



## Original Article

## Results of Anterior Fixation for Subaxial Cervical Injuries in a Tertiary Care Centre

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## ABSTRACT

Sub-axial injuries of cervical spine involving posterior ligaments, articular facets and pillars are communal, and surgical treatment is debatable, and studies describe variable consequences from combined access of anterior and posterior approach or separately. **Objective:** To assess the outcome of early (<72 hours) anterior cervical discectomy and fusion with plating for injuries of the sub-axial cervical spine. **Methods:** A retrospective analysis, from January 2018 to December 2020 was conducted in a tertiary care referral center. 110 patients (67 male, 43 females; mean age 51.1 years; range 19–80 years) who endured anterior cervical discectomy (ACD) at single-level and fusion (ACDF using a polyetheretherketone, (PEEK, cage) with plate fixation for injuries of sub-axial cervical spine were evaluated. Radiological evaluation was done considering fusion, segmental height (SH), advancement of adjacent segment disease (ASD) and lordosis (Cobb Angle). Clinical results were evaluated by means of visual analogue scale (VAS) for neck pain and Frankel Grading for neurological function. **Results:** The cervical trauma was instigated by road traffic accident (RTA) in 69 cases, slip down in 16 cases and a fall from a height in 25 cases. Simple lateral cervical X-rays and CT with reconstruction were taken in all subjects and showed dislocation or subluxation of C3 to C4 in 15 patients, 39 patients with C4 to C5 dislocation, 32 patients with C5 to C6 dislocation and C6 to C7 in 24 patients. The preoperative mean Cobb angle was  $-3.9 \pm 8.01^\circ$ .  $4.1 \pm 6.6^\circ$  was the mean Cobb angle instantly later to treatment and  $1.8 \pm 4.7^\circ$  at the final visit. The operation brings a substantial decrease in the regional kyphotic angle ( $p < 0.05$ ). The SH mean before surgery was  $37.01 \pm 1.9$  mm. The SH mean was  $41.2 \pm 1.9$  mm instantly after operation and  $37.9 \pm 1.9$  mm at the final visit. The mean rise in height at the end of observation was 0.9 mm. The variance between pre-operative SH measurements and final SH was significant ( $p < 0.05$ ). An improvement of VAS from  $8.4 \pm 1.01$  to  $2.8 \pm 1.6$  at 12 months was statistically significant. There was also an improvement in 19.1% of cases for at least one Frenkel grade at 12 months follow-up. **Conclusions:** The fusion with a PEEK cage and the fixation with anterior cervical plate resulted in satisfactory clinical results and high fusion rates deprived of any morbidity at the donor-site. This procedure is effective and safe for single-level sub-axial injuries of the cervical spine.

## INTRODUCTION

The direct visualization of faceted displacements is enabled by posterior cervical approach and facilitates decompression of the neural foramina and central canal [1–4]. Drawbacks of this method comprise the increased muscle dissection, relatively longer operative time, increased blood loss, postoperative neck pain and a relatively increased jeopardy of infection at surgical site [5,6]. This method also fails to solve the problem of ventral

compression by disc herniation. On the contrary the anterior approach i.e. plate stabilization and anterior cervical discectomy and fusion (ACDF) have been extensively used for sub-axial cervical spine injuries with good clinical outcomes and high success rates. The anterior cervical approach allows the spinal canal to be decompressed by eradicating the disc, thereby preventing further neurological worsening caused by disc dislocation

[7,8]. Although autologous bone graft is measured to be the 1st line for ACDF, this technique can cause less morbidity such as chronic pain at the donation site, hematoma, infection, adjacent nerve damage, iliac crest fracture and visceral hernia [9,10]. The benefits of using a PEEK cage with plate fixation for fusion for injuries of sub-axial cervical spine were assessed.

## METHODS

This retrospective analysis was held in a tertiary care hospital for three-years' duration from January 2018 to December 2020. A total of 110 patients (67 male, 43 females; mean age 51.1 years; range 19-80 years) who endured anterior cervical discectomy at single-level and fusion (ACDF using a PEEK cage) with plate fixation for injuries of sub-axial cervical spine were evaluated. The medical records, operating notes, and clinical and radiological data from outpatient follow-up was evaluated. Medical records were assessed for clinical variables such as gender, age, level of injury, cause of injury and degree of neurological deterioration, according to the Frankel Scale at admission and at follow-up, available at the end. Patients with less than 12 months follow-up, with accompanying injuries of the anterior cervical bone, unstable fractures of the vertebra were not included as they needed either a 360 degree (posterior and anterior) access or other surgical approaches like corpectomy. Based on X-rays and computed tomography (CT), facet fracture or lateral mass was diagnosed. MRI was performed in all patients to assess contusion, ligament or disc disruption, spinal compression and epidural hematoma. All patients were managed according to ATLS and high doses of methylprednisolone were administered intravenously to all cases with acute spinal cord injury that occurred within eight-hours of the trauma. After reduction, surgical stabilization of the anterior part of the cervical bone with interbody fusion was performed. All efforts were given to deliver surgical correction as soon as possible and not later than 72 hours of the trauma. All patients had anterior (right sided) approach with standard anterior cervical discectomy and decompression. The PEEK cage was then filled with local osteophyte-derived bone chip and Demineralized Bone Matrix (DBM) and implanted into the intervertebral space. Lastly, anterior plating was done with titanium plate and screws. The correct positioning of the cage was determined with Intraoperative fluoroscopy along with the position of the cervical spine. Postoperatively, patients were kept with Philadelphia cervical collar for eight weeks. Radiographic data was assessed by a senior radiologist using upright neutral lateral and anteroposterior radiographs at 6 weeks, three, six, and twelve months after

surgery to evaluate fusion, segmental height (SH), lordosis (cobb angle) and adjacent segment disease (ASD) progression. The patient's condition was also clinically assessed at 6 weeks, three, six, and twelve months after surgery. The clinical score was judged by the visual analogue scale (VAS) for pain in neck (0 = no pain; maximum pain in 10). Neurological scoring was performed by means of the universally accepted Frankel grading. Data was entered with SPSS 21.0 and analyzed. An independent t-test was applied for analyses. Data was accessible as mean  $\pm$  standard deviation. P value <0.05 was taken significant.

## RESULTS

The registered subjects' clinical features are given in Table 1. The cervical trauma was instigated by RTA in 69 cases, slipping in 16 cases and a fall from height in 25 cases. Simple lateral cervical X-rays and CT with reconstruction were taken in all subjects and showed dislocation or subluxation of C3 to C4 in 15 patients, 39 patients have C4 to C5 dislocation, 32 patients with C5 to C6 dislocation and C6 to C7 in 24 patients. The utmost communal dislocation levels were the C4 and C5 levels.

Variables		Value (n=110)
Mean age (years)		51.1
Sex	Male	67 (61%)
	Female	43 (39%)
Level	C3-4	15 (13.6)
	C4-5	39 (35.5)
	C5-6	32 (29.1)
	C6-7	24 (21.8)
Cause of injury	RTA	69 (62.7)
	Fall from height	25 (22.7)
	Slip down	16 (14.5)

**Table 1:** Clinical features of the patients.

The mean visual analogue score (VAS) pre-operatively for pain in neck was  $8.4 \pm 1.01$ . The mean VAS for pain in neck at the 12 months' follow-up was  $2.8 \pm 1.6$ . The variance was statistically significant post-operatively in comparison to the preoperative score ( $p < 0.05$ ). The clinical results summary is presented in Table 2. One patient who was at Frankel grade B deteriorated to A while the rest with A and B grades remained unchanged. Ultimately 21 patients (19.1%) had a minimum of one Frankel grade improvement leading to a significantly high number of patients reached to the best grade (E) at 12 months (43 patients).

Frankel grade	Preoperative	At 12 Months
A	15	16
B	07	06
C	37	23
D	29	22
E	22	43

**Table 2:** Clinical Improvement on Frankel Grading

Parameters	Preoperative	Immediately postoperative	At 12 Months
Cobb's angle (°)	-3.9±8.01	4.1±6.6	1.8±4.7
SH(mm)	37.01±1.9	41.2±1.9	37.9±1.9
P-value			<0.05

**Table 3:** The radiological parameters result

All subjects showed compacted fusion at 12 months. The fusion was reached at an average of 14.9 weeks (range 9–46 weeks) after surgery. At the operation level, no one out of 110 patients had a segmental movement of greater than 2 mm. The preoperative mean Cobb angle was  $-3.9 \pm 8.01^\circ$ .  $4.1 \pm 6.6^\circ$  was the mean Cobb angle instantly later to treatment and  $1.8 \pm 4.7^\circ$  at the final visit. The operation brings a substantial decrease in the regional kyphotic angle ( $p < 0.05$ ). The SH mean before surgery was  $37.01 \pm 1.9$  mm. The SH mean was  $41.2 \pm 1.9$  mm instantly after operation and  $37.9 \pm 1.9$  mm at the final visit. The mean rise in height at the end of observation was 0.9 mm. The variance between pre-operative SH measurements and final SH was significant ( $p < 0.05$ ). Six subjects (5.5%) exhibited variability in an adjacent segment. The radiological outcomes are presented in Table 3.

## DISCUSSION

The stabilization and realignment of injury segment is the primary goal in the management of the sub-axial cervical spine [9,10]. Operative approaches to date have been efficacious in treating sub-axial injuries using combination approach of anterior or posterior or separately; though, the ideal method has yet to be determined [11]. Posterior approaches of stabilization are used with virtuous outcomes using hooks, wires, rod systems and screws. The benefits of posterior cervical access comprise direct viewing of posterior bony-ligamentous complex [13]. But this comes with shortcomings of increased dissection of muscles, longer surgery time, severe loss of blood, post-operative neck pain and a comparatively increased infection rate. Furthermore, the frequency of intervertebral disc rupture can be as high as 40% in unilateral dislocation of facet and 80% when bilaterally [14], this approach cannot solve the problem of ventral compressive disc rupture [15]. Without proper treatment, disc rupture can cause anterior collapse of the disc space

and neurological deterioration, potentially leading to kyphotic abnormality. Also, the antero-cervical method allows the spinal canal decompression by eliminating the disc, thereby preventing neural worsening due to additional disc dislocation. Most of the subjects in this analysis had posterior lateral facets or masses fractures [16,17]. The fractures of the masses of the lateral cervical joint often cause cervical spine rotational unsteadiness. These patterns of fracture frequently happen in compression-extension injuries and lead to a rupture of the intervertebral disc annulus. In this study, we constantly found severely ruptured intervertebral discs in operation, and these discoveries directed us to prefer anterior approach [18,19]. Moreover, the fixation of the anterior plate after ACDF in a cervical dislocation can deliver operative stabilization with the benefit of fusion of segment specific to a single motion. Although posterior fixation with screws drawback is fracture of posterior elements fractures, they typically require longer fusion [20,21]. However, biomechanical analysis has shown the usefulness of a posterior fixation with screw over an anterior fixation of plate in injuries of sub-axial cervical spine. Some DBM types have osteoconductive and osteo-inductive capacity. In this sense, using DBM can be a virtuous choice for fusion [22]. ACDF with a PEEK cage occupied with DBM, trailed by fixation of the anterior plate in sub-axial lesions of the cervical bone, exhibited no noteworthy alteration in satisfactory clinical outcomes and fusion rate without pain in comparison to the autologous grafts of bone [23]. The usage of a titanium cage filled with material of osteo-synthetic and the use of an autologous tricortical iliac bone graft versus an anterior plate fixation. They also found no important differences in the fusion rate and clinical results [24,25].

## CONCLUSION

The fusion with a PEEK cage and the fixation with anterior cervical plate resulted in satisfactory clinical results and high fusion rates deprived of any morbidity at the donor-site. This procedure is effective and safe for single-level sub-axial injuries of the cervical spine.

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