Original Research Article

# A Prospective Study to Assess the Functional Outcome Following Surgical Fixation for Subaxial Cervical Spine Injuries: An Institutional Based Study

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## Abstract

**Background:** Cervical spine injuries are one of the common causes of serious morbidity mortality following trauma. Early recognition, immobilization, preservation of spinal cord function, and stabilization are the initial management of patients with cervical spine injuries. We have done the procedure of decompression and fusion with cervical H plate for the subaxial cervical spine injuries. The aim of this study to assess the functional outcome, following surgical fixation for subaxial cervical spine injuries. **Materials & Methods:** It is a prospective study involving 25 patients who are all admitted with subaxial cervical spine injuries and amenable to intervention in our Department of Orthopaedics and Traumatology, Patna Medical College, Bihar, India during August 2020 to August 2021. Cervical injuries were classified by using standard classification system i.e Allen Fergueson classification. Patients were assessed and surgical procedure planned. **Results:** In this study majority of cases were males and mean age of patients was 47.8 years. Fall from height is the most common of injury followed by road traffic accident. Incomplete neurological deficit is more common. Most of the cases are flexion distraction type of violence. C5-C6 # dislocation is most common spinal injury pattern. Only 2 cases of 25 cases operated by global fusion, both of them are presented late and found to have locked facets. Mobilization of neck started after 6 weeks. **Conclusion:** We concluded that early surgical stabilization of subaxial cervical spine injuries had good functional outcome, provided detailed clinical and radiological assessment, proper preoperative planning, selection of surgical approaches, precision in surgical techniques and early rehabilitation program are needed in achieving good results and minimizing complications.

**Keywords:** Cervical Injury, Fusion, Flexion distraction, Surgical approach.



## Introduction

Cervical instability due to trauma is usually from the level of C3 to C7 (i.e subaxial). Neurological deficits are common i.e root compression and cord compression with subluxation and dislocation[1].

Unstable cervical spine injuries with or without neurological deficit require open reduction stabilisation is done by using various implants and bone grafting. Implants provide immediate stability, whereas bone grafts provide long term stability by achieving intertvertebral fusion.

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 1 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.

Early recognition, immobilisation, preservation of spinal cord function, and stabilisation are the initial management of patients with cervical spine injuries.

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There is debate in the literature regarding the approach to stabilisation 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[2].

Hence to relieve from the primary impact, persistent compression and alignment of stable anatomy of cervical spine, early surgical intervention is necessary to relieve persistent compression and stabilization of subaxial cervical spine injuries. We have done the procedure of decompression and fusion with cervical H plate for the subaxial cervical spine injuries.

## Materials & methods

It is a prospective study involving 25 patients who are all admitted with subaxial cervical spine injuries and amenable to intervention in our Department of Orthopaedics and Traumatology, Patna Medical College, Bihar, India during August 2020 to August 2021.

**Inclusion Criteria**

- Above 20 years of age.
- Cervical spine injury with instability involving C3 cervical Level to C7 cervical spinal level (Lower Cervical Spine).
- Traumatic Disc Prolapse impinging the Cord involving C3 cervical level to C7 cervical spinal level (Lower Cervical Spine).
- All Patients with cord damage whether complete or incomplete cord lesions.

**Exclusion Criteria**

- Medical co morbidities eg: Malignancy, severe liver disease, Organic brain disease
- Multiple injuries that influence the function

- Thoracolumbar spinal injuries
- Previous cervical spine injuries

**Initial Management**

1. Management of Airway, Breathing, Circulation
2. Cervical collar immobilization
3. Fluid and electrolyte management.
4. Assessment of neurological status by ASIA motor score
5. Methyl prednisolone succinate if injury is <8 hours old. Dose-30mg/kg in first 15 minutes, followed by 5.4mg/kg/hr I.V infusion for next 23 hours.
6. Skull tong traction if needed.
7. After stabilization of patient appropriate X-rays, CT scan, MRI was taken.
8. Cervical injuries were classified by using standard classification system i.e Allen Fergueson classification.
9. Patients were assessed and surgical procedure planned.

**Surgical procedure**

Anterior Southwick and Robinson's approach from right side sandbag placed under the 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 or oblique incision was made. After incising platysma, anterior border of sternocliedo mastoid muscle 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, eosophagus and thyroid were retracted medially. Deep layers of deep cervical fascia overlying Longus colli muscles were divided bluntly. Longus colli were reflected sub periostealy[3].

A thin needle 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 were removed and space for graft was prepared. Spaces were packed with gel foam 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 2.5 mm bit and appropriate size cervical H- plate was placed and screws of 14-18 mm were used and directed towards midline.

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 cervical collar was applied and patient was extubated[4].

**Posterior Interspinous Wiring**

Wiring techniques offer the advantages of ease of application and safety. In addition, they may be used to enhance other posterior fixation techniques. A hole is made on each side of the spinous process at its base, and a towel clamp is used to connect the holes. A 1.2-mm wire is passed through the hole, brought around the spinous process of the lower level, and tightened. After decortication of the arthrodesis segment, bone graft is added and the wound is closed over a suction drain[5].

**Post Operative Protocol**

1. Patients were allowed take liquid diet once the bowel sounds appears.
2. Post operative X-rays were taken.
3. Intravenous antibiotics were given for 7 days. Oral antibiotics were given for 7 days.
4. Periodic neurological examinations were conducted.
5. Physiotherapy in the form of Active/Passive mobilization was continued.
6. Bladder, Bowel, Back care was continued.
7. Sutures removed and patients were discharged with collar on 3rd week.
8. The follow-up examinations and X-Rays with the patient reporting at an interval of 6 weeks for first 3 months and thereafter every 3 months.

**Results**

In this study majority of cases were males and mean age of patients was 47.8 years. Fall from height is the most common of injury followed by road traffic accident. Incomplete neurological deficit are more common (table 1).

**Table 1: Demographic profile of patients**

| Variables | No. of patients | Percentage of patients |
|---|---|---|
| **Mean age** | 47.8±7.23 years | |
| **SEX** | | |
| **Male** | 22 | 88% |
| **Female** | 3 | 12% |
| **MODE OF INJURY** | | |
| **Road traffic accident** | 9 | 36% |
| **Fall from height** | 13 | 52% |
| Fall with weight on back | 2 | 8% |
| Slip and fall on group level | 1 | 4% |
| **NEUROLOGICAL STATUS** | | |
| Complete | 10 | 40% |
| Incomplete | 15 | 60% |

Most of the cases are flexion distraction type of violence. C5-C6 # dislocation is most common spinal injury pattern (Table 2).

**Table 2: Classification and type of procedure**

| Variables | No. of patients | Percentage of patients |
|---|---|---|
| **CLASSIFICATION** | | |
| Compressive flexion | 1 | 4% |
| Distractive flexion | 20 | 80% |
| Vertical compression | 3 | 12% |
| Traumatic disc bulge | 1 | 4% |
| **TYPE OF PROCEDURE** | | |
| Corpectomy, bone grafting & plate fixation | 4 | 16% |
| Anterior discectomy, bone grafting & plate fixation plus posterior interspinous wiring | 3 | 12% |
| Discectomy, bone grafting & plate fixation | 18 | 72% |

Only 2 cases of 25 cases operated by global fusion, both of them are presented late and found to have locked facets (table 3).

**Table 3: Level of fusion**

| Level of fusion | No. of patients | Percentage of patients |
|---|---|---|
| **C4-C5** | 4 | 16% |
| **C5-C6** | 10 | 40% |
| **C6-C7** | 8 | 32% |
| **C6-T1** | 2 | 8% |
| **C4-C5/C5-C6** | 1 | 4% |

Mobilization of neck started after 6 weeks.

Totally 3 cases were expired. Two cases were due to acute respiratory distress syndrome. One case due to aspiration pneumonitis. Five patients developed bed sores.

**Discussion**

Spine fractures and spinal cord injury were first reported more than 5,000 years ago in the Edwin surgical papyrus. This injury was described as an ailment that should not be treated because of its grave prognosis. Until the first century A.D., therefore, such injuries, primarily the result of direct blows to the spine, were usually managed only with nonoperative, supportive care. The result was usually paralysis and eventual death because there was no way to stabilize the injured spine and prevent additional damage to the neural elements[5]. However, in 600 A.D., Paul of Aegina reported the first spinal laminectomy; he found that removing spinal lamina splinters from the cord decompressed it, allowing healing[6]. By the mid-twentieth century, the perceived mechanism of injury began to change from direct blows and sword-induced trauma to high-energy, indirect forces like high-energy motor vehicle and diving accidents, resulting in ligamentous and bony injuries. This change in etiology resulted in a change in treatment focus: the philosophy of laminectomy for spinal fracture and cord injury evolved to a philosophy of stabilization[5]. The diagnosis of spinal injury is often delayed, and the treatment is not uniformly established. The delay in diagnosis may occur because of the lack of obvious deformity on physical or radiographic examination. The most common causes for misdiagnosis are concomitant head injury or alcohol intoxication. Vaccaro et al[7] formulated a subaxial cervical spine injury classification system (SLIC) in which SLIC score 5 or > 5 needs operative management. The first recorded operative treatment for spinal injury was a laminectomy in the seventh century. Today, improved operative techniques have led to major advances in spinal stabilization. The development of dedicated spinal cord injury centers and improved postoperative rehabilitation have led to significant improvement in functional outcome. 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[5,8,9]. 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[5,10,11].In our study, progression of neurological recovery was more in patients underwent early surgical intervention. Hence early surgical intervention still offers hope[5,7,12]. 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[13]. 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. Study conducted by Lalwani et al[14] 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[15] 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.

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% [16,17].

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[5,12].Pressure sore is one of the known complications in cervical spine injuries. In our study, 5 patients had sacral pressure sore, three patients treated conservatively. Stal et al[18] 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[19] 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.

**Conclusion**

We concluded that early surgical stabilization of subaxial cervical spine injuries had good functional outcome, provided detailed clinical and radiological assessment, proper preoperative planning, selection of surgical approaches, precision in surgical techniques and early rehabilitation program are needed in achieving good results and minimizing complications.

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