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# SUB-AXIAL CERVICAL SPINE INJURY: MANAGEMENT AND DECISION MAKING

Neurosurgery

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## ABSTRACT

**Background:** Patients with post traumatic quadriplegic in whom there is no possibility of neurological recovery and in patients with incomplete injury with grade 1 power in upper extremity and grade 0 in lower extremity presented after golden hours of injury can be managed with anterior decompression and fusion. Posterior stabilisation is reserved for those patients who showed signs of neurological recovery post procedure.

**Materials and Methods:** Forty four patients with subaxial spine injury were treated and followed in a prospective study conducted in a single institution over a period of three years. Study included 39 (88.63%) male and 5 (11.36%) female patients between the age group of 22-65 years with 32 (72.27%) patients met with RTA and 12 (27.27%) history of fall. Out of 44 patients 37 (84.09%) patients had complete SCI and 7 (15.90%) had incomplete SCI with grade 1 power in upper extremity and grade 0 in lower extremity. All patients had three column disruption with 33(75%) had single level and 10(22.72%) had two level vertebral body fracture. 1 (2.27%) patient had disc prolapse with no fracture.

**Results:** In our study all patients underwent anterior cervical decompression and fusion. Out of forty four patients thirty three(75%) underwent single level corpectomy and cervical spine locking (CSLP), ten(22.72%) patients were treated with two level corpectomy and CSLP and one(2.27%) patient with micro discectomy with CSLP. Alignment was achieved in all patients and the same was confirmed with intra-oprerative imaging and also on post op day one and before discharge with X- ray C-spine. Follow up MRI was taken after three months and none of the patient showed any kind of cage/graft dislodgement, screw pull out and mal-alignment and also no clinical evidence of instability. Three patients were continued to on ventilator and succumbed due to respiratory distress. None of the patient showed clinical signs of neurological recovery and hence posterior stabilisation not done.

**Conclusion:** Even though global fusion is recommended for three column disruption, when the patients presents with above conditions, patients can be managed with ACDF alone. Posterior fixation can be reserved if patient shows signs of neurological improvement.

## KEYWORDS

Post traumatic subaxial cervical spine injury, quadriplegic, decision making, global fusion vs. ACDF.

### Introduction

A cervical spine injury occurs in 2%–3% of all blunt trauma victims.1 Injuries may range from minor ligament strains to complete fracture-dislocations resulting in severe spinal cord injury (SCI). Approximately two-third of all fractures, and three-fourth of all dislocations involve the subaxial cervical spine.2 The sixth and seventh cervical vertebra together account for 39% of all cervical spine fractures.

The most common causes of cervical spine injury are motor vehicular accidents (41%), falls (27%), violence (15%), sports-related injuries (8%), and fall of a heavy object on head.3,4 A SCI is seen in 1.3% of all blunt trauma victims.5,6 The C5–C7 region contributes to 60% of all SCI in patients with cervical spine trauma.

The Stellerman's algorithm(7) uses the anterior approach for decompression, reduction, and fixation of cervical spine injuries with facetal dislocation. If on table reduction was not able achieve due to locked facets, posterior facetectomy with global fixation is advised. In cases with retrolisthesis and translation rotational injuries associated with end plate or tear drop fractures, various authors have recommended global fixation.

In our study subaxial spine injury with complete quadriplegia and or quadriparesis patients with grade 1 motor power were approached anteriorly after reduction with skull tongs and posterior fusion reserved for those patients with more than grade 2 preop power or who recovers their motor function and/or spinal instability post procedure.

### Materials and methods

Forty four patients with post traumatic subaxial cervical spine injury between the age group of 22-65 years were included in the study over a period of three years in a single institution. 39 males and 5 female presented after a period of twenty four hours to within seven days after the injury were included in the study. Included patients presented with complete quadriplegia and /or with grade one power in upper extremity and grade zero in lower extremity. Those patients who had grade 2 or more motor power was excluded from the study. For whom we offered global fusion instead of anterior only fusion.

All patients were initially managed according to ATLS protocol in emergency ward with detailed neurological examination and subjected to ASIA grading scale system. Emergency CT cervical spine with due care was done and MRI C-spine was routinely asked for to know the morphology of vertebra, disco-ligamentous complex (DLC) and the cord status. SLIC system was used to assess the stability of spine and /or to guide for further management. All patients had three column disruptions with SLIC score more than or equal to 5 so all were subjected to surgery.

Ten patients had quadriplegia with respiratory distress, twenty seven had quadriplegia without respiratory distress and seven patients had quadriparesis with grade 1 power in upper extremity and grade 0 in lower extremity. Twenty three patients had single level vertebral body (VB) fracture, ten had two level VB fracture and one patient showed disc prolapse without VB fracture. All patients had DLC disruptions.

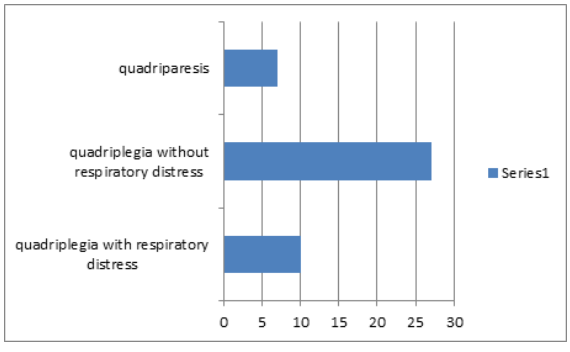


**Fig 1 Neurological status**

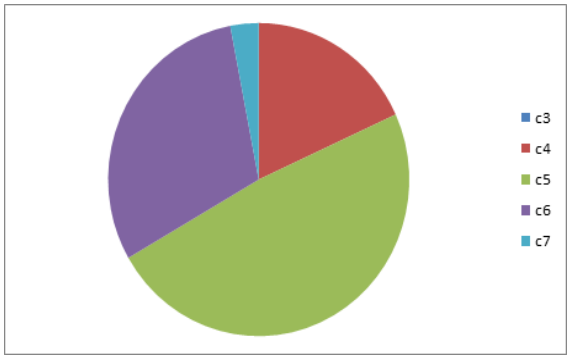


**Fig 2 Level of vertebral body fracture**

**Fig 3 Sagital T2WI images showing C3 andC4 subluxation with cord signal changes**

In our study all patients underwent anterior cervical decompression and fusion after preoperative reduction with Gardener wells traction. Of the forty four patients thirty three underwent single level corpectomy with Cervical spine locking plate (CSLP), ten were subjected to two level corpectomy and CSLP, and one patient was treated with single level discectomy and CSLP.

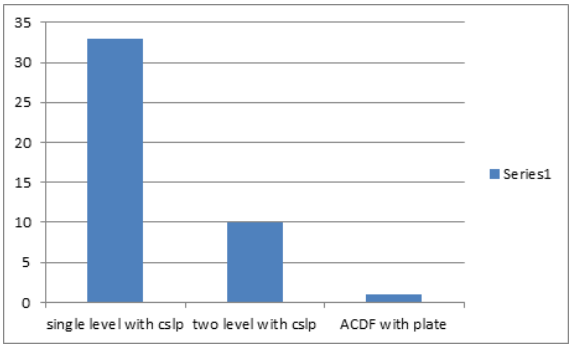


**Fig 4 Surgical procedure undertaken**

**Fig 5 Sagital T2WI showing C4 subluxation with cord contusion. C4 and C5 corpectomy and fusion with locking plate and screws.**

Corpectomy procedure was same for all patients using Anterior Sothwick and Robinson approach except for one patient in whom C6 and C7 corpectomy was done with the help of cardiothoracic surgeon for medial clavicular disarticulation to expose the T1 vertebra. Skull tongs were removed at the end of corpectomy and decompression of the cord. We used either titanium cage or iliac bone graft at the corpectomy site with good alignment was achieved in all patients and the same was confirmed with intraoperative imaging.

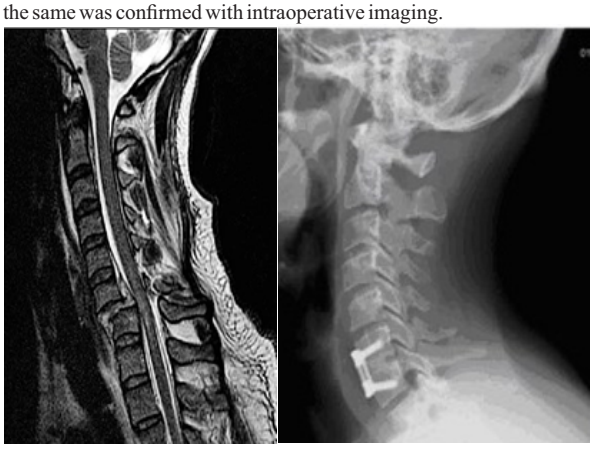

**Fig 6 Sagital T2WI showing C6-C7 post traumatic disc prolapse with sulaxation and post-op C- spine X-ray discectomy and fusion with instrumentation**

All patients were mobilised within a week and Philadelphia collar was used for 6 weeks. Passive physiotherapy was given from postop day one and frequent position change with patient made to sit with support as tolerated. Postop C- spine X-ray was taken on day one and before discharge to look for alignment. Neurological examination was done during hospital stay to assess any improvement in motor power.

Follow up detailed neurological examination and X-ray was done at 6 weeks, 3 months, and 6 months and MRI C-spine at 3 months post-surgery. Posterior lateral mass fusion was planned only if patient showed any signs of improvement in motor power and instability in spite of anterior procedure at any given point of time postoperatively.

## Results

Postoperatively patients were followed up for a minimum period of 3 months (range 3 months – 3 years) with detailed neurological examination, MRI and dynamic C- spine X-ray. Out of 44 patients 37 showed good fusion (84 .09% ) and 4 patients showed partial fusion (9.09%) at 6 months. None of the patients showed evidence of spinal instability, cage or bone graft extrusion, screw pull out or breakage of plates on dynamic X-ray.

Seven patients who were presented with quadriplegia and respiratory distress showed improvement in the form of not being dependent on ventilator. Two patients with C4 body fracture and one patient with C4-C5 fracture with quadriplegia and respiratory distress continued to be on ventilator and succumbed between 3-7 days postoperatively (6.81%).

Two out of seven patients who showed dural injury intra-operatively had CSF leak and they improved with conservative management. No reduction in graft height of studied patients. None of the patients in our study showed improvement in motor power or spinal instability postoperatively. Hence posterior lateral mass fusion was not done.

## Discussion

The diagnosis of spinal injury often delayed because of the lack of obvious deformity on physical or radio graphical examination. Concomitant severe head, chest, abdominal injuries and inebriated patients makes the early diagnosis and treatment of cervical spine injury difficult.

Vacarro *et al*. formulated a sub axial cervical spine injury classification system [SLIC] in which SLIC score 5 or >5 needs operative management. The goals of subaxial cervical spine injury includes reduction of the deformity and early rehabilitation. The choice of treatment modality is based on the anatomy of the fractures and the experience of the surgeon. [8]

Cervical plating was widely used for stabilisation of sub axial cervical spine injuries. The plate functions as a tension band in extension and as a buttress plate in flexion. After corpectomy for decompression of the spinal canal, the area is filled with a strut graft or a cage, and a plate is used as a load-sharing mechanism. [8-13].

Timing of surgical intervention is most crucial in spinal cord injury in terms of recovery in neurologically intact patients. Despite immense and on-going research efforts related to spinal cord injury treatment, neurological recovery and overall outcome remains poor. Research using models has provided evidence that early decompression surgery can lead to improved neurological recovery [14-16]. Progression of neurological recovery was more in patients who underwent early surgical intervention. Hence early surgical intervention still offers hope. [14, 17-19].

In selection of approaches to subaxial cervical spine injuries, the anterior approach directly addresses the injured elements and make easier to proceed with decompression, reduction, grafting and stabilisation. [8,11] In Case of old neglected subaxial cervical spine injuries, combined approach is preferable because of direct approach to posteriorly locked facets and to remove the excess fibrous tissues around the fracture elements. Studies also support for global fusion for neglected bifacetal subaxial cervical spine injuries [20-22].

Posterior fixation provides a more rigid fixation compared to anterior stabilization; however, the rigidity provided by anterior fixation is significantly higher than in an intact motion segment. (23) The anterior approach in addition provides direct access to the cord and the compressive elements and has a lower incidence of post-surgical kyphosis. (24)

Global stabilization was advocated in patients with retrolisthesis, facet dislocation, and shear injuries. (25) More recently, global fusion has been recommended in translation rotational injuries associated with end-plate fractures and burst or tear drop fractures; (23,26) however good fusion rates (85-90%) have been achieved following anterior fusion and fixation in flexion, distraction, and translation rotational injuries. (23,27)

Hence we preferred ACDF because 1. Adequate decompression could be achived along with stabilisation of two columns. . 2. As the power is poor there is a less chance of implant dislodgement or screws pull out. 3. We must and will plan posterior fusion if patient improves neurologically.

Fusion rates of 90-100% in a single-level corpectomy fusions and 70-100% in two-level corpectomy fusions have been reported by Cheng et al. (28) Johanson et al. (26) reported mechanical failure in two thirds of cases with end-plate fracture associated with facet fracture, subluxations, or dislocations. Epstein et al. have reported 97% fusion rates with compression plates which minimizes graft shielding and facilitates graft compression.18 In our study complete fusion rate was 84.09% and partial fusion rate was 9.09%which was similar to previous reported literature. We used compression plates for all patients.

As in most studies, the neurological outcome (29,31) was largely determined by the neurological grade in which the patient presented. Manson et al. reported no neurological improvement was noted in patients who were completely paraplegic for more than 48 h after injury. (30) In our study none of the patient had neurological recovery. One of the limitation of our study was lack of comparison with the other technique and also a small sample size.

## Conclusion

In post-traumatic sub axial spine injury with three column disruption with quadriplegia and if they present after 24 hours of injury only anterior stabilization is sufficient. Posterior stabilisation could be done only if patient shows signs of neurological improvement. Global fusion is not mandatory for the patients who present with zero power and after golden hour, even in patients with three column disruption.

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