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Functional outcome of anterior cervical decompression and fusion with locking anterior cervical plate in subaxial cervical spine injuries

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Abstract

Background: Cervical spinal injuries when associated with neurological deficit is a devastating problem leading on to significant morbidity and mortality. 6% of trauma patients have spinal injury in which more than 50% is contributed by cervical spinal injury.

Methods: All patients with cervical spine injuries having neurological deficit who were admitted in orthopaedic department, GMC Jammu were included in this study conducted "between" August 2022 - July 2023, which was prospective one.

Results: In this study all the cases are male with most of the patients are in the age group of 41-50 years. Fall from height is the most common of injury followed by road traffic accident. C5-C6 # dislocation is most common spinal injury pattern. Incomplete neurological deficit are more in this study. Most of the cases are flexion distraction type of violence. Most of the cases presented with in one week of injury. Only 2 cases of 20 cases operated by global fusion, both of them are presented late and found to have locked facets. 2 out of 3 cases are expired from complete neurological deficit. Mobilisation of neck started after 6 weeks.

Conclusion: The ultimate goal of surgical intervention for subaxial cervical spine injuries is stabilization of spine, restoration of spinal anatomy, decompression of neural elements, there by promoting the neurological recovery and early facilitation of rehabilitation. In our study, we achieved a good functional outcome following surgical intervention.

Keywords: Subaxial, dislocation, primary surgery, decompression

Introduction

Cervical spine injuries are one of the common causes of serious morbidity mortality following trauma. 6% of trauma patients have spine injuries of which >50% is contributed by cervical spine injury. Jefferson found that injuries to the cervical spine involve two particular areas: C1-2 and C5-7. Meyer identified C2 and C5 as the two most common level of cervical spine injury. Injuries of the cervical spine produce neurological deficit in approximately 40% of Patients Approximately 10% of traumatic cord injuries have no obvious radiographic evidence of vertebral injury. Early recognition, immobilization, preservation of spinal cord function, and stabilization are the keys to successful management of patients with cervical spine injuries. Cervical instability due to trauma is usually from the level of C3 to C7 (i.e. subaxial). Neurological deficits are not uncommon i.e. root compression and cord compression with subluxation and dislocation. Unstable Cervical spine injuries with or without Neurological deficit require open reduction stabilization is done by using various implants and bone grafting. Implants provide immediate stability, whereas bone grafts offer long-term stability by achieving intervertebral fusion. There is a debate in the literature regarding the approach to the stabilization of these fractures particularly with regard to injuries with disruption of both the anterior and posterior columns. The different approaches that can be used are anterior, posterior, or combined approaches. Halo vests have also been advocated for treatment of these fractures. Brodke *et al.* 2003^[3] believe that a fracture involving both columns is an indication to do a combined approach using both anterior and posterior instrumentation. This addresses the biomechanical deficiencies in both columns as well as allowing for anterior decompression.

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If an anterior or posterior alone fixation is performed, the biomechanical deficiencies are not addressed as only one column is stabilized. The advent of locked plate technology has increased the strength and stability of plate osteosynthesis. This now lends itself to the possibility of anterior alone plate fixation with postoperative immobilization in a cervical orthosis¹⁴. The rationale behind this is that locked plate fixation of the anterior column is sufficient enough to avoid having to augment the posterior column surgically, and simple immobilization in a Philadelphia collar is adequate. We have done the procedure of anterior decompression and fusion with locking cervical plate for the sub axial cervical spine injuries.

Materials and Methods

All patients with cervical spine injuries having neurological deficit who were admitted in Orthopaedic department, Government Medical College Jammu, were included in this study conducted "between" August 2022 - July 2023, which was prospective one.

Inclusion criteria

- Age greater than 18.
- All subaxial cervical fracture and fracture dislocation.

Exclusion criteria

1. **SCIWORA:** Spinal cord injury without radiological abnormality.
2. Patients with Co morbidities

All cases were preoperatively assessed clinically by ASIA grading and radiologically by X-Ray AP, lateral, open mouth, oblique, swimmers lateral views and CT, MRI. Appropriate informed written consent was obtained from the patient and their relatives after explaining the purpose of the surgery and the neurological recovery. Out of fifteen patients, two got admitted within eight hours of injury and only these two patients received the methylprednisolone therapy. All patients were treated in intensive care unit with strict monitoring of vitals like pulse rate, blood pressure, oxygen saturation, respiration. If the mean arterial blood pressure is below 90 mm Hg intravenous fluid in the form of crystalloid or colloid, or blood, or plasma is given. If oxygen saturation is less than 90% the supplemental oxygen at rate of 3 liters/min is given via a face mask. Injection methyl prednisolone in the dosage of 30 mg /kg as IV bolus and 5.4 mg / kg / 23 hours was given for patient who presented to us within 8 hours of injury. While resuscitation, patients are evaluated neurologically on the basis of ASIA impairment scale. Patient were classified into complete or incomplete lesion based on the preservation of motor or sensory function distal to the level of lesion.

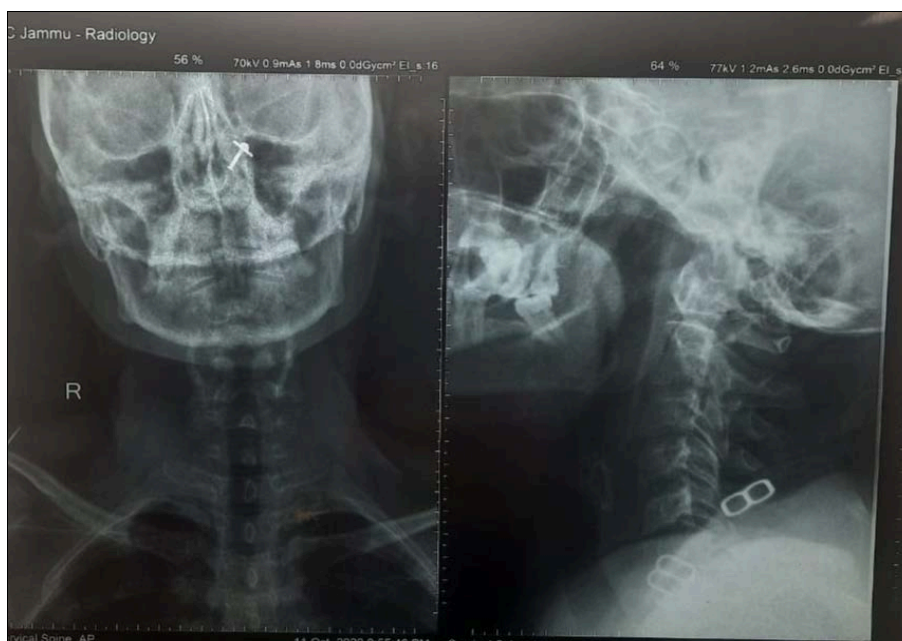


Fig 1: X-Ray AP, lateral, open mouth, oblique, swimmers lateral views and CT, MRI

Procedure

Anterior approach

Anesthesia: Cuffed end tracheal tube.

Position: Supine with neck in slight extension, sand bag under the shoulder blades. Axial traction of cervical spine is maintained by skull tongs throughout the procedure. Anterior Southwick and Robinson's approach from right side sandbag placed under inter-scapular and ipsilateral iliac regions. Both shoulders were tucked down towards the foot end of table. This position ensures hyperextension and thereby better visualization of the cervical spine intraoperatively. Palpation of thyroid, cricoid cartilage corresponding to C3, C4-C5 and C6 level respectively a standard transverse incision was made. After incising platysma, anterior border of sternocleidomastoid muscle

(SCM) was identified. Superficial layer of deep cervical fascia was incised, carotid pulsations were palpated and SCM along with carotid sheath was retracted laterally while trachea, esophagus and thyroid were retracted medially. Middle layer of deep cervical fascia enclosing omohyoid was incised and omohyoid were retracted cephalad or caudad depending upon the desired level. Deep layers of deep cervical fascia overlying Longus colli muscles were divided bluntly. Longus colli were reflected subperiosteally. A thin needle doubly bent at 90 degrees was placed in appropriate disc space and lateral radiograph was taken to verify the exact level. Anterior longitudinal ligament and annulus over disc were incised and disc taken out. End plates of adjacent bodies and space for graft were prepared. Spaces were packed with gel and wound was

covered with a clean sponge. For corpectomy the body of vertebra excluding lateral cortices was removed. A Tricortical graft harvested from iliac crest equal to measured dimensions and was fashioned into a wedge to maintain cervical lordosis. Then the graft is placed either corpectomy or discectomy space. A lateral radiograph was taken to check position of graft. The anterior cortex was drilled by 2.7 mm bit and appropriate size locking plate was placed and screws of 14-16 mm were used. They are directed towards midline at an angle of 6 degrees in a convergent manner & directed 15 degree cranially in cranial hole and 15 degree caudally in caudal hole. Position of screw was checked with C-arm and then diagonally, opposite locking screw was then placed. Position of screws and plate was again checked with C-arm. After ensuing proper haemostasis, platysma, subcutaneous tissue and skin were closed in layers without drain and a Philadelphia collar was applied and patient extubated. Patients were allowed take liquid diet on the evening of surgery depending on the neurological status and solids were allowed next day.

1. Post operative X-rays were taken. These patients were allowed to turn horizontally on 1st postoperative day and was allowed to sit upright and assisted to walk with Philadelphia collar on 2nd postoperative day.
2. Intravenous antibiotics were given for 3 days. Oral antibiotics were given for 4 days.
3. Periodic neurological examinations were conducted.
4. Physiotherapy in the form of Active/Passive mobilisation was taught.
5. Bladder, Bowel, Back care was taught.
6. Sutures removed and patients were discharged with collar on 7th postoperative day.
7. The follow-up examinations and X-Rays with the patient reporting at an interval of 1 month for first 3 months and thereafter every 3 months. The final result were analyzed on the basis of following criteria:
8. Neurological recovery as per ASIA scale, bone fusion, stability assessment, pain.



Fig 2: Post-operative X-rays

Results

In this study all the cases are male with most of the patients are in the age group of 41-50 years. Fall from height is the most common of injury followed by road traffic accident. C5-C6 # dislocation is most common spinal injury pattern. Incomplete neurological deficit are more in this study. Most of the cases are flexion distraction type of violence. Most of the cases presented with in one week of injury. Only 2 cases of 15 cases operated by global fusion, both of them are presented late and found to have locked facets. 2 out of 3 cases are expired from complete neurological deficit. Mobilization of neck started after 6 weeks.

Complication

Totally 3 cases were expired. Two cases was due to acute respiratory distress syndrome. One case due to aspiration pneumonitis. Four patients developed bed sores in which one case developed bed sore preoperatively and others postoperatively. One patient who had grade 3 sacral sore underwent flap cover with the help of plastic surgeon intervention. Other 3 patients managed conservatively.

Discussion

The treatment of cervical spine fractures and dislocations has several goals, including reduction of the deformity and stabilization, minimizing or decreasing neurologic injury, and early rehabilitation. The choice of treatment modality is based on the anatomy of the fracture and the experience of the surgeon. Cervical plating was widely used for stabilization of subaxial cervical spine injuries. The plate functions as a tension band in extension and as a buttress plate in flexion. After corpectomy for decompression of the spinal canal, the area is filled with a strut graft or a cage, and a plate is used as a load-sharing mechanism. The role of timing of surgical intervention in spinal cord injury remains one of the most important topic. Despite immense research efforts related to spinal cord injury treatment, neurological recovery and overall outcome remains poor. Research using models has provided evidence that early decompression surgery can led to improved neurological recovery. In our study, progression of neurological recovery more in patients underwent early surgical intervention. Hence early surgical intervention still offers hope. In selection of

approaches to subaxial cervical spine injuries, the anterior approach directly addresses the injured elements and make easier to proceed with decompression, reduction, grafting and stabilization. In case of old neglected subaxial cervical spine injuries, combined approach is preferable, since we can directly encountered the posteriorly locked facets and to remove the excess fibrous tissues around the fracture elements. Studies also supports for global fusion for neglected bifacial subaxial cervical spine injuries. Study conducted by Lalwani *et al.* “between” 2008 to 2011 in the series of 341 cases stated 73% of patients are between 25 to 64 years of age which was comparable to 80% of patients in our study. Between 2001 to 2004 study conducted by Shrestha *et al.* showed 60% of cases are due to fall from height in a series of 149 patients with cervical spine injuries which was comparable to 50% patients in our study, since fall from height and while carrying weight is due to occupational trend in our country like agricultural and labour work. It was generally accepted that the most injured spinal level is at 5th and 6th cervical vertebra, as this level has greatest range of flexion or extension stress and therefore most susceptible to trauma Zubia *et al.* showed 31% of patients with cervical spine injuries, the commonest level being C5-C6, in a series of 214 patients, conducted between 2003 to 2007, which was similar to our study shows 35%. In our study, most common level of injury was C5-C6 fracture dislocation (35%) followed by C6-C7 level, which was comparable to 31% noted in the earlier studies. Flexion - distraction type of violence was more in the study. These injuries can result in facet sprains, facet dislocations, jumped facets or perched facets. We observed that 80% of cases are involved with flexion distractive type of violence which was more when compared to previous studies showed 61%. In our study, 60% of patients were incomplete neurological deficit and 40% of patients are complete neurological deficit as per ASIA impairment scale, which was comparable to 59.5% complete neurological picture as quoted in earlier studies. Totally 3 patients was expired in which 2 patients were complete neurological deficit. Ducker *et al.* reported 34% of mortality at the end of 1 year in their series of 273 patients with complete cord injuries, which was more when comparable to our study 25%. (2 out of 8 patients with complete neurological deficit). Pressure sore is one of the known complication in cervical spine injuries. In our study, 4 patients had sacral pressure sore, three patients treated conservatively. One patient underwent flap cover with the help of plastic surgery intervention. Stal *et al.* cited a 20% incidence in paraplegic patients and a 26% incidence in patients who are quadriplegic, which was comparable to 20% in our series. Paramore *et al.* 1995^[21] reported hardware failure in 22% patients and concluded that plate length correlates with instrumentation problems. While in our study, there was no complications related to plating like screw pullout and implant failure. The normal lordotic curve of cervical spine is maintained in all cases. Patients were classified into five grades as per ASIA impairment scale. In grade A out of 8 patients, 4 patients had no improvement, 3 patients gained some sensory improvement of which one patient died after two months due aspiration pneumonitis and 1 patient improved to grade C. In grade B, out of 5 patients, 2 patients improved to grade D, 2 patients improved to grade E and one patient died on immediate post operative period. In grade C, out of 6 patients 4 patients improved to grade D and 2 patients improved to grade E. One patient in grade D improved to grade E after surgical intervention. We had no patients on grade E. In our study, patients improved to grade 2 more power after early surgical

stabilization and no patient underwent neurological deterioration

Conclusion

1. The use of anterior cervical plating after anterior corpectomy and fusion with autologous bone graft greatly enhances arthrodesis.
2. Locking cervical plate provides rigid stabilisation.
3. Therefore we consider that the anterior decompression and fusion with locking compression plate as a viable procedure in subaxial cervical spine injuries.

Conflict of Interest

Not available.

Financial Support

Not available.

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