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Original Research Article

Surgical management of cervical degenerative disc disease - A retrospective analysis of 100 consecutive cases

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Abstract

Background: Surgical management of cervical disc disease may produce faster symptom resolution compared to conservative treatment. Hence the present study was undertaken to analyze the outcome of patients with degenerative cervical disc disease, who were surgically treated via the anterior or posterior approach for cervical disc prolapse.
Method: Total 100 consecutive cases of cervical spondylosis and who underwent anterior cervical discectomy and fusion by auto graft and posterior cervical decompression surgery were included in the study. Clinical outcome was analyzed by Nurick's Grading System.
Results: Most of the patients (96%) were surgically intervened via the anterior approach whereas very few patients (4%) were approached through posterior route. The commonest level to be operated through anterior approach was C_5-C_6 (66.67%) followed by C_4-C_5 (40.63%) and C_6-C_7 (35.40%). Anterior cervical discectomy with fusion was done in 53 (53%) cases among them 47 (88.6%) cases had good fusion and 6 (11.3%) had poor fusion. The commonest site of fusion was C_5-C_6 (64%) followed by C_4-C_5 (39%) and C_6-C_7 (34%). Two patients underwent laminectomy and two laminoplasty by posterior approach from C_3-C_7 levels. Preoperatively, most of the patients (43%) were in Nurick's grade 0 whereas 7% were in grade V. Postoperatively patients who were in Nurick's grade 0 improved with no evidence of radiculopathy whereas 2% of patients who were in Nurick's grade V did not show any improvement.
Conclusion: The present study revealed good results with anterior cervical discectomy and fusion even for multiple levels (≥3). Also, significant proportion of patients with poor Nurick's grade improved well in this study.
Keywords: Cervical, Spondylosis, Discectomy, Decompression, Nurick's, Laminectomy, Laminoplasty, Radiculopathy.

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1. Introduction

Degenerative disc and ligamentous disease of the cervical spine are thought to represent anatomic adaptations to the continuous wear and tear of the involved structures. This process leads to structural changes in the involved joints, with thickening and calcification of the ligaments and appositional bone formation. Cervical spondylosis is a commonly used term to describe these degenerative changes and has been defined as vertebral osteophytosis secondary to degenerative disease [1-3].

The progression of cervical spondylosis can be insidious. Patients may be relatively asymptomatic or have symptoms ranging from minor findings to significant spinal cord compression with associated signs of myelopathy [4]. When symptoms from cervical degenerative disc disease become chronic, the pain and/or symptoms are likely related to conditions associated with disc degeneration, such as a herniated disc, osteoarthritis, or spinal stenosis. Depending on the cause, the pain may be temporary, or may become chronic. While nearly everyone eventually gets cervical degenerative disc disease with age, there are some factors (Genetics, obesity and smoking etc.) that can make it more likely to develop sooner and/or become symptomatic. In addition, an injury to the spine, such as a

herniated disc, can sometimes start or accelerate cervical degenerative disc disease [5].

Currently, there are various surgical techniques, including anterior, posterior, or combined approaches, in addition to new interventions being utilized in practice. Ideally, the surgical approach should be selected in consideration of each patient's clinical presentation, imaging findings, and overall medical comorbidities on an individual basis. But the unique advantages and disadvantages of each surgical technique often complicate the therapy choice in managing cervical disc diseases [6]. Although anterior cervical discectomy and fusion (ACDF) is the most widely accepted procedure performed for both single and multi-level cervical disc diseases, there are multiple modifications to this technique. Surgeons have access to different types of plates, screws, and cages and can adopt newer advances in the field such as stand-alone and minimally invasive techniques when indicated. In short, no consensus exists in terms of a single approach that is preferred for all patients [6].

2. Materials and Method

Hundred consecutive cases with cervical spondylosis were retrospectively analyzed in the Department of Neurosurgery of Sri Ramachandra Medical College and Research Institute (Deemed University), Chennai during the period of seven years. Chief complaints of the patients with duration were noted. A detailed history, neurological examinations and all relevant investigations were done. Surgical treatment was offered to patients who presented with radiculopathy (not relieved with a trial of conservative treatment), myelopathy or myeloradiculopathy secondary to cervical spondylosis.

Surgical Technique for Anterior Cervical Discectomy

The patients' active and passive range of neck movements were checked when the patient was still awake. Bolster made from bed sheets or sand bag was placed between the shoulder blades to drop the shoulders and to extend the neck. The position of head was kept neutral. In case iliac crest bone auto graft was to be obtained then the pelvis on that side was lifted by a small bolster.

For up to two levels disc prolapse, a transverse incision was marked along the Langer's line in the neck from the midline till the anterior border of sternomastoid muscle. We prefer to expose the cervical spine from the right side. For multilevel surgery (3 or 4 levels) we prefer a vertical incision along the anterior border of the sternomastoidmuscle on the right side of the neck. The incision was taken down to the level of platysma muscle. The platysma was cut and the cervical fascia was exposed. The sternocleidomastoid muscle was retracted laterally and also omohyoid muscle. Dividing the inferior belly of omohyoid muscle increases the exposure especially for C_5-C_6 disc space. The sternomastoid muscle and carotid sheath was retracted laterally and trachea, oesophagus, thyroid gland was retracted medially. Prevertebral fascia and vertebral bodies were exposed.

The prevertebral fascia was incised exposing the anterior longitudinal ligament. Longuscolli muscles were identified and dissected to expose the lateral border of vertebral bodies. Peroperative lateral X-ray of cervical spine with needle in situ was used to identify the correct disc space. Hand held retractors were placed (we avoid Cloward's retractor) under the longuscolli to expose the intervertebral disc space. The edges of the intervertebral disc and anterior longitudinal ligament were incised and the disc material was removed. Enough disc tissue was removed till posterior longitudinal ligament was reached. Operative microscope was brought into use at this stage. Posterior annulus was excised and posterior longitudinal ligaments (PLL) was checked for any herniated fragments or tears/breach. If present they were extracted and PLL cut over ball hook. We prefer to cut open the PLL in all patients with myelopathy to ensure adequate thecal sac decompression. However, in a few patients of radiculopathy when either there was a breach of PLL or there was a doubt of breach of PLL, it was deliberately opened. We prefer to remove all posterior osteophytes encountered preferably with a wooden curette or a diamond tipped drill when thick offending osteophytic bar is present. Once osteophytes were thinned out they were removed with curette or Kerrison'srongeurs. The posterolateral spur of the vertebral bodies were easily exposed and removed. We do not find it necessary to use a vertebral spreader. All patients who were fused had a tricorticate bone graft harvested from the left iliac crest. The graft was inserted beneath the anterior cortex of the vertebral body (approximately 2.0 mm) to prevent extrusion. Longuscolli muscle was always stitched in front of the grafted disc space. Hemostasis was achieved and closure of the neck wound was done in two layers.

The patients were mobilized on the first post-operative day after obtaining X- ray of the cervical spine translateral view. Patient was advised to wear a hard cervical collar for one month postoperatively.

3. Observations and Results

Total 100 consecutive cases were enrolled in the study, among them 87 were males and 13 were females. The mean age of patients was 48.36 years, ranged from 28-75 years. Maximum numbers of patients were in the age group of 41-50 years (31%), (Table 1).

Table 1: Age distribution of patients

Age group	No. of Patients	Percentage
21-30	06	6%
31-40	22	22%
41-50	31	31%
51-60	28	28%
61-70	12	12%
71-80	01	1%

The commonest presenting illness was neck pain which was present in 84% of patients. Most of the patients (62%) presented with symptoms of less than 6 months duration as shown in table 2.

Table 2: Distribution of patients according to symptoms and duration of symptoms

Symptoms	% (n=100)	Duration of symptoms	% (n=100)
Neck pain	84%	< 1 month	17%
Radicular pain	75%	1-3 months	20%
Upper limb weakness	67%	3-6 months	25%
Lower limb weakness	39%	6-12 months	13%
Wasting of muscles	27%	1-3 years	22%
Sensory impairment	65%	>3 years	3%
Bowel involvement	19%	-	-
Bladder involvement	10%	-	-

Fourteen percent of patients presented only with myelopathy as compared to 43% of patients who presented with only radiculopathy. Remaining 43% of patients had features of both radiculopathy and myelopathy. Osteophytes constituted the most common radiological abnormality (70%) followed closely by reduction in disc space (60%). Change in the curvature of cervical spine was noted in 20% of the patients.

Maximum number of patients (49%) presented with single level disc prolapse and the commonest disc space involved was C_5-C_6 (65%) followed by C_4-C_5 (40%), as shown in table 3. Equal numbers of patients (43%) were detected to have lateral and para-central disc prolapse while only minority of them had a pure central disc prolapse (14%).

Table 3:No. of levels involved on MRI cervical spine

No. of levels	No. of patients	Levels affected	No. of patients
1	49%	C_{2-3}	3%
2	34%	C_{3-4}	22%
3	10%	C_{4-5}	40%
>3	7%	C_{5-6}	65%
-	-	C_{6-7}	35%

Most of the patients (96%) were surgically intervened via the anterior approach whereas very few patients (4%) in whom multiple levels were involved were approached through posterior route. The commonest level to be operated through anterior approach was C_5-C_6 (66.67%) followed by C_4-C_5 (40.63%) and C_6-C_7 (35.40%), (Table 4).

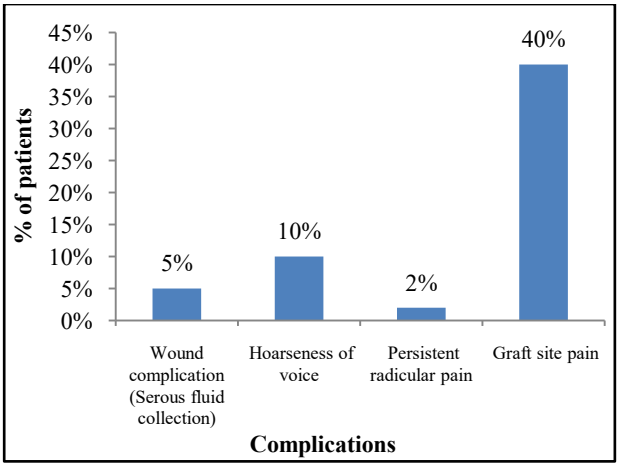
Table 4: Levels operated by anterior approach

Levels	No. of patients (n=96)	Percentage
C_{2-3}	03	3.13%
C_{3-4}	21	21.87%
C_{4-5}	39	40.63%
C_{5-6}	64	66.67%
C_{6-7}	34	35.4%

Anterior cervical discectomy with fusion was done in 53 (53%) cases among them 47 (88.6%) cases had good fusion and 6 (11.3%) had poor fusion. The commonest site of fusion was C_5-C_6 (64%) followed by C_4-C_5 (39%) and C_6-C_7 (34%). 47% were not fused, one patient in whom there was a facetal fracture secondary to trauma underwent fusion with instrumentation. Laminectomy and laminoplasty by posterior approach was done in 2% of cases in each.

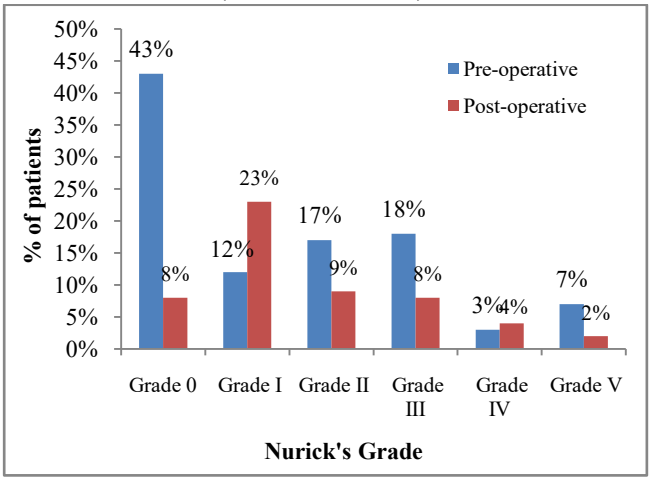
Graft site pain constituted most common post-operative complication (40%) and was transient, other complications is shown in figure 1.

Figure 1: Post-operative complications



Preoperatively, most of the patients (43%) were in Nurick's grade 0 whereas 7% were in grade V. Postoperatively patients who were in Nurick's grade 0 improved with no evidence of radiculopathy whereas 2% of patients who were in Nurick's grade V did not show any improvement, (Figure 2).

Figure 2: Pre and post-operative Nurick's grade (Clinical outcome)



The mean duration of hospital stay postoperatively for a patient with radiculopathy was 7 days, whereas for myelopathy it was 10 days. Postoperatively, 60% patients had good follow-up and 40% had short period of follow-up ranging from 1-3 months. Of 96% patients treated by anterior approach 17.7% (n=17) had cervical kyphosis at the end of 6 months follow up after surgery.

4. Discussion

The degenerative disorders of the cervical spine affect adult patients of any age, with a tendency for particular disorders to affect certain age groups. Cervical disk herniations are more characteristic in the young (less than 40 years old), while cervical spondylosis and stenosis are typically found in older patients. In present study mean age of patients was 48.36 years, male to female ratio was 6.69:1 showing male predominance, this is comparable with the previous studies [7,8].

The commonest symptom in this study was neck pain (84%) and other predominant complaints were radicular pain (75%) and weakness of muscles in upper limb (67%) and lower limbs (39%). Sensory impairment was present in 65% cases. The dysfunction of bowel and bladder was present in 19% and 10% respectively. Many other studies also give similar data [9, 10]. The duration of symptoms ranged from <1 month to up to 6 years. Most of the patients (62%) had symptoms of <6 months duration and faired well postoperatively. There has been significant data supporting better outcome in such patient. The duration of symptoms was important as patients who had myelopathy symptoms of <6 months had better prognosis as compared to patients whose symptoms were >6 months duration [11, 12]. 11% of cases had history of significant trauma and 28% of cases had history of diabetes. 61% (n=43) of patients presenting with radicular symptoms had undergone a trial of conservative treatment. On neurological examination significant wasting was seen in 22% of patients more commonly in upper limb (18%) while only 4% had wasting of lower limb secondary to disuse atrophy. Maximum weakness (up to 0/5) in both upper and lower limbs was seen in 2% of patients. Roentgenographic analysis (including mostly lateral view of the cervical spine) revealed abnormal degenerative/spondylotic findings in almost all patients. Twenty patients lost normal cervical spine lordosis. Seventy patients had significant posterior osteophytes and sixty patients had intervertebral space narrowing. Similar result reported by Bohlman *et al* [13].

Maximum number of patients (49%) presented with single level disc prolapse and 37% of patients had 2 levels of disc prolapse whereas only few patients (17%) had 3 or 4 levels. All this disc prolapses at the above levels were significant requiring discectomy at these levels and this findings are correlated well with the previous studies [10,14,15]. It was found that C_5-C_6 (65%) was the commonest disc space involved in this study and which is comparable with the study done by Ali *et al* [7] and Saravanan *et al* [8].

96% of patients were surgically intervened via the anterior approach, among these maximum numbers of patients (49%) were operated for a single level disc prolapse, 34% of patients was operated for two-level disc prolapse and about 10% of patients were surgically treated for three level disc prolapses. Of the 7 patients in whom 4 levels were involved, 3 patients were still approached via anterior route while remaining 4 patients underwent posterior decompression. The commonest level to be operated through anterior approach was C_5-C_6 (66.67%) followed by C_4-C_5 (40.63%) and C_6-C_7 (35.40%). About 21% required surgery at C_3-C_4 level and only 3% were operated for a high cervical disc prolapse involving C_2-C_3 level. None of our patient had C_7-T_1 disc prolapse. The significant posterior osteophytes were removed in 64% of cases. It was observed that PLL were disrupted in 15% by the prolapsed disc fragment.

53% cases underwent fusion with an auto graft bone harvested from the iliac crest at one or more levels. One patient who had sustained traumatic disc prolapse with facetal fracture in a preexisting spondylotic spine required instrumentation with plate along with autograft fusion. Out of 53 patients, 18 (33.9%) had single level fused, 22 (41.5%) underwent two levels fusion, 9 (17%) were subjected to 3 level fusion. only 3 (5.6%) patients had 4 levels fused. The most common level fused was C_5-C_6 (41; 64%) followed by C_4-C_5 (25; 39%) and C_6-C_7 (23; 34%). Skip lesion involving C_3-C_4 and C_5-C_6 level was seen one patient. 13 patients required C_3-C_4 fusion while only 2 patients required C_2-C_3 level fusion. Of 100 patients, 47 were underwent cervical discectomy via anterior approach without fusion (47%). Four patients who were subjected to posterior decompression have old age with posterior compression and canal stenosis. Two underwent laminectomy and two laminoplasty from C_3-C_7 levels. In this series the comparison between posterior and anterior approach is not feasible due to very few cases in the former group (4%) as compared to 96% who underwent anterior cervical discectomy. Graft site pain was the most common post-operative complication (40%) and in almost all these patients pain was transient and got relieved with analgesics and with time duration after surgery.

Postoperatively assessment of the clinical outcome was judged on the basis of Nurick's Grading system [16]. All patients (43%) who presented only with radiculopathy (Grade 0) improved postoperatively and did not suffer from radicular symptoms on follow up. Among the 12 patients who was in grade I preoperatively with or without radiculopathy, 10 (83.3%) patients improved completely with no radicular or myelopathy symptoms. One patient improved to grade 0 (only radiculopathy) and one remained in grade I. Of 17 patients in grade II, 15 (88%) improved to grade I, one (7%) to grade 0 and one (7%) remained in the same grade. There were 18 patients in grade III, after surgery one (6%) patient improved to grade 0, 8(44%) patients improved to grade I, 8 (44%) improved to grade II and only one (6%) patient remained in the same grade. 3 patients were in grade IV all of them improved by one grade to reach grade III. None of these patients improved to

a grade lower than grade III. There were 7 patients in grade V, of whom none improved to grade 0, I or II. However, one patient (14%) improved to grade III, 4 (57%) patients improved to grade IV and 2 (29%) patients remained in grade V. These results are correlated well with the prior studies [17-19] but Emery *et al* [20] study is very much consistent with the present study.

5. Conclusion

Cervical spondylosis with radiculopathy and myelopathy warrants surgical management. The long term outcome with surgical management is usually gratifying. The present study revealed good results with anterior cervical discectomy and fusion even for multiple levels (≥3). To further emphasise, corpectomy was avoided in all the patients and outcome was almost comparable to various reported series. Significant proportion of patients with poor Nurick's grade also improved well in this study. The outcome is poor in patients with advanced age and with long standing symptoms. Whether, fusion is required for single level disc prolapse in still debatable. Though fusion procedure improves short term outcome, the graft site pain has to be considered and measures to reduce graft site pain should be the outlook in the future.

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