

Traumatic cervical spinal injuries and outcome of anterior cervical fusion surgeries at Jos, North central Nigeria. A single centre experience.

Danaan J. Shilong¹, Gyang M. Bot¹, Dumura J. Alfin¹, Onyemaechi E. Nwibo¹,
Nanpan I. Kyesmen¹.

¹(Division of Neurosurgery, Department of Surgery, Jos University Teaching Hospital, Nigeria)

Abstract:

Background: Anterior cervical fusion surgeries are viable surgical options for treating many lesions that involve the ventral part of the neck. It can come in the form of anterior cervical discectomy and fusion (ACDF) or anterior cervical corpectomy and fusion (ACCF) with or without the use of plates and screws. These procedures achieve sufficient decompression of the spinal cord and the nerve roots and also the stabilization of the spine. The objective of this study is to determine the characteristics of cervical spine/spinal cord injuries and the outcome of cervical fusion surgeries in terms of neurological improvements and survival rates.

Materials and methods: This is a retrospective review of all consecutive patients presenting to our hospital with cervical spinal injuries requiring surgical decompression and fusion from January 2012 to December 2020. The vertebral level of injury and presence of cord contusions were determined using 0.3 Tesla magnetic resonance imaging (MRI) machine. Their demographics, aetiology of injury, level of injury, nature of injury, neurological recovery and survival were extracted from their case notes and inputted into SPSS version 26 for statistical analysis.

Results: There was a total of 92 patients who had anterior cervical fusion surgeries, however, only 73 had complete records and these were the ones used for the analysis. The mean age was 35.1±11.6 years. The males accounted for 80.8% of the patients. Road traffic collision was the most common cause of trauma. The most common site of injury was the C5/6 area which accounted for 28%. The most common type of injury was complete type; that is the American Spinal injury association (ASIA) impairment scale (AIS) A. About 30% of the patients experienced some improvement in their neurology. Our in hospital mortality was 27.3%.

Conclusion: Though the patients experienced some modest improvement in their neurology, the mortality following cervical spinal injury is high despite surgical intervention in our setting and this may be related to a delay in surgical intervention.

Key Word: Trauma, cervical, spinal cord, contusion, complete injury.

Date of Submission: 20-05-2021

Date of Acceptance: 05-06-2021

I. Introduction

The cervical spine is the most common site of injury following a traumatic insult to the spine. Injury to the spine may involve the bony, ligamentous or neural structures either singly or in combination. When the cervical spinal cord is involved, the spectrum of presentation can range from a transient concussion from which the patient recovers fully to a complete spinal cord transection in which the chances of useful neurological recovery is greatly reduced or nonexistent. The functional disability that follows a cervical cord injury correlates well with the severity of the injury in terms of the injury being complete or incomplete. Spinal cord injury is considered one of the most debilitating injuries one can have considering the functional impairment, short and long term complications associated with this injury.¹ Fairly common complications associated with a cervical spinal cord injury include respiratory failure, thromboembolic phenomena, urinary tract infections, pressure sores and sepsis. The most common cause of cervical spine trauma is road traffic collision and this is closely followed by falls. The most common site injured is the point of transition between the mobile and the fixed segments of the cervical spine and this corresponds to the C5/6 area. The higher the level of the cervical spinal cord injury, the more likely is the patient to have a respiratory compromise and this has a major impact on the survival of the patient. X-rays, computerized tomographic scans and magnetic resonance imaging have their roles in the evaluation of a patient with cervical spinal injury. Surgery is indicated in the scenario of a cord or nerve root compression by herniated disc material, fractured bone pieces or a situation of instability of the spine. Surgery would then be necessary to achieve a decompression and or stabilization of the spine as a goal. This goal can be achieved by either an anterior or a posterior approach or a combination of the two approaches. The

anterior approach is most favoured in dealing with ventral pathologies of the cervical spine such as subluxations, burst fractures of the vertebral bodies and herniated disc materials. The anterior approach has several categories which range from anterior cervical discectomy and fusion, anterior cervical corpectomy and fusion and arthroplasty. The fusion can be achieved by the use of autografts from the patient's iliac crest or the fibula or the use of allografts which can be cadaveric. Cages can also be used as spacers between the vertebral bodies and the whole construct can be further strengthened by the use of plates and screws. There have been several modifications of the techniques earlier described by Cloward and Smith Robinson all in a bit to achieve better decompression and stabilization. The various techniques are not without their complications ranging from transient mild complications to those that are life threatening and permanent. These complications include respiratory difficulty which is the commonest. Others include dysphagia, deep space haematomas, dural penetration, oesophageal perforation, recurrent laryngeal nerve palsy, Horner's syndrome.^{2,3,4} In order to reduce the complications associated with these surgical procedures, some use steroids as adjuncts to the surgery. However, the benefits of the steroids have not been fully evaluated.⁵

The aim of this study is to describe the characteristics of the cervical spinal injuries, the neurological outcome and survival following anterior cervical fusion surgeries in our environment.

II. Materials And Methods

This is a retrospective study of all consecutive patients with cervical spinal injury who had anterior cervical fusion surgeries managed at the Jos University Teaching Hospital from January 2012 to December 2020.

Study Design: A retrospective review of all consecutive patients

Study Location: This study was done at Jos University Teaching Hospital which is a tertiary institution located at Jos, the capital city of Plateau state, North central Nigeria.

Study Duration: From January 2012 to December 2020.

Sample Size: Seventy three (73) patients

Sample Size calculation: Total target population sampling.

Subjects and selection methods: All consecutive patients with cervical spinal injury who had anterior cervical fusion surgery presenting to our hospital within the period stated earlier.

Inclusion criteria: Patients of all ages and sex with cervical spinal injury necessitating anterior cervical fusion surgery.

Exclusion Criteria: Patients with incomplete records or unable to do a cervical MRI.

Procedure Methodology: Data concerning the demographics, survival, severity of the spinal cord injury (using the ASIA Impairment Scale) at admission and post-operative ASIA Impairment Scale at time of discharge were retrieved from the patient's case notes, while data related to vertebral injury and spinal cord contusion were obtained from their corresponding MRI. These data were then entered into SPSS version 26 spreadsheet.

Statistical analysis: SPSS version 26 was used to run descriptive statistics for the inputted data. Age was summarized as mean and standard deviation while the remaining categorical variables were expressed as frequencies and percentages. Some of the categorical variables were represented as bar charts.

III. Results

There was a total of 92 patients who had anterior cervical fusion surgeries for traumatic cervical injuries with predominantly anterior lesions, however, only 73 had complete records and these were the ones used for the analysis. The mean age was 35.1±11.6 years. The males accounted for 80.8% of the patients. Road traffic collision was the most common cause of trauma (74.0%) followed by falls (16.4%), then axial loading (6.8%), assault (1.4%) and sports injury (1.4%) as indicated in figure 1. The complete type of spinal injury; that is the American Spinal injury association impairment scale (AIS) A was the most common form of injury and accounted for 71.2% of the patients, followed by ASIA C (11.1%) [Figure 2]. The most common site of injury was the C5/6 area which accounted for 28%, closely followed by the C6/7 area accounting for 24.7% [Figure 3]. About 30% of the patients experienced some improvement in their neurology [Table 1]. Our in-hospital mortality was 27.3%. A Pearson's Chi square test for association between the presence of cord contusion and survival gave a chi square value of 9.304 and a p value of 0.002, indicating a statistically significant association between presence of cord contusion and mortality. The calculated odds ratio was 6.85, p value 0.003, indicating about seven times chance of a mortality in those with spinal cord contusion compared to those without spinal cord contusion.

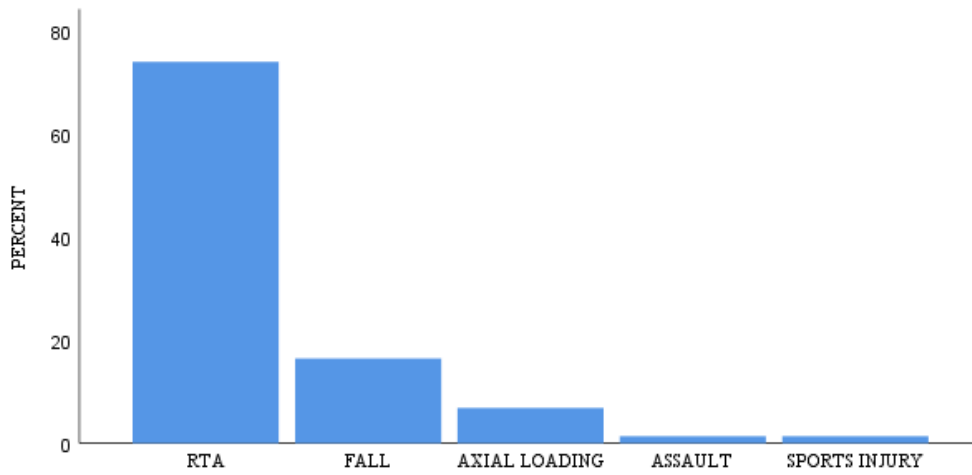


Figure 1: Shows the aetiology of cervical spinal cord injury in our setting and the various proportions

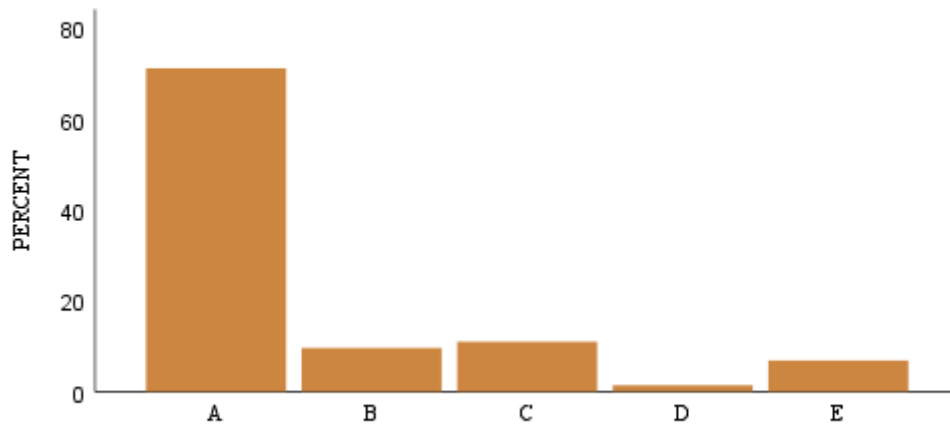


Figure 2: The ASIA Impairment Scale at presentation

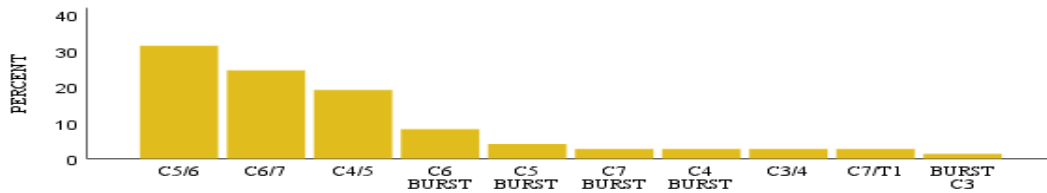


Figure 3: Shows proportion of subaxial cervical vertebral injuries

Table 1: Shows the relationship between the ASIA Impairment scale at presentation and at discharge

		ASIA at discharge						Total	
		A	B	C	D	DIED	E		
ASIA grade on presentation	A	Count	22	3	8	1	18	0	52
		% within ASIA grade on presentation	42.3%	5.8%	15.4%	1.9%	34.6%	0.0%	100.0%
		% of Total	30.1%	4.1%	11.0%	1.4%	24.7%	0.0%	71.2%
B	Count	0	3	1	3	0	0	0	7
		% within ASIA grade on presentation	0.0%	42.9%	14.3%	42.9%	0.0%	0.0%	100.0%
		% of Total	0.0%	4.1%	1.4%	4.1%	0.0%	0.0%	9.6%
C	Count	0	0	2	2	1	3	8	8
		% within ASIA grade on presentation	0.0%	0.0%	25.0%	25.0%	12.5%	37.5%	100.0%
		% of Total	0.0%	0.0%	2.7%	2.7%	1.4%	4.1%	11.0%
D	Count	0	0	0	0	0	1	1	1
		% within ASIA grade on presentation	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
		% of Total	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	1.4%
E	Count	0	0	0	0	0	5	5	5
		% within ASIA grade on presentation	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
		% of Total	0.0%	0.0%	0.0%	0.0%	0.0%	6.8%	6.8%
Total	Count	22	6	11	6	19	9	73	
		% within ASIA grade on presentation	30.1%	8.2%	15.1%	8.2%	26.0%	12.3%	100.0%
		% of Total	30.1%	8.2%	15.1%	8.2%	26.0%	12.3%	100.0%

IV. Discussion

The dominance of the male gender and the young age group in our series compare well with most other series related to trauma. Again, similar to most series on trauma, road traffic collisions are the most common cause followed by falls which is the picture see in our series.^{6,7,8} The C5/6 cervical segment is the most common vertebral site of injury in our study and this is similar to the findings in most series on cervical vertebral injuries.^{7,9} This segment represents the transition zone between the mobile upper segment and the fixed area that is closely related to the thoracic spine. Most of our patients presented with the most severe form of spinal cord injury (AIS A). None of our patients was able to have an early surgical decompression and stabilization of their spines. They all had their surgeries beyond 72 hours of injury. The search for the optimal time for surgery had been on for decades with current studies showing that early surgery (within 24 hours) of injury are associated with better neurological outcome when compared to delayed surgery(beyond 24 hours).^{10,11} The surgical timing in acute spinal cord injury study(STASCIS) which related neurological outcome and timing of the surgery showed that the best chance of achieving any meaningful improvement in the patients' neurology was when surgeries were performed early, ie within 24hours of the injury.¹² All our patients either presented late beyond the 24 hours or for the few that presented early did not have the finance for their surgeries. Thus, all our patients had delayed surgical intervention. The fact that most our patients presented with the most severe form of the injury, presented late and did not have the resources to undertake a surgical intervention has made the management of patients with spinal injury in our environment both challenging and frustrating. The rationale for still undertaking the delayed surgical intervention was largely for the purpose of allowing for early rehabilitation, correction of deformity and for reducing the chances of chronic pain. The chances of a neurological recovery are most threatened by this delayed surgical intervention. Generally, patients with AIS A are said to have little or no chance of achieving any neurological improvement when compared to the incomplete types (B-D). Interestingly, 35.3% of the survivors of those in ASIA A showed an improvement in at least 1 level of their ASIA grade. This is in contradistinction to what many studies conclude by stating that patients with complete spinal cord injury do not recover useful neurological function. Recently however, some studies have indicated that a significant proportion of patients with complete spinal cord injury experienced significant improvement in their neurology.^{13,14,15} Another study indicated that the chances of a recovery in those with a complete spinal cord injury are improved further if the surgical decompression and stabilization is done within 8 hours of injury.¹⁵ Our study showed a statistically significant association between the presence of signal changes on the spinal cord seen on magnetic resonance imaging and survival at the time of discharge. In our study patients with signal changes of the spinal cord had about seven times chance of experiencing a mortality when compared to those that do not have these signal changes. This is consistent with similar studies and reviews.^{16,17}

A limitation of our study is our inability to have a medium and a long term follow up of our patients to determine any neurological changes, morbidities or survival following our surgical intervention.

V. Conclusion

Traumatic cervical spinal cord injury carries a high morbidity and mortality despite anterior cervical fusion surgeries in our setting and this may be related to the late presentation and surgical intervention. All efforts must be made to ensure early decompression and stabilization in patients with indications in order to improve their chances of having any meaningful neurological recovery.

References

- [1]. Prabhat V, Boruah T, Lal H, Kumar R, Dagar A, Sahu H. Management of post-traumatic neglected cervical facet dislocation. *J Clin Orthop Trauma*. 2017 Apr 1;8(2):125–30.
- [2]. Tasiou A, Giannis T, Brotis AG, Siasios I, Georgiadis I, Gatos H, et al. Anterior cervical spine surgery-associated complications in a retrospective case-control study. *J Spine Surg*. 2017;3(3):444–59.
- [3]. Berlowitz DJ, Wadsworth B, Ross J. Respiratory problems and management in people with spinal cord injury. *Breathe*. 2016;12(4):328–40.
- [4]. Nandoe Tewarie RDS, Bartels RHMA, Peul WC. Long-term outcome after anterior cervical discectomy without fusion. *Eur Spine J*. 2007;16(9):1411–6.
- [5]. Zadegan SA, Jazayeri SB, Abedi A, Bonaki HN, Vaccaro AR, Rahimi-Movaghar V. Corticosteroid Administration to Prevent Complications of Anterior Cervical Spine Fusion: A Systematic Review. *Global Spine Journal*. 2018; 8: 286–302.
- [6]. Ojo OA, Poluyi EO, Owolabi BS, Kanu OO, Popoola MO. Surgical decompression for traumatic spinal cord injury in a tertiary center. *Niger J Clin Pract* 2017;20:1455-60.
- [7]. Uche EO, Nwankwo OE, Okorie E, Nneziyanya I. Cervical Spine injury: A ten-year multicenter analysis of evolution of care and risk factors for poor outcome in southeast Nigeria. *Niger J Clin Pract*. 2015;18(2):203–8.
- [8]. Mirza SK, Chapman JR, Anderson PA, Bailey JC, Grady MS, Yuan HA. Early Versus Delayed Surgery for Acute Cervical Spinal Cord Injury. *Clinical Orthopaedics and Related Research*. 1999;359:104–14.
- [9]. Ogunbo B. Anterior decompression, fusion and plating in cervical spine injury: Early experience in Abuja, Nigeria. *Surg Neurol Int*. 2011; 2:156
- [10]. Gaag BSNA Van Der, Oner FC, Peter W. Early surgical decompression improves neurological outcome after complete traumatic cervical spinal cord injury : a meta-analysis. *Journal of Neurotrauma*. 2018;1–44.
- [11]. Grasner L, Maier D. Impact of surgery on the outcome after spinal cord injury – current concepts and an outlook into the future. *Neural Regen Res*. 2016;11(12):11–2.
- [12]. Wilson JR, Tetreault LA, Kwon BK, Arnold PM, Mroz TE, Shaffrey C, et al. Timing of Decompression in Patients With Acute Spinal Cord Injury: A Systematic Review. *Global Spine Journal*. 2017; 7: 95S-115S.
- [13]. Valerie P, Haan Y De, Feller RE, Oner FC, Vandertop WP. Complete Traumatic Spinal Cord Injury : Current Insights Regarding Timing of Surgery and Level of Injury. *Global Spine Journal*. 2020;10(3):324–31.
- [14]. Sainte-justine CHU, Division B, Surgery O, Montr GO, Author C. Do patients with complete spinal cord injury benefit from early surgical decompression? Analysis of neurological improvement in a prospective cohort study . *Journal of Neurotrauma* . 2015;(514):1–30.
- [15]. Lee D, Park Y, Song S, Hwang S. The Importance of Early Surgical Decompression for Acute Traumatic Spinal Cord Injury. *Clinics in Orthopaedic Surgery*. 2018; 10(4) 448–54.
- [16]. Wilson JR, Grossman RG, Frankowski RF, Kiss A, Davis AM, Kulkarni A V., et al. A clinical prediction model for long-term functional outcome after traumatic spinal cord injury based on acute clinical and imaging factors. *J Neurotrauma*. 2012;29(13):2263–71.
- [17]. Tarawneh AM, D'Aquino D, Hilis A, Eisa A, Quraishi NA. Can MRI findings predict the outcome of cervical spinal cord Injury? a systematic review. *Eur Spine J [Internet]*. 2020;29(10):2457–64. Available from: <https://doi.org/10.1007/s00586-020-06511-7>

Danaan J. Shilong, et. al. "Traumatic cervical spinal injuries and outcome of anterior cervical fusion surgeries at Jos, North central Nigeria. A single centre experience." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 20(06), 2021, pp. 54-58.