

# Surgical Results of Sub-Axial Cervical Injury in Adult Patients Treated Via Anterior Approach

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## ABSTRACT

**Objectives:** To determine the results of treatment of sub-axial cervical injury in adults using open reduction, anterior approach and injury stabilization <72 hours.

**Place and Duration:** In the Neurosurgery department of Pakistan Institute of Medical Sciences, Islamabad for one-year duration from January 2021 to December 2021.

**Methods:** 82 total patients diagnosed with history of traumatic sub-axial injury using MRI and anteroposterior and x-rays lateral and anteroposterior views were selected. ASIA Impairment Scale was applied for valuation, which was completed at admission and 6-months later.

**Results:** The patients mean age in this analysis was 39.20± 5.11 years. Conferring to the ASIA scale, 2 grades enhancement were realised in 24 cases and 54 cases have one grade improvement. Death occurred in 4 cases, 2 were linked to accompanying trauma, one was associated with the complication of the surgery, and the remaining 1 death were related to complications like aspiration. The results were good in 58 (74.5%) of 78 cases and satisfactory in 20 (25.5%).

**Conclusions:** Anterior Cervical Discectomy and Fusion (ACDF) in this study showed good results and considered reliable option of treatment for improved stabilization of the spine anatomically with primary reduction.

**Keywords:** Anterior approach, sub-axial cervical injury and ASIA (American Spinal Injury Association) scoring.

## INTRODUCTION

Injury to the sub-axial cervical spine is measured to be the leading causes of morbidity and death in the overall people. The annual frequency is 12 to 59 cases per million, with whiplash injuries in 3% to 4%<sup>1-2</sup>. The falls from a height and Road accidents are supposed to be the communal cervical trauma mechanism related to trauma of other body parts<sup>3-4</sup>. There are many surgical methods accessible for injury of cervical spine, whether it is anterior, posterior, or both approaches. The approaches are improved depending on the state of the injury to the sub-axial cervical spine<sup>5-6</sup>. Cervical spine computed tomography is considered to be one of the most sensitive examinations, however, MRI of the cervical spine correlates the problem with spinal protrusion, spinal cord contusion respectively, and is regarded as beneficial<sup>7-8</sup>. Patients with whiplash injuries with multiple organs pose a challenge for caregivers, starting at the sites of the injury and then moving on to final care management. Patients with multiple traumas should receive treatment according to protocol until radiological exclusion; Problems such as hypoxemia and hypotension can worsen spinal cord injury which must be treated on time. The cervical spine injuries complications, such as chest congestion, pressure ulcers, thromboembolism, and bowel and urination problems, should be managed as part of multidisciplinary management to reduce morbidity<sup>9-10</sup>. A spine surgeon did a high-quality examination, but another whiplash injury continues to explore a different horizon<sup>11</sup>. The objective of this study was to govern the results of treatment of sub-axial cervical injury in adults using open reduction, anterior approach and injury stabilization <72 hours.

## MATERIAL AND METHODS

This study was held at the Neurosurgery department of Pakistan Institute of Medical Sciences, Islamabad for one-year duration from January 2021 to December 2021. Patients approximately 17 years of age with a history of cervical injury at 72 hours were included. Patients less than 17 years of age with pre-existing bone lesions and birth defects such as a tumor or infection were excluded from the study. After hospital committee approval from ethical committee and acquainted consent, 82 total patients diagnosed with history of traumatic sub-axial injury using MRI and anteroposterior and x-rays lateral and anteroposterior views were

selected. ASIA Impairment Scale was applied for valuation, which was completed at admission and six months later.

The patient was kept in HDU, and the neurological examination was performed before the operation and during the 6-month follow-up. Antibiotics were administered, and physiotherapy was prescribed in the postoperative period. Data were analyzed for mean ± standard deviation for qualitative data and frequencies for quantitative data using the statistical program SPSS version 23.

**Surgical Procedure:** Under GA; all the patients had surgery in the supine position with a traction on cervical. The cervical spine surface was marked for incision using aseptic precautions, and after that the incision was given. The medial sternocleidomastoid border was traced to the cervical spine. The cervical level of trauma was traced with the C arm and the removal of damaged disc was done. Corpectomy was performed and from the anterior superior iliac spine; graft was taken. The graft was formed conferring to the space of corpectomy and was placed in-situ. The cervical plate was applied and the traction was detached. The wound was closed in layers, drain was placed and hemostasis was secured and in the last the collar was applied. The gentamicin and ceftriaxone antibiotics were administered.

## RESULTS

82 cases with a chronicle history < 72 hours were encompassed in the analysis. Of the 82 patients, 52 (63.4%) were male and 30 (36.4%) females. The patients mean age in this analysis was 39.20± 5.11 years and ranged from 20- 65 years. There were 15 patients under 30 years of age, 33 patients aged 31-40 years, 26 patients aged 41-50 years and 16 subjects were 51-60 years of age.

The road accidents were the moist communal cause of cervical injury and were detected in 50(60.9% patients, followed by fall from height in 14(17.1%) and assault in 18(21.9%) of cases.

Table 1: Level of Trauma.

Level of trauma	n	%
Cervical 5-Cervical 6	35	42.7%
Cervical 6-Cervical 7	19	23.2%
Cervical 4-Cervical 5	16	19.5%
Cervical 3-Cervical 4	12	14.6%

The level of injury to the patient's cervical bone is presented in Table 1. The Cervical injury at C3-4 level was noticed in 14.6% cases, C4-5 was observed in 19.5%, C5-6 in 42.7% of patients and C6-7 injury was seen in 23.2% of patients.

The patient's postoperative convalescence was based on the ASIA classification system. Conferring to the American Spinal Injury Association (ASIA) scale, 2 grades enhancement were realised in 24 cases and 54 cases have one grade improvement (Table 2).

Table 2: Asia Score at 6 Months.

Initial ASIA n Scale	After 6-Month ASIA Scale			
15	D	E		
Improved two grades	9	B	C	
12	B	C		
Improved one Grade	29	A		C
13	A	B		

The fusion was performed using bicortical bone graft that was taken from the right anterior superior iliac spine in all cases. Death occurred in 4 cases, 2 were linked to accompanying trauma, one was associated with the complication of the surgery, and the remaining 1 death were related to complications like aspiration. The results were good in 58 (74.5%) of 78 cases and satisfactory in 20 (25.5%). Table 3 displays the results for the age groups.

Table 3: Outcome Related with Age Groups.

Age Groups	n	Good	Fair
≤ 30	12	7(58.3%)	5(41.7%)
31 to 40	30	22(73.3%)	8(26.7%)
41 to 50	24	20 (83.3%)	4 (16.7%)
51 to 60	12	9 (75%)	3(25%)

## DISCUSSION

We determine the etiology and frequency of cervical spine injuries and estimate them according to the ASIA classification. Timely reactivation of said work will support in improvement of patient and treatment, help us progress management, and may help reduce mortality and morbidity<sup>11</sup>. The Quarrington et al study enrolled patients with cervical injuries and institute that 52.3% of the injuries were connected to unilateral dislocation, while bilateral dislocation of facet in 48.8%. The similar analysis also reported that approximately 39.1% were young patients, with the utmost communal engrossment at the C6 / C7 spine level<sup>12-13</sup>. This analysis also found that adults are more likely to be affected by injuries of the cervical spine. In our study, the most common level was C5 / C6 and the second most common level was C6 / C7. In Izzo et al study; Computed tomography of the spine and the cervical spine MRI were the correct and preferred methods to know the cervical spinal cord injury status<sup>14-15</sup>. In other study, 24 patients who were managed conventionally in the preliminary phase were followed for approximately 172 days, all of which presented some development in symptoms. Conferring to the ASIA scale, 2 grades enhancement were realised in 24 cases and 54 cases have one grade improvement<sup>16-17</sup>. Zaveri et al considered the usage of intravenous methylprednisolone for early injuries of the spinal cord in their research group, but this management remains debated. Non-surgical treatment in the study populace contained of external mobilization for 8 to 12 weeks, and it turned out that the aim of the operation was the spine decompression, sustain spine position, and stabilize the spine<sup>18-19</sup>. We also relatively do not recommend 2 months of mobilization and long-term physiotherapy to patients. Approximately 90% of subjects with radiculopathy preoperatively were recovered and were asymptomatic at follow-up. Han et al evaluated 27.6 months of follow-up, in which 21 cases (21.4%) showed an improvement in the Frankel grade with complete fusion in all cases<sup>20-21</sup>. In Anissipour et al analysis who shared data on 36 patients with

dislocation of facet treated with ACDF by fixed plate and for 324 days were followed-up. One-sided facet damage was found in 16 patients, and bilateral in 20 patients. ACDF treatment failure was reported in 3 (8%) of 36 patients. All these failures were seen within 4 weeks. In the study of Lozano et al, no cases of cervical anastomosis (wound) infection were observed in patients managed with primary tracheostomy, but 6 patients (8.9%) had infection with late tracheostomy and infection of wound was observed in 4 patients who underwent posterior approach fusion surgery, while an anterior approach infection was observed in one<sup>22-23</sup>. There was no difference between the two groups in terms of mortality and length of stay in hospital. In this analysis, 7 patients only endured a tracheostomy, but infection was not seen in any case, all were operated aseptically with an antibiotic-coated anterior brace to lessen infection.

## CONCLUSION

The results of the analysis exhibited that ACDF is regarded as a better treatment for restoring the correct anatomical configuration and stabilizing the spine with early reduction. Early mobilization and cord decompression aids in minimizing stay in hospital and lower overall management costs, delivering better outcomes in developing countries.

## REFERENCES

- Patel AA, Hurlbert RJ, Bono CM, Bessey JT, Yang N, Vaccaro AR. Classification and surgical decision making in acute subaxial cervical spine trauma. *Spine*. 2010 Oct 1;35(21S):S228-34.
- Kwon BK, Vaccaro AR, Grauer JN, Fisher CG, Dvorak MF. Subaxial cervical spine trauma. *JAAOS-Journal of the American Academy of Orthopaedic Surgeons*. 2006 Feb 1;14(2):78-89.
- Dvorak MF, Fisher CG, Fehlings MG, Rampersaud YR, Öner FC, Aarabi B, Vaccaro AR. The surgical approach to subaxial cervical spine injuries: an evidence-based algorithm based on the SLIC classification system. *Spine*. 2007 Nov 1;32(23):2620-9.
- Kalhor A, Panezai AS, Hassan S, Javeed F, Rehman L. The Outcome of Subaxial Cervical Injury in Adult Patients Managed Surgically Through an Anterior Approach. *Pakistan Journal of Neurological Surgery*. 2020;24(4):337-42.
- Dreizin D, Letzing M, Sliker CW, Chokshi FH, Bodanapally U, Mirvis SE, Quencer RM, Munera F. Multidetector CT of blunt cervical spine trauma in adults. *Radiographics*. 2014 Nov;34(7):1842-65.
- Chamoun RB, Relyea KM, Johnson KK, Whitehead WE, Curry DJ, Luerssen TG, Drake JM, Jea A. Use of axial and subaxial translamina screw fixation in the management of upper cervical spinal instability in a series of 7 children. *Neurosurgery*. 2009 Apr 1;64(4):734-9.
- Quarrington RD, Jones CF, Tchervenkiakov P, Clark JM, Sandler SJ, Lee YC, Torabiardakani S, Costi JJ, Freeman BJ. Traumatic subaxial cervical facet subluxation and dislocation: epidemiology, radiographic analyses, and risk factors for spinal cord injury. *The Spine Journal*. 2018 Mar 1;18(3):387-98.
- Samuel S, Lin JL, Smith MM, Hartin NL, Vasili C, Ruff SJ, Cree AK, Ball JR, Sergides IG, Gray R. Subaxial injury classification scoring system treatment recommendations: external agreement study based on retrospective review of 185 patients. *Spine*. 2015 Feb 1;40(3):137-42.
- Joaquim AF, Ghizoni E, Tedeschi H, Da Cruz HY, Patel AA. Clinical results of patients with subaxial cervical spine trauma treated according to the SLIC score. *The journal of spinal cord medicine*. 2014 Jul 1;37(4):420-4.
- Cho SK, Safir S, Lombardi JM, Kim JS. Cervical spine deformity: indications, considerations, and surgical outcomes. *JAAOS-Journal of the American Academy of Orthopaedic Surgeons*. 2019 Jun 15;27(12):e555-67.
- Del Curto D, Tamaoki MJ, Martins DE, Puertas EB, Bellotti JC. Surgical approaches for cervical spine facet dislocations in adults. *Cochrane Database of Systematic Reviews*. 2014(10).
- Sandean D. Management of acute spinal cord injury: a summary of the evidence pertaining to the acute management, operative and non-operative management. *World Journal of Orthopedics*. 2020 Dec 18;11(12):573.
- Gelb DE, Aarabi B, Dhall SS, Hurlbert RJ, Rozzelle CJ, Ryken TC, Theodore N, Walters BC, Hadley MN. Treatment of subaxial cervical spinal injuries. *Neurosurgery*. 2019 Mar 1;72(suppl\_3):187-94.

14. Rhee PC, Pirola E, Hébert-Blouin MN, Kircher MF, Spinner RJ, Bishop AT, Shin AY. Concomitant traumatic spinal cord and brachial plexus injuries in adult patients. *The Journal of Bone and Joint Surgery. American volume.* 2018 Dec 21;93(24):2271.
15. Bilsky MH, Boakye M, Collignon F, Kraus D, Boland P. Operative management of metastatic and malignant primary subaxial cervical tumors. *Journal of Neurosurgery: Spine.* 2005 Mar 1;2(3):256-64.
16. Lin JL, Samuel S, Gray R, Ruff S, Vasili C, Cree A, Hartin N. Occult subaxial cervical disco-ligamentous injuries in computer tomography negative trauma patients. *European Spine Journal.* 2017 Apr;26(4):1277-83.
17. Vaccaro AR, Hulbert RJ, Patel AA, Fisher C, Dvorak M, Lehman Jr RA, Anderson P, Harrop J, Oner FC, Arnold P, Fehlings M. The subaxial cervical spine injury classification system: a novel approach to recognize the importance of morphology, neurology, and integrity of the disco-ligamentous complex. *Spine.* 2017 Oct 1;32(21):2365-74.
18. Gore PA, Chang S, Theodore N. Cervical spine injuries in children: attention to radiographic differences and stability compared to those in the adult patient. In *Seminars in Pediatric Neurology* 2019 Mar 1 (Vol. 16, No. 1, pp. 42-58). WB Saunders.
19. Mascarenhas D, Dreizin D, Bodanapally UK, Stein DM. Parsing the utility of CT and MRI in the subaxial cervical spine injury classification (SLIC) system: is CT SLIC enough?. *American Journal of Roentgenology.* 2016 Jun;206(6):1292-7.
20. Purvis TE, De la Garza-Ramos R, Abu-Bonsrah N, Goodwin CR, Groves ML, Ain MC, Sciubba DM. External fixation and surgical fusion for pediatric cervical spine injuries: Short-term outcomes. *Clinical Neurology and Neurosurgery.* 2018 May 1;168:18-23.
21. Jain V, Madan A, Thakur M, Thakur A. Functional outcomes of subaxial spine injuries managed with 2-level anterior cervical corpectomy and fusion: a prospective study. *Neurospine.* 2018 Dec;15(4):368.
22. Copley PC, Tilliridou V, Kirby A, Jones J, Kandasamy J. Management of cervical spine trauma in children. *European Journal of Trauma and Emergency Surgery.* 2019 Oct;45(5):777-89.
23. Crosby ET. Considerations for airway management for cervical spine surgery in adults. *Anesthesiology clinics.* 2017 Sep 1;25(3):511-33.