

Management of Delayed Presentation of Traumatic Cervical Spine Dislocation (TCSD) – A Modified Safe Protocol: An Institutional Experience

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Abstract

Introduction: The usual management of traumatic cervical spine dislocation (TCSD) includes early reduction of the dislocation to relieve spinal cord compression, with stabilization to protect the cord from further injury. Both anterior and posterior techniques have their advantages and disadvantages.

Aim: To study the safety and efficacy of modified protocol for the management of TCSD.

Material and Methods: A 6 months prospective study of 7 patients who presented with incomplete cervical cord injury due to TCSD after 2 weeks of injury. After regular workup, they were subjected to a protocol designed by us to reduce intraoperative manipulation of the cord. Post-operative neurological status was recorded to assess the protocol.

Results: There was no immediate post-operative neurological deterioration in any of the patients. Post-operative imaging showed good reduction and fusion of the affected segments.

Conclusion: With this study, we can conclude that the new protocol is safe as it reduces the chance of injuring the cord due to intraoperative over manipulation of the patient and is efficacious as it reduces the overall operative time significantly.

Key words: Cervical fusion, Incomplete cervical cord injury, Reduction of dislocation, Traumatic cervical spine dislocation

INTRODUCTION

Traumatic cervical spine dislocation (TCSD) with or without cervical cord injury is one of the most common conditions encountered by a neurosurgeon today yet there is no agreed consensus regarding the surgical approach.

Cervical spine dislocation is usually associated with disruption of the disc and posterior longitudinal ligament anterior to the cord and fracture of the posterior elements of the vertebra and disruption of the surrounding ligaments.¹ Sagittal or coronal deformity of the spine or a combination of both may result in instability and compression of

the cord. Such compression is often complicated by the presence of cervical canal stenosis due to conditions such as cervical spondylosis, ossified posterior longitudinal ligament, and rarely ossified ligamentum flavum.

Neurological deterioration due to spinal cord injury may result either from an extruded disc or due to canal stenosis as a result of dislocation. Extreme flexion and extension of the cord may itself result in spinal cord injury. Spinal cord injury without radiological abnormality is an entity wherein there is neurological deterioration without any radiological abnormality. The degree of dislocation at the time of presentation may not directly reflect on the severity of injury to the cord as the severity of neurological deterioration is further complicated by certain important factors such as disruption of vascularity to the cord, hypoxia, and hypovolemia.

The delay in providing treatment for these patients is usually due to poor economic status, lack of awareness and rampant belief in native treatment.

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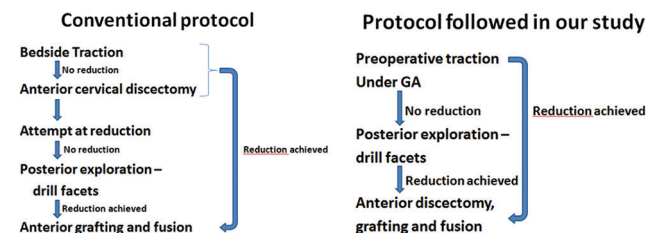
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Surgery includes reduction with proper alignment of the vertebral bodies and then stabilizing the affected segment either by an anterior² or posterior³ approaches or a combined approach⁴ involving both. The surgical options further diversify when dislocation is complete and bilateral in which case a proper reduction is essential to achieve proper alignment before stabilizing the segment affected. The reduction can be achieved by either closed technique with traction and weights or by anterior or posterior surgical approaches.

MATERIALS AND METHODS

Inclusion criteria included patients with incomplete cervical spine injury due to TCSD who presented after 2 weeks of injury. Those with obvious sequestered discs, perched facets, multiple dislocations, and those requiring corpectomy were excluded. The patients with a complete cervical spine injury and with pre-existing cervical spine pathology were also excluded.

A prospective study of 7 patients who presented with TCSD and satisfied the inclusion criteria was done between October 2015 and March 2016. These patients presented to our center with TCSD at a single level at least 2 weeks after injury. Subjects included were all considered for single attempt at pre-operative reduction with traction. Once reduction failed the subjects were directly subjected to a posterior approach in prone position for drilling of the facet of the dislocated joint to achieve reduction. Once the dislocation was reduced, they were turned supine and anterior discectomy and fusion was done.



RESULTS

The following results are based on the analysis of data obtained from seven patients. All the seven patients had presented to us after a minimum period of 2-week after the injury to the spine. All of them were adult males belonging to the age group of 22-45 years. Six of them had injury due to fall and one sustained injury to the spine due to road traffic accident.

All of them had neurological deterioration following the injury. One person had paraplegia due to spinal shock and

had recovered his power in all four limbs significantly at presentation to our hospital. All of them were assessed based on American Spinal Injury Association (ASIA) score and found to have incomplete spinal cord injury (Table 1).

All the patients were subjected to an X-ray cervical spine and a magnetic resonance imaging at admission to the hospital. Five out of the seven patients had bilateral facet dislocation and two had unilateral dislocation on radiology.

All of them were subjected to a single attempt at reduction with traction under general anesthesia before proceeding for surgery. In our experience, we have not found it useful as reduction could not be achieved in any of the seven subjects. With traction in place, they were then subjected to posterior cervical surgery which included drilling of the facet to achieve reduction. Anterior approach involved discectomy and fusion with iliac crest graft or metal spacer.

There was no further post-operative neurological deterioration noted in any of the subjects. Post-operative images showed reduction of dislocation in all the subjects. All subjects were discharged from the hospital after suture removal with advice regarding physiotherapy.

DISCUSSION

The usual management of TCSD includes early reduction of the dislocation to relieve spinal cord compression with stabilization to protect the cord from further injury. Both anterior and posterior techniques have their advantages and disadvantages.

Anterior cervical discectomy and fusion (ACDF) enables the surgeon to achieve removal of the disrupted and sequestered disc and fusion at the same time.^{5,6} Anterior approaches address neurological deterioration due to both sequestered disc and canal stenosis due to dislocation and obviate the need for another procedure. Surgeons' familiarity with the procedure and minimal disruption of normal tissues during the procedure are other advantages. However, it may not be feasible to achieve anterior reduction at all times and anterior fusion without reduction may result in disastrous consequences.

Table 1: Detail list of subjects

Level	ASIA score	Dislocation
C5-C6	C	Bilateral
C3-C4	D	Bilateral
C6-C7	D	Unilateral
C4-C5	C	Bilateral
C7-D1	C	Unilateral
C5-C6	C	Bilateral
C4-C5	C	Bilateral

Posterior instrumentation has been found to be biomechanically superior and has a higher rate of successful arthrodesis in comparison to ACDF.^{7,8} Surgeons familiarity and high biomechanical stability in resisting flexion movements are other advantages. Neurological deterioration due to disc sequestration may be a subset which might not benefit from this procedure and may worsen further after the procedure.

There is no study that has objectively analyzed TCSD to determine the criterion to decide about the appropriateness and adequacy of a single approach. If reduction cannot be achieved after anterior decompression then subsequent posterior open reduction and fusion is indicated.

We had included in our study only the subjects with better ASIA scores so that post-operative neurological deterioration can easily be detected which might not have been possible had we included subjects with poor ASIA scores. As the subset of patients included in the study presented late for treatment (>2 weeks), it was presumed that bedside traction or anterior approach alone will not result in complete reduction due to the formation of fibrous tissue around the sites of injury and dislocated joint. As per the available literature, the incidence of permanent neurological injury after closed reduction is 1% and transient injury 2% to 4%.⁹ They were, therefore, subjected to a posterior approach in prone position to achieve reduction by drilling the facet of the dislocated joint once closed reduction failed. This enabled us to achieve reduction in a quick and efficient way without subjecting the patient to too many changes of positions. Posterior fusion was not contemplated as anterior discectomy and fusion with a graft results in better stability and also the risk of post-operative deterioration due to disc prolapse after achieving reduction can be prevented. As per the literature, the major cause for post-operative neurological deterioration after posterior cervical approaches in TCSD is disc prolapse causing cord compression.^{10,11}

We could not find any statistics regarding the incidence of cord injury due to change of position of the patients intraoperatively to perform both anterior and posterior surgeries, but there is a theoretical possibility that the chance of having a cord injury is higher especially with a dislocated spine if the patient is subjected to too many changes of positions during the surgery. According to the study by Hindman *et al.*, there is almost 20% chance of cord injury during any spine procedure due to position of head and neck.¹² This percentage may even rise if a patient needs to be turned around multiple times intraoperatively for anterior and posterior procedures. Through our study we would like to highlight the fact that by following the protocol proposed and by reducing the number of steps

during surgery the extent of manipulation of the subject and thus the chance of injury to the cord is minimized. Our protocol enabled us to achieve the desired results without any post-operative neurological deterioration.

There might have been a selection bias in choosing the patients as our study group is small and only a subset of the whole spectrum was included and studied. A larger study including a larger number of subjects and from entire spectra of the disease will be needed to definitely confirm the benefits of the protocol. The protocol under study might significantly reduce the operative time and time under

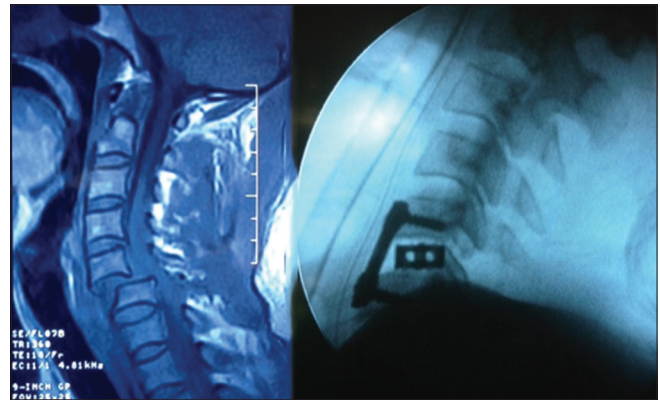


Figure 1: C5 - C6 level bilateral facet dislocation with canal narrowing before and after reduction and fusion



Figure 2: C7 - D1 level dislocation before and after the procedure, preoperative MRI also shows T2 hyperintense signal changes within the cord and complete disruption of disc.



Figure 3: C6 - C7 level dislocation before and after with preoperative MRI showing complete disruption of posterior ligaments between the involved segments, thinning of the cord but the disc is intact. C5 was also included to strengthen the fusion

anesthesia which might benefit patients with complete spinal cord injury especially those with hemodynamic instability and poor respiratory reserve (Figures 1-3).

CONCLUSION

In spite of the significant advances in the field of neurosurgery definite recommendations regarding the appropriate line of treatment of common conditions like TCSD are yet to be formulated. Through our modified protocol we expand the existing armamentarium for treating TCSD. In view of the small number of subjects in our study a further trial with a larger number of subjects might confirm the benefits of this protocol.

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