

## Comparison of long terms follow up results in patients with cervical disk disease treated with anterior PEEK cage implantation and without it in Rasoul Akram Hospital

Reza Mollahoseini<sup>1</sup>, Ashkan Khajoo<sup>2</sup>, Zeynab Sharifian<sup>3</sup>, Mir Abolfazl Motiei<sup>4</sup>

*Department of Neurosurgery, Tehran University of Medical Sciences, Tehran, Iran.*

Received: 19 July 2011

Revised: 23 May 2012

Accepted: 13 June 2012

### Abstract

**Background:** Anterior interbody fusion of the cervical spine have become the gold standard for treating spinal diseases, hence the aim of this study was to compare long term follow up results in patients with cervical disk disease treated with anterior PEEK cage implantation and without it in anterior approach.

**Methods:** Retrospectively 63 patients with known cervical discogenic disorders who went under surgery with and without cage implantation were enrolled. The neurological examination and neurologic function were assessed by using the Japanese Orthopedic Association (JOA) scoring system and neurological cervical spine scale (NCSS) before and 8 years after surgery in each patient and at the end all complications were recorded.

**Results:** In the first group, there were 15 males and 14 females (mean age: 49±10 years) and in the second group there were 27 male and 7 female (mean age: 47±9 years). The NCSS score was significantly different between two groups after surgery ( $p=0.035$ ) but there was no significant difference before surgery ( $p=0.163$ ). No statistical significance difference was also observed in JOA score and complications before and after procedure, but JOA post surgery score between two groups had significant difference ( $p=0.047$ ).

**Conclusion:** In conclusion, present study showed that PEEK cage implantation is a highly useful alternative to the conventional treatment methods.

**Keywords:** Anterior cervical fusion, PEEK cage, Cervical disk diseases, Long term follow up.

### Introduction

A variety of surgical approaches have been used in the treatment of symptomatic patients with cervical discogenic disease refractory to medical management, but anterior interbody fusion of the cervical spine have become the gold standard for treating this kind of diseases (1-3). The most important benefit of anterior approach is that it allows direct visualization of the entire disc space and wide decompression of the anterior

or aspect to spinal cord and nerve roots.

For this procedure various kind of implants such as ceramic, carbon and PEEK cage have been used (4-8) and developed. The PEEK cages are widely used because of the immediate good stabilization with minimum donor site-related complications. Instead of one possibility, nowadays another possible treatment is considering; cervical anterior discectomy without implantation of any structure (CAD). A debate started as which method is the best. While this discussion is

1. Assistant Professor of Neurosurgery, Rasoul Akram Hospital, Tehran University of Medical sciences, Tehran, Iran. r\_mollahoseini@yahoo.com

2. Assistant professor of Neurosurgery, Islamic Azad University, Tehran Medical Branch, Tehran, Iran. a.khajoo@gmail.com

3. (Corresponding author), Medical Doctor, Islamic Azad University, Tehran Medical Branch, Tehran, Iran. z.sharifian@gmail.com.

4. Medical Student Research Committee, Faculty of Medicine, Tehran University of Medical Sciences, Tehran, Iran. heart\_iums@yahoo.com

still not closed, and it is not clear which one could reduce symptoms and could result in better response in patients. Therefore, the aim of this study was to compare long term follow up results in patients with cervical disk disease treated with anterior PEEK cage implantation and without it.

### Methods

During this historical cohort study in Rasoul Akram Hospital (Tehran, Iran) retrospectively 160 patients who underwent cervical disk procedure with anterior approaches more than eight years and came to department of neurosurgery of for follow up, 98 patients were excluded. Patients were enrolled conveniently. This left a study population of 63 patients with known cervical discogenic disorders who went under surgery with and without cage implantation. All patients were treated by medication and physical therapy for more than three months, but symptoms and signs did not improve. The neurological examination and neurologic function were assessed by the Japanese Orthopedic Association (JOA) scoring system before and 8 years after surgery in each patient.

Antero posterior and lateral radiographs were performed at before and 8years after follow-up. At the end, all complications were recorded. Also the neurologic state of the patients was evaluated according to the neurological cervical spine scale (NCSS) (9) which evaluated motor function of the lower and upper extremities and sensory deficits.

*Inclusion criteria:* All adult patients aged between 18 and 55 years with cervical disk diseases had signs and symptoms. The radiological findings were in accordance with the clinical presentation. Furthermore, at the preoperative dynamic lateral X – ray, the involved level was not fused in. Exclusion criteria were Symptoms and/or signs of myelopathy, previous cervical surgery and psychiatric or mental disease.

*Surgical technique:* Anesthetic exposure was via a left-sided skin incision according

to the Robinson and Smith technique (10). The operating levels confirmed with fluoroscope and then PEEK cage were placed. Before closing the wound, a lateral fluoroscopic image was obtained and the correct position of the implant checked.

All participants were given written informed consent for inclusion in the study. The study protocol was approved by the Ethic Committee of the Tehran University of Medical Sciences, Tehran, Iran.

*Statistical analysis:* Paired and Independent sample T-test and Wilcoxin and Mc-Nemar Chi2 were used for data analysis, with the mean±SD. P<0.05 was considered significant. All analyses were performed with SPSS 16.0 (Statistical Package for Social Sciences) for Microsoft Windows.

### Results

Patients were divided into two groups. In

Table 1. Assessment scale proposed by the JOA.

Score	Description
I)	Motor dysfunction of upper extremity
0	Unable to feed oneself
1	Unable to handle chopsticks, able to eat with spoon
2	Handle chopsticks with much difficulty
3	Handle chopsticks with slight difficulty
4	None
II)	Motor dysfunction of lower extremity
0	Unable to walk
1	Walk with walking aid
2	Able to go up or down stairs with handrail for support
3	Lack of stability and smooth reciprocation
4	None
III)	Sensory deficit
A)	Upper extremity
0	Severe sensory loss of pain
1	Mild sensory loss
2	None
B)	Lower extremity, same as A
C)	Trunk, same as A
IV)	Sphincter dysfunction
0	Unable to void
1	Marked difficulty in micturition (pollakiuria, hesitation)
2	Difficulty in micturition (pollakiuria, hesitation)
3	None

the first group, there were 44 levels of anterior cervical surgery with no cage among 35 patients affected by discogenic diseases. The second group contained 48 levels of anterior cervical fusion from among 27 patients who were fused with PEEK cage and autograft. The characteristics of patients are showed in Table 2 but in overall view there were not any significant difference between two groups on the bases of aged ( $p=0.342$ ) and gender ( $p=0.512$ ).

The mean preoperative NCSS score was  $10.7\pm 1.4$  and the mean post operative score after follow up was  $12.8\pm 0.9$ . Our samples showed significant difference between pre and post operative function based on NCSS score ( $p<0.001$ ). The NCSS score shows significantly different between two groups after surgery ( $p=0.035$ ) but this difference before surgery was not significant ( $p=0.163$ ). According to the JOA score, the group with PEEK cage improved from 11.2 pre-operatively to 14.9 after surgery, with no complication. In the second group, the post-operative score had achieved  $13.2\pm 2.6$  from  $10.3\pm 1.8$ , with no non-union and without complication. No statistical significance difference was observed in JOA score and complications before and after procedure, but JOA post surgery score between two groups was significantly different ( $p=0.047$ ), and in none of the cases reoperation, graft complications, collapse or dislodgement, operative site infection, esophageal injury or related nerve injury were seen.

### Discussion

Present study showed that postoperative function based on NCSS score was significantly different between two groups after surgery. Since 1950s anterior cervical discectomy and fusion has gained immense popularity by Smith Robinson and Cloward (11,12). Conventionally autologous iliac bone grafts were used to achieve interbody fusion (13-15). However donor site morbidity were common so other study evaluated better material for interbody fusion (7,16,17). In the present study satisfactory results were seen in patients who treated

Table 2. Baseline characteristics of cases and controls.

	With cage (n=27)	Without cage (n=35)
Male: female	15:14	27:7
Age (years± SD)	49±10	47±9
Level (number, %)		
One level	17 (52%)	28 (80%)
Two level	11 (33%)	5(14%)
Three level	3 (12%)	2 (6%)
Operation level		
C3-4	8 (16%)	7(16%)
C4-5	9 (18%)	13(30%)
C5-6	17 (35%)	14(32%)
C6-7	14(31%)	10(22%)

Case= Anterior approach with cage insertion; control= Anterior approach without cage insertion

with PEEK cages in comparison with other who were not.

Jung CC (18) reported cervical fusion using the cage containing a bovine xenograft, with 84% good to excellent results and a subsidence rate of 8%. In another study Topuz K (19) showed that cervical fusion with PEEK cage packed with demineralized bone matrix had 87% good to excellent results and a non-union rate of 8.3%. No instability or significant complications were observed in the study by Agrillo et al. (20). In the present study, results were identical to previous study and without any complications. It seems one of the most important things which changed interbody cages implantation to the popular procedure is providing immediate stability, restoring alignment and minimizing operative time and complications which seen in the present study.

Our study was performed to evaluate the results of treatment of cervical disk diseases with anterior cervical discectomy and fusion, which provided stability by the PEEK cage, and in compared anterior discectomy without cage. We found anterior cervical discectomy and fusion with PEEK cage is more effective than anterior discectomy without PEEK cage in terms of subsidence and nonunion.

There has not been any study to compare the anterior discectomy in patients with use of PEEK cage and patients without cage. The clinical outcome by JOA score was signifi-

cantly different. Donor site pain was a concern in anterior disectomy with PEEK cage implantation. However, present study based on JOA score showed that PEEK cage implantation had little problem with donor pain. To reduce donor site complications and operative times, PEEK cage in disectomy is better than disectomy without PEEK cage.

### Conclusion

In conclusion, present study showed that PEEK cage implantation is a highly useful alternative to the conventional treatment methods. The authors have no conflict of interest.

### References

1. Cloward RB. The anterior approach for removal of ruptured cervical disk. *J Neurosurgery* 1958;15:602-617.
2. Kim P, Wakai S, Matsuo S, Moriyama T, Kirino T. Bisegmental cervical interbody fusion using hydroxyapatite implants: surgical results and long-term observation in 70 cases. *J Neurosurg* 1998; 88(1):21-7.
3. 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* 1958;40-A(3):607-24.
4. Ciappetta P, Boriani S, Fava GP. A carbon fiber reinforced polymer cage for vertebral body replacement: technical note. *Neurosurgery J* 1997; 41(5):1203-6.
5. Koyama T, Handa J. Porous hydroxyapatite ceramics for use in neurosurgical practice. *Surgery Neurol* 1986;25:71-3.
6. Lowery GL, Swank ML, McDonough RF. Surgical revision for failed anterior cervical fusions. Articular pillar plating or anterior revision? *Spine (Phila Pa 1976)* 1995 Nov 15;20(22):2436-41.
7. Matge G. Anterior interbody fusion with the BAK-cage in cervical spondylosis. *Acta Neurochir (Wien)*. 1998;140(1):1-8.
8. Wilson DH, Campbell DD. Anterior cervical disectomy without bone graft. Report of 71 cases. *J Neurosurg* 1977 Oct;47(4):551-5.
9. Kadoya S. Grading and scoring system for neurological function in degenerative cervical spine disease--Neurosurgical Cervical Spine Scale. *Neurol Med Chir (Tokyo)* 1992 Jan;32(1):40-1.
10. Robinson RA, Smith GW. Anterolateral cervical disc removal and interbody fusion for cervical disc syndrome. *Bull Johns Hopkins Hosp* 1955; 6:22-4.
11. Cloward RB. The anterior approach for removal of ruptured cervical disks. 1958. *J Neurosurg Spine* 2007;6(5):496-511.
12. Smith GW, Robinson RA. The treatment of certain cervical- spine disorders by anterior removal of the intervertebral disc and interbody fusion. *J Bone Jt Surg Am* 1958;40-A(3):607-624.
13. Bishop RC, Moore KA, Hadley MN. Anterior cervical interbody fusion using autogeneic and allogeneic bone graft substrate: a prospective comparative analysis. *J Neurosurg* 1996;85(2):206-10.
14. Profeta G, de Falco R, Ianniciello G, Profeta L, Cigliano A, Raja AI. Preliminary experience with anterior cervical microdiscectomy and interbody titanium cage fusion (Novus CT-Ti) in patients with cervical disc disease. *Surg Neurol* 2000;53(5):417-26.
15. Thomé C, Krauss JK, Zevgaridis D. A prospective clinical comparison of rectangular titanium cages and iliac crest autografts in anterior cervical discectomy and fusion. *Neurosurg Rev*. 2004;27(1):34-41.
16. Carreon LY, Glassman SD, Djurasovic M. Reliability and agreement between fine-cut CT scans and plain radiography in the evaluation of posterolateral fusions. *Spine J* 2007;7:39-43.
17. Hacker RJ, Cauthen JC, Gilbert TJ, Griffith SL. A prospective randomized multicenter clinical evaluation of an anterior cervical fusion cage. *Spine* 2000; 25:2646-2655.
18. Jung CC, Jie KY, Feng CY, Rau G, Hwei TY. Anterior cervical fusion using a polyetherterketone cage containing a bovine xenograft. *Spine*. 2008; 33:2524-8.
19. Topuz K, Colak A, Kaya S. Two level contiguous cervical disc diseases treated with PEEK cages packed with demineralized bone matrix: results of 3 year follow up. *Eur Spine J* 2009; 18:238-43.
20. Agrillo U, Mastronardi L, Puzilli F. Anterior cervical fusion with carbon fiber cage containing coralline hydroxyapatite: preliminary observations in 45 consecutive cases of soft-disc herniation. *J Neurosurg* 2002; 96:273-6.