

Original Research Article

Early outcome of surgical intervention in subaxial cervical spine injuries

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ABSTRACT

Background: Sub-axial cervical spine includes the C3 through C7 segments, a very mobile area of the spine with potential for devastating injuries as a result of instability and risk of spinal cord injury. Goal of treatment is to stabilize the spine and decompress when necessary, in order to promote the optimal environment for recovery.

Methods: This is a retrospective study of 40 patients with sub-axial cervical spine injury who underwent surgery in this institute from January 2016 to March 2017.

Results: Most of the patients were young males with road traffic accident. They underwent cervical traction for reducing translation and surgical management, mostly anterior procedures and in some cases posterior stabilisation.

Conclusions: Most of the subaxial spine injuries can be treated by anterior procedures. Preoperative neurological status is an important predictor in postoperative neurological improvement.

Keywords: Anterior approach, Subaxial cervical spine trauma, Surgical management

INTRODUCTION

Sub-axial cervical spine includes the C3 through C7 segments, a very mobile area of the spine with potential for devastating injuries as a result of instability and risk of spinal cord injury. These injuries are frequently caused by high energy mechanisms such as motor vehicle accidents, extreme sports or fall from height. 2% to 6% of all blunt trauma patients suffer cervical spine injury, of whom 10% to 25% may deteriorate later on.¹ In one large population-based study, the yearly reported incidence of cervical spine injury was up to 64/100,000 population.² Cervical spine injuries are very often associated with spinal cord injury in almost 55% of the cases.³ At times, it may cause significant morbidity and mortality. The risk of cervical injury increases with age and male gender and acute mortality may reach 20% in older patients.⁴ With recent advances in cervical spine instrumentation and surgical techniques, surgical treatment is now most

commonly advised to patients with cervical spine fractures. Conservative treatment can lead to post-traumatic instability and chronic pain, which can be a constant source of disability.⁵ The goals of surgical treatment are to achieve maximum function, minimal pain, neurological improvement and future disability prevention. Surgery can offer best restoration of anatomy, direct decompression of neural elements and early mobilisation.⁶ Controversies are now mostly about the approach of surgical management to choose between anterior, posterior or combined approaches. In recent years anterior approach is gaining popularity. Most of the cervical spine fractures are treated with anterior approach. It is less traumatic and can directly decompress the cord, achieves better fusion rates and there is no need for adjacent segment fusion like in the posterior approach. The rate of infection in posterior approach is high, can lead to late deformity and it cannot address disrupted disk.⁷ However, posterior approach is used in

locked facets in cases of cervical fracture dislocations and severe instability where anterior procedure alone may not be sufficient.⁸ Anterior approach for sub-axial cervical spine was introduced in 1952. Initially, iliac crest bone graft was used for intervertebral fusion. Then, standard AO plates ("Arbeitsgemeinschaft für Osteosynthesefragen" [German for "Association for the Study of Internal Fixation]) were used for fixation following which H-type locking plates were introduced. In cervical spine trauma, the cord compression is due to instability, fragments or dislocation which all can be addressed from the anterior.⁹ Posterior approach is now rarely used for locked facets that cannot be reduced preoperatively with traction usually in old fracture dislocations. However, there are now advocates of open reduction from anterior approach.¹⁰

In this study, authors have analysed our experience in the surgical management of subaxial cervical spine injury patients treated in this institute which is a high trauma case load tertiary care center and the early postoperative outcome of these patients in terms of neurological status using the ASIA score (American Spine Injury Association impairment scale).

METHODS

This is a retrospective study of 40 patients with sub-axial cervical spine injury who underwent surgery in Institute of Neurosurgery, Madras Medical College from January 2016 to March 2017. All patients presenting with Subaxial cervical spine injury with indication for surgical management decided by SLIC (Subaxial spine injury classification) score were included in the study. Exclusion criteria were patients with associated moderate to severe head injury, patients in whom pre-operative MRI could not be taken and patients with other significant comorbidities and patients who were lost to followup. Age, sex, mode of injury, preoperative neurological status, co-morbidities, pre-op ASIA score, SLIC score, MRI finding, steroid usage, surgical approach and post-op ASIA score were the parameters included in this study.

All patients were initially stabilised according to Advanced Trauma Life Support (ATLS) protocol. Plane X-rays of the cervical spine were obtained in all cases. Computed tomography (CT) scan, magnetic resonance imaging (MRI) were obtained in all cases. Initial stabilisation of the spine was achieved with hard cervical collar. After stabilisation of the patient, detailed history was obtained, and complete examination was done. Patients' preoperative neurological statuses were graded according to the American Spinal Injury Association (ASIA) Impairment Scale. In cases of fracture dislocations, patients were taken to the operation theatre (OT) and axial traction was applied with skull tongs. We did not delay traction for MRI to assess disc rather we gradually applied traction and closely monitored neurology for any deterioration. Serial X-rays were

obtained in traction and neurology was monitored carefully. If dislocation reduced, which was mostly the case, patients were operated on next operative list. We routinely used anterior approach for surgery and posterior only for unsuccessful reduction or combined approach was used when there was severe instability. For fusion we used tricortical bone graft in anterior cervical discectomy and fusion (ACDF) or titanium cage filled with autologous bone. Postoperative mobilisation of the patients was done as soon as the condition allowed. Patients were then followed in outpatient department (OPD) after 1 month and 3 months. X-rays were done to assess implant fixation and fusion.

Statistics were done with Chi-square test and SPSS software and >2 SD and p value <0.05 was taken as significant.

RESULTS

Cervical spine fractures are the most common fractures of spine and most often associated with underlying spinal cord injury. Most of the patients of this study group were young to middle aged adults and males (87.5%) (Figure 1).

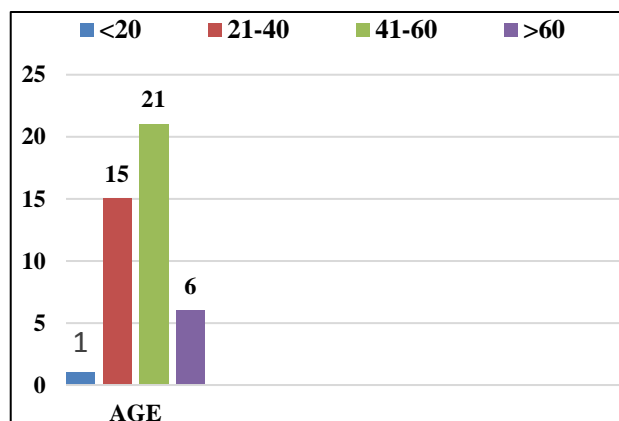


Figure 1: Age distribution of patients.

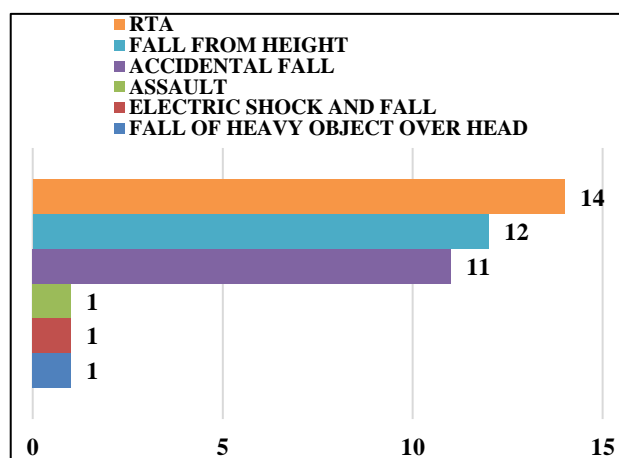


Figure 2: Mode of injury leading to subaxial cervical spine trauma.

Most common mode of injury was Road traffic accident (35%) closely followed by fall from height (30%) and accidental falls (27%) (Figure 2).

There was no significant neurological improvement in the group in which steroid was administered compared to the not administered group (p=0.54). ASIA grade at admission appeared in this study as a still further element that can influence post operative outcome. Of the total 40, 13 succumbed (32%) and all belonged to ASIA grade A and C and most of them required cardiovascular and respiratory support before surgery. In the study, 13 patients remained in the same grade, 12 patients had 1 grade improvement from pre-op ASIA score and 2 patients had 2 grade improvements (Figure 3) (Figure 4).

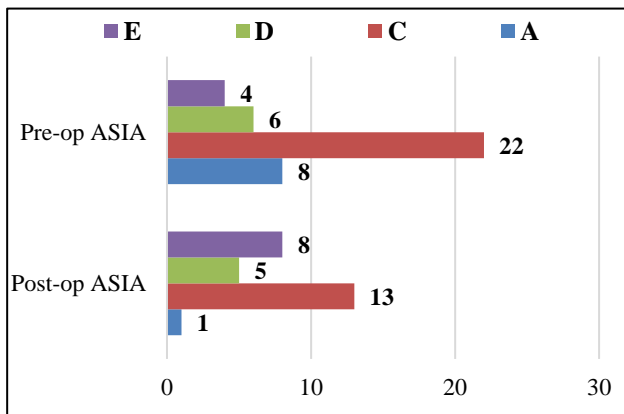


Figure 3: Pre and post operative ASIA Score of patients who underwent surgical management.

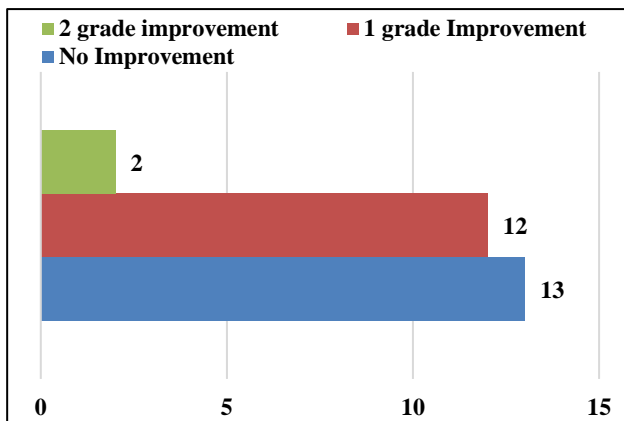


Figure 4: Improvement in ASIA score in patient undergoing Surgical management.

In this study, all patients operated had SLIC (Subaxial spine Injury Classification) score more than 4. Majority of injuries treated in this series were translational in nature (65%) (Figure 5) of which 25 patients had a disrupted disco-ligamentous complex. C6-C7 was the most commonly affected segment, followed by C5-C6, which correlated well with earlier studies. In this study, most patients (38) underwent an anterior stabilisation procedure (Figure 6A and 6B).

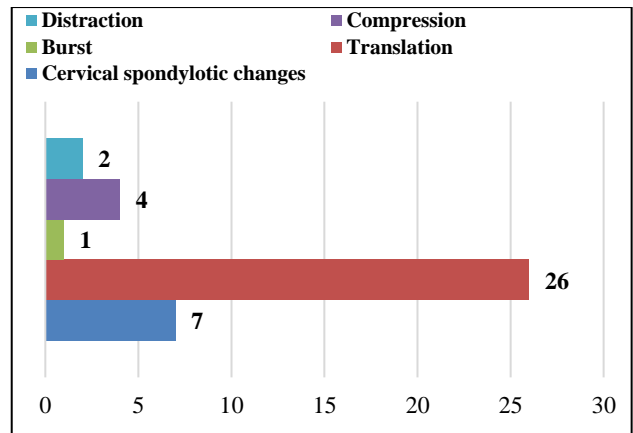


Figure 5: Morphology of injury in imaging who underwent surgical management.

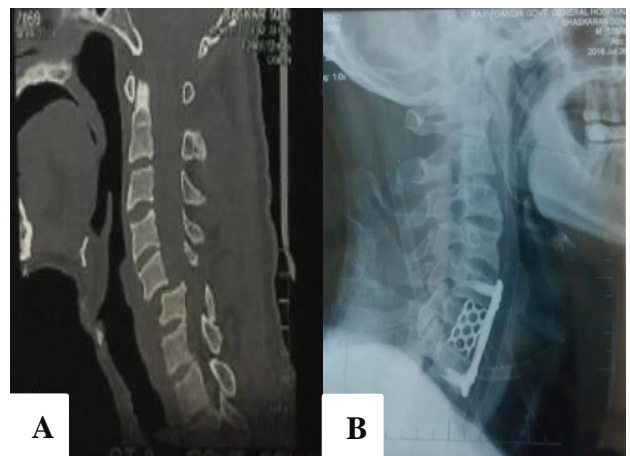


Figure 6: A) Preoperative sagittal CT cervical spine showing translational injury at C4-C5 LEVEL. B) Postop X-ray cervical spine of the same patient showing satisfactory reduction with stabilisation through anterior approach.

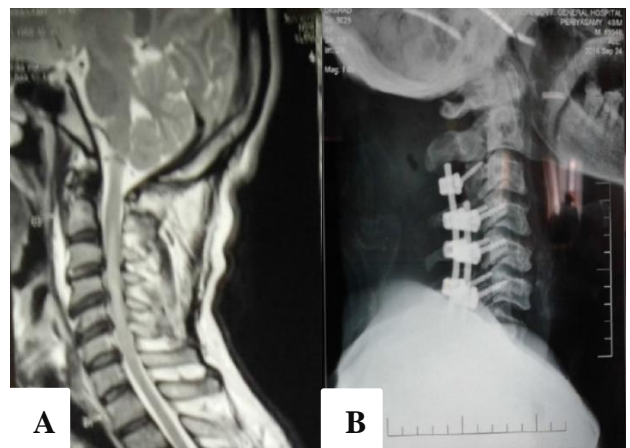


Figure 7: A) Preoperative sagittal MRI cervical spine showing cord changes after trauma and multiple level pre-existing spondylotic changes. B) Post op X-ray cervical spine showing multiple level decompression and posterior stabilisation.

There were two underwent posterior decompression and lateral mass screw and rod stabilisation (multi-level pre-spondylotic changes) (Figure 7A and 7B). Combined (global) fusion procedure wasn't done in this study. Of 19 patients who had cervical traction, satisfactory reduction was obtained in 15 (79%).

DISCUSSION

Proper and timely treatment of sub-axial spine fractures is of paramount importance. Cervical spine fractures are the most common fractures of the spine and most often associated with spinal cord injury. Regardless of the treatment modality, any delay in treatment can leave the patient with lifelong morbidity and some time may lead to acute mortality. Timely surgical treatment can decompress the cord and may lead to neurological improvement. This improvement in neurology, sometime by a single grade, can save patient from lifelong disability.¹¹ Each approach for cervical spine fracture treatment has its advantages and disadvantages. The job of the spine surgeon is to properly select optimal treatment for each patient with sub-axial cervical spine fractures so as to achieve good results.

Today the most common indication for posterior surgery remains sub-axial fracture dislocation that fails to reduce on axial traction and severe instability. Majority of the cervical fracture dislocations can be reduced with axial skull traction. The reported success rate is about 80%.¹² In this study, we were able to reduce cervical fracture dislocation in 15 (79%) out of 19 patients with axial skull traction. This is why majority of our patients had anterior surgery. The most important factor for reduction failure is late presentation.

One of the issues in patients with cervical fracture dislocation is the role of MRI prior to reduction for identification of herniated disc material. During reduction, the herniated disc can further deteriorate neurology. This is a rare phenomenon, but it may have a worse outcome.¹³ Authors do not delay traction for MRI as it takes time to be done in this setting. Authors applied skull tongs and gradual traction monitoring the neurological status of the patient. Authors have not had a single case with worsening of neurological status on traction.

Regarding timing of surgery, a multicentre prospective cohort study, STASCIS concludes that Decompression prior to 24 hours after SCI can be performed safely and is associated with improved neurologic outcome, defined as at least a 2 grade AIS improvement at 6 months follow-up.¹⁴ Recently there are more evidences to support early surgery for spinal cord injury and its feasibility in tertiary care institutes is well demonstrated.⁶ In this study, 5 patients were operated within 72 hours of admission and one patient showed improvement in ASIA grade during discharge. There is no significant difference in outcome among patients operated within 72 hours and those who

operated more than 72 hours ($p>0.05$). But due to the small sample size and short follow up period, authors cannot comment on the usefulness of early surgical management improving the outcome in terms of neurological status.

Pre-operative neurological status as signified by ASIA score at admission appeared in this study as a still further element that can influence post operative outcome as other authors have stated.¹⁵ All the patients who succumbed due to the injury belonged to poorer ASIA score and Postoperative improvement in neurological status was significantly better in patients presenting with better preoperative ASIA score.

Limitations of this study are that it is a single institution, retrospective study. Only early (<3 months) follow up of intactness of construct and neurological status of patients studied. Timing of surgery as a factor improving post op neurological status couldn't be studied as early surgery group is very small in this study.

CONCLUSION

Majority of sub-axial cervical spine fractures can be treated effectively with good outcome through anterior approach. Gradual axial skull traction is an easy and safe method for reduction of cervical fracture dislocations.

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Ethical approval: Not required

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