

**STUDY ON ANTERIOR CERVICAL DISCECTOMY AND FUSION BY CERVICAL  
CAGE WITH BONE GRAFT FOR THE TREATMENT OF DOUBLE LEVEL CERVICAL  
SPONDYLOTIC MYELOPATHY.**

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Article Received on 11/05/2020

Article Revised on 31/05/2020

Article Accepted on 21/06/2020

**ABSTRACT**

**Background:** Cervical spondylotic myelopathy (CSM) is a common disorder of spinal cord seen in aged population. Anterior cervical decompression and fusion is a popular and rewarding procedure for the treatment of CSM. **Objectives:** The aim of the study is to find out the results of ACDF by cervical cage with bone graft for the treatment of double level cervical spondylotic myelopathy. **Methods:** This prospective observational study was conducted in the Department of Orthopaedics, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka over a period of two years from March 2015 to August 2017. In this study, 40 patients with spondylotic myelopathy including double level of cervical spine were enrolled where diagnosis was on the basis of presenting complains, clinical evaluation and relevant investigations. History of the patients were collected; clinical examination was done and relevant investigation was done for each patient. Neurological evaluation was done by Nurick grading and VAS scale was used for evaluation of pain which were analyzed for evaluation of result. **Result:** Male were predominant in this study. Male to female ratio was 2.63:1. Mean age of the patients was 45.9 ± 9.1 years within the range of 30-65 years. Both sides were affected in 14 (35.0%) cases, only right side was affected in 15 (37.5%) cases and only left side was affected in 11 (27.5%) cases. Involved disc spaces were C<sub>3/4</sub> (10.0%), C<sub>4/5</sub> (22.5%), C<sub>5/6</sub> (42.5%) and C<sub>6/7</sub> (25.0%). Transient dysphagia was observed in 2 (5.0%) cases, transient paraparesis in 1 (2.5%) case, wound infection in 1 (2.5%) case and damage to the dura was observed in 1 (2.5%) case. Sign of fusion was observed in 10 (25.0%) cases after 3 months, 30 (75.0%) cases after 6 months and in all patients after 12 months. Result was found excellent in 35 (87.5%), good in 5 (12.5%) cases. **Conclusion:** Anterior cervical discectomy and fusion by cervical cage with bone graft is an effective procedure for double level cervical spondylotic myelopathy.

**KEYWORDS:** ACDF, Bone graft, Cervical cage, Cervical myelopathy.

**INTRODUCTION**

Cervical spondylosis is responsible for spinal cord compression and thus myelopathy.<sup>[1]</sup> Cervical myelopathy is common in men and presents at early age than in women. It is found in 13% of men in the third decade and after 70 years of age almost all men suffer from it. But it is found in 5% of women in the fourth decade going up to 96% over the age of 70.<sup>[2]</sup>

Cervical spondylotic myelopathy is dependent on a number of factors.<sup>3</sup> The degenerative changes in the spine which includes discs, ligaments, connective tissue and the joint is a pathological spectrum known as spondylosis. And the important mechanism in the development of CSM can be subdivided as static-mechanical, dynamic-mechanical and spinal cord ischemia.<sup>[4]</sup> The decrease in spinal canal diameter and eventual spinal cord compression is static-mechanical.

The inter vertebral discs dry out with loss of disc height due to aging.<sup>[5]</sup> Dynamic stressors indicate the abnormal motion of the cervical spine during flexion or extension, which may cause spinal cord injury synergistically with static mechanical factors.<sup>[6]</sup> Spinal cord ischemia occurs when degenerative elements compress blood vessels that supply the cervical spinal cord and proximal nerve roots.<sup>[7]</sup>

Neck stiffness, unilateral or bilateral deep, aching neck, arm and shoulder pain and possibly stiffness or clumsiness while walking are the signs and symptoms of CSM. Complaints of neck stiffness are common in the early stages of CSM. Weakness or stiffness in the legs is the hallmark symptom of CSM.<sup>[8]</sup>

Anterior cervical discectomy and fusion (ACDF) procedure developed by Cloward,<sup>[9]</sup> and Smith and

Robinson<sup>10</sup> is the surgical management of CSM. Restoration of intervertebral disc height along with decompression of the spinal canal, enlargement of stenotic neural foramen is convenient with this approach. Various interbody implanting devices are used for reconstructing the stability of the segment involved after anterior discectomy.<sup>[11,12]</sup>

Autogenous tricortical iliac crest graft is considered as the “gold standard” of anterior reconstruction due to its high fusion rates.<sup>[13,14]</sup> But it causes around 25% of donor site morbidity including hematoma, persistent donor site pain and infection.<sup>[15,16]</sup> The hollow cylindrical stainless steel cage device (Bagby Bone Basket) allowed bone in growth to prevent these complications was first design of its kind.<sup>[17]</sup> Later on it was replaced by titanium mesh cage (TMC) which is the most widely used device in anterior fusion for its remarkable mechanical behavior and preferable clinical outcomes.<sup>[18,19]</sup> In this study, cage with bone graft was used.

## METHODS

This prospective observational study was conducted in the Department of Orthopaedics, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh from March 2015 to August 2017. Forty double level cervical spondylotic myelopathy patients age between 30 – 65 diagnosed on the basis of clinical presentation and examination with relevant investigations were enrolled in this study. Patients with cervical spine injury (fracture or dislocation), nerve injury, cervical tumors, inflammatory and autoimmune disorder were excluded from this study.

A questionnaire was prepared by the researcher considering key variables like age, sex, presenting complains, clinical findings, associated medical conditions, investigations, preoperative findings & outcome of the surgery by Nurick grading. The aims, objectives, procedures, risks and benefits of the operation were explained to the selected patients. Then written informed consent was taken from each patient. History of the patients was collected; clinical examination and relevant investigation was done for each patient. Results of the study were evaluated using Nurick grading and VAS Scale. Radiological evaluation of fusion was done by X-ray and CT scan.

**Surgical procedure:** Horizontal skin incision over the involved vertebral level was performed. The platysma was identified and incised. The esophagus was retracted medially, while laterally the sternocleidomastoid and underlying carotid sheath were retracted. The prevertebral fascia was divided, and the longus colli was further retracted. The offending disc was removed with a rongeur. As the posterior end of the vertebral body was reached, osteophytes were removed. The posterior longitudinal ligament was visualized. The entire disc, vertebral body endplates was decorticated. Bone graft was taken from the shin of the tibia. The graft was then

applied in the cervical cage and applied in the disc space. Position was checked by fluoroscope. Then after proper haemostasis, longus colli muscle along with cut edge of anterior longitudinal ligament were approximated, omohyoid muscle was repaired, platysmal layer, subcutaneous layer and skin were closed in layer. Sterile dressing was given and cervical orthosis was applied before extubation. The cervical brace was worn for 6 weeks.

Statistical significance was set at  $p < 0.05$  and confidence interval set at 95% level. Categorical data were assessed by Chi-square test and numerical data were assessed by paired t test.

## Grade Description

1. Signs or symptoms of root involvement but without evidence of spinal cord disease.
2. Signs of spinal cord disease but no difficulty in Walking.
3. Slight difficulty in walking which does not prevent full-time employment.
4. Difficulty in walking which prevented full time employment or the ability to do all housework, but which was not so severe as to require someone else's help to walk.
5. Able to walk only with someone else's help or with the aid of a frame.
6. Chair bound or bedridden

Recovery		Nurick grading
Excellent	=	0 – I
Good	=	II – III
Fair	=	IV
Poor	=	V



**Pre-operative X-ray**



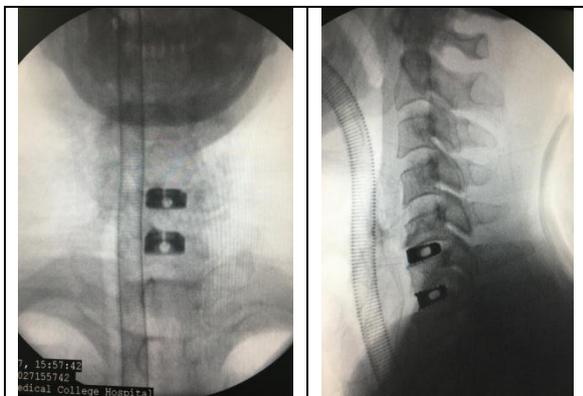
**Preoperative MRI of cervical spine sagittal and axial view**



**Per-operative picture**



**Cage with bone graft**



**Per-operative C-arm picture**

## RESULTS

Mean age of the patients was  $45.9 \pm 9.1$  years within the range of 30-65 years. Male were predominant. Male female ratio was 2.63:1. Both sides were affected in 14 (35.0%) cases, only right side was affected in 15 (37.5%)

cases and only left side was affected in 11 (27.5%) cases. Involved disc spaces were C<sub>3/4</sub> (10.0%), C<sub>4/5</sub> (22.5%), C<sub>5/6</sub> (42.5%) and C<sub>6/7</sub> (25.0%). Transient dysphagia was seen in 2 (5.0%) patients which were recovered within very short period, transient paraparesis in 1 (2.5%), wound infection 1 (2.5%) and damage to the durra was observed in 1 (2.5%) patients.

After 1 month, 10 (25.0%) patients had pain, neck stiffness was observed in 4 (10.0%) patients and gait disturbance in 2 (5.0%) patients. After 3 months, neck stiffness was observed in 1 (2.5%) patients. After 6 months no complication was observed. All patients had weakness of both lower limb before operation and after operation it was present in 4 (10.0%), 1 (2.5%) and 0 (0.0%) patients after 1 month, after 3 months and after 6 months respectively. Sign of fusion was observed in 10 (25.0%) patients after 3 months and in 30 (75%) patients after 6 months and 40 (100%) after 12 months. After treatment all patients were followed up 1, 6 and 12 months. Outcome was assessed using Nurick grading. Result was found excellent in 35 (87.5%), good in 5 (12.5%) cases.

## DISCUSSION

In this study, most of the patients were in age group 41-50 which was 20(50%) followed by 9(22.5%), 8(20.0%) and 3(7.5%) in  $\leq 40$  years, 51 – 60 years and  $>60$  years age group respectively. Mean age of the patients was  $45.9 \pm 9.1$  years within the range of 30-65 years. Li et al.<sup>[20]</sup> and Yu et al.<sup>[21]</sup> found mean age of their study subjects was more than 55 years. Male was predominant in this study and male female ratio was 2.63:1. Male was also predominant in the study of Yu et al.<sup>[21]</sup> and Li et al.<sup>[20]</sup>

In our study, the highest percentage of inter space involvement was seen in C<sub>5/6</sub> (42.5%). But in the study of Smith and Robinson<sup>[10]</sup>, C<sub>5/6</sub> was the commonest level (50%). In Gore and Sepic<sup>[22]</sup> series commonest level of involvement was also C<sub>5/6</sub> (51%). C<sub>5/6</sub> is the commonest level of involvement because it is the mobile area of cervical spine.

Regarding peri operative complications, transient dysphagia was seen in 2 (5.0%) patients which were recovered within very short period, transient paraparesis in 1 (2.5%), wound infection 1 (2.5%) and damage to the durra was observed in 1 (2.5%) patients. Dysphagia was observed in 2.8% cases in the study of Yu et al.<sup>[21]</sup>

All patients had weakness of both lower limb before operation and after operation weakness of both lower limb was present in 4 (10.0%), 1 (2.5%) and 0 (0.0%) patients after 1 month, after 3 months and after 6 months respectively. Sign of fusion was observed in 10 (25.0%) patients after 3 months and in 30 (75%) patients after 6 months and 40 (100%) after 12 months. Up to 3 levels of ACDF has been effective and safe in decompressing

ventral pathology and the rate of fusion in double level ACDF ranges from 80% to 95%.<sup>[23,24]</sup>

After treatment all patients were followed up 1 to 12 months. Outcome was assessed using Nurick grading. Result was found excellent in 35 (87.5%), good in 5 (12.5%) cases. In the study of Smith and Robinson<sup>[10]</sup>, outcome obtained as excellent in 64.2%, good in 14.2%, fair in 14.2% and poor in 7.1%. Rosenorn et al.<sup>[25]</sup> showed the outcome was excellent in 41.3%, good in 27.5%, fair in 6.2% and poor in 24.1% cases. Islam MA showed the outcome was excellent in 50.00%, good in 37.50% and fair in 12.5%.<sup>[26]</sup>

## CONCLUSION

From this study results it can be concluded that anterior cervical discectomy and fusion by cervical cage with bone graft is an effective procedure for the management of cervical spondylotic myelopathy.

## REFERENCES

1. Brain WR, Northfield D, Wilkinson M. The neurological manifestations of cervical spondylosis. *Brain*, 1952 Jun 1; 75(2): 187-225.
2. Irvine DH, Foster JB, Newell DJ, Klukvin BN. Prevalence of cervical spondylosis in a general practice. *The Lancet*, 1965 May 22; 285(7395): 1089-92.
3. Bohlman HH, Emery SE. The pathophysiology of cervical spondylosis and myelopathy. *Spine*, 1988 Jul 1; 13(7): 843-6.
4. Fehlings MG, Skaf G. A review of the pathophysiology of cervical spondylotic myelopathy with insights for potential novel mechanisms drawn from traumatic spinal cord injury. *Spine*, 1998 Dec 15; 23(24): 2730-6.
5. Wilkinson M. The morbid anatomy of cervical spondylosis and myelopathy. *Brain*, 1960 Dec 1; 83(4): 589-617.
6. Baron EM, Young WF. Cervical Spondylotic Myelopathy A Brief Review Of Its Pathophysiology, Clinical Course, And Diagnosis. *Neurosurgery*, 2007 Jan 1; 60(suppl\_1): S1-35.
7. Firooznia H, Ahn JH, Rafii M, Ragnarsson KT. Sudden quadriplegia after a minor trauma. The role of preexisting spinal stenosis. *Surgical neurology*, 1985 Feb 28; 23(2): 165-8.
8. Adams RD, Victor M. and Ropper AH. Diseases of the spinal cord, peripheral nerve and muscle. *Principles of neurology. 5th ed. New York: McGraw-Hill, Health Professions Division*, 1993; 1100-1101.
9. Cloward RB. The anterior approach for removal of ruptured cervical disks. *Journal of neurosurgery*, 1958 Nov; 15(6): 602-17.
10. Smith GW, Robinson RA. The treatment of certain cervical-spine disorders by anterior removal of the intervertebral disc and interbody fusion. *JBJS*, 1958 Jun 1; 40(3): 607-24.
11. Malloy KM, Hilibrand AS. Autograft versus allograft in degenerative cervical disease. *Clinical orthopaedics and related research*, 2002 Jan 1; 394: 27-38.
12. Zdeblick TA, Phillips FM. Interbody cage devices. *Spine*, 2003 Aug 1; 28(15S): S2-7.
13. Faldini C, Leonetti D, Nanni M, Di Martino A, Denaro L, Denaro V, Giannini S. Cervical disc herniation and cervical spondylosis surgically treated by Cloward procedure: a 10-year-minimum follow-up study. *Journal of Orthopaedics and Traumatology*, 2010 Jun 1; 11(2): 99-103.
14. Kao FC, Niu CC, Chen LH, Lai PL, Chen WJ. Maintenance of interbody space in one-and two-level anterior cervical interbody fusion: comparison of the effectiveness of autograft, allograft, and cage. *Clinical orthopaedics and related research*, 2005 Jan 1; 430: 108-16.
15. Siddiqui AA, Jackowski A. Cage versus tricortical graft for cervical interbody fusion. *Bone & Joint Journal*, 2003 Sep 1; 85(7): 1019-25.
16. Silber JS, Anderson DG, Daffner SD, Brislin BT, Leland JM, Hilibrand AS, Vaccaro AR, Albert TJ. Donor site morbidity after anterior iliac crest bone harvest for single-level anterior cervical discectomy and fusion. *Spine*, 2003 Jan 15; 28(2): 134-9.
17. Bagby GW. Arthrodesis by the distraction-compression method using a stainless steel implant. *Orthopedics*, 1988 Jun 1; 11(6): 931-4.
18. Majd ME, Vadhva M, Holt RT. Anterior cervical reconstruction using titanium cages with anterior plating. *Spine*, 1999 Aug 1; 24(15): 1604.
19. Eck KR, Bridwell KH, Ungacta FF, Lapp MA, Lenke LG, Riew KD. Analysis of titanium mesh cages in adults with minimum two-year follow-up. *Spine*, 2000 Sep 15; 25(18): 2407-15.
20. Li F, Li Z, Huang X, Chen Z, Zhang F, Shen H, Kang Y, Zhang Y, Cai B, Hou T. Comparison of two reconstructive techniques in the surgical management of four-level cervical spondylotic myelopathy. *BioMed research international*, 2015 Jan 27; 2015.
21. Yu S, Li F, Yan N, Yuan C, He S, Hou T. Anterior fusion technique for multilevel cervical spondylotic myelopathy: a retrospective analysis of surgical outcome of patients with different number of levels fused. *PloS one*, 2014 Mar 11; 9(3): e91329.
22. Gore DR, Sepic SB. Anterior Cervical Fusion for Degenerated or Protruded Discs: A Review of One Hundred Forty-Six Patients. *Spine*, 1984 Oct 1; 9(7): 667-71.
23. Cauthen JC, Kinard RE, Vogler JB, Jackson DE, DePaz OB, Hunter OL, Wasserburger LB, Williams VM. Outcome analysis of noninstrumented anterior cervical discectomy and interbody fusion in 348 patients. *Spine*, 1998 Jan 15; 23(2): 188-92.
24. Martin Jr GJ, Haid Jr RW, MacMillan M, Rodts Jr GE, Berkman R. Anterior cervical discectomy with freeze-dried fibula allograft: overview of 317 cases

- and literature review. *Spine*, 1999 May 1; 24(9): 852-9.
25. Rosenørn J, Hansen EB, Rosenørn MA. Anterior cervical discectomy with and without fusion: A prospective study. *Journal of neurosurgery*, 1983 Aug; 59(2): 252-5.
  26. Islam MA, Habib MA, Sakeb N. Anterior Cervical Discectomy, Fusion and stabilization by plate and screw—early experience. *Bangladesh Medical Research Council Bulletin*, 2012 Dec 9; 38(2): 62-6.