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Original Research Article

Evaluation of clinical profile, radiological and functional outcome following anterior cervical discectomy and fusion for cervical compressive myelopathy

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ABSTRACT

Background: Symptomatic cervical disc prolapse is best managed with anterior cervical discectomy with or without fusion. We studied the clinical, radiological and surgical profile with postoperative outcome of the patients undergoing anterior cervical discectomy and fusion (ACDF) for cervical compressive myelopathy at one level.
Methods: In this retrospective study, data was collected from patients who underwent ACDF for cervical compressive myelopathy in our hospital between 2016 and 2019. Clinical, radiological profile with surgical outcome were studied.
Results: A total of 283 patients were recruited. They could be followed up for a period of at least 6 months and so were recruited for the study. Out of these 283 patients (201 males; 82 females; mean age, 48.4 years, range, 22 years to 83 years), magnetic resonance imaging (MRI) cervical spine without contrast and x-ray cervical spine was available for all the patients. Nape of neck pain was the most common presenting symptom followed by tingling sensation in all four limbs and trunk. Average time taken for surgery was 2 hours 10 minutes with an average blood loss of 50 ml. Mean follow up duration was 2.7 years (range 6 months to 4 years).
Conclusions: ACDF is the treatment of choice for the patients with clinical and radiological evidence of cervical cord compression. The techniques is associated with minimal blood loss and exceptionally good surgical outcome. Following discectomy, putting an autologous graft or titanium cage improves the spine stability and maintains the cervical lordosis.

Keywords: ACDF, Cervical discectomy, CSM, Fusion, Myelopathy, Radiology

INTRODUCTION

Cervical spondylotic myelopathy (CSM) is the most common cause of non-traumatic myelopathy in the adults more than 55 years of age.[1,2] The exact mechanism of CSM is not known. It may result either due to compression of the cord directly but studies have found the ischemia of the cord and the resultant damage as a possible causative factor.[3,4] Compression and ischemia, both may occur due to age related wear and tear. Trauma is another common cause of the cervical disc prolapse. Lateral disc prolapse mostly presents with features of radiculopathy and central disc prolapse results in clinical features of myelopathy. In most of the cases, the myelopathy is associated with radiological evidence of compression over the cord and associated T2W changes in MRI. Such patients show improvement following the surgery. One level cord compression is best dealt with the anterior cervical discectomy with or without fusion. Multilevel involvement requires either a multilevel discectomy, cervical corpectomy or laminectomy with or without fusion. Anterior cervical discectomy and fusion (ACDF) was described by Robinson and Smith in 1955 and Cloward in 1958.[5,6] Since then, this surgery has

gained immense popularity and is treatment of choice for cervical disc prolapse.

In this series we have discussed our results with anterior cervical discectomy and fusion done for single level cervical disc prolapse in patients with clinical symptoms of myelopathy.

METHODS

This was a retrospective study, conducted at Himalayan Institute of Medical Sciences, Jolly Grant, Dehradun, Uttarakhand for the patients operated from May 2015 to June 2019.

Inclusion criteria

All patients more than 20 years of age who underwent one level ACDF for cervical compressive myelopathy were included in the study.

Exclusion criteria

Patients who had radiculopathy without associated myelopathy, myelopathy requiring discectomy and fusion of more than one level, infective aetiology, less than 6 months follow up were excluded from the study.

All necessary clearances were obtained from Institutional research review committee and Ethics committee.

Patients

Patients presenting to EMR and OPD of our hospital with clinical features suggestive of cervical myelopathy were subjected to MRI cervical spine. On correlation of myelopathy features with cord compression due to disc prolapse, disc osteophyte complex or focal ossified longitudinal ligament (OPLL), they were advised to undergo surgery. X-ray cervical spine was also done. Patients with history of trauma and suspicion of OPLL on MR imaging were further subjected to CT cervical spine. All the surgeries were performed at Himalayan hospital, Swami Rama Himalayan University, Jolly Grant, Dehradun by 4 Neurosurgeons between 2015 and 2019.

Clinical profile

Patients were evaluated as per the Nurick grading system preoperatively and postoperatively at an interval of 1 week, 1 month, 3 months and 6 months.[7] Postoperative long term recovery was studied in terms of satisfaction with surgery, return to work or household activities.

Radiological profile

MRI cervical spine (Figure 1) was assessed in terms of indentation of CSF column, T2W changes in the cervical cord, evidence of disc prolapse, disc osteophyte complex, degenerative changes, ligamentum flavum calcification and OPLL. X-ray cervical spine was done to note the baseline cervical lordosis and primary evaluation of fracture or associated atlanto-axial dislocation. CT cervical spine was done for the patients when, MR and X ray images were suggestive of a fracture or OPLL.

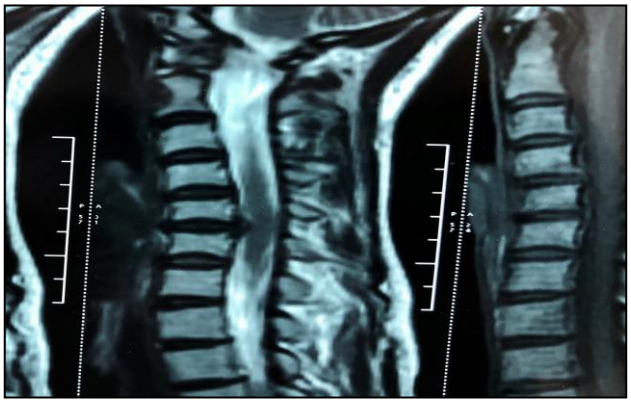

Figure 1: MRI cervical spine, sagittal T2W image showing loss of normal cervical lordosis and C5-6 central disc prolapse causing indentation of anterior CSF column and cord compression; there were minimal T2W hyperintensities in the cord.

Surgical technique

All the patients were operated under general anaesthesia. Flexo-metallic tubes were used for intubation. Patients were positioned supine maintaining extension. Based on C-arm image intensifier guidance, level confirmation was done and using a transverse incision along the transverse skin crease in the neck, blunt and sharp dissection was carried out to reach, the pre-vertebral space keeping trachea and oesophagus medially and internal carotid artery and sternocleidomastoid muscle laterally. After putting self retaining retractor system and confirmation of the level again using C arm, discectomy was done. Using vertebral distractor, complete discectomy with removal of the overhanging osteophytes was achieved.

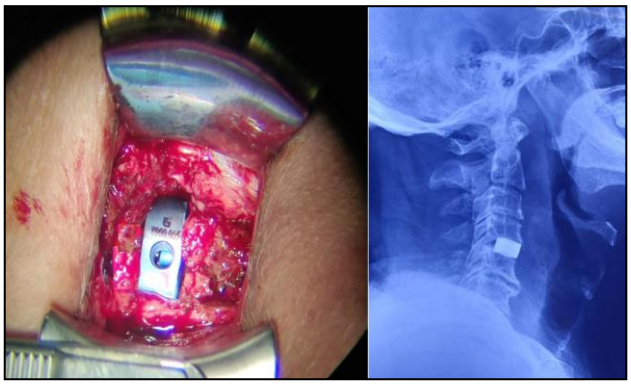

Figure 2: Intra-operative image after insertion of the titanium cage into the disc space. As the cage was found fitting snugly into the disc space, the patient did not require any anterior cervical plating; image on the right shows postoperative X-ray of cervical spine lateral view, showing the cage with maintained cervical lordosis.

Posterior longitudinal ligament was divided and/or excised based on the plane with duramater till the dura bulged into the discectomy defect. A snugly fitting titanium cage was introduced into the disc space (Figure 2) in all the cases and reinforced by anterior cervical plate wherever found necessary (Figure 3). Hemostasis was achieved properly and the operative wound was closed over a negative suction mini vacuum drain in layers using vicryl sutures.

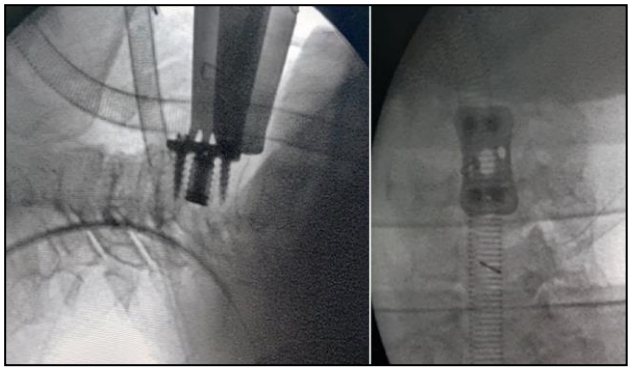

Figure 3: Intraoperative X-ray images (lateral and AP) of anterior cervical plating and screw placement in vertebral bodies following anterior cervical discectomy and cage insertion.

Postoperative care and follow up

The patients were kept for one day in the recovery ward and motivated to walk from the first postoperative day itself with the help of a relative or walking aids, if needed. Opioid analgesics were given with intravenous antibiotics for three days postoperatively. Operative drain was removed on first perioperative day. Urinary catheter was removed for all the patients who were indicating and voiding normally before surgery. The patients were advised Philadelphia cervical collar for 3 months and discharged on 4th postoperative day. The clinical and radiological profile was assessed on 1st day, 7 days, 1 month, 3 month and 6 months from the date of surgery. Some of the patients, hailing from remote areas were followed up telephonically.

Statistical analysis

Data were entered in Excel software (Microsoft, Seattle, WA) and were analyzed using SPSS software, version 11.5 (SPSS, Inc. Chicago, IL).

RESULTS

There were 283 patients (201 males; 82 females; mean age, 48.4 years, range, 22 years to 83 years). Most of the patients were in range of 36 to 50 years. 90% of patients had compressive myelopathy due to degenerative causes and rest of the patients had traumatic aetiology. Most common level of involvement was C5-6 (33.6%) followed by C4-5 (29.7%). C7-T1 (1.4%) and C2-3 (0.7%) levels were least common to get involved.

Table 1: Age and diagnosis (n=283).

Variables	No. of patients (%)
Age in years	
<35	30 (10.6)
36-50	160 (56.5)
51 to 70	84 (29.7)
≥71	9 (3.2)
Sex	
Males	201 (71)
Females	82 (29)
Level of compression	
C2-3	2 (0.7)
C3-4	28 (9.9)
C4-5	84 (29.7)
C5-6	95 (33.6)
C6-7	70 (24.7)
C7-T1	4 (1.4)
Etiology	
Degenerative	255 (90.1)
Post traumatic	28(9.9)

Clinical profile

The clinical features of the patients are summarized in Table 2.

Table 2: Clinical features (n=283).

Feature	No. of patients (%)
Symptoms	
Nape of neck pain	283 (100)
Sensory symptoms	269 (95.1)
Motor weakness	152 (53.7)
Autonomic symptoms (urinary urgency, constipation)	220 (77.7)
Urinary and fecal incontinence	14 (4.9)
Preoperative functional grade	
Nurick grade I	20 (7.1)
Nurick grade II	88 (31.1)
Nurick grade III	98 (34.6)
Nurick grade IV	46 (16.3)
Nurick grade V	31 (10.9)

All the patients had history of nape of neck pain at the time of presentation in hospital. Sensory symptoms (95%) including tingling, paraesthesia and numbness were second most common symptoms. About half of the patients had motor symptoms, predominantly due to spasticity. On proper questioning, three forth of the patients were found to have at least one autonomic symptom, predominantly urinary urgency and constipation. Urinary and fecal incontinence were the least common symptoms and were mostly associated with

post traumatic disc prolapse. Functional status of the patients was assessed using the Nurick grade system7. About one third patients had Nurick grade 3 followed by Nurick grade 2.

Radiological profile

The features are summarized in Table 3. MRI cervical spine and X-ray cervical spine was available for all the patients. 75 (26.5%) of the patients had computed tomographic (CT) images of cervical spine, out of which most of the patients had traumatic aetiology of radiological suspicion of OPLL on X-ray and MR imaging. Most common compressing element was disc osteophyte complex. About one third patients had pure disc prolapse without associated osteophyte compression. Focal OPLL was the least common cause for compression. 94% patients had T2W changes associated with cord compression. Rest of the patients had no T2W changes but other clinic radiological features of compressive myelopathy were present.

Table 3: Radiological features.

Feature	No. of patients (%)
Compressive element	
Prolapsed cervical disc	106 (37.5)
Disc osteophyte complex	168 (59.4)
Focal OPLL	9 (3.2)
T2W changes in spinal cord	
Present	267 (94.3)
Absent	16 (5.6)
Evidence of fracture on X ray or CT	
Present	19 (6.7)
Absent	264 (93.3)

Perioperative analysis

One level discectomy and fusion was performed for all the patients. Fusion was achieved with titanium cage in all cases and anterior cervical plates with screws in selective cases. Average time taken for surgery was 2 hours 10 minutes with an average blood loss of 50 ml. Dural tear was noted for 7 patients (2.5%). About 4% of our patients noted postoperative dysphagia, which resolved in all the patients within 7 days. 7 patients developed hoarseness of voice, out of which 3 improved till 6 months. Incidence of postoperative hoarseness of voice was associated with C6-7 level or C7-T1 level surgeries. 72% of the patients had objective improvement in sensory or motor functions within one week of surgery which increased to 94% after six months. We had zero mortality related to cervical pathology or surgery.

Postoperative care and follow up

Out of 320 patients operated, 11.6% of the patients were lost to follow up and so were not included in the study. 283 patients recruited for the study could be followed up for 6 months duration. Mean follow up duration was 2.7 years (range 6 months to 4 years). There were 4 cases of repeat surgery due to implant migration. On telephonic follow up, about 70% patients were able to join their job or household work within 3 months of the surgery. About half of the patients noted complete satisfaction after 6 months of surgery whereas 25% noted moderate satisfaction (at least 50% improvement in symptoms).

Table 4: Follow up and outcome (n=283).

Feature	No. of patients (%)
Subjective improvement in spasticity within 1 month	
Perceived	264 (93.3)
Not Perceived	19 (6.7)
Improvement in autonomic symptoms within 1 month (n=220)	
Perceived	154 (54.4)
Not Perceived	66 (23.3)
Return to work/normal household within 3 months of surgery	
Yes	196 (69.3)
No	87 (30.7)
Quality of life	
Improved after surgery	237 (83.8)
Unchanged	38 (13.4)
Worsened after the surgery	8 (2.8)
Subjective satisfaction with surgery (6 months post op)	
Complete satisfaction	142 (50.2)
Moderate satisfaction	69 (24.4)
Minimal satisfaction	48 (17)
Not satisfied	24 (8.5)

DISCUSSION

Since the initial description of ACDF by Robinson and Smith in 1955 and Cloward in 1958, this surgery became the treatment of choice for compressive myelopathy and radiculopathy.[5,6] Though it can be performed for several levels but it's less common in more than 3 level involvement.[8] For multilevel involvement, corpectomy becomes the surgery of choice.

Different types of graft materials have been used to fill up the disc space. Some surgeons routinely put anterior cervical plate after putting the cage. Putting a plate is associated with complications such as dysphagia, screw pull out and plate migration.[9] Some other surgeons do not put plates after putting the graft. This is associated with increased risk of cage migration.[10,11] Overall literatures have equivocal results favouring standalone cage or cage with plate fixation. One of the largest meta-analysis by Oliver et al showed no significant difference in clinical outcome of the patients with or without plate.[12] Most of our cases were operated using cage and plate but in cases where, cage was snugly fitting in the disc space after minimal traction, plate was not used. 4 of our cases

(1.4%) had to be operated again due to migration of plate or screws. One case out of these 4 cases, for whom plate was not used had dorsal displacement of the cage resulting in worsening of myelopathy.

Our patient group was almost identical to study done by Bourgonjon et al on 90 patients, where the mean Nurick grade was 2.5.[13] Mean preoperative Nurick grade for our patients was 2.9. Our surgical outcome and fusion rates were comparable to other studies analyzed by Oliver et al.[12]

Due to corridor surrounded by multiple important organs, ACDF has been found to be associated with multiple complications. Authors have reported recurrent laryngeal nerve paresis, oesophageal injury, tracheal injuries, injury to carotid artery and jugular vein, wound hematoma resulting in respiratory distress, dural tear and cord injuries in their experience.[13-22] Authors have reported postoperative dysphagia ranging from 0 to 24% as the most common complication associated with ACDF.[23-25] In most of the cases it was found to be associated with the use of anterior cervical plate. About 4% of our patients had noted postoperative dysphagia, which resolved within 7 days of the surgery. Paresis of recurrent laryngeal nerve has also been reported in literature with incidence of about 8.3%.[18] There is a theoretical advantage of the left anterior cervical approach but studies have not shown any significant difference in the incidence of RLN paresis with side.[26] All our cases were operated from right side. In our series, 7 patients (2.5%) developed hoarseness of voice, out of which 3 improved till 6 months. Incidence of postoperative hoarseness of voice was associated with mostly C6-7 level or C7-T1 level surgeries. Overall, our complication rates were minimal. Patients had good surgical outcome as assessed with subjective satisfaction with surgery, return to work or household.

CONCLUSION

Patients with clinical features suggestive of cervical compressive myelopathy and radiological features explaining the same do not improve with conservative management alone. ACDF is the treatment of choice for these patients. The technique is associated with minimal blood loss and exceptionally good surgical outcome. Though the surgeons have mixed opinion regarding the use of an endogenous or exogenous graft after discectomy, modern practice of putting a cage or autologous bone has been found effective. Other than improving the spine stability and fusion, it maintains the cervical lordosis too. Due to morbidity associated with harvesting an iliac bone graft, surgeons prefer using a titanium cage filled with locally harvested osteophytes during the surgery. Patients with recent onset of symptoms before surgery show significantly better outcome postoperatively. Despite being associated with rare incidences of dysphagia, hoarseness of voice and perioperative hematoma formation, it has remained the surgery of choice. Patients with long level continuous ossified posterior longitudinal ligament (OPLL) do not benefit with discectomy and require corpectomy or posterior decompression. Longer follow up with larger database would be needed for better prognostication and analysis.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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