Anterior Discectomy With Fusion And Stabilization For The Management Of Mono-Segmental Cervical Spondylotic Radiculopathy And Myelopathy

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Abstract

The purpose of the current study is to discuss the authors' experience and results in managing degenerative monosegmental cervical radiculopathy and myelopathy by anterior discectomy with fusion and stabilisation. This is a retrospective study which evaluates the results of anterior discectomy with fusion and stabilization performed between 1997 and 2004 at a tertiary-level health care institution. A Magnetic Resonance Imaging (MRI) scan was obtained in each case, and MRI depiction of a prolapsed cervical intervertebral disc was essential for inclusion in the study. Left-sided standard anterior cervical approach was used. Tri-cortical bone graft was impacted into the disc space, and stabilization was done using a standard anterior cervical H-type plate. Good to excellent results were seen in 87.95 % of patients in the radiculopathy group and 70.0 % of patients in the myelopathy group. Most of the complications were related to graft site morbidity. Non-union was seen in 3 of the patients.

INTRODUCTION

Cervical degenerative disc disease begins with biochemical dessication changes of disc nuclear material[1,2,3,4,5]. This leads to loss of disc height and osteophyte formation at the intervertebral end plates. As the degenerative cascade progresses, it has an irritative and compressive effect on the neural elements, producing features of either discogenic neck pain, radiculopathy, or myelopathy[6,7]. In addition, dynamic cord compression as well as compromised vascular supply of the spinal cord contribute to worsening of symptoms of myelopathy[8,9].

Many patients with symptoms of neck pain with or without radiculopathy can be managed non-operatively[10,11]. Indications for surgery in cervical radiculopathy include failure of a 3-month trial of non-operative treatment to relieve radicular arm pain, and a progressive neurological deficit[12,13].

Unlike as in radiculopathy, natural history of cervical spondylotic myelopathy is one of a gradual progressive loss of spinal cord function, and role of non-operative treatment is very limited[14,15,16].

Surgery by anterior approach for decompression and fusion of the cervical spine was developed in 1950s[15,16,17]. Subsequently, anterior disc excision and fusion has been noted to produce good results in mono-segmental cervical spondylosis[18]. However, as the number of involved levels increases, so does the risk of pseudoarthrosis, instrumentation failure, and loss of cervical alignment[19,20,21]. Hence, posterior procedures such as laminectomy with lateral mass plating, and laminoplasty have been recommended for multi-level spondylotic myelopathy[22,23,24].

The purpose of the current study is to discuss the authors' experience and results in managing degenerative monosegmental cervical radiculopathy and myelopathy by anterior discectomy with fusion and stabilisation.

METHODS

This is a retrospective study which evaluates the results of anterior discectomy with fusion and stabilization performed between 1997 and 2004 at a tertiary-level health care institution, for monosegmental cervical radiculopathy and myelopathy. The study included a total of 116 patients (87 males and 29 females), with a mean age of 38.6 years (range 21 to 67 years), with features of either cervical radiculopathy or myelopathy. Out of these, 5 were excluded on account of inadequate follow-up i.e. less than a minimum of 1 year. A

Magnetic Resonance Imaging (MRI) scan was obtained in each case, and MRI depiction of a prolapsed cervical intervertebral disc was essential for inclusion in the study. Each patient was carefully evaluated to confirm clinico-radiological correlation. Patients with a definite history of significant trauma followed by sudden onset or significant progression of symptoms were excluded from the study. Also, patients with multi-level disc disease were excluded from the study.

Patients included in the radiculopathy group were those presenting with either or all of the following features in the upper limb: Radiating pain, muscle weakness, focal atrophy, reflex changes, sensory loss, and paraesthesias.

Patients included in the myelopathy group were evaluated pre-operatively as per the modified Japanese Orthopaedic Association (mJOA) scoring system (Table 1) [22].

Table 1: Modified Japanese Orthopaedic Association scoring system [22]

I. Motor dysfunction of the upper extremity
0: Unable to feed oneself
1: Unable to use a knife and fork; able to eat with a spoon
2: Able to use a knife and fork with much difficulty
3: Able to use a knife and fork with slight difficulty
4: None

II.Motor dysfunction in lower extremity
0: Unable to walk
1: Can walk on flat floor with walking aid
2: Can walk up and/or down stairs with handrail
3: Lack of stability and smooth gait
4: None

III. Sensory deficit
0: Upper extremity, severe sensory loss or pain
1: Upper extremity, mild sensory loss
2: Upper extremity, no sensory loss
0-2: Lower extremity
0-2: Trunk

IV. Sphincter dysfunction
0: Unable to void
1: Marked Difficulty in micturition (retention)
2: Difficulty in micturition
3: None

(Total in normal patient = 17)

Each patient was operated under general anaesthesia, in the supine position. Left-sided standard anterior cervical approach was used. After identification of the involved disc level using radiographic marker, discectomy was performed and thorough decompression was achieved. Tri-cortical bone graft was harvested from the iliac crest, and was shaped to conform to the shape of the disc space. The graft was impacted into the disc space, and stabilization was done using a standard anterior cervical H-type plate. Post-operatively, a Philadelphia cervical collar was applied, usually for 6 weeks, and patient was allowed to sit up from day one.

In the radiculopathy group, at each follow-up, the patients were evaluated clinically on the basis of criteria proposed by Herkowitz et al. (Table 2)[25]. In the myelopathy group, the mJOA scoring system was used to clinically evaluate the patients at follow-up. Radiological evaluation included standard antero-posterior and lateral cervical spine radiographs.

Table 2 : Criteria proposed by Herkowitz et al. for evaluating results of surgery for radiculopathy[25] .

- Excellent: complete relief of pain and weakness
- Good: improvement of pain and weakness
- Fair: improvement of pain and weakness requiring analgesics with lifestyle restrictions
- Poor: no improvement of pre-operative symptoms and signs.

OBSERVATIONS AND RESULTS

The patients included in the study were divided into three groups:

- Radiculopathy only group – 71 patients
- Myelopathy only group – 28 patients
- Patients with features of both radiculopathy and myelopathy – 12 patients.

For purposes of evaluation, the features of radiculopathy and myelopathy in the third group were considered individually in the first and second groups respectively, thus creating the following two groups:

- Group A : Radiculopathy group – 71 + 12 = 83

patients

- Group B : Myelopathy group – 28 + 12 = 40 patients.

In Group A, at each follow-up, the results of surgery were evaluated on the basis of the criteria prosposed by Herkowitz et al. (Table 2) 25. For evaluating the final results, the clinical status of each patient noted at his / her final follow-up results were as follows:

1. Excellent – 16 patients (19.28 %)
2. Good – 57 patients (68.67 %)
3. Fair – 7 patients (8.43 %)
4. Poor – 3 patients (3.61 %)

In Group B, the mJOA score was noted at each follow-up, and the score noted at the final follow-up was considered for evaluating the final results. To calculate the improvement in myelopathy, the formula proposed by Hirabayashi et al. was used[26]:

Final mJOA score - Pre-operative mJOA score X 100 17 - Pre-operative mJOA score

The mean pre-operative mJOA score was 11.42±2.4.
The mean final post-operative mJOA score was 15.24±1.7.

Based on the Hirabayashi formula, the mean recovery was 68.46 %.

The break-up of results was as follows:

Excellent (75-100% recovery) : 6 patients.
Good (50-74 % recovery) : 22 patients.
Fair (25-49 % recovery) : 10 patients.
Poor (0-24 % recovery) : 2 patients.

Most of the complications were related to graft site morbidity, with a painful iliac scar seen in 8 of the patients, iliac wound haematoma in 3 patients, and iliac wound infection in one of the patients. Non-union was seen in 3 of the patients. However, all 3 of these patients had reasonable improvement in symptoms, with painful pseudoarthrosis in only one of the patients. Two patients developed post-operative infection, which responded to local debridement and parentral antibiotics. There was no incidence of mortality, worsening of neurological symptoms, or dural injury seen in the current study.

DISCUSSION

Surgery plays an important role in improving the quality of life of patients with symptomatic cervical disc disease. In the current series, anterior cervical disc excision followed by fusion and stabilisation was noted to produce good results, with a very low complication rate. In the radiculopathy group, excellent and good results were noted in 73 patients (87.95 %), while in the myelopathy group, excellent and good results were seen in 28 patients (70.0 %). Herkowitz et al., in their study on surgical management of soft disc herniations, noted excellent and good results in 85% of the patients[25]. Linsford et al. reported an 87% success rate after anterior cervical discectomy and fusion for soft cervical disc herniations[27]. Gore and Sepic reported a 96% improvement rate in 146 patients who underwent anterior cervical discectomy and fusion[28].

The posterior approach to the cervical spine may be better as compared to the anterior approach when the disc herniation is far lateral, or there is a purely lateral spur[34]. The advantages of posterior approach i.e. decompression by foraminotomy or laminotomy are that it avoids risk to vital neck structures, immobilisation may be unnecessary, and the possibility of graft dislodgement is avoided. However, the anterior approach carries the distinct advantage of directly visualising the pathology, allowing better decompression, and hence creating a more favourable environment for neurological recovery[34].

Herkowitz et al. studied 44 consecutive patients with the diagnosis of one –level cervical radiculopathy or myelopathy[25]. Out of the 17 patients who had undergone an anterior fusion, the results were excellent or good in 94%, while out of the 16 patients who had undergone a laminotomy-foraminotomy, the results were excellent or good in 75% of cases. Though the difference in these results was not statistically significant, the authors noted a trend towards better results with anterior surgery, and they concluded that the recommended procedure for the surgical management of cervical soft disc herniation is an anterior discectomy and fusion.

Anterior cervical discectomy without fusion is associated with a very high rate of disc space collapse[29,30,31,32]. Though instability has been rarely reported following discectomy without fusion, post-discectomy kyphosis is common[29,31,32]. Dunsker reported that post-operative neck pain is more

common when fusion is not performed[33]. Moreover, without fusion, anterior cervical discectomy fails to accomplish disc space distraction which is required for the unbuckling of the posterior longitudinal ligament and the ligamentum flavum, nor does it mechanically open the neural foramina[34].

Routine use of anterior cervical plating in degenerative cervical disease remains controversial. Grob et al. compared the results of anterior cervical discectomy with or without plating, and reported equal pain relief and fusion rates, but better fusion quality with the use of a plate[35]. Caspar et al. concluded that cervical plating results in a higher arthrodesis rate and a lower rate of re-operation[36]. Routine anterior cervical plating for one-level disc disease provides immediate stability, avoids anterior graft dislodgement, restores a normal lordotic curve, enhances the quality of fusion, and shortens the fusion time[18,37,38,39]. Wang et al. and Zoega et al. reported less segmental kyphosis in the plated groups[40,41]. We in our series have supplemented tricortical bone grafting with anterior cervical plating in all the cases, with excellent fusion rates (97.32%) and minimal complications.

CONCLUSION

The current study effectively demonstrates the safety and efficacy of anterior cervical discectomy with fusion and stabilization with a plate in the management of mono-segmental cervical spondylotic radiculopathy and myelopathy. The procedure is associated with minimal complications, and provides good relief in both cervical radiculopathy and myelopathy. We strongly recommend routine use of anterior cervical plating as an adjunct to bone grafting.

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