

## ANTERIOR DECOMPRESSION, FUSION AND PLATING IN CERVICAL SPINE INJURY: OUR EARLY EXPERIENCE

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**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. The Descriptive case series study was conducted at Department of Neurosurgery, Liaquat University Hospital, Jamshoro, Sindh Pakistan during year 2005 to 2007.

**Methods:** Patients with cervical spine injuries were admitted during study period were included in this study. All cases were evaluated for their clinical features. During initial phase, level and degree of neurological injury was assessed using ASIA impairment scale. Cervical traction was applied to all patients. Operative and post operative record with x-rays and MRI were maintained. Patients with Injury to C3–6 underwent decompression, fusion and local titanium plate implant fixation by anterior approach. The follow-up ranged from 6 to 12 months with clinical and radiological assessment.

**Results:** 37 cases of sub axial cervical spine injuries included in this study during year 2005 to 2007. Out of these, 28 (75.67%) were males and 9 (24.32%) females. Age range was 8–60 years mean (32–40%). Common mode of injury was fall. Post operative follow up showed good clinical and radiological outcome, bony fusion and favour early rehabilitation. No immediate complication found except temporary dysphagia. **Conclusion:** Anterior decompression, fusion and titanium plate fixation is an effective method with good neurological and radiological outcome.

**Keywords:** Cervical spine injury, anterior cervical decompression

### INTRODUCTION

Spinal cord injury was first reported more than 5000 years ago in the Edwin Surgical Papyrus.<sup>1</sup> This was described as ailment that should not be treated because of poor prognosis. By the mid-twentieth century, the mechanism of injury began to change from direct blow and sword induced trauma (penetrating) to high energy, indirect forces (ligaments & bony injuries). This change in aetiology resulted in a change in treatment focus. Early spinal arthrodesis were performed as stand-alone structural grafts and required prolonged bed rest or cast immobilization. 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.<sup>2,3</sup> Bohler in 1967 first reported use of anterior cervical plate and screw fixation in a patient with cervical spinal trauma.<sup>4</sup> Although anterior cervical instrumentation was initially used in cervical trauma, indications for its use have been expanded over time to degenerative cases, tumours and infections. Hence, there has been a progressive increase in the number of surgeries with anterior cervical arthrodesis and plating.

Anterior cervical plating may be used for anterior column support to patients with severe compression fracture or instability or burst fracture. The plate functions as a tension band in extension and as a buttress plate in flexion. Anterior cervical fusion with plate fixation provides immediate stability to affected area, reduces risk of graft extrusion, avoids need for extended post operative external immobilization and significantly shortens the rehabilitation period.<sup>5</sup>

### MATERIAL AND METHODS

This study includes the patients of cervical spine injury admitted during the year 2005 to 2007, with an average follow up period of 1 year. Inclusion criteria were sub axial cervical spine injury with anterior vertebral body fracture or compressive element like traumatic disc. Exclusion criteria were C1–2 injury, posterior column injury, cord contusions without bony injury, and patients with severe respiratory compromise. During the initial phase, level and degree of neurological injury was assessed using ASIA impairment Scale. Operative and postoperative record with X-Ray and MRI, were maintained. Radiographic assessment was performed preoperatively, immediately after surgery and 6 months post-operatively. Patients with Sub axial cervical spine injury underwent fusion and instrumentation through anterior approach. Titanium plate was used. We evaluated the neurological outcome and radiological stability after anterior fusion and instrumentation in cervical spine injury.

### RESULTS

From March 2005 to May 2007, this study included 37 patients; out of these 28 were males, and 9 females. Their ages ranged from 08–60 years. (Table-1). In this study, common mode of injury was fall. (Figure-1). The most common site of injury was C5–6 & 7 (Figure 2a & 2b) presented as compression fracture, burst fractures, sub-luxation and flexion distraction injuries (Table-1). Out of 37 patients, 25 patients presented as complete spinal cord injury with G0/5 motor power in lower limbs. Remaining 8 patients have G2/5 power, 2

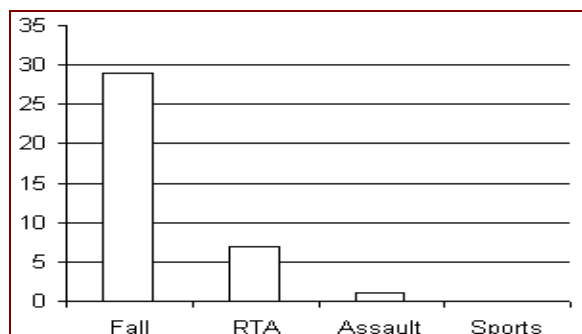
patients have power of G3/5 and 2 patients G4/5 power (Table-2). In upper limbs, most of the patients had G3 or 4 powers. All patients have severe pain at the site of injury. All patients underwent surgery with right sided anterior cervical approach, except those with injury below C5 where the left side was preferred to prevent recurrent laryngeal nerve injury. Level was identified by fluoroscope (Figure-3). Corpectomy was done. Graft was taken from iliac crest and applied between two vertebral end plates. Skeletal traction was applied to secure the head during the surgery. Finally under fluoroscopic guidance, titanium plate and screws fixed to the upper and lower vertebral body for fixation.

**Table-1: Demographics (n=37)**

	No	%
<b>Age</b>		
Upto 10 Yrs	1	2.70
11-20 Yrs	5	13.51
21-30 Yrs	15	40.54
31-40 Yrs	12	32.43
41-50 Yrs	4	10.81
<b>Sex</b>		
Male	28	75.67
Female	9	24.32
<b>Site of Injury</b>		
C2-3, (Traumatic disc)	1	2.70
C3 (Compression fracture)	1	2.70
C3-4 (Subluxation, Traumatic disc, Ankylosing spondylitis)	3	8.10
C4 (Burst fracture)	1	2.70
C4-5 (Subluxation, Traumatic disc)	3	8.10
C5 (Compression and burst fracture)	5	13.51
C5-6 (Subluxation-6 Flexion distraction)-5 Traumatic disc - 1	12	32.43
C6-7 Flexion distraction - 5 Burst -1, Subluxation - 3	9	24.32
C7 (Burst)	2	5.40

**Table-2: Neurological Deficit according to ASIA impairment scale (n=37)**

Pre-operative		Post-operative		No.	%
Upper limb	Lower limb	Upper limb	Lower limb		
Grade 4/5	Grade 4/5	Grade 5/5	Grade 5/5	2	5.40
Grade 3/5	Grade 3/5	Grade 5/5	Grade 5/5	2	5.40
Grade 2/5	Grade 2/5	Grade 3/5	Grade 3/5	8	21.62
Grade 3/5	Grade 0/5	Grade 4/5	Grade 2/5	10	27.02
Grade 3/5	Grade 0/5	Grade 3/5	Grade 0/5	15	40.54

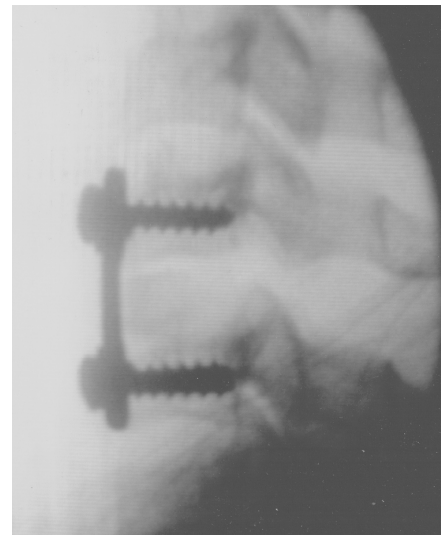


**Figure-1: Showing mode of injury**

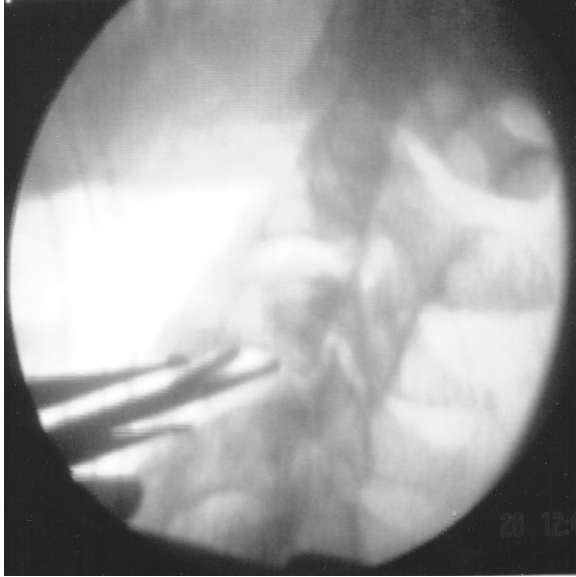
The presenting neurological status, post operative neurological outcome and complications were recorded. We used American spine injury association (ASIA) motor index to evaluate the neurological status before and after the operation. (Table-2). SPSS method was used for data analysis. There were no wound and donor side complications. Most of the patients experienced hoarseness due to retraction to trachea. One patient was deteriorated after discharge from hospital due to aspiration pneumonia. X-Ray of cervical spine were taken after surgery and served as baseline films and compare with the X-Rays at the subsequent follow-up period. There was removal of screw from the bone in one patient. No significant instability found in others at 6 months follow-up period.



**Figure-2a: X-Ray Cervical Spine lateral view of 19 years old girl showing traumatic C5-6 subluxation**



**Figure-2b: Fluoroscopic image of same patient showing fusion with bone graft and fixation with cervical plate and screws.**



**Figure-3: luoroscopic image of patient with ankylosing spondylitis showing removal of the traumatic disc.**

## DISCUSSION

The treatment of cervical spine fractures and dislocations has several goals, including reduction of deformity and stabilization, minimizing neurological injury and early 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.<sup>4-7</sup>

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.<sup>8</sup> Motor vehicle accidents are the main cause of cervical spine injury.<sup>9</sup> In our study, young population was found affected with cervical spine injury with male predominance as the worldwide studies but mode of injury was fall compared to the western countries. Traffic accidents were dominated among the childhood cervical spine injuries in comparison to our study.<sup>10</sup>

Aebi *et al*<sup>11</sup> 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*<sup>12</sup> also stressed about the technique of anterior bone grafting and plating as reliable for anterior and posterior lesions of cervical spine. Goffin *et al*<sup>13</sup> presented follow up results of 5–

9 years after cervical fusion and anterior plating for fractures and fracture dislocations of the cervical spine. Similar results have been obtained by others describing anterior plate fixation as a useful technique in the majority of patients with cervical injury.<sup>14,15</sup>

Despite biomechanical data suggesting greater efficacy of posterior fixation, 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.

Some of the earliest plate systems were made of stainless steel and were secured with unlocked bicortical screws and shown to be biomechanically superior to unicortical screws, but other studies denied this concept.<sup>16,17</sup> Several issues were raised including potential danger of spinal cord damage with posterior cortical penetration and these concerns have led to development of unicortical locking Screw plates system. We have used local made titanium plate in our study with good results during follow up period. No spinal cord injury with bicortical purchase found in our study. We found restoration of spinal alignment and adequate stabilization during our follow up period. Anterior instrumentation is highly cost effective in surgical management of patients with cervical trauma. Poor patients in our set up can not bear the burden of costly instrumentation. A variety of plating system are available in the market for virtual cervical spine fixation but the basic technique is same.

The most important technical aspect in anterior cervical plating include a suitable graft and its maximum surface contact between the vertebral bodies, selection of appropriate length plate and proper position of the screws. Any anterior osteophytes should be removed with rongeur or high speed drill to maximize bony contact with plate. Fluoroscopic image is used to assure correct placement of screws and prevent any extension of screws beyond posterior cortical wall.

The complications related to anterior cervical approach are many including injury to nerves, vessels, trachea, oesophagus, cord and complications related to implant, graft and graft site. Injury to recurrent laryngeal nerve can be protected by using long blade retractor placed under medial edges of longus colli muscles.<sup>18</sup> Hoarseness may be secondary to irritation of trachea or injury to larynx. Injury to sympathetic nerve produces Horner syndrome and it is protected by avoiding dissection laterally to transverse process.<sup>19</sup> In our study hoarseness was found in most of the patients due to retraction of trachea but no injury to sympathetic nerve found. Several vessels are also encountered

during the dissection. Carotid sheath lie posterior to sternocleidomastoid muscle and avoid placing self retaining retractors in the area of carotid sheath. It is better to perform the blunt dissection with fingers to separate muscles to reach prevertebral space. Most injuries to vertebral arteries are the result of an air drill.<sup>20</sup> In our study no vascular injury occurred. Most catastrophic complications involve injury to oesophagus and trachea. Care should be taken to avoid injury by gentle retraction and proper placement of blade retractors under medial edge of longus colli muscle. Oesophageal erosion may occur post-operatively and this can be avoided by removing anterior osteophytes and contour plate appropriately.<sup>21</sup> In our study no peroperative injury to esophagus and trachea occurred.

Paramore *et al*<sup>22</sup> reported hardware failure in 22% patients and concluded that plate length correlates with instrumentation problems. Earlier follow up of up to 6 months in our series showed only one implant failure. The true efficacy of anterior cervical decompression, fusion and plating in cervical spine injuries can be defined after long follow up and large scale study.

## CONCLUSION

The use of anterior cervical plating in cervical spine injuries enhances arthrodesis. Improved fusion rates, low complications and early rehabilitation justify the use of anterior instrumentation in cervical spine injury.

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