence of cervical spine injury as compared to females. [2] In this study also the mean age was 36 with males outnumbering females. In karnali region, males are more prone to injury because they are the active members working on farms and travelling for job related activities.

Road traffic accidents, fall from height, sports related injuries, physical assault are the most common causes of cervical spine injury. In elderly trivial injuries can cause fractures. 3] In this study the major cause of injury was fall injury in 16 (55.17 %) of cases followed by road traffic accident in 11 (37.9 %) cases. Two cases had history of trivial injury. Fall is common in Karnali region because of the practice of climbing trees for picking up fruits, harvesting honey and due to the hilly and mountainous geographic terrain predisposing to falls.

The C5/C6 and C6/C7 are the most frequently injured cervical vertebrae following trauma, followed by the C1/C2 vertebrae. The common mechanisms of injury are axial compression causing Jefferson-type fractures in C1 vertebrae, occipito-condylar fractures or burst fractures in other vertebrae; hyper-flexion, hyper-extension, and rotational-type injuries. [4]
Management of patients with suspected cervical spine injury begins in the field. Excessive movements can cause secondary cervical spine injury. [5] Triad of a cervical collar, a spine board, and head immobilization between a pair of sandbags or foam wedges is used. This enables full in-line spinal immobilization and adequately minimizes head motion or rotation during the transfer of patients in the pre-hospital setting and during initial assessment in hospital. But patients should be immediately transferred to softer mattress as soon as possible to prevent pressure ulcers.[6,7] All the patients in at our hospital were immobilized using hard cervical collar and transferred in a spine board except for patients presenting late in the out patient department.

All patients should have a neurologic assessment using the International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) impairment scale, pre-transfer, post-transfer, and pre- and post-operatively.[8] A CT scan of the cervical spine is the gold standard imaging modality for patients with a suspected cervical spine injury. [9] MRI is more sensitive to soft tissue injuries and can detect disruptions of the discoligamentous complex. MRI scans can provide clinically useful information in 48% of cases with change in management in 39 % and a decision for surgery in patients in 24 % previously assumed to be non- operative.[10] All the patients in our hospital underwent CT C spine followed by MRI C spine and CT vertebral angiography.
The principles of treatment of a spinal injured patient are to decompress neurological structures, prevent or correct segmental collapse and deformity, restore normal spinal mechanics, avoid and manage complications, facilitate early ambulation and rehabilitation. Indications for surgical management of SCI are unstable injuries, progressive neurological deterioration, for early mobilization in neurologically

compromised patient, in patients with a high incidence of late complications, eg, kyphosis of 30° or loss of height of more than 50%. Surgical options for treating subaxial cervical injuries include anterior decompression (discectomy/corpectomy) and fusion, posterior stabilization with or without decompression and a circumferential approach to the spine that combines both anterior and posterior approaches.[11] All the cases in our hospital were managed based upon these principles.
The Surgical Timing in Acute Spinal Cord Injury Study (STASCIS), a multicentre international study that recruited patients between the age of 16 to 80 with a cervical SCI, showed a 19.8% ≥2 ASIA grade improvement in patients who had early surgery (14.2±5.2 hours) compared to an 8.8% rate of improvement in patients who had late surgery (48.3 ± 29.3 hours).[12] The average time to surgery in our surgery was 4 days.

Dhakal et al. performed an epidemiological retrospective study to describe the demographics, timing to surgery, delay, short-term neurological recovery, and complications in surgically treated subaxial cervical trauma in Nepal. The study included 30 patients. There were 27 male and 3 female patients with mean age 40 years. Twenty-four sustained fall injury, and 27 patients were from outside Kathmandu. No patients were treated within the first 48 hours; only 9 were treated between 3 and 7 days, 16 between 8 and 30 days, and 5 a month later. [14]

Acharya et al. performed a study to determine the epidemiology of traumatic spinal cord injury in Nepal. A narrative synthesis of the data that comprised 1796 patients was conducted. Males comprised 73%, and the mean age varied from 32 to 47 years. The two leading causes of SCI were falls

(60%) and accidents (17%). Most patients had incomplete neurology (AIS grade B, C and D = 42%) followed by AIS A grade (36.3%). Cervical injury (37.4%) was the most common level of injury. Mortality during hospital stay was low (1.98%) whereas after rehabilitation was high (24.32%). [15]

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