

Usage of an Empty Cervical Cage after Anterior Cervical Discectomy

Sameh Ahmed Sakr

Department of Neurosurgery, Cairo University

ABSTRACT

Cervical disc herniation can be treated by different surgical methods. Controversy exists among spine surgeons and in literature reviews as to whether anterior cervical discectomy and nerve root decompression should be followed by some sort of disc replacement **Objectives** *to evaluate prospectively the radiological and clinical outcome of anterior cervical discectomy followed by implantation of an empty cage of any type in the treatment of patients with cervical disc problems* **Methods.** *From January 2006 till December 2008, 125 patients (80men, 45 women, mean age 45 years) with cervical disc diseases due to cervical disc herniation and osteophyte were treated by anterior cervical discectomy followed by implantation of an empty cage. On lateral flexion-extension radiographs segmental stability at a mean follow up of 17 months (range 3-34 months) was demonstrated in all 125 patients, Self-scored neck pain based on a visual analog scale (1, minimum; 10, maximum) changed from a preoperative average of 7 to an average of 2 at follow up; radicular pain was reduced from 6 to 2.1 postoperatively* **Conclusions.** *Implantation of an empty cervical cages in the treatment of cervical disc herniation avoids donor site morbidity associated with autologous bone grafting as well as the use of any supplementary material inside the cage. Restoration or maintenance of intervertebral height and thus segmental lordosis and a very high rate of segmental stability and fusion are achieved using this technique.*

Key Words. *Anterior cervical discectomy, interbody cage, empty cage*

INTRODUCTION

Cervical disc herniation can be treated by different surgical methods. Controversy exists among spine surgeons and in literature reviews¹ as to whether anterior cervical discectomy and nerve root decompression should be followed by some sort of disc replacement. Restoration of foraminal height, achieving more rapid segmental stability, and maintenance or reconstruction of physiological cervical lordosis are noted advantages of the latter method.^{2,3,4,5,6} Kyphotic malalignment has been shown in one study to promote degeneration in adjacent intervertebral spaces.⁷ On the other hand prolonged operating time, extrusion of an interbody device, donor site morbidity in autologous bone

grafting,⁸ and unknown infectious risk in allograft,² artificial bone, or cage material have been discussed as disadvantages of cervical interbody fusion, which has motivated spine surgeons to perform anterior discectomy only.^{10,11,12,13,14} In the past years new interbody materials have been developed to overcome the disadvantages of bone grafting, graft collapse, or graft extrusion.^{15,16,17,18,19,20,21,22}

PATIENTS & METHODS

This prospective study done in all cervical disc prolapse patients start from jan.2006 till December 2008 in kasr el aini university hospitals, 125 consecutive patients with compressive radiculopathy due to cervical disc

herniation were treated by anterior cervical discectomy and implantation of a cage without any filling. There were 80 men and 45 women, and their mean age was 45 years (range 29-60 years). The inclusion criteria were severely symptomatic any-level any-sided compressive radiculopathy due to cervical disc herniation, which was radiologically confirmed by MR imaging in all patients and the exclusion criteria are evidence of cervical instability, "whiplash syndrome," systemic infection,

metabolic bone disease, active malignancy, and psychiatric disease. 38 patient with one level disc (30.4%), 52 patients with 2 levels disc (41.6%), 27 patients with 3 levels (21.6%) and only 8 patients with 4 levels disc (**fig. 1**) or osteophyte formation (6.4%) At admission symptoms included neck pain in all patients, radicular pain in 115 patients (92%), motor deficit in 91 (72.8%), and sensory deficit in 84 (67.2%) 255 cages was inserted in the 125 patients, 183 peek cage and 72 titanium cages were used.



Fig. (1): Showing 4 level empty cage fusion

Surgical Technique

Surgery was performed after the patient received a general anaesthetic. A standard anterior approach to the cervical spine was followed by microsurgical anterior cervical discectomy, disc space distraction, cutting of the posterior longitudinal ligament in all cases, and nerve root decompression. The vertebral endplates were completely cleaned of any cartilage with curettes or a high-speed drill. Cortical endplates were carefully preserved. After

determination of the cage size by means of a template, an empty cage from any type was inserted with its anterior edge flush or 1 to 2 mm deep to the anterior disc space margin, and then the disc space distractor was removed. The cage is a medical grade composite of (polyetherketonetherketonketon) matrix (**Fig. 2**) or titanium cage (**Fig. 3**); it is 12 or 14 mm wide and 12 mm deep and is available in 4,5,6,7 or 8 mm anterior heights and 0 or 5° lordosis. The mean duration of surgery

was 96.5 minutes (range 55-180 minutes) according to the number of the levels removed. The mean estimated intraoperative blood loss was 50 to 100ml.



Fig. (2): Showing C3-4 anterior cervical peek cage

Patients were mobilized on the 1st postoperative day and no collar application was necessary; however, the patients were instructed to avoid excessive cervical motion. Physical therapy to strengthen the cervical paraspinal muscles was prescribed 3 months after surgery. The discharged from the hospital usually 1 day following surgery after X-ray cervical spine follow up.

The follow-up evaluation, which was at a mean of 17 months (range 3-34 months). Segmental stability was determined on lateral flexion-extension

radiographs and defined as less than 2° motion in the operated segment, allowing compensation for experimental error and variation.



Fig. (3): Showing C5-6 anterior cervical titanium cage

Bone fusion was assumed if in addition to segmental stability, less than 50% of the intervertebral space was radiolucent or if continuous iso- or hypodense trabecular bridges between the endplates were seen on lateral radiographs. The radiolucency of the peek cage is advantageous in the assessment of bone fusion (**Fig. 4**) and the lateral whole present in the titanium cage an also assess the bone fusion (**Fig. 5**).



Fig. (4): Showing bony fusion in peek cage 1.5 year following surgery

The pre- and postoperative anterior intervertebral body height and the segmental angle on lateral radiographs were measured. The anterior intervertebral body height was measured as the vertical distance between the anterior border of the inferior endplate and the anterior border of the superior endplate. The segmental angle was defined as the angle between the inferior endplate of the lower vertebra and the inferior endplate of the upper vertebra.



Fig. (5): Showing the whole in the lateral view of the titanium cage at C 5-6 level

Data were statistically described in terms of frequencies (number of cases). Yates correction equation was used when the expected frequency is less than 5. A probability value (p value) less than 0.05 was considered statistically significant. P-value of 0.06 was considered marginally significant. All statistical calculations were done using computer program Microsoft Excel version 7 (Microsoft Corporation, NY, USA) and PASW (formerly SPSS, statistical package for the social sciences; SPSS Inc., Chicago, IL, USA) version 17 for Microsoft Windows.

RESULTS

Segmental stability was demonstrated in all 125 patients. Bone fusion at the time of follow up was revealed in 114 (91.2%). Relevant secondary loss of intervertebral height (≥ 2 mm) due to cage subsidence was found in 6 (4.8%). all are titanium cages. Only one patient (08%) where anterior displacement of the cage occurred and reoperated again 6 months after surgery

Neck pain as scored using the VAS (1, minimum; 10, maximum) decreased

from a preoperative average of 5.8 ± 4.1 to 2 ± 2.1 at follow up, with a significant difference between pre- and postevaluation ($p < 0.0008$). Radicular pain also significantly decreased from a preoperative mean value of 7.8 ± 2.9 to 1.9 ± 2.1 at follow up ($p < 0.0001$). Motor deficit was improved in 79 (86%) of 91 patients and unchanged in 12 patient (13.1); Sensory deficit was improved in 74 of 84 (84%) patients and unchanged in 10 patient (11.9%);

Self-rating by the patients was excellent in 77, good in 28, fair in 16, poor in 4 patients. Mean hospitalization time was 2 days (range 1-3 days).

There were 4 postoperative complications: dysphagia for 1 week, which spontaneously resolved without further treatment. which happened in 12 patients and interscapular pain which happened in 34 patients and in one patient minimal forward displacement of the cage 3 weeks after surgery and 2nd operation where done 6 months and a fibrous band where found crossing into the empty middle part of the cage preventing it from further displacement. and one case had post-operative cervical haematoma and reoperated 1 day after surgery, and it was venous in origin

DISCUSSION

An important development in degenerative cervical interbody surgery has taken place in the past several years. Donor site morbidity with long-term discomfort has been seen in a substantial percentage of patients;⁸ thus, the use of traditional tricortical iliac crest bone grafting introduced by Robinson and Smith²³ and Cloward²⁴ has recently given way to interbody cages. Such cages are

usually made of titanium or carbon fiber, and most surgeons fill them with autologous iliac crest or cancellous bone,^{3,20} therefore requiring a second incision and causing certain donor site morbidity. Other surgeons fill the cages with allogenic bone¹⁶ or hydroxyapatite,^{1,12,15} which theoretically increases the risk of infection by adding a second foreign material to the cage. Authors of one recent study reported filling carbon fiber cages with local bone harvested from local osteophytes or with bone dust acquired during drilling.¹⁹ Other authors reported good long-term clinical results in 249 patients who underwent polymethylmethacrylate interbody fusion;¹⁷ however, after a minimum of 2 years of follow up the "complete fusion rate" was only 53.8% and the "partial fusion rate" 7.7%.

Based on the finding of new bone formation around a biocompatible osteoconductive polymer²⁶ laboratory evidence of bone growth around removed lumbar carbon fiber interbody cages,²⁷ and a study reporting bone formation around a carbon fiber cage filled with iliac crest bone,²⁵ we hypothesized that bone ingrowth through and around an empty cage should occur and lead to segmental stability. Whether the cage actually has osteoinductive qualities in addition to osteoconductive properties remains an open question.

We observed segment stability in all of our 114 patients and bone fusion from 125. The 11 patient in whom we did observe bone fusion was followed for only 3 months, at which time bone ingrowth into the intervertebral space was seen from the lower and upper endplates without continuity (Fig. 4). We assume that further ingrowth will occur in the following months. After interbody fusion with autologous bone

graft, isodense bone is seen on postoperative lateral radiographs, whereas usually only hypodense filling of the intervertebral space is visible on follow-up images after implantation of an empty cage. We conclude that trabecular bone is formed through and/or around the cage, which is less dense than iliac crest bone grafts.

Cage subsidence in the months after implantation has been our biggest concern. We have observed significant loss (≥ 2 mm) of anterior intervertebral height in 6 (4.8%) of our patients. Although great care was taken in preserving the cortical endplates after complete removal of the cartilage, cage subsidence did occur, most commonly into the upper endplate of the lower vertebra.

No posterior cage migration or cage breakdown was observed. Operative time and hospitalization time compare favorably with those for cervical discectomy alone as well as those for interbody bone grafting and the procedure is technically feasible and uncomplicated.

According to our literature research there is 2 study in which the authors have reported on implantation of empty cages after cervical discectomy.²² The 1st Report on 18 patients with cervical disc disease in whom implantation of an empty titanium cage was performed and compared the results with 18 patients who were treated with iliac crest autograft. At 1-year follow up they observed a 87% stability rate in the cage-treated group, defined as less than 2° motion on lateral flexion-extension radiographs. It was not possible to assess fusion because of the radioopacity of titanium. They describe cage subsidence of more than 2 mm in eight of the 23 operated levels in their series, which was more frequently seen

at the beginning of the study (first four of five patients) because of extensive cortical endplate removal.

And the other paper report only 25 patients Twenty-five consecutive patients (12 men, 13 women, mean age 45 years) with monoradiculopathy due to cervical disc herniation were treated by anterior cervical discectomy followed by implantation of an empty CFCF cage. On lateral flexion-extension radiographs segmental stability at a mean follow up of 14 months (range 5-31 months) was demonstrated in all 25 patients, and bone fusion was documented in 24 of 25 patients. The mean anterior intervertebral body height was 3.4 mm preoperatively and 3.8 mm at follow up in 20 patients. In these patients the mean segmental angle (angle between lower endplate of lower and upper vertebra) was 0.9° preoperatively and 3.1° at follow up. In the remaining five patients preoperative images were not retrievable.

CONCLUSION

Our prospective evaluation of the 125 patients shows that implantation of an empty cage in the treatment of cervical discogenic compressive is a safe and technically feasible procedure with excellent clinical and radiological results. This method avoids donor site morbidity due to autologous bone grafting as well as the use of supplementary material inside the cage. Restoration or maintenance of intervertebral disc height and a very high rate of segmental stability and fusion are achieved.

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