ORIGINAL RESEARCH PAPER
Volume-6 | Issue-10 | October-2017 | ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 78.46
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

OPERATIVE OUTCOME OF DEGENERATIVE CERVICAL MYELOPATHY AND RADICULOPATHY

Orthopaedics

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ABSTRACT

Recovery from cervical spondylitic neurological deficit occurs rapidly following first 3 months of decompression surgery and stabilizes thereafter till 6 to 9 months of surgery. Rehabilitation should begin early to optimize this neurological recovery. Severe deficit seems to follow the same process and levels off at a lower neurological level. Exploration and follow-up of these patients requires refining more specific assessment scales than the JOA score, using quantifiable and reliable criteria. For now, evaluation of neurological recovery should preferentially take into account the absolute JOA score rather than the Hirabayashi neurological recovery rate, which is poorly adapted to evaluating patient progression.

Anterior cervical discectomy with fusion for 1-2 levels has given good results than posterior laminectomy for 3 or more levels. Cervical radiculopathy alone has good recovery results after decompression surgery than myelopathy or myelopathy with radiculopathy.

Duration of symptoms preoperatively, age at presentation, number of levels involved affects the recovery. They are negatively correlated with recovery. Sex of the patient and level of involvement has no correlation with recovery pattern. Severe neurodeficit at presentation also follows the same pattern of recovery, but attains lower JOA score at 9 months than patients with less neurodeficit at presentation. ODI score recovery rate also follows the same pattern of functional improvement and parallels to JOA recovery rate. Radicular pain relief occurs earlier than neck pain as measured by visual analogue scale.

Based on this short to medium term study, we found that the results of surgery for cervical spondylotic myelopathy are excellent. The best neurological and functional recovery is seen in patients with mild to moderate functional disability at the time of surgery.

KEYWORDS

INTRODUCTION

Cervical spondylotic myelopathy (CSM) refers to long tract signs in the upper and lower extremities arising from a combination of static and dynamic compression due to disc herniation, osteophtye formation, hypertrophy of facet joints and hypertrophy of ligaments, as well as due to vascular phenomenon.

The management of CSM is controversial as its natural history is still unclear. Cervical radiculopathy refers to symptoms in a specific dermatomal distribution in the upper extremity. Patients describe sharp pain, tingling, or burning sensations in the involved area. There may be sensory or motor loss corresponding to the nerve root involved, and reflex activity may be diminished. Radicular complaints in the arm originate from the cervical nerve roots at some point between their origins as nerve rootlets from the spinal cord and their transition into peripheral nerves as they emerge from the neural foramen. Degenerative changes at the cervical motion segment, soft disc herniations, stenosis, intrinsic nerve root pathology, and trauma all can result in these symptoms. Management of such cases is done by non operative therapies like physiotherapy NSAIDs, immobilization and so on. Surgical management is reserved for patients who donot respond to medical management or progress to some functional disability. LaRocca[1] was of the opinion that medical management was inappropriate for patients with moderate functional disability and should be managed operatively. [2]

Surgery is done to decompress the spinal cord and to provide a stable spine. Surgical approach depends upon the direction of the compression, number of levels involved, sagittal alignment and presence or absence of instability with axial neck pain. Posterior approach is favored for multilevel cervical stenosis with dorsal cord compression with a well maintained cervical lordosis. Anterior approach is favoured in ventral cord compression, instability or kyphotic deformity with significant neck pain. However, the neurological recovery is variable.

Recently McAfee[3], Epstein and others[4] have reported excellent neurological recovery following a combined anterior plus posterior decompression and fusion for cervical trauma, tumors, OPLL , etc. It has also been suggested that patients having multilevel cervical spondylosis with degenerative kyphosis or congenital stenosis, causing severe anterior plus posterior cord compression, circumferential decompression and fusion may provide a better neurological recovery.

This study was designed for post operative neurological recovery pattern in patients with cervical spondylotic myelopathy and radiculopathy following anterior, posterior or circumferential approach to cervical decompression and fusion.

METHODOLOGY

A consecutive series of 30 patients with functional disability secondary to cervical degenerative myelopathy and radiculopathy underwent surgery for decompression of the spinal cord with or without spinal stabilization from March 2012 till March 2013 were studied. All patients were operated by a single surgeon and reviewed independently. All the patients had received appropriate conservative management before undergoing surgical intervention. The ethics committee approved the study plan and informed consent was obtained from all patients before the operation.

All patients who were diagnosed with degenerative cervical myelopathy with involvement of sub-axial cervical spine and age between 30-80 years with radiculopathy and did not improve inspite of appropriate conservative management and progressed to functional disability were included in this study.

Patients with myelopathy secondary to medical causes, traumatic myelopathy, congenital myelopathy, previous history of cervical spine surgery, psychiatric disorders and patients who were medically unfit or without a definite diagnosis were excluded from the study After a detailed history and examination radiographs and MRI of the cervical spine were taken. After confirming the diagnosis clinically and radiologically surgical intervention was planned. All patients were operated by a single surgeon and reviewed independently. Surgery was done by a senior spine specialist for a definite diagnosis. Patients were operated in prone position for laminectomy using posterior approach and supine position for anterior approach using left lateral transverse incision.

Pain and neurological examination was assessed pre and postoperat ively by using Japanese Orthopaedic Association (mJOA) score, Owestry Diasblilty Index (ODI) and Visual Analogue Scale. The mJOA score may range from 0 to 18 with higher scores representing a

more preserved neurological and functional status.

Based upon the direction of spinal cord compression, the number of spinal segments involved, the sagittal alignment of the cervical spine and the presence or absence of spinal instability and axial neck pain, the patients underwent one of three different operations –

1. Anterior cervical discectomy and fusion - ACDF Anterior cervical corpectomy and fusion - ACCF
2. Posterior multilevel laminectomy - PL
3. Anterior cervical decompression and fusion + posterior laminectomy (ACDF+PL)

RESULTS:

The study group comprised of 27 males and 3 females aged between 36 and 75 years with a mean age of 56 years that presented with functional disability secondary to cervical myelopathy and radiculopathy. Patients in this study were divided into two groups to find out significance of age in neurological recovery pattern. Most patients presented were fifth and sixth decade of life [2/3rd:36-59 years and 1/3rd:>=60years]. Males were more in number than females.

Myelopathy patients were more in number than radiculopathy. Single level involvement was more common than multiple levels. Anterior cervical discectomy with fusion (ACDF) was done more commonly than posterior laminectomy (PL). It was seen that neurological recovery (JOA score) after myelopathy at intervals between 15 days to 3 months was significant after which recovery was occurring but was not significant (Table 1). It was found that neurological recovery (JOA score) for radiculopathy at intervals upto 3 months post surgery was significant after which recovery was not significant (Table 2). It was found that neurological recovery in radiculopathy occurs faster than myelopathy and attains plateau earlier (Figure 1).

It was found that age, number of levels involved, time since symptomatic were correlated with JOA score and ODI recovery rate (negative correlation).(Table 3) It was found that as age increases neurological recovery rate myelopathy and radiculopathy decreases. It was found that as number of levels involved increases neurological recovery rate for myelopathy and radiculopathy decreases. It was found that as duration of symptoms increases neurological recovery rate (JOAS) decreases for myelopathy and radiculopathy. As age increases neurological recovery rate (ODI) decreases for myelopathy and radiculopathy. As number of levels involved increases neurological recovery rate using ODI score for myelopathy and radiculopathy decreases. It was found that as duration of symptoms increases neurological recovery rate using ODI score for myelopathy and radiculopathy decreases.
Neck pain was decreasing upto first 3 months of post surgery and then becomes slow to decrease. Radicular pain was decreasing upto first 3 months of post surgery and then becomes slow to decrease.

DISCUSSION

The overall analysis of our series showed an initially rapid neurological recovery during the first 3 months after surgery. Subsequently, the result obtained at 3 months after surgery only improved very slightly, with the curve nearly leveled off, with patients progressing little beyond the sixth month. This recovery process describes an analogue curve, whatever the severity of the initial deficit. On average, patients presenting a very severe initial deficit show the same recovery process as patients with less severe impairment but final score achieved in former was less than later.

Many publications have evaluated the more or less long-term results of cervical cord decompression surgery in myelopathy. We found no studies evaluating the speed of this recovery. Seichi et al. [5][6] showed that the JOA score remains stable after 1 year postoperative, Neurological recovery, when evaluated by JOA score, progresses a mean of 5 points. Matsuda et al.[6] came to the same conclusion with patients over 75 years of age. The results expressed in this study are based on the JOA score

The pre-op mJOA score in group of 22 patients undergoing anterior surgery was 12.04 which improved to 16.73 at last follow-up after 9 months. These results were comparable to those reported by Wada et al. who reported an improvement in mJOA scores from 7.9 to 13.3 at 1 year follow-up in 23 patients that underwent ACCF. That means both studies were comparable and showed 4-5 points recovery. Comparing these studies it seems that points of recovery were more in patients with less preoperative score but final attained score was more in patients with higher preoperative score. Emery et al also reported a high rate of pain relief, neurological and functional improvement in 108 patients that underwent anterior discectomy or partial or subtotal corpectomy for CSM. They co-related good outcomes with milder pre-operative neurologic deficit and disability whilst recurrent myelopathy was co-related with a non-union. In our study we were also compared the results of radiculopathy with myelopathy. Radiculopathy alone had quicker recovery and attained higher JOA score than myelopathy or myelopathy with radiculopathy. Recovery rate for radiculopathy alone was 100% as compared with 66.67% for myelopathy.

The patient with the neurological deterioration showed significant neurological improvement but continued to have a mild disability even at last follow-up. Whilst a mild difficulty in swallowing is not uncommon for a few days post-op, one patient had severe dysphagia due to paresis of the pharyngeal musculature following excessive retraction during a corpectomy. This patient required a feeding gastrostomy for one month before he recovered from the dysphagia.

At long-term follow-up, 3 patients developed radiological evidence of adjacent level degeneration with reduction in disc height, anterior and posterior osteophytes. One of these patients was asymptomatic, a second had mild axial neck pain which was treated symptomatically. A third patient developed a prolapsed disc at the adjacent segment and developed radicular arm pain which settled with non-operative treatment.

Posterior surgery, ie, laminectomy has for long been the treatment for multilevel cervical spondylotic myelopathy. It allows excellent decompression of the spinal cord, is safe and quick. Hence it is the preferred method of decompression in the elderly. Potential adverse outcomes of laminectomy include instability and epidural scar formation which may result in post-operative neck pain or headache. In the long-term, loss of normal cervical lordosis or development of kyphosis along with late deterioration of neurology have been problems. Fear of instability and the need to maintain sagittal cervical spine alignment has resulted in many surgeons performing posterior lateral mass fixation with interfacetal fusion at the same time. In a kyphotic spine, the posterior translation of the spinal cord does not occur and hence the indirect decompression of the spinal cord does not take place.

In our series, 8 patients underwent laminectomy. The pre-operative mJOA score that underwent posterior surgery alone was 9.63. Post-operative the mJOA score improved to 13.37. Houten et al. evaluated 38 patients who underwent laminectomy and lateral mass plating for CSM.[7]Significant improvement in neurological function occurred in 97% of patients. The mJOA score improved from 12.9 to 15.6 at a mean follow up of 6 months. Complications included a C5 nerve root palsy. Here also points of recovery are more with severe neurodeficit but final achieved score is less and our study shown comparable results.

In the group that underwent posterior surgery, we have had one patient who had foraminal osteophytes but no radicular pain pre-operatively, developed arm pain post-operatively. This patient was given intravenous solumedrol over 48 hours before the pain settled down. One patient had a drop in neurology immediately post-operative who not shown neurological recovery on follow up. One patient has a C5 nerve root palsy which recovered over a period of three months.

In our study we also studied the VAS score for pain relief and ODI score for improvement of overall disability of patient. Patients with radiculopathy alone got quicker pain relief than myelopathy or myelopathy with radiculopathy. Pain relief was more in first 3 months after which very few patients required medicine for pain relief. ODI score also showed the results more or less parallel to JOA score but it measured actual functional capacity of doing daily activities. This was assessed by ODI recovery rate, 3 patients with less than 40% recovery were moderately disabled. 6 patients with around 60% recovery were mildly disabled. And remaining 21 patients were returned to their occupation.

In our study factors like age, duration of symptoms, number of levels involved were correlated with neurological recovery. JOA score, ODI score recovery had negative correlation with these factors. Sex of the patient, level of compression had no correlation with neurological recovery of patient.

Our study is a single surgeon based consecutive cohort of patients studied and reviewed independently using valid outcome measures. The study group is large and helps us to study the role of surgery in CSM whilst comparing the results and complications following different surgical approaches.

However the study also has several limitations. The decision regarding the surgical approach used is not randomized. Hence the different groups cannot be compared with each other. The only outcome measure used is the mJOA score which does not measure the patient`s pain and the disability thereof. The study duration too is small. With further follow-up, one may find failures of the posterior fusion/ instrumentation because interfacetal fusion is difficult to assess on plain xrays. Further with longer follow-up, adjacent level degeneration and post-laminectomy deformity may also affect the clinical outcome. The location of the compressive pathology, the number of levels involved, the sagittal cervical spine alignment and the presence or absence of instability and axial neck pain, factors in the decision as to which approach would be most appropriate for a particular patient.

CONCLUSION

Based on this short to medium term study, we found that the results of surgery for cervical spondylotic myelopathy are excellent. The best neurological and functional recovery is seen in patients with mild to moderate functional disability at the time of surgery.

TABLES

Table 1 : Comparison of JOAS at variables time intervals among the Myelopathy cases (n=26)

JOAS-	Mean	SD	Median	IQR	Chi-Square	p-value
At presentation	11.08	2.06	12.00	4.00	119.695	3.64E-24
15 days post-op	11.73	2.26	12.00	3.00		
1 month	13.08	2.35	14.00	4.00		
3 month	14.42	2.08	15.00	3.00	Difference is significant	
6 month	15.31	2.11	16.00	3.00		
9 month	15.50	2.10	16.00	3.00		

Note: Friedman Repeated Measures ANOVA on Ranks applied.

Table no.2: Comparison of JOAS at variable time intervals among the Radiculopathy cases (n=4)

JOAS-	Mean	SD	Median	IQR	Chi-Square	p-value
At presentation	13.50	0.58	13.50	1.00	19.836	0.00134
15 days post-op	15.50	0.58	15.50	1.00		
1 month	16.00	0.00	16.00	0.00		
3 month	18.00	0.00	18.00	0.00	Difference is significant	
6 month	18.00	0.00	18.00	0.00		
9 month	18.00	0.00	18.00	0.00		

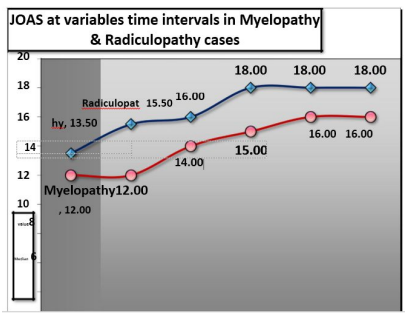
Note: Friedman Repeated Measures ANOVA on Ranks applied.

Table no.3: Nonparametric correlation between various variables

Variablity	Spearman's rho	Age (years)	No. of levels involved	Time since symptomatic (months)	JOAS recovery rate (%)	ODI recovery rate (%)
Age (years)	CorrelationCoefficient	1	.368(*)	.439(*)	-.521(**)	-.548(**)
	p-value	.	0.0455	0.0151	0.0031	0.0017
No. of levels involved	CorrelationCoefficient	.368(*)	1	0.284	-.784(**)	-.701(**)
	p-value	0.0455	.	0.128	1.00E-06	1.57E-05
Time sincesymptomatic (months)	CorrelationCoefficient	.439(*)	0.284	1	-.453(*)	-.377(*)
	p-value	0.0151	0.128	.	0.012	0.0401
JOAS recovery rate (%)	CorrelationCoefficient	-.521(**)	-.784(**)	-.453(*)	1	.877(**)
	p-value	0.0031	######	0.012	.	1.00E-06
ODI recovery rate (%)	CorrelationCoefficient	-.548(**)	-.701(**)	-.377(*)	.877(**)	1
	p-value	0.0017	######	0.0401	1.00E-06	
* Correlation is significant at the 0.05 level (2-tailed).						
** Correlation is significant at the 0.01 level (2-tailed).						

FIGURES

Figure 1



At presentation	15 days post-op	1 month	3 month	6 month	9 month
		Time intervals			

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