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Outcome Analysis of Discectomy with Standalone Cage for Management of Cervical Disc Prolapse

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ABSTRACT

Background: Anterior cervical decompression and fusion (ACDF) is the major treatment option in the management of cervical degenerative disease leading to persistent radiculopathy or myelopathy. The standalone cage was initiated by Bagby was used since 1988. To counteract the complications with the plating for anterior cervical discectomy and fusion (ADCF), standalone cage concept was developed and favourable outcomes have been described with a low rate of dysphagia.

Objective:
The purpose of this study is to evaluate radiological / clinical outcome of patients who underwent anterior cervical discectomy and fusion (ADCF) with standalone cages (SAC)

Methods:
Total 15 patients who underwent ADCF with SAC between Jan 2010 and Dec 2014 were evaluated prospectively. Fusion was assessed using standard X-rays with flexion/extension views. The clinical outcomes evaluated by Visual Analogue Scale for pain and Odom's criteria.

Results:
The majority were Males (9 vs 6) with average age of 43.1 Mean followup period was 61.3 months. Out of the 15 cases in 7 cases we used Titanium cage and 8 cases we used PEEK cage. Fusion rate was 86.6%. In two cases we did a double level disc with good clinical outcome. Our patients had 5.4 scales improvement on VAS Score on average. One of our case got infected and cage exit was done and in one other case anterior pull out of the cage was seen without affecting the neurology of the patient so we did not plan for any second procedure in that patient.

Conclusion:
Discectomy with Standalone cage is a safe and effective procedure providing favourable clinical and radiological outcome. Good fusion rates can be obtained (86.6% in our study) with this method.

KEYWORDS : radiculopathy, myelopathy, anterior cervical discectomy and fusion, stand-alone cage fusion, fusion rate

Introduction:
Anterior cervical decompression and fusion (ACDF) is the major treatment option in the management of cervical degenerative disease leading to persistent radiculopathy or myelopathy. Anterior surgery of the cervical disc with fusion using iliac crest auto-graft was introduced in the 1950s [1]. After decompression, fusion is performed to stabilise the segment, restore the height and recreate the normal cervical lordosis. Initially ACDF was performed using tricortical iliac bone graft with good fusion rates. The use of autologous bone graft gave rise to complications like acute and chronic pain at the donor site. Donor site morbidity favoured development of cage technology. Anterior cervical plating was added to un-instrumented autograft fusion to prevent graft settling and collapse and to enhance a solid fusion.

Plating however has its own challenges. Despite its effectiveness, anterior plating is associated with a number of potential drawbacks. Apart from the initial design and application flaws that lead to higher incidence of adjacent level disease[2-4], some literature suggests that soft tissue injury and dysphagia are among the most common complications linked to plating[5-7]. Though the underlying cause of plate related dysphagia is not well understood, plate design does seem to have an effect on dysphagia incidence. Not surprisingly, plate size and shape has been implicated in development of postoperative dysphagia; wider and thicker plates have been shown to have a significantly higher incidence of postoperative dysphagia.[8]

Stand-alone cages were developed as a means to mitigate the complications associated with anterior plating. The standalone cage concept was initiated by Bagby and has been used in the human spine since 1988. The rectangular cages used resemble the dimensions and anatomy of the disc space and vertebral end plates. These devices employ screws to anchor an interbody spacer directly into the adjacent endplates and do not use any additional internal fixation or plating. This design provides a smoother and more anatomic juxtaposition for the esophagus on the anterior cervical spine.

Stand-alone cages afford comparable mechanical stability and efficacy compared to anterior plating. There are concerns with stand-alone cage usage regarding expulsion and migration of the cage. The impact of the study is aimed to show that discectomy with standalone cage fusion is a safe and effective procedure which provides a good clinical and radiological outcome.

Methods:
A prospective review was done on patients who underwent anterior cervical decompression and fusion using stand-alone cage from Jan 2012 and Dec 2014. Patients presenting with non-traumatic single level disc prolapse with radiculopathy and myelopathic symptoms were taken into study.

Surgical technique:
Anterior cervical discectomy and fusion (ACDF) was developed by Smith and Robinson in 1958 for the treatment of neurologic deficits and symptoms associated with cervical spine degeneration[9]. The anterior approach affords access to the entire cervical spine through an intermuscular plane. This muscle-sparing interval is generally better tolerated by patients and has been shown to lead to fewer procedure-related complications than the posterior approach. Intervertebral disc, posterior longitudinal ligament and osteophyte were resected.

In cases with radiculopathy, unco-foraminotomy was utilized for the neural foraminal decompression. the cage size was determined by releasing distractor pins and assessing resistance to pull-out. The cage was located 1–2 mm depth from the anterior margin of the vertebral body. Post-operative immobilisation in a Philadelphia brace for 12 weeks was the standard of care.

Assessment of radiologic and clinical outcomes:

Fusion rates were assessed using standard X-rays with flexion/extension views as shown in *Figure 1*. Trabecular continuity and bone bridging across the disc space, absence of motion with flexion/extension views and absence of a dark halo around the implant on AP and lateral views were assessed. Fusion was defined as less than 2 mm change between the tips of the spinous processes of the treated level by the comparing the flexion-extension lateral radiographs or definite bony bridge of the index level on a lateral plain radiograph.[10]

We compared the first postoperative, one-month, one-year, two-year standing radiographs and the ultimate follow-up radiographs. The TIH was measured by three portion; anterior, middle and posterior points of the upper end plate of the cranial vertebral body and the lower end plate of the caudal vertebral bodies. More than 3 mm decrease at any of the three points was considered to represent significant subsidence.

Patient clinical outcome was assessed using Odom's criteria and Visual Analogue Score (VAS) were used.[11] We categorized Odom's criteria as Excellent (1), Good (2), Fair (3), and Poor (4). Then we reviewed all the medical records of the patients at the ultimate visit and the Odom's criteria were filled out. Neck and arm VAS were checked pre- and postoperatively (annual fashion), and the ultimate follow-up period of the index surgery.

Results:

Fifteen patients were treated with stand-alone anterior cervical cages between January 2012 and December 2014. The majority were Males (9 vs 6) with average age of 43.1 Mean followup period was 37.4 months. Out of the 15 cases 7 in 7 cases we used Titanium cage and 8 cases we used PEEK cage. Fusion rate was 86.6%. In two cases we did a double level disc with good clinical outcome. Our patients had 5.4 scales improvement on VAS Score on average.

One of our case got infected and cage exit was done and in one other case anterior pull out of the cage was seen without affecting the neurology of the patient so we did not plan for any second procedure in that patient. 9 patients were male and 6 were female, with an average age of 43.1 years of age. Indications for surgery are shown. Follow-up was from 24 to 45 months with an average of 61.3 months. Most patients (8) underwent C5/C6 fusion, followed by C3/4 (4) as shown. Thus a total of 17 levels were fused. 2 patients (13.3%) had a non-union, giving a fusion rate of 86.6%. None of the non-unions were painful.

Discussion:

Degenerative disease of the cervical spine can result in significant radiculopathy, myelopathy or both. ACDF, first developed by Smith and Robinson in 1958, has
undergone an intricate evolution to enhance fusion, alignment and patient satisfaction. The anterior approach is the preferred method for decompression of the roots because of the easy patient positioning and surgical approach by blunt dissection through anatomical planes.

The addition of anterior plating almost 30 years ago has afforded an expansion in indications for the procedure, as well as improved clinical success, with increased fusion rates in as many as 3 consecutive fused levels.[12] While its advantage of a stable construct with decreased subsidence and graft extrusion rates are unquestioned[13], anterior plating has also been criticized for its prevalent physical profile abutting the anterior cervical spine[2-8]. Literature has shown that some plate designs are associated with increased esophageal injury and irritation, dysphagia, overhang leading to adjacent segment disease, and adhesions to the plate causing neck pain.[7,14,15]

In order to mitigate these potential complications, while maintaining the stability necessary to achieve solid fusion, zero-profile stand-alone cages were invented. Success of the design of such stand-alone cages hinges on fixation of the interbody cage to the adjacent vertebral bodies. Several variations of the design exist today, though all prototypes rely on fixed angle screws through the adjacent endplates' dense subchondral bone, anchoring the implant in the intervertebral space. Since the first Food and Drug Administration–approved stand-alone device was made available in 2008, several studies have sought to evaluate the implant and compare it to ACDF with anterior plating.[16-22]

Results of our study are comparable to other recent publications for stand-alone cage fusions. Marota *et al*[23] in their study of 132 patients showed an 87% fusion rate at 5-years' follow-up. Dunn *et al*[24] had a 92% fusion rate in 34 patients at 2-years' follow-up. Fraser *et al.* did a meta-analysis of fusion rates comparing different anterior fusion methods. They found fusion rate to be 84.99% using anterior cervical decompression, 92.1% using anterior cervical decompression and fusion, and 97.1% using anterior cervical decompression and fusion with anterior plating. Plating is however more costly, requires longer operative times, and may be associated with problems such as breakage or dislocation of the screws and perforation of adjacent structures. The use of interbody cages for anterior cervical fusion was introduced to prevent problems such as graft resorption and expulsion and therefore loss of alignment as seen with tricortical iliac bone graft.[25]

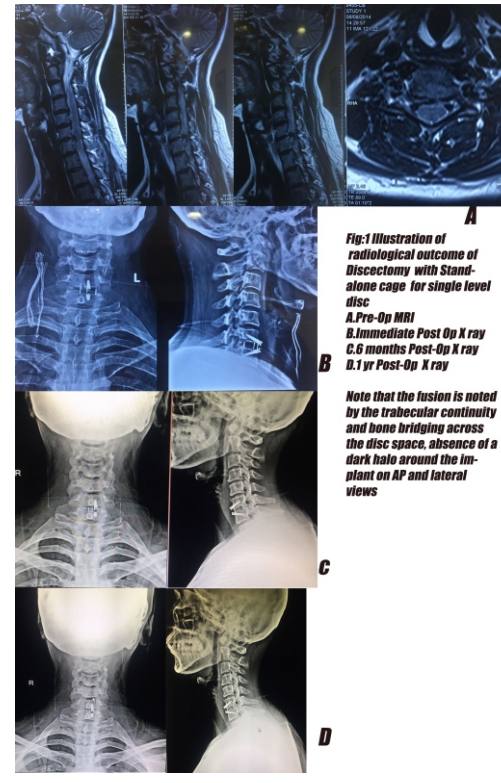

Fig:1 Illustration of radiological outcome of Discectomy with Stand-alone cage for single level disc
A.Pre-Op MRI
B.Immediate Post Op X ray
C.6 months Post-Op X ray
D.1 yr Post-Op X ray

Note that the fusion is noted by the trabecular continuity and bone bridging across the disc space, absence of a dark halo around the implant on AP and lateral views

Fig:2 Clinical outcome of the patient illustrated in Fig 1 at 1 yr of follow up

Fig: 3 Illustration of the complication : Double level cage fixation of C5-C6 & C6-C7 Cage pull out noted at 1 1/2 yr follow up without any clinicial deficit

Conclusion:

We feel stand-alone cage fusion is a safe and effective procedure providing a
good clinical and radiological outcome for the management of cervical degenerative disease. Good fusion rates can be obtained (86.6%) using this method.

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References:

1. Cloward RB. The anterior approach for removal of ruptured cervical discs. *J Neurosurg* 1958;15:602-17.
2. Baba H, Furusawa N, Imura S, Kawahara N, Tsuchiya H, Tomita K. Late radiographic findings after anterior cervical fusion for spondylotic myeloradiculopathy. Spine (Phila Pa 1976). 1993;18:2167-2173.
3. Hillibrand AS, Carlson GD, Palumbo MA, Jones PK, Bohlman HH. Radiculopathy and myelopathy at segments adjacent to the site of a previous anterior cervical arthrodesis. J Bone Joint Surg Am. 1999;81:519-528.
4. Hillibrand AS, Robbins M. Adjacent segment degeneration and adjacent segment disease: the consequences of spinal fusion? Spine J. 2004;4:190S-194S.
5. Fountas KN, Kapsalaki EZ, Nikolakakos LG, et al. Anterior cervical discectomy and fusion associated complications. Spine (Phila Pa 1976). 2007;32:2310-2317.
6. Zhong ZM, Jiong JM, Qu DB, et al. Esophageal perforation related to anterior cervical spinal surgery. J Clin Neurosci. 2013;20:1402-1405.
7. Yue WM, Brodner W, Highland TR. Persistent swallowing andvoice problems after anterior cervical discectomy and fusion with allograft and plating: a 5- to 11-year follow-up study. Eur Spine J. 2005;14:677-682.
8. Lee MJ, Bazaz R, Furey CG, Yoo J. Influence of anterior cervical plate design on dysphagia: a 2-year prospective longitudinal follow-up study. J Spinal Disord Tech. 2005;18:406-409.
9. Smith GW, Robinson RA : The treatment of certain cervical-spine disorders by anterior removal of the intervertebral disc and interbody fusion. J Bone Joint Surg Am 40-A : 607-624, 1958
10. Cannada LK, Scherping SC, Yoo JU, Jones PK, Emery SE : Pseudoarthrosis of the cervical spine : a comparison of radiographic diagnostic measures. Spine (Phila Pa 1976) 28 : 46-51, 2003
11. Zoëga B, Kärrholm J, Lind B : Outcome scores in degenerative cervical disc surgery. Eur Spine J 9 : 137-143, 2000
12. Fraser JF,HartlR.Anterior approaches to fusion of the cervical spine: a meta-analysis of fusion rates. J Neurosurg Spine. 2007;6:298-303.
13. Scholz M, Reyes PM, Schleicher P, et al. A new stand-alone cervical anterior interbody fusion device: biomechanical comparison with established anterior cervical fixation devices. Spine (Phila Pa 1976). 2009;34:156-160.
14. Sahjpaul RL. Esophageal perforation from anterior cervical screw migration. Surg Neurol. 2007;68:209-210.
15. Rhyne AL 3rd, Spector LR, Schmidt GL, et al. Anatomic mapping and evaluation of the esophagus in relation to the cervical vertebral body. Eur Spine J. 2007;16:1267-1272.
16. Wang ZW, Jiang W, Li X, et al. The application of zero-profile anchored spacer in anterior cervical discectomy and fusion. Eur Spine J. 2015;24:148-154.
17. Li YB, Hao D, He B, Wang X, Yan L. The efficiency of zeroprofile implant in anterior cervical discectomy fusion: a prospective controlled long-term follow-up study. J Spine Discord Tech. 2013;28:398-403.
18. Son DK, Son DW, Kim HS, Sung SK, Lee SW, Song GS. Comparative study of clinical and radiological outcomes of a zeroprofile device concerning reduced postoperative dysphagia after single level anterior cervical discectomy and fusion. J Korean Neurosci. 2014;56:103-107.
19. Qi M, Chen H, Liu Y, Zhang Y, Liang L, Yuan W. The use of a zero-profile device compared with an anterior plate and cage in the treatment of patients with symptomatic cervical spondylosis: a preliminary clinical investigation. Bone Joint J B. 2013;95:543-547.
20. Vanek P, Bradac O, Delacy P, Lacman J, Benes V. Anterior interbody fusion of the cervical spine with Zero-P spacer: prospective comparative study-clinical and radiological results at a minimum 2 years after surgery. Spine (Phila Pa 1976). 2011;38:E792-E797.
21. Wang ZD, Zhu RF, Yang HL, et al. The application of a zeroprofile implant in anterior cervical discectomy and fusion. J Clin Neurosci. 2014;21:462-466.
22. Miao JH, Shen Y, Kuang Y, et al. Early follow-up outcomes of a new zero-profile implant used in anterior cervical discectomy and fusion. J Spinal Disord Tech. 2013;26:E193-E197.
23. Marota N, Landi A, Tarantino R, Mancarella C, Ruggeri A, Delfini R. Five-year outcome of stand-alone fusion using carbon cages in cervical disc arthrodesis. *Eur Spine J* 2011;20(Suppl 1):S8–S12.
24. Dunn RN, Pretorius C. Cervical PEEK cage standalone fusions – the issue of subsidence. *SA Orthopaedic Journal* 2011;10(1):25-29.
25. Bohlman HH, Emery SE, Goodfellow DB, Jones PK. Robinson anterior cervical discectomy and arthrodesis for cervical radiculopathy. Long-term follow-up of one hundred and twenty patients. *J Bone Joint Surg (Am)*1993;75:1298-1307.