

OUTCOME OF ANTERIOR CERVICAL DISCECTOMY AND FUSION IN DEGENERATIVE COMPRESSIVE MYELOREDICULOPATHY WITH STAND-ALONE TITANIUM CAGE

Md Rabiul Karim^{1*} Md Manzoorul Islam² Md Anisul Islam Khan² Dhiman Chowdhury³
Mohammad Sanaullah⁴ Anwarul Kibria⁵ Md Ismail Hossain⁶

Abstract

Background : Anterior Cervical Discectomy and Fusion (ACDF) is widely performed for cervical degenerative disease with autograft or allograft with long term satisfactory outcome. But the complications of autogenous bone grafting cause the spinal surgeons to seek alternative method. This prospective study was conducted to observe the outcome of using stand-alone titanium cage in ACDF. **Materials and methods :** Total 50 patients (68 levels) with degenerative compressive cervical myeloreduculopathy were operated using stand-alone titanium cage from July 2013 to June 2015 in the Department of Neurosurgery, Chittagong Medical College Hospital. All patients were examined and evaluated preoperatively by plain X-ray and MRI and postoperatively by plain X-ray at one, three and 12 months. Clinical and neurological outcome was assessed by Japanese Orthopedic Association (JOA) score. **Results:** The mean age was 42.04±7.94 years ranged from 30 to 66 years. Maximum patients were in 41-50 years age group. Quadriparesis was found most common

symptom (60%) followed by brachialgia (20%). Out of 50 patients, 32 (64%) suffered from single level compression while 18 (36%) patients suffered from two level compression. Among all operated levels, C₅₋₆ (n=30, 44.2%) was most common level followed by C₆₋₇ (n=20, 29.4%) and C₄₋₅ (n=12, 17.6%) level. All patients improved in terms of their neck pain, redicular arm pain, clumsy hand movement and quadriparesis after surgery. Subsidence was observed in 15 (30%) patients and kyphosis was observed in 10 (20%) patients. All patients with subsidence and kyphosis were neurologically stable and no revision was required. Mean preoperative JOA score was 8.38±3.71 and mean post operative JOA score was 12.92±3.39. Among all patients in post operative follow up, 22 (44%) patients showed excellent recovery and 15 (30%) patients showed good recovery. **Conclusion:** Anterior cervical fusion using a stand-alone titanium cage is a safe and effective procedure allowing excellent to good functional recovery and avoiding donor site morbidity. Titanium cage can be an effective alternative to iliac bone autograft.

Key words

Cervical spondylosis; Radiculopathy; Stand-alone titanium cage; JOA score.

Introduction

Cervical spondylosis is a common problem that is increasing in incidence in aging population. Presentation is mainly with neck pain, radiculopathy, myelopathy or combination of these. The pathogenesis of cervical spondylosis is age related degeneration with loss of vertebral height and posterior or posterolateral disc herniation, bulging of ligamentum flavum, osteophyte formation and Ossification of the Posterior Longitudinal Ligament (OPLL)¹. In fact the condition is becoming more prevalent as life expectancy increases. This condition is often asymptomatic, but in 10 to 15% of patients, there

1. Assistant Professor of Neurosurgery
Chittagong Medical College, Chittagong.
2. Associate Professor of Neurosurgery
Chittagong Medical College, Chittagong.
3. Associate Professor of Neurosurgery
Bangabandhu Sheikh Mujib Medical University, Dhaka.
4. Assistant Professor of Neurosurgery
Cox'sbazar Medical College, Cox's Bazar.
5. Lecturer of Anatomy
Chittagong Medical College, Chittagong.
6. Resident of Neurosurgery
Chittagong Medical College Hospital, Chittagong.

***Correspondence:** Dr. Md. Rabiul Karim
Email : rkarim_31st@yahoo.com
Cell : 01711748893

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is compression of the cord or nerve roots causing myelopathy or radiculopathy².

If supportive medical treatment and physical therapy fail to relieve clinical symptoms and if neurological deficits due to bony spurs or disc herniation are present, surgery may be indicated. Anterior Cervical Discectomy and Fusion (ACDF) have become the standard method of treatment and can provide adequate neural decompression and good stabilization³⁻⁵.

The classic method of ACDF, described by Cloward and Smith and Robinson using an autologous tricortical iliac bone graft has been reported to have problems of donor site morbidity and subsidence⁶⁻¹¹. Anterior cervical plating also has complications like screw loosening, screw breakage, screw migration and soft tissue injury¹²⁻¹⁴. In order to overcome these problems, ACDF using an intervertebral cage has been recently used with favourable results. Stand-alone cages are made of a range of materials such as stainless steel, titanium, carbon fiber and polyetheretherketone (PEEK)^{15,16}. These are effective for restoring the intervertebral disc height and lordosis, providing load bearing support to the anterior column and preventing graft collapse^{15,17}. However nonunion and subsidence into the endplate have been reported as the complications of this procedure¹⁵⁻²⁰.

The interbody cages were developed in 1979 and a titanium cervical cage for spinal fusion surgery in human was approved by United States Food and Drug Administration (USFDA) in 1996. The purpose of this study was to observe the outcome of stand-alone titanium cage in ACDF as well as its complications. It may enable us to obtain a technique which is less time consuming, less post operative pain and cost effective.

Materials and methods

This was a prospective observational study held in Neurosurgery Department of Chittagong Medical College Hospital from 2013 to 2015. Total 50 patients with degenerative compressive cervical myelo-radiculopathy were included in this study. Patients with trauma, infection and neoplasm were excluded. All the patients were examined and evaluated and diagnosed as degenerative compressive cervical disc disease. For preoperative evaluation, all patients did plain X-ray and MRI. They underwent ACDF by stand-

alone titanium cage (Maxion, Gujarat, India) following Smith- Robinson technique. To assess fusion, subsidence and kyphosis during follow up, X-ray was taken after one month, three months and one year. All the patients were advised to use cervical collar for six weeks postoperatively. Neurological and functional outcome was assessed by Japanese Orthopedic Association scale. Data were processed and analysed using computer software SPSS (Statistical Package for Social Sciences). For any analytical test, the level of significance was set at 0.05 and p-value < .05 considered significant.

Results

Table I : Baseline data of subjects

Variable	Data	n	(%)
Age	< 40 years	07	14%
	41-50 years	25	50%
	51-60 years	16	32%
	> 60 years	02	4%
Sex	Male	35	70%
	Female	15	30%
Signs	Myelopathy	30	60%
	Radiculopathy	20	40%
Symptoms	Quadriplegia	30	60%
	Brachialgia	10	20%
	Upper monoparesis	6	12%
	Neck pain	4	8%
Level of surgery	C ₃₋₄	06	8.8%
	C ₄₋₅	12	17.6%
	C ₅₋₆	30	44.2%
	C ₆₋₇	20	29.4%

Table II : Post-operative complications

Post operative complications	Frequency	Percentage (%)
Subsidence	15	30
Kyphosis	10	20
Extrusion	0	0
Breakage	0	0
RLN injury	0	0
Oesophageal injury	0	0
CSF leak	0	0

Table III : Pre-operative and post-operative JOA score

JOA score	n	Mean	Range
Pre-operative	50	8.0	5-17
Post-operative	50	13.0	5-17

Table IV : Recovery rate grading

Recovery rate grading	Frequency	%
Excellent (>75%)	22	44
Good (50-75%)	15	30
Fair (25-50%)	09	18
Poor (<25%)	04	8

A total of 50 patients, 35 male and 15 female, were included in this study. All the patients were diagnosed as degenerative compressive cervical myeloreduculopathy. The mean age was 42.04 ± 7.94 years ranged from 31 to 66 years. Maximum patients were in 41-50 years age group. Quadripareisis was found most common symptom (60%) followed by brachialgia (20%). Out of 50 patients, 32 (64%) suffered from single level compression while 18 (36%) patients suffered from two level compression. Total levels operated were 68. Among all operated levels, C₅₋₆ (n-30, 44.2%) was most common level followed by C₆₋₇ (n-20, 29.4%) and C₄₋₅ (n-12, 17.6%) level (Table I).

All patients improved in terms of their neck pain, radicular arm pain, clumsy hand movement and quadripareisis after surgery. Subsidence was observed in 15 (30%) patients and kyphosis was observed in 10 (20%) patients. All patients with subsidence and kyphosis were neurologically stable and no revision was required. No case of cage extrusion, breakage, recurrent laryngeal nerve injury, oesophageal injury and cerebrospinal fluid leak was observed (Table II).

Mean preoperative JOA score was 8.38 ± 3.71 and mean post operative JOA score was 12.92 ± 3.39 (Table III). This difference of JOA score was tested by paired t-test and found highly significant.

Among all patients in post operative follow up, 22 (44%) patients showed excellent recovery and 15 (30%) patients showed good recovery (Table IV).

Discussion

Cervical spondylosis usually arises in the disc level, including disc herniation, osteophyte formation at end plates and uncovertebral joints. This pathophysiology determines that the relieve of anterior compression of the spinal cord is the most direct treatment. Anterior cervical discectomy and fusion remains the gold standard in the surgical treatment of the patients with multilevel cervical disc disease resulting in well established results and less complications²⁷.

ACDF using an intervertebral cage has become a popular alternative to prevent the complications of the classic method using a tricortical iliac bone autograft and anterior cervical plating⁸⁻¹⁴. ACDF using an intervertebral cage is credited with promoting instant stability, restoration of the neural foraminal height and interbody fusion by providing an environment for bone growth¹⁷⁻²¹. Fusion cage was first introduced to fuse unstable motion segments in horses with "wobblers' syndrome" in 1980s. During last decade there has been an increasing interest for their use in human not only in lumber but also in cervical spine²².

Different types of cages are available and each type has its own characteristics. Titanium cages have been criticized to produce more cage subsidence due to higher elasticity module. Nevertheless titanium implants are likely to provide a good immediate stability and osseointegration and several clinical studies demonstrated successful results after implantation of titanium cage²⁷.

Lind et al found no significant difference between autograft and fusion cage both without plate after 02 years in regard of narrowing of disc space (Mean 1.7 and 1.4 respectively) or deformation of fused segment into flexion (Mean 7.7° and 4.6° respectively). Patients in cage group had a significantly better clinical outcome²².

Hwang et al demonstrated that titanium cage assisted ACDF provided long term stabilization, increased lordosis, increased segmental and foraminal height in both groups of patients with plate and without plate. However lower complication rate and shorter hospital stay made the cage assisted fusion without plate better than with plate²³.

Thome et al found good to excellent functional recovery, no significant difference in neck or arm pain in his study of 36 patients. 18 patients received rectangular titanium cage and 18 patients

received iliac autograft. He also found 89% fusion in autograft group and 83% fusion in cage group after one year. He concluded that titanium cage in ACDF constitute a safe and efficient alternative to iliac crest autograft²⁴.

Sugawara et al found comparable or better result in a study of 41 cases and at least 5 years (Range-5-8.3 yrs) postoperative follow up after ACDF using titanium cage than those after ACDF with autograft or allograft and the author concluded that ACDF with titanium cage can achieve rigid fixation and provide good long term results²⁵.

Subsidence is a concern with the use of interbody cages because it causes disc height narrowing, which can decrease the neuroforamen space created by cage distraction. Gercek et al. found subsidence in 5 cases out of 9 (56%) and 4 of those 5 patients had no clinical symptom¹⁸. Schmieder et al. found 45% (30 out of 67) subsidence and there was also no clinical complication¹⁹. Van Jonbergen et al. found 9% (10 out of 71) subsidence²⁰. Wu et al. treated 57 consecutive patients (68 levels) with stand-alone titanium cages and found that cage subsidence had occurred in 13 (19.1%) cases but subsidence had no significant impact on long term clinical outcome²⁶. In our study, we found subsidence in 15 patients (30%) and there were no clinical or neurological deterioration in this patients.

Chen Y et al reported significant increase of JOA score after ACDF using stand-alone titanium cage. Their preoperative JOA score was 9.6 ± 1.4 and postoperative JOA score was 12.8 ± 1.8 ($p < .05$)²⁷. In our study, JOA score was also significantly increased from 8.38 ± 3.71 to 12.92 ± 3.39 ($p < .05$).

Conclusion

ACDF using a stand-alone titanium cage is a safe and effective procedure in treating cervical myeloreduculopathy. This procedure enables to avoid donor site morbidity and complications related to anterior cervical plating. As there is excellent to good functional recovery, significant increase of JOA score after surgery and no serious postoperative complication, stand-alone titanium cage can be an effective alternative to iliac bone autograft.

Disclosure

All authors declare no competing interest.

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