# **ORIGINAL ARTICLE**

# Outcome of Single Level ACDF + Peek Cage Fixation in Cervical Myelopathy, an Early Experience

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# ABSTRACT

Aim: To determine the outcomes of single Level ACDF + Peek Cage Fixation in Cervical Myelopathy. Study Design: Prospective/Observational

**Place and Duration:** Department of neurosurgery MTI, Lady reading hospital Peshawar from March 2015 to February 2017.

**Methodology:** A total of 27 patients met the inclusion criteria who were patients having undergone ACDF with PEEK cage for cervical myelopathy due to single level disc herniation. Nurick grading system was used for Patients pre op and post op neurological status evaluation. Imaging studies used were X rays, CT and MRI cervical spine. X ray (AP and lateral views) were used preoperatively to exclude osteophytes, bony fusion, any spondylolisthesis and to measure pre and post op cervical lordotic angle using Cobb's method. Patients had post op follow up at 01, 03 and 06 months then one year and 18 months. Data was analyzed by SPSS 24.0

**Results:** There were 23(85%) male and 04(15%) female. Ages ranged from 37 years to 58 years with mean age of 47. Follow up was from 5-18 months with mean of 07 months. 20 patients (74%) were in Nurick grade 3 and 07 (26%) patients were in the Nurick grade 2 cervical myelopathy.

**Conclusion:** It is concluded that stand alone empty PEEK cages have clinical and radiological outcomes comparable to other devices used for single level anterior cervical discectomy.

Keywords: Cervical Myelopathy, ACDF, PEEK Cage Fixation, Nurick Grade

## INTRODUCTION

Cervical myelopathy due to disc herniation is one of the most common entities in neurosurgical practice. The post operative clinical outcome of cervical myelopathy is closely related to pre operative neurological status of the patient. Nurick grading is the commonly employed grading system for cervical myelopathy. The system has 0-5 grades1. Grade 0 patients have sign, symptoms of root involvement but no evidence of cord compression, grade 1 having signs of cord disease but no difficulty in walking, grade 2 having slight difficulty in walking not preventing full time employment, grade 3 having walking difficulty preventing full time employment or the ability to do all house work but not so severe to require assistance, grade 4 having severe walking difficulty needs assistance and grade 5 bound to bed or wheel chair. . Anterior cervical discectomy has been the standard of care for cervical disc herniation<sup>2</sup>. The procedure was first introduced by smith & Robinson<sup>3</sup> in 1958 where they had combined discectomy with bone graft placement and since then the bone graft has been replaced with multiple implant devices. These are PEEK cages<sup>4</sup>, porous tantalum<sup>5</sup>, Zero -P integrated plate and spacer<sup>6</sup> and many more. In this article we share our early experience of PEEK cages for single level cervical disc herniation. PEEK is a semi crystal polyaromatic linear polymer which is elastic and radiolucent. We used PEEK cages as standalone devices without anterior plate fixation or filling with bone grafts.

### MATERIALS AND METHODS

We conducted this observational study in the department of neurosurgery MTI, Lady reading hospital Peshawar from

March 2015 to February 2017. A total of 27 patients met the inclusion criteria who were patients having undergone ACDF with PEEK cage for cervical myelopathy due to single level disc herniation. Patients having been operated for multiple levels disc herniation or patients having ACDF with PEEK cage for other causes of cervical myelopathy (multiple disc herniation, cervical stenosis, trauma, cervical bony tumor and OPLL) were excluded. Also patients having lost follow up were excluded. Nurick grading system was used for Patients pre op and post op neurological status evaluation. Imaging studies used were X rays, CT and MRI cervical spine. X ray (AP and lateral views) were used preoperatively to exclude osteophytes, bony fusion, any spondylolisthesis and to measure pre and post op cervical lordotic angle using Cobb's method. Cobb's angle was measured by drawing lines parallel to inferior end plates of C2 and C7. Then perpendicular lines were drawn on each parallel line. The angle formed between the two perpendiculars was measured as the Cobb's angle (Fig 1). Early post operative X rays were utilized for any post op listhesis and PEEK cage displacement while late X rays in follow up were done to exclude late complications of cage subsidence, displacement, listhesis, movements at operated disc site and changes in cervical curve. Pre op CT cervical spine in selected cases was mainly used to exclude ossified posterior longitudinal ligament (OPLL). The basic purpose of pre op MRI use was to evaluate the status of the cord i.e. cord compression, any demylinating disease, high signals in the cord, cervical intra/extra dural and osteolytic/osteoblastic bony tumors, multiple level disc herniation and other causes of cervical stenosis. Post op MRI was used only in selected cases having persistence of

neurological symptoms. Patients had post op follow up at 01, 03 and 06 months then one year and 18 months. Mean follow up was 07 months. The study was approved by the ethical review board of our institute.



Fig 1. Cobb<sup>,</sup>s angle measurement

Surgical Procedure: Keeping in view the high incidence of infection with implant use, we employed maximum antisepsis care. After general anaethesia a 3-5 cm right sided transverse incision was used at the desired level keeping in mind the surface anatomical land marks. Tissue dissection was carried out in tissue planes with less tissue trauma. After dissection the desired level was confirmed with per op X ray with C arm by placing a needle at the proposed disc level. Self retaining soft tissue retractors were intermittently released to reduce post operative complaint of dysphagia. With size 15 surgical blade cut was made in the desired disc space and discectomies and, when appropriate, foraminotomies are performed using high speed drill, curettes, and Kerrison cervical rongeurs. Care was taken to carefully curette the end plates. The maximum implant size is used to optimize stability of the segment. We use PEEK cage as empty stand alone device without any bone or bone cement filling and without anterior plate and screw fixation. The final implant position is then radiographically verified in the anteroposterior and lateral directions relative to the vertebral bodies. We did not put suction drain in operative site in any case. All patients were placed in a collar postoperatively for six weeks. Data was analyzed by SPSS 24.0

#### RESULTS

A total of 27 patients having met the inclusion criteria were 23(85%) male and 04(15%) female. Ages ranged from 37 years to 58 years with mean age of 47. Follow up was from 5-18 months with mean of 07 months. 20 patients (74%) were in Nurick grade 3 and 07 (26%) patients were in the Nurick grade 2 cervical myelopathy.

Disc levels operated were C3-C4 one case (3.7%), C4-C5 03 cases (11%) and C6-C7 08 cases (29.6%). The maximum number of surgeries was at C5-C6 i.e.15 (55.55%) (Tab: 1).

After surgery 20 (74 %) patients showed clinical improvement to Nurick grade 0. Of these 20 cases, 17 patients were in Nurick grade 3 and 03 in Nurick grade 2 pre operatively.05 cases (18.5%) improved to Nurick grade 1 in 1-3 months follow up.04 of them were in Nurick grade 2 and one in Nurick grade 3 pre operatively.02 (7.4%) patients in Nurick grade 3 with pre op high signals in MRI did not improve (Tab: 2).

Radiological improvement in the form of cervical lordosis on X rays was noted in all patients. None of the patients had lost their lordosis till the last follow up. Average Pre op CLA measured with Cobb's method was 11.8 and immediate post op CLA was 16.7. Fusion was seen on simple radiographs from 03 months onward post operatively in 25 patients (100% as of completed 03 months follow up). This bony fusion was marked by the bony osteophytes bridging across the operated disc and no movement> 2 degrees on flexion/extension films. Early post operative dysphagia was reported in 3 (11%) cases which improved over 2-3 days in all cases. None of our patients had any complication of dysphonia, cage subsidence (defined as height of surgical segment that is the distance from upper end plate of vertebra above the operated disc to lower end plate of vertebra below the operated disc, a loss of >3mm intervertebral height by Chen Y et al7), cage displacement, listhesis, wound infection, neurological deterioration or CSF leak.



Fig 2: Saggital T2W MRI showing C5-C6 large disc



Fig 3: Post op X rays showing PEEK cage in place

Table 1. Operated Disc Levels

Disc level	No of cases	
C3-C4	1(3.7%)	
C4-C5	3(11%)	
C5-C6	15(55.55%)	
C6-C7	8(29.6%)	

Nurick grade	Number of patients	Number of patients post
	pre op	ор
0	0	20 (Pre op 17 Nurick
		3 + 03 Nurick 2)
1	0	05 (Pre op 01 Nurick
		3 + 04 Nurick 2)
2	7	0
3	20	2
4	0	0
5	0	0

Table 2. Nurick Grades with Pre and Post Op No. of Patients

#### DISCUSSION

Anterior cervical discectomy and fusion with bone graft from iliac crest as a treatment for cervical disc herniation was first popularized by Robinson and Smith in 1958. Since then the procedure has undergone many advances particularly with respect to implants materials. These advances were mainly employed to reduce the donor site complication (traditionally iliac crest) which was infection, hematoma, chronic pain and injury to ilioinguinal nerve<sup>8</sup>. The majority of affected patients were 40-50 of age with mean of 47 years. Azimi et al<sup>9</sup> have reported the same age in their study. The most common cervical level involved was C5-C6. Ali et al<sup>10</sup> and Jed Vanichkachorn et al<sup>11</sup> have reported the same level as the level of most common involvement. In our study we employed the Nurick grading system for neurological evaluation as it was an easy and more objective way of assessment both pre and post operatively. Manish K Kasliwal et al<sup>12</sup> have also employed Nurick grade as assessment tool in their series.17 (63%) of our 20 patients who were in Nurick grade 3 improved to Nurick grade 0 in 1-3 months follow up and the same status maintained till the last visist.02 (7.4%) patients with Nurick grade 3 remained in same status and did not show any further deterioration. Those patients had high signals in their pre op MRI of cervical spine. 03 (11%) patients with pre op Nurick 2 improved to Nurick 0 in 1-3 months follow up.01 (3.7%) patient with Nurick grade 3 and 04 (14%) patients with Nurick 2 improved to Nurick grade 1 in 1-3 months follow up. These patients also had improved to Nurick 0 at 06th month follow up. So overall improvement was 91.7%. Manish K Kasliwal et al<sup>12</sup> in their series of 59 patients having undergone cervical corpectomy and PEEK cage fixation have reported 43 % improvement in Nurick grades. High improvement in our series was related to our patient selection for disc herniation cases only while Manish K Kasliwal et al had patients with degenerative, neoplastic, infective and traumatic pathologies. Islam MA et al13 have reported 80 % improvement in symptoms and neurological status after discectomy and fusion with bone graft, plate and screw fixation. All of our patients had shown improvement in their cervical lordotic angle (CLA). The average pre op CLA measured with Cobb's method was 11.8 and immediate post op CLA was 16.7. Our results of CLA improvements are comparable to that of Salih Gulsen et al<sup>14</sup>. Improvements in cervical lordosis were related with favorable long term results as stated by Wen-Jian Wu et al15 . We assessed fusion by the bony osteophytes bridging across the operated disc level and no movements >2 degrees on flexion/extension films. We observed these findings on plain X rays in 25 (100%) of our patients having completed their follow up of 03 months. Our

results are comparable to those listed in literature<sup>6,15, 16</sup>.in our study we saw post op complaint of dysphagia in 3 (11%) cases which improved over 2-3 days with no chronic symptom of dysphagia. In literature chronic dysphagia has been reported in 10-35% cases with improvements over time<sup>6,17, 18. 19</sup>. We thought of dysphagia at the lower end of incidence in our study compared to other studies to be strongly related to intermittent release of soft tissue retractors during surgery. Post op dysphonia with incidence of 3% reported in literature<sup>20</sup> was not seen in any of our patients. None of our patients had any other known complications of the surgery like cage displacement, cage subsidence, listhesis, neurological deterioration, wound infection or CSF leak. Subsidence isdefined as height of surgical segment that is the distance from upper end plate of vertebra above the operated disc to lower end plate of vertebra below the operated disc (a loss of >3mm intervertebral height by Chen Y et al)7. In literature the reported subsidence ranges from 2-33 %<sup>21, 22, 23, 24</sup>.We consider that no subsidence in our study was related to careful curettage of the vertebral end plates preserving the strength of underlying vertebral surfaces which both add to fusion and strength of the union. There is controversy regarding the correlation between cage subsidence and clinical outcome though most studies show no significant effect on the outcome<sup>15, 25</sup>.

# CONCLUSION

We conclude that stand alone empty PEEK cages have clinical and radiological outcomes comparable to other devices used for single level anterior cervical discectomy. It has the added benefits of easy use and least number of donor site complication that are associated with use of bone grafts harvested for other types of implants. We think that the low subsidence rate and dysphagia at the lower end of incidence in literature observed in our study are most probably related to careful curettage of end plates and intermittent release of soft tissue retractors during surgery respectively.

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