

## Original Research Article

# Neurological outcome and postoperative stability after anterior cervical spine fixation by the use of cervical spine locking plate

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### ABSTRACT

**Background:** The fractures of cervical spine are divided into upper cervical spine (C1-C2) and lower cervical spine (C3-C7) also called sub axial cervical spine. Sub axial cervical injuries are common, ranging in severity from minor ligamentous strain or spinous process fracture to complete fracture dislocation with bone and ligament disruption, resulting in severe spinal cord injury. The objective of this study was to determine the neurological outcome and postoperative stability after anterior cervical spine fixation by the use of cervical spine locking plate (CSLP) attached with cancellous screws.

**Methods:** This descriptive study was carried out in the Department of Neurosurgery, Nishtar Hospital, Multan, Pakistan. One hundred and fifteen patients fulfilled the inclusion criteria were selected. Patient of either gender more than 15 years of age and less than 60 years of age having unstable lower cervical spine injuries from C-3 to C 7 on X-ray underwent anterior cervical fixation.

**Results:** Age range from 15 to 60 years with mean  $32.34 \pm$  standard deviation (SD) =12.06. The mean Frankel grading of the patients was  $3.26 \pm$  standard deviation (SD) =1.33. There were 97 (84.3%) male patients and 18 (15.7%) female patients. The neurological outcome was good in 107(89.6%) patients and poor in 12 (10.4%). The postoperative stability was YES in 109 (94.8%) patients and NO in 06 (5.2%). In the mode of injury there were 65 (56.5%) patients having road traffic accident, 41 (35.7%) patients having fall from tree/roof/stairs, 6 (65.2%) patients having fall of brick on the patient, 1 (0.9%) patient having Buffalo hit/animal contact, 2 (1.7%) patient having contact of head at floor of swimming pool after jumped in.

**Conclusions:** It is concluded from this study that good results were achieved with the use of the CSLP. The use of anterior approach in treatment of the injured lower spine is safe and effective.

**Keywords:** Anterior fixation, Cervical spine, Cervical spine locking plate, Sub axial cervical spine injuries

### INTRODUCTION

The fractures of cervical spine are divided into upper cervical spine (C1-C2) and lower cervical spine (C3-C7), also called sub axial cervical spine.<sup>1</sup> Sub axial cervical injuries are common, ranging in severity from minor ligamentous strain or spinous process fracture to complete fracture dislocation with bone and ligament disruption, resulting in severe spinal cord injury.<sup>2</sup> Motor vehicle accident, falls, gunshot wounds and contact or

water sports are the main causes. Moreover, it is saddening that the most vulnerable are from youth and middle age groups.<sup>3</sup>

They cause a broad spectrum of disabling conditions ranging from minor pains to quadriplegia and even death. The consequences are of great concern to many individuals, not only to the medical profession responsible for their treatment but also the patient's family. Patients with spinal cord injury are severely

handicapped, dependent on others for everything and prone to develop secondary and tertiary complications easily.<sup>4</sup>

The surgeon has to offer the patient the maximum possible recovery from neurological deficit in the shortest possible period of time with the least amount of suffering. The primary goals of treatment are to realign the spine, prevent loss of function of uninjured neurological tissue, improve neurological recovery, obtain and maintain spinal stability and obtain early function recovery.<sup>5</sup> Cervical spine injuries were usually treated by skeletal traction for 3-6 weeks. By this method proper decompression, bony fusion and stabilization of the injured cervical spine are not possible. Unstable injuries of the cervical spine, with or without neurological deficit, generally require operative treatment. The use of anterior approach with cervical spine locking plate (CSLP) in the treatment of injured lower cervical spine is safe and effective. It allows us to carry out decompression as well as insertion of a graft and plate under direct visual control.<sup>6</sup>

A study from Czech Republic showed that this procedure is associated with minimum complications and a high probability of bony fusion post operatively up to 95%.<sup>7</sup> The Canadian study showed that improvement in neurological outcome is 40% in sub axial cervical spine injuries treated with anterior fixation.<sup>2</sup> Another study from Columbia showed that unilateral facet injuries can be treated with either anterior or posterior fixation techniques with reportedly good neurological outcomes (98%).<sup>8</sup> The current study will provide the data about stabilization and neurological outcome after anterior cervical fusion with plate fixation in lower cervical spine injuries at our center. As there is no local data available and above mentioned international studies showed huge variation in neurological outcome. Therefore, this study was carried out to determine the neurological outcome and postoperative stability after anterior cervical spine fixation by cervical spine locking plate (CSLP) attached with cancellous screws in lower cervical spine injuries.

## METHODS

This descriptive study was carried out in the Department of Neurosurgery, Nishtar Hospital, Multan, Pakistan, after approval from Institutional Review Board (IRB).

### Inclusion criteria

- Patients having unstable lower cervical spine injuries from C-3 to C-7 on X-ray
- Patient of either gender more than 15 years of age and less than 60 years of age.

### Exclusion criteria

- Patients having upper cervical spine injuries from C-1 to C-2

- Patients without history of trauma
- Patients having multiple injuries e.g. fracture of long bones, chest injuries and massive abdominal injuries
- Patients having anesthesia complications.

### Data collection procedure

Patients who presented to the Emergency Department of Neurosurgery, Nishtar hospital Multan and fulfilled the inclusion criteria were selected. Initial investigation was X-rays cervical spine (AP and Lateral view) to assess the degree of compression and displacement followed by MRI cervical spine.

Cervical traction was applied for reduction and for immobilization. Informed consent was taken before surgical procedure, surgery was done by same consultant having more than 5 years' experience and following factors were taken into consideration.

- The degree of retropulsion of the vertebral bodies and encroaches of the spinal canal
- Disruption of disc and displacement into spinal canal. Associated signal changes within the spinal canal.

Variables of interest such as mode of injury and pre-operative neurological deficit according to Frankel grading were recorded in a proforma. Patients stayed in hospital after operation for three days in an uneventful recovery. Antibiotics were given. Daily dressing was done. Final neurological outcome in terms of good or poor, and postoperative stability were observed after 3 months and was recorded on the approved proforma.

### Statistical analysis

The data was analyzed using SPSS version 19. The mean and standard deviation was calculated for quantitative variable like age and Frankel grading. Frequencies and percentages were calculated for gender, neurological outcome (good, poor), postoperative stability and mode of injury. Stratification with respect to age, gender and mode of injury was done. Post stratification Chi-square test was applied.  $P \leq 0.05$  was taken as significant.

## RESULTS

One hundred and fifteen patients having lower cervical spine injuries from C-3 to C-7 were selected from the Emergency Department of Neurosurgery, Nishtar Hospital Multan. Age range was from 15 to 60 years with mean  $32.34 \pm$  standard deviation (SD)=12.06.

The mean Frankel grading of the patients was  $3.26 \pm$  standard deviation (SD)=1.33. There were 97 (84.3%) male patients and 18 (15.7%) female patients. The neurological outcome was good in 107 (89.6%) patients and poor in 12 (10.4%). The postoperative stability was good in 109 (94.8%) patients.

**Table 1: Common study variable and their distribution.**

Common study variables	
<b>Gender</b>	
Male-97	(84.3%)
Female-18	(15.7%)
Age (Mean±SD)	32.347±3.26
Frankel Grading (Mean±SD)	12.06±1.33
<b>Neurological outcome</b>	
Good	103 (89.6%)
Poor	12 (10.4%)
<b>Postoperative stability</b>	
Yes	109 (94.8%)
No	06 (5.2%)
<b>Mode of injury</b>	
RTA	65 (56.5%)
Fall from TREE/roof/stairs	41 (37.6%)
Fall of brick/wall on the patient	06 (5.2%)
Buffalo hit the patient/animal contact	01 (0.9%)
Contact of head at floor of swimming pool after jump in	02 (1.7%)

**Table 2: Age distribution in positive neurological outcome cases.**

Age group	Frequency/percentage
15-20	23 (22.33%)
21-30	38 (36.89%)
31-40	19 (18.45%)
41-50	18 (17.47%)
51-60	05 (4.86%)
Total	103 (100%)

**Table 3: Gender distribution in positive neurological outcome cases.**

Gender	Frequency/percentage
Male	86 (83.49%)
Female	17 (16.51%)
Total	103 (100%)

**Table 4: Mode of injury distribution in positive neurological outcome cases.**

Mode of injury	Frequency/percentage
Road traffic accident	60 (58.25%)
Fall from tree/roof/stairs	35 (33.98%)
Fall of brick on the patient	06 (5.83%)
Buffalo hit/animal contact	00
Contact of head at floor of swimming pool after jump in	02 (1.94%)
Total	103 (100%)

In the mode of injury, there were 65 (56.5%) patients suffered from road traffic accident, 41 (35.7%) patients having fall from tree/roof/stairs, 6 (5.2%) patients

having fall of brick on the patients, 1 (0.9%) patients having buffalo hit/animal contact, and 2 (1.7%) patients having contact of head at floor of swimming pool after jumped in. Male patients with age group 21-30, and mode of injury road traffic accident showed good neurological outcome and postoperative stability.

**Table 5: Age distribution in positive post-operative stability cases.**

Age Group	Frequency
15-20	24 (22.02%)
21-30	38 (34.87%)
31-40	20 (18.34%)
41-50	22 (20.19%)
51-60	5 (4.58%)
Total	109 (100%)

**Table 6: Gender distribution in post-operative stability cases.**

Gender	Frequency/percentage
Male	92 (84.4%)
Female	17 (15.6%)
Total	109 (100%)

**Table 7: Mode of injury distribution in positive post-operative stability cases.**

Mode of injury	Frequency/percentage
Road traffic accident	60 (55.04%)
Fall from tree/roof/stairs	40 (36.7%)
Fall of brick on the patient	06 (5.5%)
Buffalo hit/Animal contact	01 (1%)
Contact of head at floor of swimming pool after jump in	02 (1.84%)
Total	109 (100%)

**DISCUSSION**

The fractures of cervical spine are divided into upper cervical spine (C1-C2) and lower cervical spine (C3-C7) also called sub axial cervical spine.<sup>1</sup> Sub axial cervical injuries are common, ranging in severity from minor ligamentous strain or spinous process fracture to complete fracture dislocation with bone and ligament disruption, resulting in severe spinal cord injury.<sup>2</sup> Motor vehicle accident, falls, gunshot wounds and contact or water sports are the main causes. Moreover, it is saddening that the most vulnerable are from youth and middle age groups.<sup>3</sup> They cause broad spectrum of disabling conditions ranging from minor pains to quadriplegia and even death. The consequences are of great concern to many individuals, not only to the medical profession responsible for their treatment but also the patient’s family. Patients with spinal cord injury are severely handicapped, dependent on others for everything and prone to develop secondary and tertiary

complications easily.<sup>4</sup> In present study, the mean age of the patients was 32.34±12.06 years and range of 15 to 60 years. As compared with the study of Stulik et al the mean age of the patients was 37.6 years and range of age was from 12 to 79 years, which is same and comparable with our study.<sup>9</sup> In present study 84.3% of the patients were male and 15.7% patients were female. As compared with the study of Kocis et al.<sup>6</sup> there were 83% male patients and 17% female patients which is comparable with our study. In present study preoperative Frankel grading the grade 1 was (17.4%), grade 2 (8.7%), grade 3, (21.7%), grade 4 (34.8%), grade 5 (17.4%) as compare with the study of Khan et al.<sup>10</sup> preoperative Frankel grade was grade 1 was (5.40%) grade 2 was (5.40%) grade 3 was (21.62%) grade 4 was (40.54%) and grade 5 was (27.02%) which is comparable with the study. In present study the common mode of injury was road traffic accident (56.5%) but Khan et al.<sup>10</sup> showed common mode of injury was history of fall (78.37%).

In present study on follow up of 3 months, the neurological outcome was good in 107 (89.6%) patients and poor in 12 (10.4%). As compared with the study of Columbia showed the good neurological outcome in (98%) which is comparable with our study.<sup>8</sup> In current study on follow up of 3 months, the postoperative stability was YES in 109 (94.8%) patients and NO in 06 (5.2%). As compare with the study of Czech Republic showed the postoperative stability up to (95%) which is comparable with our study.<sup>7</sup> Stulik et al, evaluated that very good results were achieved with the use of the CSLP monocortically system in his study (98.5% fusion without broken screws or plates).<sup>9</sup> The principal condition is a careful preparation of both the endplates of vertebral bodies and the graft.

After insertion, this should stay in place without any tendency to extrude. If the graft is too long, it imposed an increased load on plates or screws that consequently act ventrally. The CSLP monocortically system is fully capable to stabilize the lower cervical spine after injury, supposing all procedures described above are completed. In more serious trauma and type B or C instability, the additional dorsal instrumented fusion is indicated. Zhang et al, concluded that cervical fractures and spinal cord injury, an ideal reduction and immediate stability can be obtained through the anterior approach.<sup>11</sup> Early surgery can significantly improve the spinal cord function and avoid missing the operation opportunity due to occurring complications.

## CONCLUSION

It is concluded from this study that good results achieved with the use of the CSLP and it is fully capable to

stabilize the lower cervical spine after injury. The use of anterior approach in treatment of the injured lower spine is safe and effective. Patient with age group 21-30, gender male and mode of injury road traffic accident showed good neurological outcome and postoperative stability.

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