

Study of Functional Outcome of Anterior Cervical Decompression and Fusion Using Tricortical Iliac Bone Graft for Degenerative Cervical Spondylotic Myelopathy with Modified Japanese Orthopedic Association Score

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Abstract

Objective: To determine functional outcome of anterior cervical decompression and fusion using tricortical iliac bone graft (ACDF) for degenerative cervical spondylotic myelopathy with modified Japanese orthopedic association score (MJOA).

Materials and Methods: 60 diagnosed cases of one and two levels cervical myelopathy were prospectively analyzed preoperatively and at 3 months, 6 months, 1 year using MJOA.

Results: 46 patients underwent Single level ACDF with C5-C6 the commonest level to be affected. The correlation between Duration of Symptoms to Preoperative and postoperative MJOA was statistically significant. We noted statistically significant improvement in symptoms of axial neck pain, radicular arm pain, clumsy hand, and gait disturbances post operatively at one year. Statistically significant difference was noted while comparing MJOA of Pre-operative to 6 months and 1 year, and 3 months to 6 months and 1 year. Statistically significant difference in blood loss and anesthesia time for one level fusion compared with two level fusions was also noted. The fusion rate for single level ACDF was 95.65% compared to 71.42% for two levels.

Conclusion: Functional outcomes in operated patients at 1-year follow up are better if ACDF surgery is done early. Symptoms of axial neck pain; radicular arm pain, clumsy hand and gait disturbances show significant improvement at one year follow up. While bladder and bowel involvement showed the least recovery. Significant improvement in function occurs postoperatively between 3 and 6 months, and then it plateaus from 6 months to 1 year. Fusion rates for single level ACDF are better than two levels ACDF.

Keywords: Cervical myelopathy; Cervical fusion; ACDF; Modified Japanese orthopedic association score

Introduction

Cervical spondylotic myelopathy refers to clinical syndromes arising from a combination of static and dynamic compression of neural structures due to disc herniation, osteophyte formation, hypertrophy of facet joints and hypertrophy of ligaments, as well as due to vascular phenomenon. Surgical intervention is considered if conservative treatment fails. The surgical aim is to decompress, stabilize and to restore the alignment of spine. LaRocca [1] was one of the first to recommend early spinal cord decompression with or without stabilization to halt the progression of the disease for patients presenting with moderate functional disability. The management of cervical spondylotic myelopathy continues to be shrouded in controversy. Common surgical technique includes discectomy without fusion or discectomy with fusion (ACDF) [2-8] and corpectomy with fusion (ACCF) [3,5,9,10]. Fusion technique includes use of bone graft or cage and addition of plate [9,10]. ACDF has been confirmed to be beneficial in treatment of cervical myelopathy in both long and short-term follow up [11,12]. In a meta-analysis of ACDF vs. ACCF for treatment of cervical myelopathy in 2015 authors concluded that blood loss and numbers of complications during surgery in ACDF were significantly less than that with ACCF, while the clinical outcome was similar for both the procedures [13]. In the present study, we have analyzed post-operative functional recovery in patients undergoing anterior cervical decompression and fusion surgery for degenerative

cervical spondylotic myelopathy according to 'Modified Japanese Orthopaedic Association Scores' (MJOA).

Materials and Methods

60 patients between August 2009 to March 2014 with clinical and radiological diagnosis of cervical spondylotic myelopathy of one or two levels were prospectively analyzed using 'Modified Japanese Orthopedic Association scoring' (MJOA). All cases were operated using anterior approach under fluoroscopic guidance. Following discectomy, autologous tricortical iliac bone graft was used for fusion. MJOA scoring was done pre-operatively and post-operatively at 3 months, 6 months and at 1 year (Table 1). Data was collected by direct observations as per the performa prepared. Radiographs of the cervical spine (Antero

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Received August 13, 2015; **Accepted** September 05, 2015; **Published** September 07, 2015

Citation: Sharma A, Dhake M, Singh V, Natraj B, Mahajan R, et al. (2015) Study of Functional Outcome of Anterior Cervical Decompression and Fusion Using Tricortical Iliac Bone Graft for Degenerative Cervical Spondylotic Myelopathy with Modified Japanese Orthopedic Association Score. J Spine 4: 255. doi:10.4172/2165-7939.1000255

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According to modified Japanese orthopedics association scoring	
Mild	- 14 and above
Moderate	- 10 – 13.
Severe	- 9 and below

Table 1: Modified Japanese orthopedics association scoring.

posterior and Lateral) and MRI of the spine was done in all cases. Data was analyzed using - McNemar Test: For comparison between pre-operative and post-operative symptoms at 1 year follow up of axial neck pain, radicular arm pain, clumsy hands, gait disturbances and bowel and bladder symptom. ($p=0.05$ is considered to be significant). Kruskal-Wallis One Way Analysis of Variance on Ranks and All Pairwise Multiple Comparison Procedures (Turkey Test): For comparison of MJOA score at various time intervals among the cases. Spearman rank correlation coefficient: -For correlation between Duration of symptoms till surgery and Pre-operative MJOA Correlation between Duration of symptoms till surgery and Post-operative MJOA at 1 year, Chi-Square tests (Pearson Chi-Square, Continuity Correction, Fisher's Exact Test): -For association among the cases between- Number of levels Mann-Whitney test: - For comparison of blood loss and Anesthesia time by number of levels.

Results

The mean age in our study was 51.07 years with (± 9.39 SD) range 30 years to 72 years. Out of 60 patients enrolled 36 patients were male and 24 were female. Out of 60 patients, 22 patients presented with signs and symptoms of myelopathy alone while remaining 38 patients had signs and symptoms of myelopathy and radiculopathy. At presentation, 34 patients had mild disability (i.e. MJOA 14 and above), 12 patients had moderate disability (i.e. MJOA 10 to 13), 14 patients had severe disability (i.e. MJOA 9 and below). At one year follow up, 42 patients had mild disability (i.e. MJOA 14 and above), 2 patients had moderate disability (i.e. MJOA 10 to 13) and 16 patients had severe disability (i.e. MJOA 9 and below) (Figure 1). 46 patients underwent single level ACDF with C5-C6 being the commonest level to be affected in 24 patients. In 14 patients, two level ACDF was done (Figure 2). In our study, the mean duration of symptoms present before surgical treatment was 3.63 months (± 2.57 SD). The correlation between duration of symptoms (months) to pre-operative MJOA scores was statistically significant (p -value=0.015). The correlation between duration of symptoms (months) to post-operative MJOA scores was statistically significant. (p -value=0.013) (Table 2). We noted statistically significant improvement in symptoms of axial neck pain (p value=0.00012), radicular arm pain (p value=0.004), clumsy hand (p value=0.031), gait disturbances (p value=0.039), post-operatively at 1

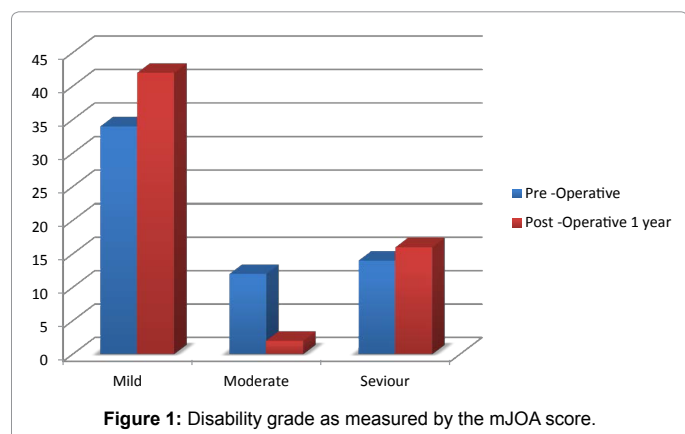


Figure 1: Disability grade as measured by the mJOA score.

year follow up. All Pairwise Multiple Comparison Procedures (Turkey test) applied, there was statistically significant difference noted with comparison pairs of pre-operative vs. 6 months, pre-operative vs. 1 year, 3 months vs. 6 months, 3 months vs. 1 year. But no significant difference was found between pre-operative MJOA vs. post-operative 3 months score and post-operative 6 months MJOA vs. post-operative MJOA at 1 year (Table 3). This suggests that there was no significant improvement immediately after surgery to 3 months. But the functional recovery increased in post-operative period from 3 months to 6 months with plateaued phase from 6 months to 1 year (Figure 3). Also with Mann-Whitney test, we noted a statistically significant difference when blood loss and anesthesia time for one level fusion compared with two level fusions. In our series for single level fusion, mean blood loss was 114.78 ml (± 18.65 SD) and anesthesia time 104.78 minutes (± 12.01 SD). For two level fusions, mean blood loss was 250 ml (± 40.83 SD) and anesthesia time 172.86 minutes (Figure 4).

Out of 60 patients, 46 patients underwent single level non-instrumented ACDF. Only 2 (4.34%) had pseudoarthrosis (Figure 5). The fusion rate for single level ACDF in our series was 95.65% (Figure 6). Remaining 14 patients underwent two level non-instrumented ACDF out of which 4 patients (28.57%) had pseudoarthrosis. The fusion rate for two levels ACDF in our series is 71.42% (Figure 7). Overall

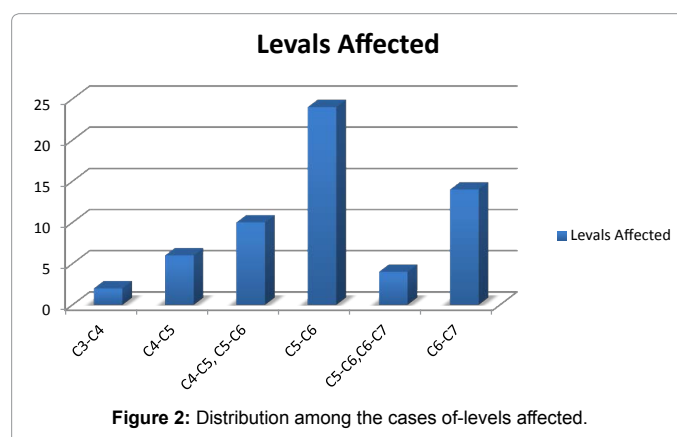


Figure 2: Distribution among the cases of levels affected.

Variables ^	Mean	SD	Median	IQR		
Preop MJOA	12.40	3.68	14.00	5.25	56.754	2.90E-12
Postop MJOA at 3 months	12.33	4.02	14.00	6.50	Difference is significant	
Postop MJOA at 6 months	14.17	4.32	16.50	6.25		
Postop MJOA at 1 year	14.27	4.59	17.00	7.50		

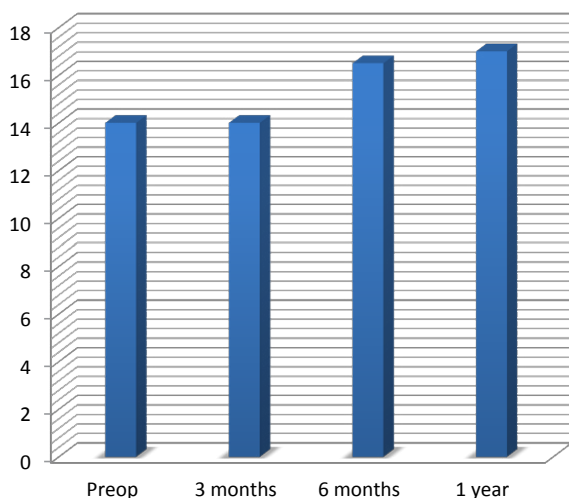
Table 2: Comparison of MJOA score at various time intervals.

Comparison pairs	Difference of Ranks	Q-value	p-value	Difference is-
Pre-op vs. 3 months	2.000	0.283	>0.05	Not significant
Pre-op vs. 6 months	48.000	6.788	≤ 0.05	Significant
Pre-op vs. 1 year	50.000	7.071	≤ 0.05	Significant
3 months vs. 6 months	46.000	6.505	≤ 0.05	Significant
3 months vs. 1 year	48.000	6.788	≤ 0.05	Significant
6 months vs. 1 year	2.000	0.283	>0.05	Not significant

*The mean difference is significant at the 0.05 levels.

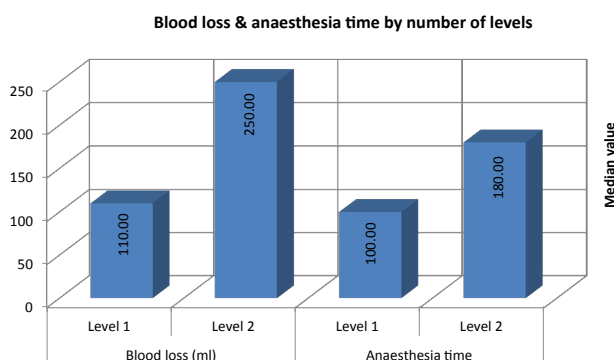
Comparison of MJOA score at various time intervals among the cases was done using all Pairwise Multiple Comparison Procedures (Turkey Test). There was statistically significant difference noted with comparison pairs of pre-operative vs. 6 months, pre-operative vs. 1 year, 3 months vs. 6 months, 3 months vs. 1 year

Table 3: All pairwise multiple comparison procedures (Turkey Test).



Comparisons of MJOA median score at various time interval

Figure 3: Comparison of MJOA score at various time intervals among the cases.



GRAPH NO. 4

Figure 4: Blood loss and anesthesia time by number of levels.



Figure 5: X ray showing pseudoarthrosis in a case of C3-C4, spondylotic myelopathy treated by ACDF with tricortical iliac bone graft at 1 year follow up.



Figure 6: MRI showing C4-C5, spondylotic myelopathy (A) C4-C5, fusion after ACDF with tricortical iliac bone graft at 1 year follow up (B).

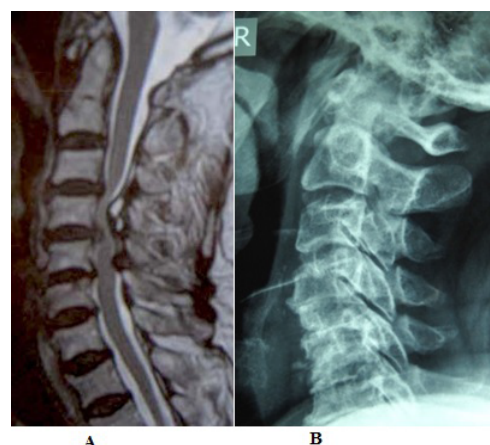


Figure 7: MRI showing C4-C5, C5-C6 spondylotic myelopathy (A) C4-C5, C5-C6 fusion after ACDF with tricortical iliac bone graft at 1 year follow up (B).

fusion rate in 60 patients was 90%. In our study out of 60 patients, 20 patients had bowel/bladder symptoms pre-operatively out of which 6 patients (30%) had complete relief post-operatively at 1 year follow-up while 14 patients (70%) had persistent bowel/bladder symptoms post-operatively at 1 year follow up. Also 2 patient who did not have any pre-operative bowel/bladder symptoms developed bowel/bladder symptoms in post-operative period.

Discussion

The management of cervical spondylotic myelopathy continues to be debated due to the inadequacy of information available about natural history of this disorder [14,15]. However there is some agreement in literature that a shorter duration of symptoms and milder neurological deficit prior to surgery yields a better post-surgical outcome. Successful surgical treatment of cervical spondylotic myelopathy rests on identifying the specific pathology responsible for clinical syndrome. The surgical approach is then tailored to deal with various static and dynamic factors causing the spinal cord compression, which are often superimposed on congenitally or developmentally narrow spinal canal: 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, helps in the decision making as to which approach would be most appropriate for a particular patient. In our study, 60 patients of cervical spondylotic myelopathy were treated by anterior cervical decompression and fusion using tricortical iliac bone graft. Majority (63.3%) of patients presented with symptoms of myelopathy and radiculopathy. C5-C6 levels were most commonly involved in 40% followed by C6-C7 in 23.3%. Multiple level involvements were seen in 23.5% of cases. Chagas in his article reported C5 to be the most frequently involved vertebral body in spondylotic myelopathy [16]. Mean duration of time between start of symptom and surgery was 3.63 months. The correlation between Duration of Symptoms to pre-operative and post-operative MJOA scores was statistically significant. Ebersold in his study of 100 cases concluded the only factor related to potential deterioration was the duration of symptoms pre-operatively. Age, severity of disease, number of levels operated, and pre-operative grade were not predictive of outcome [17]. We noted statistically significant improvement in symptoms of axial neck pain; radicular arm pain, clumsy hand and gait disturbances at 6 months and 1 year follow up. While no significant difference in symptoms were noted at 3 months follow up. Similarly no significant difference was observed between post-operative 6 months MJOA vs. MJOA at 1 year. This suggests that the functional recovery increased significantly in post-operative period from 3 months to 6 months with plateaued phase from 6 months to 1 year. In our series for single level fusion, mean blood loss was 114.78 ml and anesthesia time 104.78 minutes. For two level fusions, mean blood loss was 250 ml and anesthesia time 172.86 minutes. We noted a statistically significant difference when blood loss and anesthesia time for one level fusion compared with two level fusions. The fusion rate for single level ACDF in our series was 95.65%. The fusion rate for two levels ACDF in our series is 71.42%. Overall fusion rate in 60 patients was 90% at one year follow up. Literature search and meta-analysis suggest patients who undergo 2-level ACDF without fixation had lower fusion rates than those who undergo 1-level ACCF without fixation [18,19]. In our study, 20 patients had bowel/bladder symptoms pre-operatively out of which only 6 patients (30%) had completely recovered at 1 year follow-up. Compared to other symptoms bladder and bowel involvement showed the least recovery.

Limitation of Study- Lack of control group to compare the functional result and lack of long term follow up.

Conclusion

Anterior cervical decompression and fusion with tricortical iliac bone graft surgery is effective in the treatment of cervical spondylotic myelopathy with one and two levels affected. From our study it is evident that Duration of symptoms is related to both pre-operative MJOA and post-operative MJOA scores. We recommend early anterior cervical decompression and fusion as soon as the diagnosis of cervical spondylotic myelopathy is made. Functional outcomes in operated patients at 1-year follow up are better if ACDF surgery is done early. Symptoms of axial neck pain, radicular arm pain, clumsy hand and gait disturbances show significant improvement at one year follow up following surgery compared to bladder and bowel involvement which showed the least recovery. Significant improvement in function occurs post-operatively between 3 and 6 months, and then it plateaus from 6 months to 1 year. Fusion rates for single level ACDF are better than two levels ACDF.

Conflict of Interest

No funding or grant was taken for the above project.

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