

Anterior Decompression, Plate Stabilisation & Inter-Body Fusion in Sub Axial Cervical Spine Injuries

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Abstract

Background: Cervical Spine injuries are one of the common causes of serious morbidity and mortality following trauma. Sub-axial cervical spine includes the C3 through C7 segments, a very mobile area of the spine with potential for serious injuries as a result of instability and risk of spinal cord injury. The treatment is to stabilize the spine and decompress and to promote the optimal environment for recovery.

Objective: To evaluate the efficacy of anterior cervical decompression, fusion and titanium plate fixation in sub axial cervical spine injuries in respect of neurological outcome, postoperative stability and early rehabilitation. Goal of treatment is to stabilize the spine and decompress when necessary, in order to maintain the minimal environment for recovery.

Methods: Patients with cervical spine injuries were admitted during November 2017-November 2019. All cases were evaluated for their clinical features. During initial phase, patients were analyzed on the basis of level and degree of neurological injury as per ASIA Scale(American Spinal Injury Association). All patients were initially managed with a Philadelphia collar. Injection Methylprednesolone Succinate was given if the patients has presented within 8 hrs of injury. Appropriated X-Ray, CT scan, MRI was taken and skull traction was applied. The patients were following up monthly for three months, thereafter at 3 months interval.

Results: 20 cases of sub axial cervical spine injuries were taken during year 2017-2019. Age of patients were from 18-60 yrs with a mean age of 39 years. Out of these 15(75%) male and 5(25%) were female. Common Mode of injury was Road traffic accident. Post operative follow up showed good clinical and radiological outcome, bony fusion and favour early rehabilitation.

Conclusion: Anterior decompression, fusion and titanium plate fixation is an effective method with good neurological outcome.

Keywords: Cervical spine injury, Anterior cervical decompression.

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Introduction

Spinal cord injury was first reported more than 5000 years ago in the Edwin Surgical Papyrus [1]. This was described as ailment that should not be treated because of poor prognosis. By the mid-twentieth century, the type of injury began to change from direct blow to high energy forces to ligaments & bony injuries. This etiological changes result in change in treatment pattern. This change in etiology resulted in a change in treatment focus. Early reports of cervical arthrodesis were published by Cloward, Smith and Robertson and others, and involved non instrumented cervical spine arthrodesis with a high nonunion rate. [2,3]. Bohler in 1967 first reported use of anterior cervical plate and screw fixation in a patient with cervical spinal trauma [4]. Initially anterior cervical instrumentation was used in cervical trauma, but now indications for its use have been expanded to degenerative cases, tumors and infections. Now there has been a progressive increase in the number of surgeries with anterior cervical arthrodesis and plating.

Cervical injuries are one of the common causes of serious morbidity & mortality following trauma. Percentage of trauma patients have spinal injuries of which 50% are associated with cervical spine injury. Early recognition, immobilization, preservation of spinal cord function and stabilization are the key to successful management. In severe compression fracture or instability or burst fracture anterior cervical plating can be used for anterior column support. The plate functions as a tension band in extension and as a buttress plate in flexion. Advantage of Anterior cervical fusion with plate fixation are-(i) immediate stability to affected area (ii) reduces risk of graft extrusion (iii) avoids need for extended post operative external immobilization (iv) significantly shortens the rehabilitation period. Unstable cervical spine injuries with neurological deficit require open

reduction stabilization and inter body fusion.

Material & Method

This is a prospective study of 20 patients with sub-axial cervical spine injury who underwent surgery at SCB Medical College and Hospital, Cuttack from November 2017 to November 2019. All patients presenting with Subaxial cervical spine injury with indication for surgical management decided by SLIC (Subaxial spine injury classification) score were included in the study. The study was conducted with clearance from the institutional Ethics Committee. Informed consent was obtained from all the patients. Inclusion criteria were All subaxial cervical spine injuries including fracture, spondylosis and disc prolapsed with anterior vertebral body fracture or compressive elements like traumatic disc. Age was more than 18 years and less than 60 years included. Exclusion criteria were C1-2 injury, posterior column injury, Associated injury of limbs, Risk of Anesthesia, Other Co morbid conditions. X-ray, CT scan MRI was done and skull traction was applied to all patients. Patients were managed with a Philadelphia collar. Neurological status was evaluated. Injection Methylprednesolone Succinate was given if patient has presented within 8 hrs of injury.

Cervical spine were classified according to Allen Ferguson criteria. Through transverse incision the spine were exposed. A thin needle doubly bent at 90 degree was placed in the intended disc space and level was verified through C-arm image intensifier. End plates of adjacent vertebral bodies was scooped out and space for graft was prepared. For corpectomy the body of the vertebrae including cortices was removed using speed burr.

A tricortical graft was harvested from the iliac crest, fashioned to a wedge such to maintain the cervical lordosis. Lateral

radiograph was taken to check the position of graft. The plate was placed, anterior cortex was drilled with 2.7mm drill bit, locking screws of 14-16mm were used to fix the plate. After completion of the procedure the position of the plate was checked under C –arm. The wound was closed in layers over suction drain and the neck was immobilized in a Philadelphia collar.

Postoperative periodic neurological evaluation were done. Physiotherapy in the form of active/passive mobilizing was taught. The patients were following up monthly for three months, thereafter at 3 months interval. The final result was analyzed on the basis of ASIA Scale, Bone fusion, stability assessment and pain.

Result

Cervical spine fractures are the most common fractures of spine and most often associated with underlying spinal cord injury. From March 2005 to May 2007, this study included 20 patients; out of these 15 were males, and 5 females. Their ages ranged from 18–60 years. (Table-1) with mean age of 39 years. In this study, common mode of injury was road traffic accident (50%). Other mode of injuries are Fall from Height (30%), fall with weight on back (20%) (Table-2). The most common site of injury was C5–6 Subluxation. Other site of injuries are C5-6 Subluxation with disc prolapsed, Traumatic Disc prolapsed, C 6-7 Subluxation.(table-3) Type of injuries

presented as Distractive flexion, compression flexion, Vertical compression, Traumatic disc bulge, (Table-4). Out of 20 patients, 1 patient presented as complete spinal cord injury with G0/5 motor power in lower limbs (Grade A). 1 patient has Grade B, 3 patients have Grade C, 10 patients have Grade D, 5 patients have Grade E (Table-5) according to Frankels Grade. Frankels Grade based on motor and sensory function.

Grade A- Absent motor and Sensory function

Grade B- Sensation Present but motor absent

Grade C-Sensation present, motor active but not useful (grade< 3/5)

Grade D- Sensation present, motor active and useful (grade> 3/5)

Grade E- Normal motor and sensory function

Time of presentation following injury with 24 hrs. are 12 cases, 1 day-1 week-6 cases, 1 week-1 month-2 cases are present. Out of 20 cases 2 patients were dead and pressure sore developed in 2 cases.

The presenting neurological status, post operative neurological outcome and complications were recorded. We used Frankels Grading system to evaluate the neurological status and pain before and after the operation.

Table 1: Age distribution of patients

Age in Yrs.	No of Patients	Percentage
18-20	2	10
21-30	4	20
31-40	6	30
41-50	5	25
51-60	3	15

Table 2: Mode of injury

Mode of Injury	Patients	Percentage
Road Traffic Accident	10	50
Fall From Height	6	30
Fall With Weight on Back	4	20

Table 3: Types of lesion

Type of Lesion	Patients
C6-7 Subluxation	2
C 5-6 Subluxation	7
C 5-6 Subluxation with Disc Prolapse	5
C 5-6 Traumatic Disc Prolapse	3
C 4-5 Traumatic Disc Prolapse	2
C 4-5 Subluxation	6

The Presenting Neurological Status, Post Operative Neurological Outcome And Complications Were Recorded. We Used Frankels Grading System To Evaluate The Neurological Status And Pain Before And After The Operation.

Table 4: Post Operative Frankel Grade

Pre-Operative	Post Operative					Total
	A	B	C	D	E	
Grade-A=1	1	-	-	-	-	1
Grade-B=1	-	1	-	-	-	1
Grade-C=3	-	-	-	2	1	3
Grade-D=10	-	-	-	1	9	10
Grade-E=5	-	-	-	-	5	5
Total-20	1	1	-	3	15	20

Table 5: Mechanism of injury

Type	No of Patients
Compressive Flexion	3
Distractive Flexion	12
Vertical Compression	2
Traumatic Disc Bulge	3

Table 6: Preoperative neurological deficit (frankles grade)

Grade	No of Patient
A	1
B	1
C	3
D	10
E	5



Figure 1: Pre-Operative X-Rays And MRI



Figure 2: Post Operative X-Rays



Figure 3: Follow-Up X-Rays After 12 Months

The mean duration for fusion was 22weeks.

Complication

(1) Neurological complications: 2 (10%) patients deteriorated postoperation of Grade A and died after 3 days of operation. 2 patients of Grade C developed Pressure sore 5 days after operation

Variables	Mean±SD
Blood Loss MI	425.7±85.6 MI
Operative Time	65.2 ±15.2 Min
Operative Data	

Discussion

Subaxial cervical spine, spondylolistheses and dislocations represent a common injury pattern in active age group. Decision making regarding reduction and surgical approach is still controversial. The principal goal of treatment of cervical spine fractures and dislocations are stabilization of vertebrae, decompression of neurological elements and facilitation of rehabilitation. The selection of an appropriate surgical approach depends on type of fracture, age of patient and experience of surgeon. Ideally approach should be least invasive. Anterior cervical approach is relatively atraumatic compared with posterior approach. Anterior approach avoids the risk of prone positioning in a traumatized cervical spine, and allows direct anterior decompression at the site of injury. [4–7]

This can be achieved by anterior, posterior or a combined approach. Progressive kyphotic deformity,

Deterioration of the neurological deficit and also related complications remains a significant concern. Regardless of the treatment modality, any delay in treatment can leave the patient with lifelong morbidity and some time may lead to acute mortality. Timely surgical treatment can decompress the cord and may lead to neurological improvement. This improvement in neurology, sometime by a single grade, can save patient from lifelong disability [8].

Anterior cervical decompression, bone grafting and instrumentation were used in our patients. Cervical spine injury is most frequently a problems of the young adult males with a male predominance [9]. Motor vehicle accidents are the main cause of cervical spine injury

Aebi et al [10] concluded that the operative technique of bone grafting and plating of cervical spine trauma was relatively straight forward, safe and effective for anterior and predominantly posterior lesions. Casper et al [11] also emphasized about the technique of anterior bone grafting and plating as reliable for anterior and posterior lesions of cervical spine. According to Goffin et al [12] after cervical fusion and anterior plating for fractures and fracture dislocations of the cervical spine follow up results of 5-9 years are very good. Some Others describing anterior plate fixation as a useful technique in the majority of patients with cervical injury [13,14]. According biomechanical data, posterior fixation has more efficacy but, clinical results of anterior inter-body fusion and plate fixation have been quite satisfactory. In our study, we found anterior approach easy with early stabilization, rehabilitation and subsequent fusion

Regarding timing of surgery, a multicentre prospective cohort study, concludes that Decompression prior to 24 hours after SCI can be performed safely and is associated with improved neurologic outcome, defined as at least a 2 grade Frenkles Grade improvement at 6 months follow-up [15]. Recently there are more evidences to support early surgery for spinal cord injury and its feasibility in tertiary care institutes is well demonstrated. In our study, 6 patients were operated within 72 hours of admission and three patient showed improvement in Frenkles grade during discharge. But there is no significant difference in outcome among patients operated within 72 hours and those who operated more than 72 hours ($p>0.05$). But due to the small sample size and short follow up period, authors cannot comment

on the usefulness of early surgical management improving the outcome in terms of neurological status. [16]

Pre-operative neurological status has vital role for improvement of patients in post operative period. It influence the improvement of grading of frankles grading. Those patients who succumbed due to the injury belonged to poorer Frankles grading. Postoperative improvement in neurological status was significantly better in patients presenting with better preoperative ASIA score. In our study two patients succumbed due to very poor grading; Grade-A, Grade-B.

Conclusion

The goal of surgical intervention for subaxial cervical spine injuries is stabilization, restoration of spinal anatomy, decompression of neural elements, there by facilitating neurologic recovery and early rehabilitation.

Majority of sub-axial cervical spine fractures can be treated effectively with good outcome through anterior approach. Gradual axial skull traction is an easy and safe method for reduction of cervical fracture dislocations.

This study achieved good functional outcome following anterior cervical decompression, stabilization with locked plate & screw system and fusion using iliac tricortical bone graft.

Reference

1. Garfin SR, Blair B, Eismont FJ. Thoracic and upper lumbar spine injuries. In: Browner BD, Jupiter JB, Levine AM, Traflon PG, eds. *Skeletal trauma: Fracture, Dislocations, ligamentous injuries*, 2nd ed. Philadelphia: WB Saunders, 1998;p.947–1034.
2. Cloward R. Treatment of acute fractures and fracture dislocations of the cervical spine by vertebral body fusion. A report of 11 cases. *J Neurosurg* 1961;18:201–9.
3. Robinson R, Smith G. Anterolateral cervical disk removing and interbody fusion for cervical disk syndrome. *Bull Johns Hopkins Hosp* 1955; 96:223–4.
4. Bose B. Anterior cervical instrumentation enhances fusion rates in multilevel reconstruction in smokers. *J Spinal Disord* 2001;14:3–9.
5. Grubb MR, Currier BL, Shih, SJ, Bonin V, Grabowski, JJ, Chao, EY. Biomechanical evaluation of anterior cervical plating stabilization. *Spine* 1998;23:886–92.
6. Caspar W, Pitzen T. Anterior cervical fusion and trapezoidal plate stabilization for redo surgery. *Surg Neurol* 1999; 52:345–51.
7. Cabanela ME, E bersold MJ. Anterior plate stabilization for burstng tear drops fractures of cervical spine. *Spine* 1988;13:888–91.
8. 8.Koller H, Reynolds J, Zenner J, Forstner R, Hempfing A, Maislinger I, et al. Mid to long term outcome of instrumented anterior cervical fusion for subaxial injuries. *Eur Spine J.* 2009; 18:630-53.
9. Stillerman CB, Roy RS, Weiss MH, Cervical spine injuries: Diagnosis and Management. In: *Neurosurgery*, Wilkins RH, Rangachary SS. Editors Vol-II, 2nd ed. New York: McGraw-Hill, 1995: p.2875–904.
10. Aebi M, Zuber K, Marchesi D. Treatment of cervical spine injuries with anterior plating. *Spine* 1991; 16: S38–S45.
11. Caspar W, Barbier DD, Klara PM. Anterior cervical fusion and casper plate stabilization for cervical trauma. *Neurosurgery* 1989;25: 491–502.
12. Goffin J, van Loon J, Van Calenbergh F, Plets C. Long term results alter anterior cervical fusion and osteosynthetic stabilization for fractures and/or dislocation of the cervical spine. *J Spinal Disord* 1995; 8: 500–8.
13. Garvey TA, Eismont FJ, Roberti LJ. Anterior decompression, structural

- bone grafting and caspar plate stabilization for unstable cervical spine fractures and/or dislocations. *Spine* 1992;17:5431–5.
14. Ripa DR, Kowall MG, Meyer PR Jr, Rusin JJ. Series of ninety two traumatic cervical spine injuries stabilized with anterior ASIF plate fusion technique. *Spine* 1991;16:S46–S55.
15. Fehlings MG, Vaccaro A, Wilson JR, Singh AW, Cadotte D, Harrop JS, et al. Early versus Delayed Decompression for Traumatic Cervical Spinal Cord Injury: Results of the Surgical Timing in Acute Spinal Cord Injury Study (STASCIS). *PLoS ONE*. 2012;7(2):e32037.
16. Balde A. K., S D., C K. K. B., K, B. A., M B. T., F H., M S. D., & A M. Alteration Perimetriq-ues Glaucomateuses Au Depistage: Experience Du Cades/O Donka De Conakry. *Journal of Medical Research and Health Sciences*, 2022;5(9): 2210–2220.