Research Paper

Anterior decompression and fusion with Cervical Spine Locking Plate for various cervical spine disorders: a prospective series of 20 patients.

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This prospective study was conducted in the Post Graduate Department of Orthopaedics, Government Medical College Jammu, India from November 2007 to October 2008 and included twenty cases, 19 males and 1 female in the age group of 20 - 60 years with various disorders of cervical spine who underwent anterior decompression and fusion using TCI graft and CSLP. Results were evaluated as neurological improvement according to Frankel's grading, bony fusion achieved at final follow-up and rate of complications. Eighteen out of 20 (90%) patients showed neurological improvement, with 10 (50%) patients showing complete neurological recovery. A stable bony fusion was achieved in all the cases. Two patients suffered from dysphagia, urinary tract infection and bed sores were seen in 2 patients and one developed joint contractures. There were no instances of surgical or hardware related complication.

Key words: Cervical Spondylomyelopathy (CSM), Discectomy, Cervical spine locking Plates (CSLP), Anterior Cervical Decompression and Fusion (ACDF).

INTRODUCTION

There is very limited muscular support around cervical spine. This renders it much more mobile than any other region of spine and therefore makes it more prone to injuries as well as various diseases like cervical spondylisis causing radiculopathy and myelopathy. The cervical spine has traditionally been approached surgically from posterior as well as from anterior side for various pathologies. Although it may have been performed even before, the first written evidence for an anterior approach to the cervical spine was given by (Chipault, 1895). monograph on neurologic surgery. After half a century of neurosurgical silence, (Robinson and Smith, 1955) reported on the first anterior cervical fusion with an autologous bone graft.

Several surgeons then laid the ground for the modern ventral fusion of the cervical spine. The development of anterior cervical plates represents a rapidly changing aspect of spine surgery. Over the past two decades a seemingly exponential proliferation of devices for anterior cervical fusion has occurred. Initially utilizing a plate and screws for anterior cervical fusion was controversial and many early papers supported alternative bone grafts and the special notching of allograft, all in the hopes of minimizing the need for plate stabilization. Over the years, however, the use of plates and screws have gained widespread acceptance and have become the most common form of cervical spine fusion. The early cervical plate developments are credited to (Orozo and Houet, 1971), (Bohler and Gaudernak, 1980), (Morscher et al., 1986) and (Caspar et al., 1989). Anterior cervical plates have been reported to improve both fusion rate and neurological
outcome in patients undergoing anterior cervical procedures. The aspects that are cited in the favour of anterior cervical plating include earlier patient mobilization, decreased need for external support, decreased incidents of graft dislodgement and improved ability to correct pre-operative deformity.

METHODS

This prospective study was conducted in the Department of Orthopaedics, Government Medical College and Associate Hospitals, Jammu from November, 2007 to October, 2008. Twenty cases, 19 males and 1 female in the age group of 20-60 years with various disorders of cervical spine like, PIVD, TB, spondyloymelopathy and Traumatic cervical spine injuries with neurodeficit were included in the study. Informed and written consent was taken from all the patients. On arrival, the patient were assessed and stabilized in terms of airway, breathing and circulation. Immobilization with hard Philadelphia cervical collar was done immediately. The patient after stabilization and immobilization were subjected to detailed history, physical examination and neurological examination according to Frankel’s grading. Radiographs of cervical spine, anterior-posterior and lateral were taken to know exact level of pathology, anterior-posterior translation of vertebrae, and any spondylotic changes. CT and MRI were done to know exact site of pathology and any cervical cord damage as and when required. Skull traction through crutch field tongs or head halter, depending upon the extent of instability and neurological deficit was given on admission.

Exclusion criteria

• Stable fractures without any neurological deficits.
• Improvement in neurological deficits in stable cervical spine pathologies by conservative method.
• Patients with significant co-morbidities which precluded general anaesthesia and surgery.

SURGICAL PROTOCOL

Under general anaesthesia, anterior decompression of cervical spine followed by tricortical iliac grafting and stabilization with 1, 2 or 3 level CSLP was done. After administration of GA, the patient was placed supine, Crutchfield tongs traction applied and the neck turned to right side. Anterior Southwick and Robinson’s approach from left side was performed in all the cases. Bolsters were 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 intra-operatively. Palpation of hyoid, thyroid and cricoid cartilage corresponding to C3, C4-C5 and C6 level, respectively was done. Skin and subcutaneous tissues were infiltrated with epinephrine. A standard longitudinal incision along a line joining the sternal notch and mastoid process, centered over the calculated level of decompression was made. After incising platysma, anterior boarder of sternocleidomastoid muscle (SCM) was identified. Superior 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 caudal depending upon the desired level. Deep layers of deep cervical fascia overlying Longus colli muscles were divided bluntly. Longus colli were reflected subperiostially. A thin K wire 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 (Fig1). End plates of adjacent bodies and space for graft were prepared. Spaces were packed with gel foam and wound was covered with a clean sponge.

A Tricortical graft was harvested from iliac crest equal to measured dimensions and was fashioned into a wedge to maintain cervical lordosis (Fig2). Longitudinal traction through tongs was increased and graft was snugly placed. Traction was released after placement of the graft.

A lateral radiograph was taken to check position of graft. The anterior cortex was drilled by 2.7 mm bit and appropriate size CSLP was placed using 12 mm monocortical locking screw (Fig 3).

Position of screw was checked with C-arm and then diagonally, opposite locking screw was then placed and plate locked in 2 + 2 configuration. 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 was extubated and tongs were removed.

POSTOPERATIVE PROTOCOL

Patients were allowed semisolids on the evening of surgery and solids were allowed next day. These patients were allowed to turn horizontally on 1st postoperative day and was allowed to sit upright and assisted to walk with proper collar on 2nd postoperative day. Periodic neurological examinations were conducted. Stitches were removed and patients were discharged with collar on 7th postoperative day. The follow-up examinations and x-Rays (Fig4) were done for an average period of one year, with the patient reporting at an interval of 1 month for first 3 months and thereafter every 3 months. The final results were analyzed on the basis of following criteria:
1. Neurological recovery as per Frankel’s grading.
TABLE 1. Neurological Improvement in the patients who underwent Anterior Cervical Decompression and Fusion (ACDF) using CSLP (n = 20).

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<tr>
<th>Frankel's Grade</th>
<th>Pre-operative</th>
<th>Post-operative</th>
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<tbody>
<tr>
<td></td>
<td>No. of Patients</td>
<td>Percentage</td>
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<tr>
<td>A</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>B</td>
<td>7</td>
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<td>C</td>
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<td>D</td>
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 Figure 1. Anterior Cervical Discectomy.

 1. Status of fusion.
 2. Complications.

RESULTS

We included 20 patients with 19 male and 1 female with average age of 44.5 years (22-58 years) with different cervical spine pathologies (CSM-13, Traumatic - 6 and TB-1 patient) who underwent either discectomy or corpectomy and were fused using TCI graft in all patients using CSLP. The neurologic deficits improved in 18 out of 20 (90%) patients with 10 (50%) patients showing full neuro-recovery (Table1). Only two patients did not show any recovery, they both had traumatic cervical spine injuries with complete cord injuries. A stable bony fusion was achieved in all the 20 the cases. Two patients in our study suffered from dysphagia which recovered completely by the time they were discharged from the hospital. Urinary tract infection and bed sores were seen in 2 patients. They both were Traumatic cervical spine fractures with complete cord injuries and both did not show any recovery with one of them developing joint contractures also. None of our patients suffered from any surgery or Implant related complication.

DISCUSSION:

Advantages of the anterior cervical approach include easy positioning of the patient, a less traumatic approach,
TABLE 2. Distribution of Corpectomy and Discectomy in the patients who underwent ACDF using CSLP (n = 20)

<table>
<thead>
<tr>
<th>Anterior Cervical Procedure</th>
<th>No. of Patients</th>
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<tbody>
<tr>
<td>1- Level Discectomy</td>
<td>11</td>
</tr>
<tr>
<td>2- Level Discectomy</td>
<td>5</td>
</tr>
<tr>
<td>1 -Level Corpectomy</td>
<td>3</td>
</tr>
<tr>
<td>2 -Level Corpectomy</td>
<td>1</td>
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Fig no 3: Anterior CSLP in Situ

and direct visualization of the dural surface. This route allows direct removal of space-occupying, degenerative, traumatic or neoplastic lesions which are mostly located anterior to the spinal cord. The development of locking plates with unicortical screw fixation was an attempt to increase the stability of unicortical screw-fixation systems. Preliminary studies have shown that unicortical screw fixation can be used for anterior plate fixation with a comparable immediate stability of bicortical screw fixation. Furthermore, anterior plate systems with bicortical screw fixation have been repeatedly cited for the potential to cause neurologic injuries due to posterior cortex perforation. Anterior cervical fusion is a widely accepted technique for treatment of unstable spinal injuries, as well as other cervical diseases like CSM and TB cervical spine. (Stulik et al.) treated 68 patients of lower cervical spine injury with mean age of 37.6 years using CSLP and achieved very good results (98.5% fusion), whereas (Lee et al., 2008) published a prospective study of patients on three-level anterior cervical discectomy and fusion in CSM using anterior. Locking plates and achieved union in all. CSM represents a spectrum of degenerative changes involving the intervertebral discs and the vertebral bodies that results in the formation of osteophytes which lead to compression of nerve roots and the spinal cord, inducing a wide range of clinical signs and symptoms. When osteophytic compression of neural elements produces symptoms that are not alleviated by conservative measures, decompressive surgery is indicated. The development of the anterior cervical approach as well as a variety of internal fixation devices gradually expanded the options available for the surgical management of cervical spondylosis and anterior cervical surgery now represents one of the most frequently performed spinal procedures for CSM. (Kalfas, 2002) concluded that advances in surgical techniques and spinal stabilization methods have expanded the role of anterior decompression and fusion with CSLP for the management of CSM. In our series 65% patients (13/20) were having CSM and there was a significant observation that all the patients of CSM showed very good recovery, with 7 out of 13 patients (54%) of CSM patients recovering fully and 6 (46%) of the patients showing 2 to 3 grade improvement. We did anterior discectomy in 16 patients and corpectomy in four patients (Table 2). The most frequent site of pathology was C5-C6. Increased incidence at C5-C6 signifies the increased mobility at this junction making it more prone to degeneration as well as trauma.

In many cases of cervical myelopathy, cord compression does not result from osteophytic lesions only the so-called hard disc-but also from additional compression.
because of anterior narrowing of the spinal canal by the ossified posterior longitudinal ligament and the hyperostotic vertebral body. Corpectomy is the treatment of choice in such cases and represents the most appropriate technique for relieving cord compression. The main benefit of spinal instrumentation is provision of immediate postoperative stability to the surgical zone before the development of osseous fusion. Locking plates are the most recent devices for achieving anterior cervical spinal fusion and offer considerable advantages such as faster and easier implantation and fewer implant-related failures than older plate systems. We used different levels of CSLP (1level-12, 2level-7 patients and 3level-1 patient) in our series and achieved solid union in all. The neurologic improvement was highest in CSM patients and was lowest in traumatic cervical spine injuries with complete cord injuries.

One of the major complications when using ventral instrumentation techniques is screw loosening and screw backout with subsequent ventral dislocation of the whole implant, which may cause dysphagia or even esophageal perforation. (Coe and Vaccaro, 2005) reported the prevalence of screw and plate loosening between 0 and 15.4%. However none of our patients suffered from any screw breakage or screw loosening. Two patients in our study suffered from transient dysphagia which recovered completely in both the patients by the time of discharge from the hospital.

 Injury to the recurrent laryngeal nerve is considered the most common neurological complication after anterior cervical spine surgery the incidence being between 0.2 and 11% (18, 19, 20). Self retaining retractor are too deep, exerting pressure on the trachea and tracheo-esophageal groove can result in direct recurrent laryngeal nerve injury which is more common in right-sided approaches where the recurrent laryngeal nerve is more variable. We used left-sided longitudinal approach in all of our cases, with the surgeon standing on left side and the first assistant on right side of the patient in all the cases. We did intermittent relaxation of the retractors during surgery and never placed self-retaining retractors in any of our cases. None of our patient suffered RLN palsy.

The CSLP system seems to be a versatile device that is technically non demanding and can be implanted in a relatively simple and fast way that is safe to the patient. Mechanically, the plate is exceptionally rigid and promotes a high rate of successful bony fusions and hence indicated for selected traumatic and non-traumatic cervical spine pathologies. The cervical spine surgery especially from anterior approach is one of the most difficult surgeries requiring great skills, precision and expertise. This series is first of its kind from our institution and we feel that this will certainly add to the knowledge of medical fraternity and provide a ray of hope to the patients of cervical spine disease who cannot afford to go to highly equipped spine centres outside our state.

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REFERENCES


