

Outcome of Anterior Cervical Discectomy and Fusion with Autograft and Plating in management of Cervical Spondylotic Myelopathy

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Abstract

Cervical spondylotic myelopathy (CSM) is the most common cause of cord dysfunction in patients over 55 years of age. Although the most common symptoms are pain and parasthesia in limbs, the disease is progressive and can lead to debilitating gait disturbances, total inability to use limbs and sphincter disturbances. Anterior cervical discectomy and fusion (ACDF) using autogenous bone graft is standard management of CSM; however the procedure can cause recurrence of symptoms and kyphotic changes at the fused segment. We intend to evaluate efficacy of anterior cervical discectomy with autogenous bone grafting and plating in patients of CSM in relieving the neurological symptoms, maintaining lordosis of cervical spine and to identify any complication arising from the procedure.

STUDY CONDUCTED AT

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INTRODUCTION

Cervical spondylotic myelopathy (CSM) is defined as spinal cord compromise arising from degenerative changes in the cervical vertebral column [1]. Bedford et al pointed out that the primary factor causing CSM is degeneration of intervertebral disc. The degenerated disc leads to altered stress and biomechanics, which ultimately leads to osteophyte formation and capsular thickening [12]. Park and Panjabi pointed out that loss of disc height also leads to thickening and in folding of ligamentum flavum [3]; thus the canal compromise which begins anteriorly eventually becomes circumferential.

CSM however, is not a fixed anatomical entity. Bernhardt et al highlighted the dynamic factors by demonstrating that spinal cord stretches with flexion of the cervical spine and thickens with extension [4], this thickening of cord in extension makes it more susceptible to pressure from the in folded ligamentum flavum or lamina. Role of vascular factors in CSM was first proposed by Barre (1924); Hukuda and Wilson concluded that vascular insufficiency and cord compression are additive and this may explain the clinical

signs of CSM in the patients with relatively slight mechanical compression [5]. When all these factors combine to cause decrease beyond a critical level, in the space available to the spinal cord, the patient becomes symptomatic. The extent of the spinal canal narrowing together with factors such as duration over which narrowing has occurred, vertebral alignment, dynamic cord compression and vascular supply decides the severity of the symptoms [12].

Clinically, the disease is characterized by weakness in the limb and gait disturbance; parasthesia and numbness, with or without pain; and vasomotor symptoms [26]. Objective signs of muscular weakness and wasting, exacerbation of deep tendon reflexes, sensory disturbances and sphincter dysfunction as a result of upper motor neuron lesion are other characteristics of the disease [267]. The natural history of CSM, although varying from patient to patient, is characterized by a gradual and progressive loss of cord function. Clarke and Robinson concluded that no patient ever returns to normal state [8]. The progressive cord compression eventually causes irreversible damage.

Being a non invasive test, clear depiction of soft tissue anatomy including the spinal cord, capsular thickening, ligamentum flavum and non calcified disc protrusion;

magnetic resonance imaging (MRI) is the investigation of choice in CSM [9]. MRI is also helpful in predicting the prognosis in a case of CSM. Matsuda et al concluded that clinical outcome was worse in patients who have increased signal intensity in T2 weighed sequence [10]. Morio et al while correlating the MRI findings and surgical outcome in patients of CSM have concluded that patients with low signal intensity on T1 weighed sequence have poorer outcome [11]. Probably these findings indicate irreversible changes in the cord.

Management of CSM is aimed at relieving the pressure on cord. If intervention is delayed or ignored the cord functions may be permanently damaged. Although CSM can be managed conservatively, The Cervical Spine Research Society (2000) concluded that surgically treated patients had significant improvement in functional status, over all pain and neurological symptoms. Patients treated conservatively have a significant worsening of their ability to perform activities of daily living and worsening of neurological symptoms.

Laminectomy was the first surgical intervention planned to relieve the pressure in CSM. Now a days Laminectomy is not favored because of the sequel it can cause; such as segmental instability, kyphosis, 'swan-neck' deformity and late deterioration [112].

Whitecloud noted that monosegmental CSM requiring operative intervention responds well to anterior disc excision and fusion with autograft [13]. Anterior discectomy by Smith and Robinson approach is less disruptive to neck musculature as there are natural planes in anterior approach [14]. Anterior approach provides for adequate fusion of 2nd to 7th cervical vertebrae. However, as the number of involved levels increases so does the risk of pseudoarthrosis, instrument failure and loss of cervical alignment [115,16]. Multilevel cervical spondylosis (more than 3 intervertebral levels), multilevel spondylosis and congenital cervical stenosis, multilevel spondylosis and degenerative kyphosis, post laminectomy kyphosis, traumatic kyphosis and S-type curves are appropriate indications for combined cervical arthrodesis [17].

Anterior cervical plating has numerous potential benefits as adjunct to anterior cervical discectomy and fusion. It provides rigid fixation, resists development of segmental kyphosis, promotes higher fusion rates, allows for less cumbersome external immobilization and reduces the

chances of graft extrusion.

MATERIALS AND METHODS

In this prospective study, 25 patients with clinical and radiological evidence of cervical spondylotic myelopathy, who underwent anterior cervical discectomy and fusion with plating; were evaluated for a mean duration of 2.8 years to assess outcome of the procedure.

EXCLUSION CRITERIA

1. patients with multilevel disease (> 3 levels)
2. those with kyphotic deformity of the spine
3. congenital cervical stenosis
4. patients with non lordotic spinal alignment (straight/sigmoid)

Each patient underwent thorough clinical and radiological evaluation. Preoperative Nurick's grade was recorded for all patients. Radiological evaluation included anteroposterior X-rays and MRI. Sagittal alignment of patients was classified based on classification proposed by Toyama et al [72]. Findings on T1 and T2 weighed sequence of MRI and cervical canal diameter was recorded.

Figure 1

Figure 1: Preoperative MRI showing circumferential cord compression



All patients were operated by Smith-Robinson approach. After discectomy, decompression was carried out laterally up to the Uncinate process and the end plates were curetted. Graft size was measured using a divider and tricortical bone graft harvested from Iliac crest was press fitted in the disc space with cortical surface facing the dura. Appropriate size plate was applied over the vertebral surface.

Philadelphia collar was given for additional support in post operative period and patient was allowed to sit with collar from first post operative day.

Figure 2

Figure 2: Collar immobilisation on 2 postoperative day

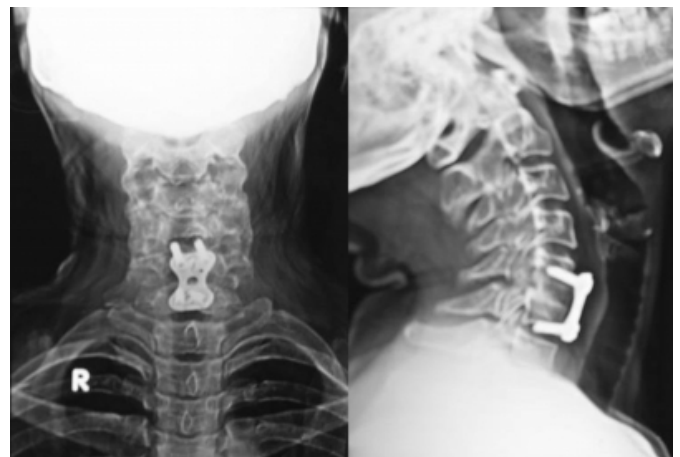


A follow-up at six weeks, twelve weeks, six months and one year was done in all cases. Patients were then evaluated at 6 months interval. The mean duration of follow-up in the study was 2.8 years. At the follow-up, the patients were evaluated clinically to look for improvement in neurological function based on Nurick's grading and

Odom's criteria. Radiological evaluation included antero-posterior and lateral x-rays of cervical spine to evaluate the fusion and to see for sagittal alignment as per the Toyama et al classification.

Figure 3

Figure 3: Radiograph at 18 months showing sign of fusion and normal lordosis



STATISTICAL METHODS

Pre and post operative neurological status were compared using Mc Nemar test. Differences in surgical outcome among different age groups were compared using Anova test and unpaired t-test was used to compare result of surgery in patients having different signal intensities on MRI.

RESULTS

The mean age of patients included in the study was 44.52 years, ranging from 22 years to 70 years. 23 of the patients were male and 2 were females. At the end of follow up:

All patients were free of permanent pain

24% of patients had pain episodes

17% of patients remained with radicular pain

19% still used pain medications

30% patients had impaired range of cervical motion

17% patients had persistent muscle weakness

37% of the patients had sensory disturbance

13% patients had pathological reflex status

Quality of life were (as per Odom's criteria) excellent in 80% (Nurick's grade 0,1 and 2) of the cases and good in rest 20% of cases (Nurick's grade 3 and 4).

Fusion occurred in 80% of operated disc spaces.

Pre and post operative differences were compared using Mc Nemar test and were found significant at $p < 0.001$.

Based on Toyama's classification, no patient developed kyphotic change in the cervical spine but loss of lordosis to neutral was observed in 2 (8%) patients.

2 patients (8%) developed superficial wound infection. No other complication occurred during the study.

OUTCOME IN DIFFERENT AGE GROUPS

For the purpose of evaluation, patients were divided into three groups.

- Patients aged less than/equal to 50 years: 17
- Patients aged between 51-60 years : 5
- Patients aged more than 60 years : 3

The difference in mean recovery in the three age groups was compared using Anova test and was found to be statistically insignificant.

Based on signal changes on MRI: Patients were divide into three groups based on signal changes in MRI.

- Group 1- having normal signals on T1 and T2 sequences
- Group 2- having increased signal on T2 sequence

- Group 3- having decreased signal on T1 sequence

Inter group variation was compared using unpaired T test. The p-value of comparison between group 1 and 2 was 0.7578 which is not significant; there by suggesting that result of the surgery do not differ between the two groups.

The p-value of second comparison (group 1- group 3) was .00978, thus indicating that outcome of the surgery is worse in patients having low signal intensity in T1 weighed images than those with no such changes.

DISCUSSION

CSM is essentially a degenerative disorder, which after onset in a patient manifests clinically only after cervical spine has been subjected to a few decades of wear and tear. The patients included in the study ranged from 22 to 70 years.

The patients in a study of CSM by Houten and Cooper (2003) ranged from 44 to 86 years of age. Another study by Kumar et al (1999) had patients aged between 33 to 79 years.

In the current study, the patients were classified on the basis of age as less than or equal to 50 years, 51-60 years and more than 60 years of age. The final outcome was found better in younger age group but this was statistically insignificant.

Guidetti and Fortuna (1969), observed better outcome in younger age group (25-40) compared to older age group (61-70).

Similar results were observed by brain et al in 1952.

It has long been speculated that signal intensity changes on MRI represent pathologic changes in the cord and can reliably predict stage of the disease. Ramanauskas et al reported that in early and intermediate stage the spinal cord shows high signal intensity on T2 weighed images and it corresponds to cord edema. Low signal intensity on T1 weighed sequence, which appears later stage reflects cystic necrosis of the central grey matter after prolonged cord edema. Morio et al (2001), in a study of 73 patients of CSM concluded that low signal intensity changes on T1 sequence indicate poor prognosis. They also speculated that high signal intensity changes on T2 weighed images include a broad spectrum of compressive myelomalacic pathologies.

Al Mefty et al (1993) suggested that high signal intensity on

T2 weighed images indicate myelomalacia and low signal changes on T1 weighed sequence indicated cystic necrosis or secondary syrinx.

In the current study high signal intensity changes in T2 weighed sequence was present in 12 patients and low signal intensity on T1 weighed sequence in 3 patients. Our study suggests that at least some of the high signal intensity changes on T2 weighed sequence may represent reversible changes in the spinal cord while low signal intensity changes on T1 weighed sequence represent irreversible damage to a portion of spinal cord thus accounting for poor prognosis.

In the current study kyphotic deformity was not observed in any of the patients. The normal lordotic curve of the cervical spine was maintained in all but two patients; however this was not associated by any neurological deterioration in the patient. This demonstrates efficacy of anterior cervical plating in achieving good internal fixation of the cervical spine.

Longer follow up would better assess efficacy of the procedure in maintaining the cervical stability and neurological recovery.

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