

## Original Article

# Functional Outcome of Anterior Surgery for Acute Sub Axial Cervical Spine Injury

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## ABSTRACT

**Introduction:** Subaxial cervical spine injuries are common following blunt trauma. Unstable cervical spine injuries are frequently managed with anterior decompression and instrumented fusion. This study aims to measure clinical and radiological outcome of anterior surgery for sub-axial cervical spine injuries done in our center.

**Methodology:** This was a retrospective analysis of the cases operated from July 2015-June 2019. Patients aged 18-80 years, presenting with subaxial cervical fractures within 7 days of injury with Sub-axial Injury Classification system (SLIC) score more than 3, managed with anterior surgery were included in the study. Outcome was evaluated at 6 months and at one year with Neck Pain Disability Index and Bridewell Interbody Fusion Grading System.

**Results:** Among 31 patients, ACDF was performed in 14 cases and ACCF in 17 patients. At final follow-up, 43.75% patients had improvement in at least one grade neurology following surgery. Among patients with complete neurological deficit, 25% had minimal disability, 35% moderate, 25% severe and 15% had very severe disability. Similarly, among patients with incomplete neurological involvement, minimal, moderate, severe and very severe disability was seen in 65%, 15%, 20% and none respectively. On average, 90.1% case had grade I fusion, 3.3 % each had grade II, grade III and grade IV fusion. 7 cases had dysphagia which relieved after few days. 1 patient had hoarseness of voice which relieved after few days. Pseudoarthrosis was seen in 1 case and graft subsidence in 2 cases.

**Conclusion:** Anterior cervical fusion for acute sub-axial cervical spine injuries gives good clinical and radiological outcome with minimal complications.

**Keywords:** Subaxial cervical spine injury, ACDF, ACCF, Neck Pain Disability Index, Bridewell Interbody Fusion Grading System

## INTRODUCTION

Cervical spine injuries occur in 2-3% of all blunt trauma.<sup>1,2</sup> Sub-axial cervical spine is more prone to injury as it is more mobile. Cervical spine injuries can be approached through anterior, posterior, or combined approaches. Anterior fixation can be done with autograft or allograft alone, stand-alone cages and with various types of plates. There is less muscle dissection and less bleeding in anterior cervical surgery compared to posterior. Anterior decompression and instrumented fusion alone have been described as an adequate form of treatment for unstable cervical spine injuries.<sup>3</sup>

This study aims to measure clinical and radiological outcome of anterior surgery for sub-axial cervical spine injuries done in our tertiary care center.

## METHODS

This was a retrospective analysis of the cases operated from

July 2015-June 2019. Patients aged 18-80 years, presenting with vertebral fracture between C3 and C7 within 7 days of injury with Sub-axial Injury Classification system (SLIC) score more than 3 were included in the study.<sup>4</sup> Patients with C1, C2 and T1 injuries, combined anterior and posterior surgery, previous spine surgery and patients presenting late (after 7 days) were excluded from the study.

Demographic data, neurology, imaging findings and follow-up records were reviewed. All patients had anterior surgery through Smith Robinsons approach. If needed, intraoperative reduction of the fracture was done. Iliac crest bone graft was harvested, and fixation was done with titanium locking plate and screws. Anterior cervical discectomy and fusion (ACDF) was done for subluxation or dislocation of sub-axial cervical spine without associated fractures while anterior cervical corpectomy and fusion (ACCF) was done for cases with burst fracture, split or tear drop fractures.

Post-operatively, Philadelphia collar was prescribed for 6 weeks, then soft collar was given for next 6 weeks. Static cervical exercises were advised, and cervical movements were started at 6 weeks. Follow up was done at 2 weeks, 6 weeks, then 3 monthly for first 6 months and then yearly

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thereafter. Outcome was evaluated at 6 months and at one year with neck pain disability index and Bridewell Interbody Fusion Grading System.<sup>5,6</sup>

## RESULTS

Thirty one patients were included in the study from registry. Mean age was 35±13.68 years (range 18-80 years). Male to female ratio was 3:1 and motor vehicle accident was the commonest mode of injury, followed by fall from height. Burst fracture was found in 17 cases, 1 in C4, 6 in C5, 4 in C6 and 6 in C7 vertebral levels. Similarly, there were 1 subluxation and 1 dislocation in C4-C5 level, 3 dislocations and 2 subluxations in C5-C6 level and 2 dislocations and 5 subluxations in C6-C7 levels. 9 patients had ASIA A neurology, 2 had ASIA B, 1 with ASIA C, 4 with ASIA D and 15 patients had intact neurology. Average time of presentation at hospital was 3.2 days (6 hours-7 days). Average time to surgery from admission was 15 hours (12 to 30 hours). ACDF was performed in 14 patients and ACCF was done in 17 patients. Average hospital stay was 20.5 days (6 -56 days). Average follow up was 14 months (12-36 months). At final follow-up, none of the patients with ASIA A neurology improved, while 1 patient with ASIA B neurology improved to ASIA C at 9 months and another patient with same grade improved to ASIA D at 11 months. Similarly, 1 patient with ASIA C neurology and all 4 patients with ASIA D neurology improved to ASIA E at 7 months and 4.5 months respectively. None of the patients with intact neurology had any deterioration. In general, 43.75% patients with impaired neurology had improvement in at least one grade following surgery.

Neck pain Disability Index was calculated at final follow up. Disability was minimal in both ACDF and ACCF subgroups in majority of the cases. Moderate disability was seen in 20 % cases of ACDF and 10% cases of ACCF while severe disability was found in 5% cases of ACDF and 20% cases of ACCF. No cases had very severe disability at final follow-up. Among patients with complete neurological deficit, 25% had minimal disability, 35% had moderate, 25% had severe and 15% had very severe disability. Similarly, among patients with incomplete neurological involvement, minimal, moderate, severe and very severe disability was seen in 65%, 15%, 20% and none respectively. Among neurologically intact patients, 80.0% had minimal disability, 13.3% had moderate and 6.7% had severe disability at final follow-up.

Bridewell interbody Fusion Grading System was measured at 6 months and 12 months. Majority of the cases in both ACDF and ACCF groups had grade I fusion at both 6 and 12 months. At 6 months follow up, among ACDF group, there were 81.49% cases with grade I fusion and 6.17% cases each with grade II, III and IV fusions. All cases with grade II and III fusion at 6 months progressed to grade I fusion at final follow-up. Similarly at 6 months follow up among ACCF cases, there were 66.7%, 13.3 % and 20% cases with grade I, II and III fusions each. 1 case of grade II fusion and 2 cases of grade III fusion progressed to grade

I fusion at final follow-up. On average including both groups, at 12 months, 90.1% case had grade I fusion, 3.3 % each had grade II, grade III and grade IV fusion.

None of the cases had any intra-operative complications. 7 cases had dysphagia which relieved after few days. 1 patient had post-operative hematoma requiring debridement. Similarly, 1 patient had hoarseness of voice which relieved after few days. Superficial infection was seen in 1 case and was managed with antibiotics. Pseudo-arthritis was seen in 1 case and graft subsidence in 2 cases.

## DISCUSSION

Anterior surgery is frequently performed for acute sub-axial cervical spine injury. We had 31 cases in our study. Mean age was 35 years (range 18-80 years) which was similar to studies by Gattozzi et al (35 years), Dhakal et al (40 years) and Shrestha et al (40 years) (Table 1).<sup>7-9</sup>

Male to female ratio in our study was 3:1 which was similar as described by Gattozzi et al (3:1) and Shrestha et al (4:1) but Dhakal et al reported a remarkably high male to female ratio of 9:1. Male predominance in all these studies can be described by higher outgoing nature of males as compared to females.

**Table 1: Epidemiology comparison with other studies.**

	Our study	Gattozzi et al.7 (2018)	Dhakal et al.8 (2019)	Shrestha et al.9 (2007)
<b>Number of patients</b>	31	36	30	149
<b>Mean age</b>	35 (18-80)	35	40	40 (6-88)
<b>M:F</b>	3:1	3:1	9:1	4:1
<b>Commonest mode of injury</b>	MVA	MVA	Fall	Fall
<b>Average hospital stays (days)</b>	20.5 (6-56)	10.6 (1-39)	NA	31 (2-50)
<b>Timing of surgery</b>	<7 days	<24 hours	3-31 days	5-25 days

Motor vehicle accident was the most common mode of cervical spine injury in our study. This is similar to study by Gattozzi et al. (2018) whereas Dhakal et al. (2019) and Shrestha et al. (2007) reported fall injury as the most common mode of injury.<sup>7,9</sup> This can be explained by the fact that motor vehicle accident forms the major bulk of our patients.

Most literatures report early surgery (<48 hours) has better outcome and only few studies describe equal or greater improvement in patients who undergo delayed surgery (>72 h after injury).<sup>10</sup> In our study, average time of presentation was 3.2 days (range: 6 hours-7 days) and average time to surgery from admission was 15 hours (12-30 hours). Dhakal et al. (2019) reported that 40% of the patients were brought within 48 hours and none of them were operated within 48 hours.<sup>8</sup> More than half (53.3%) had their surgery between 8 to 30 days, and only 30% were operated between 3 to 7 days. Similarly in a study by Shrestha et al, 62% of the patients were

brought within 24 hours and only 1/3rd were operated between 3 and 30 days. Surgical delay can be due to variability in surgical timing (due to lack of a clear definition of "early surgery"), logistical issues, delays in medical transfers or unavailability of key imaging or surgical resources.

Average hospital stay in our study was 20.5 days (range: 6-56 days). Gattozzi et al. (2018) reported average hospital stay of 10.6 days (range: 1-39 days) whereas Shrestha et al. (2007) reported average stay of 31 days (range: 2-50 days).<sup>7,9</sup>

There were 17 cases of burst fracture who underwent ACCF and 14 cases of fracture dislocation who underwent ACDF in our study. Gattozzi et al. (2018) reported 36 cases with anterior surgery among whom 20 had ACDF and 16 had ACCF (Table 2).<sup>7</sup>

**Table 2: ACDF and ACCF surgery**

	Our study (n = 31)	Gattozzi et al. <sup>7</sup> (n = 36)
<b>Burst fracture</b>	17	10
<b>Fracture dislocation</b>	14	26
<b>Complete SCI</b>	9	10
<b>Incomplete SCI</b>	7	26
<b>ACDF</b>	14	20
<b>ACCF</b>	17	16

No intra-operative complications were encountered in our study. Dysphagia was the most encountered post-operative problem. This was similar to study by Gattozzi et al. (2018). Incidence of post-operative hematoma was similar in the two studies. 1 patient had hoarseness of voice in our study whereas none had hoarseness in the study by Gattozzi et al (Table 3) (2018).<sup>7</sup>

Bridwell interbody fusion at 12 months in this study was grade I in 90% cases, grade II, III and IV in 3.3% cases each. Jain et al. (2018) reported grade I fusion in 69.56% cases, grade II in 21.73% cases and grade III in 8.69% cases respectively in subaxial spine injuries managed with 2-level anterior cervical corpectomy and fusion.<sup>11</sup>

It was a retrospective study of small sample size, done in a single center. Patients with different grades of neurology were included in the study. As clinical confounding factor, the presence of concomitant cervical degenerative disease was not assessed.

**Table 3: complications**

Complications	Our study (n = 31)	Gattozzi et al (n = 36)
<b>Intra-operative complications</b>	No	No
<b>Dysphagia</b>	7	7
<b>Post-operative hematoma</b>	1	1
<b>Hoarseness of voice</b>	1	NA
<b>Superficial infection</b>	1	2
<b>Pseudoarthrosis</b>	1	NA
<b>Graft subsidence</b>	2	NA
<b>Hardware failure</b>	No	2

## CONCLUSION

Anterior cervical fusion for acute sub-axial cervical spine injuries gives good clinical and radiological outcome with minimal complications.

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