

**Operative Management of Subaxial Cervical Spine Injury with Anterior Cervical Discectomy and Fixation: A Short Term Prospective Study**Vipin Bijlwan<sup>1</sup>, Shubham Pandit<sup>2</sup><sup>1</sup>Senior Resident, MS Orthopaedics, Department of Orthopaedics, North Bengal Medical College & Hospital, Sushrutnagar, Darjeeling, 734012<sup>2</sup>Senior Resident, MS Orthopaedics, Department of Orthopaedics, NRS medical college, Sealdah, Raja Bazar, Kolkata, West Bengal 700014

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Conflict of interest: Nil

**Abstract****Introduction:** It has been reported that the cervical spine is injured in 2.4% of blunt trauma patients. Subaxial cervical spine fractures can be the result of high-energy mechanisms such as motor vehicle accidents and falls from heights to moderate energy mechanisms such as contact and non-contact sports.**Aims:** To estimate the clinical, radiological and functional outcome of management of subaxial injury with anterior cervical discectomy and fixation**Materials and Method:** It is an institutional based prospective study was conducted in Orthopaedics department of Burdwan Medical College and Hospital. This period of study was 18 months. 15 patients were included in this study.**Result:** The distribution of mechanism of injury 66.7% of the patients had history of RTA and 33.3% had history of fall from height. The value of z is 1.8257. The value of p is .06724. The result is not significant at  $p < .05$  the various diagnosis of the fractures. Majority of the fractures were C5-C6 Subluxation (26.7%) followed by C3-C4 Subluxation (13.3%), C4 Compression (13.3%), C4-C5 Compression (13.3%), C5 Compression (13.3%), C6 Compression (13.3%) and C7-C7 Subluxation (6.7%). The value of z is 1.4697.**Conclusion:** In conclusion, anterior cervical discectomy and fixation has proven to be an effective method for the operative management of subaxial cervical spine injuries in the short term. This approach not only provides reliable stabilization but also facilitates neural decompression and promotes fusion. The study demonstrates favourable outcomes in terms of pain relief, functional recovery, and minimal complications. However, long-term follow-up is essential to assess the durability of these results and to evaluate any potential risks of hardware failure or adjacent segment disease. Overall, this technique remains a valuable option in the surgical treatment of subaxial cervical spine trauma.**Keywords:** Subaxial Cervical Spine Injury, Anterior Cervical Discectomy, Cervical Spine Fixation And Spinal Cord Injury.

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**Introduction**

It has been reported that the cervical spine is injured in 2.4% of blunt trauma patients. Subaxial cervical spine fractures can be the result of high-energy mechanisms such as motor vehicle accidents and falls from heights to moderate energy mechanisms such as contact and non-contact sports. [1] Cervical spine injuries due to athletic activity most commonly occur in athletes under the age of 30. They can even occur in lower energy mechanisms such as ground-level falls. Very low energy mechanisms can present in the patient population with ankylosis spondylitis (AS) the cervical spine is vulnerable to injury due to the vast amount of motion allowed in this region of the spine. The different mechanisms of injury lead to

both different fracture patterns as well as various ligamentous injuries. Vertebral body fractures can take many forms. An antero-inferior teardrop fracture can result from a flexion compression mechanism. [2] This injury often occurs with the failure of the posterior tension band. An extension teardrop fracture represents an avulsion injury from an extension mechanism and inherently is stable compared to a flexion teardrop. Compression and burst fractures of the cervical spine occur with an axial load applied to the cervical spine in neutral alignment. The load is transmitted through the disc to the vertebral body, which then fails. Injuries to the subaxial cervical spine can be bony, soft tissue, or a combination of the two.[3] The potential

catastrophic events associated with subaxial cervical spine trauma, includes tetraplegia and severe permanent disability. Many classification schemes have been developed to guide clinical and surgical treatment of subaxial cervical spine trauma. Many of these systems represent milestones in the understanding of cervical trauma including the Holdsworth classification, the first comprehensive system for spinal column injuries. [4] Subsequent schemes like by Allen and Ferguson, in 1982, and its modified version proposed by Harris et al. in 1986, were also important advancements.[5,6] However, despite the comprehensive nature of these systems, their ultimate use has been limited because they are based on a presumed mechanism of injury based on plain radiographs without consideration of the supporting ligaments to maintain spine stability or the patient's neurological status. To estimate the clinical, radiological and functional outcome of management of subaxial injury with anterior cervical discectomy and fixation.

### Materials and Methods

**Study area:** Department of Orthopaedics and Radio diagnosis of Burdwan Medical College & Hospital

**Study population:** Patients attending OPD and emergency department of Burdwan Medical College & Hospital with traumatic subaxial cervical spine in the stipulated time periods

#### Inclusion criteria:

1. Age: 18 yrs - 75 yrs
2. Sex: both sexes.
3. Patients willing to give informed consent.
4. All subaxial cervical spine injuries including traumatic disc prolapses with more than one column involvement are included in this study.

Subaxial cervical injury is to be classified as per subaxial cervical spine injury classification (SLIC) system.

#### Exclusion criteria:

1. Non-traumatic cause of cervical spine fracture such as Pott's disease, Rheumatoid arthritis etc.
2. Other co-morbidities prohibiting surgery.
3. Severely osteoporotic patient.

#### Study period:

Total duration of study is 18 months (from April 2021 to September 2022). First 15 months for data

entry, procedures and follow up. And last 3 months for data analysis.

**Sample size:** From the hospital data records they have found that total number of patients of traumatic cervical spine in Burdwan medical college and hospital in previous years who underwent fixation were 20. Approximately 10-15% was removed after application of inclusion and exclusion criteria. They expect another 10% will not give valid consent. So total 25% was excluded study. So tentative sample size of this study were 15.

**Study design:** It is an institutional based prospective study.

#### Plan for analysis of data:

All the cases undergoing the procedure and included in the study was evaluated using proforma. Socio- demographic profile of the patients, type of fracture, intraoperative observation, postoperative clinical and radiographic findings, including Neurological recovery as per ASIA scale, bone fusion, stability assessment, and pain was recorded. The patients were asked to come for follow up at 4th week then at 6th week thereafter every 3 month. The contact details like postal address and personal mobile number was taken to ensure that no patient is lost in follow up. Patient was considered as lost for follow up if evaluation cannot be done on. Data was collected, tabulated and analysis by standard statistical methods.

#### Statistical Analysis:

For statistical analysis data were entered into a Microsoft excel spread sheet and then analysed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and Graph Pad Prism version 5. Data had been summarized as mean and standard deviation for numerical variables and count and percentages for categorical variables. Z-test (Standard Normal Deviate) was used to test the significant difference of proportions.

Once a t value is determined, a p-value can be found using a table of values from Student's t-distribution. If the calculated p-value is below the threshold chosen for statistical significance (usually the 0.10, the 0.05, or 0.01 level), then the null hypothesis is rejected in favour of the alternative hypothesis. P-value  $\leq$  0.05 was considered for statistically significant.

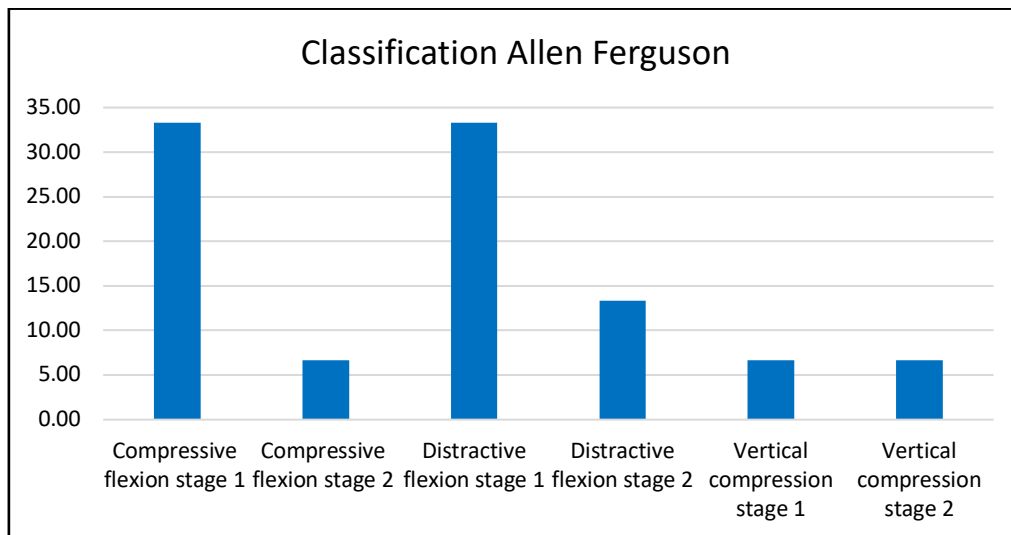
#### Result

**Table 1: Distribution of Mechanism of injury, Diagnosis**

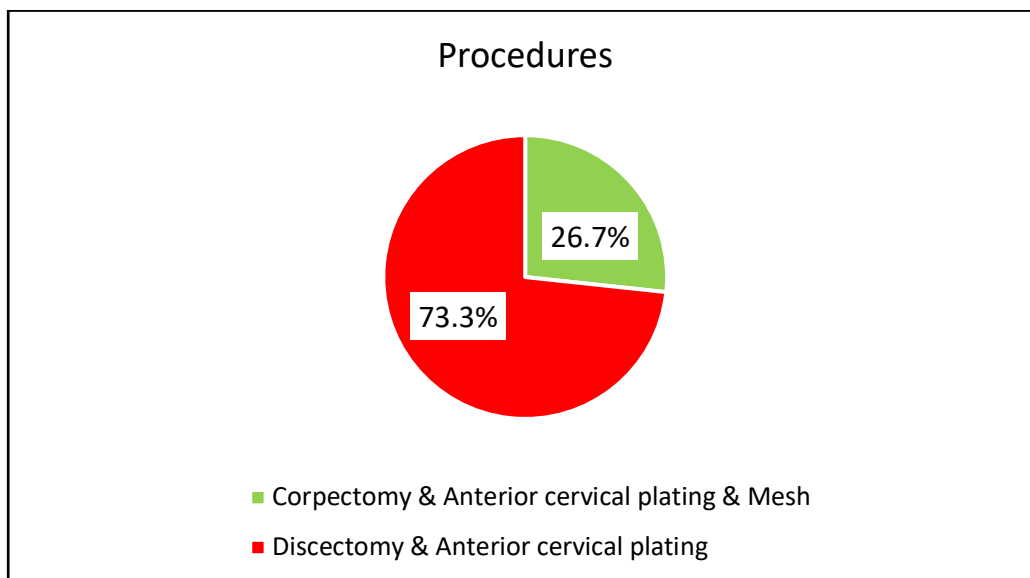
	Parameter	N	%
Mechanism of injury	Fall from height	5	33.3
	RTA	10	66.7
Diagnosis	C3-C4 Subluxation	2	13.3
	C4 Compression	2	13.3
	C4-C5 Compression	2	13.3
	C5 Compression	2	13.3
	C5-C6 Subluxation	4	26.7
	C6 Compression	2	13.3
	C6-C7 Subluxation	1	6.7

**Table 2: Distribution of AIS Grades**

AIS Grade		N	%	P value	Significance
Pre op AIS grade	B	5	33.3	0.009	Significant
	C	10	66.7		
Post op AIS grade	C	2	13.3		
	D	6	40.0		
	E	7	46.6		



**Figure 1: Distribution of Classification Allen Ferguson**



**Figure 2: Distribution of Procedures**

The distribution of mechanism of injury 66.7% of the patients had history of RTA and 33.3% had history of fall from height. The value of z is 1.8257. The value of p is .06724. The result is not significant at  $p < .05$  the various diagnosis of the fractures. Majority of the fractures were C5-C6 Subluxation (26.7%) followed by C3-C4 Subluxation (13.3%), C4 Compression (13.3%), C4-C5 Compression (13.3%), C5 Compression (13.3%), C6 Compression (13.3%) and C7-C7 Subluxation (6.7%).

The value of z is 1.4697. The value of p is .14156. The result is not significant at  $p < .05$ . The distribution of the classification by Allen Ferguson. Most of them were Compressive flexion stage 1 (33.3%) and Distractive flexion stage 1 (33.3%) followed by Distractive flexion stage 2 (13.3%), Compressive flexion stage 2 (6.7%), Vertical compression stage 1 (6.7%), Vertical compression stage 2 (6.7%). The value of z is 1.8257. The value of p is .06724. The result is not significant at  $p < .05$ . The distribution of the procedures done. Majority of the cases were treated with Discectomy & anterior cervical plating (73.3%) followed by Corpectomy & Anterior cervical plating & Mesh (26.7%). The value of z is 2.556. The value of p is .01046. The result is significant at  $p < .05$ .

The distribution of AIS Grades during the preoperative and postoperative phases. During the preoperative phase, 66.7% were grade C and 33.3% were grade B which were greatly improved to the postoperative phase with grade E, 40% grade D and 13.3% grade C. Chi square test shows that the difference in the distribution of grades between the groups was statistically significant ( $p < 0.05$ ).

### Discussion

Joaquim AF et al [7] (2011) found that retrospective clinical study of patients treated for subaxial cervical spine trauma (SCST) at a tertiary medical center. Age >12 years, presence of SCST with complete clinical and radiological (CT and MRI) data.

Premkumar TC et al [8] (2018) found that cervical instability due to trauma is usually from level c3 to c7 (i.e sub axial). all the cases are male with most of the patients are in the age group of 41-50 years. It was found that, out of 100 patients, most of the patients were 40-60 years old [10 (66.7%)] rest of. Age was statistically significant ( $p = .00288$ ) ( $Z = 2.9814$ ).

In our study, male population [12 (80.0%)] was higher than the female population [3 (20.0%)]. Male: Female ratio was 4:1. Sex was statistically significant ( $p = .001$ ) ( $Z = 3.2863$ ). It was found that, more of the patients had RTA [10 (66.7%)] and though it was not statistically significant

( $p = .06724$ ) ( $Z = 1.8257$ ). Premkumar TC et al [8] (2018) found that cervical instability due to trauma is usually from level c3 to c7 (i.e sub axial). Fall from height is the most common of injury followed by road traffic accident, C5-C6 dislocation is most common spinal injury pattern. Our study showed that, higher number of patients had C5-C6 Subluxation [4 (26.7%)] but It was not statistically significant ( $p = .14156$ ) ( $z = 1.4697$ ). It was found that, majority number of patients had Compressive flexion stage 1 and Distractive flexion stage 1 [5(33.3%)] but It was not statistically significant ( $p = .06724$ ) ( $z = 1.8257$ ).

Premkumar TC et al [8] (2018) found that cervical instability due to trauma is usually from level c3 to c7 (i.e sub axial). Four patients developed bed sores in which one case developed bed sore preoperatively and other postoperative lay. We found that, lower of the patients had Bed sore [4 (26.7%)] which was statistically significant ( $p = .01046$ ) ( $z = 2.556$ ). It was found that, higher number of patients had AIS Grade in Pre op AIS grade C [16 (80.0%)] compared to Post op AIS grade E [7 (46.6%)] but this was statistically significant ( $p = 0.009$ ).

### Conclusion

In conclusion, anterior cervical discectomy and fixation has proven to be an effective method for the operative management of subaxial cervical spine injuries in the short term. This approach not only provides reliable stabilization but also facilitates neural decompression and promotes fusion.

The study demonstrates favorable outcomes in terms of pain relief, functional recovery, and minimal complications. However, long-term follow-up is essential to assess the durability of these results and to evaluate any potential risks of hardware failure or adjacent segment disease. Overall, this technique remains a valuable option in the surgical treatment of subaxial cervical spine trauma.

### Reference

1. Feuchtbaum E, Buchowski J, Zebala L. Subaxial cervical spine trauma. *Curr Rev Musculoskelet Med.* 2016 Dec; 9(4):496-504.
2. Schroeder GD, Vaccaro AR. Cervical Spine Injuries in the Athlete. *J Am Acad Orthop Surg.* 2016 Sep; 24(9):e122-33.
3. Stauffer ES. Subaxial injuries. *Clin Orthop Relat Res.* 1989 Feb; (239):30-9.
4. Holdsworth F. Fractures, dislocations, and fracture-dislocations of the spine. *J Bone Joint Surg Am.* 1970; 52:1534-51.
5. Allen BL, Jr, Ferguson RL, Lehmann TR. A mechanistic classification of closed, indirect

- fractures and dislocations of the lower cervical spine. *Spine (Phila Pa 1976)* 1982; 7:1–27.
6. Harris JH, Edeiken-Monroe B, Kopansiky DR. A practical classification of acute cervical spine injuries. *Orthop Clin North Am.* 1986; 17:15–30.
  7. Joaquim AF, Lawrence B, Daubs M, Brodke D, Patel AA. Evaluation of the subaxial injury classification system. *Journal of Craniovertebral Junction and Spine.* 2011 Jul; 2(2):67.
  8. Premkumar TC. A study on functional outcome following surgical fixation for subaxial cervical spine injuries. *International Journal of Orthopaedics.* 2018; 4(2):590-5.