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## Functional outcome of surgically managed cervical degenerative disease patients with anterior cervical discectomy & fusion using standalone PEEK cages

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### Abstract

Conservative management of cervical spondylosis comprises of analgesics, physiotherapy, traction, postural training and activity modification. Surgery is indicated when symptoms are not relieved or neurological deficits occur. Anterior cervical discectomy and fusion (ACDF) using a locking plate is the standard treatment for cervical spondylosis with prolapsed disc causing radicular or myelopathy symptoms. This study was undertaken to study outcomes of ACDF using standalone Polyethyl ether ketone (PEEK) cages without plate fixation. 9 operated patients were followed up for a minimum period of 6 months. 6 patients had radiculopathy and 3 had myelopathy. At 6 months all radiographs showed fusion. VAS reduced from an average 8.22 pre-op to 2.33 postoperatively. All myelopathy patients showed improvements in Nurick grade and mJOA scores. As per Odom's criteria 5 patients showed excellent outcome, 2 patients had good outcome, 1 patient had fair outcome and 1 patient showed worsening.

**Keywords:** PEEK cage, cervical spondylosis, ACDF

### Introduction

Cervical Degenerative Disorders are a major cause of disability in the population aged 40yrs and older.

It is a chronic degenerative process leading to herniated intervertebral discs, osteophyte formation, and ligament hypertrophy causing stenosis of the spinal canal, lateral recess, and foramina and may be associated with a serious complication of Cervical Spondylotic Myelopathy (CSM). The most common clinical symptom is neck pain [10]. Other symptoms include numbness, weakness, and tingling in the neck and/or upper limbs, neck stiffness, and headache [9]. According to the global burden of disease study of 2013 [11], in 301 acute and chronic diseases and injuries in 188 countries, neck pain was one of the top 10 causes of years lived with disability. Moreover it is an economic burden on the individual as well as the healthcare system. The use of plate in ACDF increases the cost of surgery, the surgical time and blood loss and increases the incidence of implant related complications. Stand alone cage fixation minimizes these complications.

Many studies have shown similar fusion rates and functional outcomes of cage fixation and plating. This study was conducted at the Orthopaedics department of Government Medical College & New Civil Hospital, Surat from August 2018 to May 2019. All cervical spondylosis patients needing ACDF were given the option of standalone cage fixation. Those giving informed consent were included in the study

### Material and Methods

Permission was obtained from the Human research and ethics committee of the institute. 11 patients were included in the study of which 2 patients migrated to other states and were not available for final follow-up hence excluded from the study.

### Inclusion criteria

1. An age of eighteen years or older,

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2. Patients with persistent severe radicular pain that had not responded to medical therapy for at least 4 week
3. Selected cases with myelopathy secondary to cervical canal stenosis that can be adequately decompressed with ACDF
4. MRI documented compression of cervical nerve roots or spinal cord, which most likely explain the clinical symptom

**Exclusion criteria**

1. Traumatic disc prolapse
2. Previous history of cervical spine surgery
3. Tumors or any other pathology involving cervical spine

Details of 9 patients were recorded in designed format with a minimum of 4 visits at post-op 12th day, at 1 month, 3 months and at 6 months. Clinical and Neurological assessment was done and AP and Lateral Radiographs of cervical spine were done at each visit. MRI was done preoperative and post operatively and was evaluated for extent of disease, cord changes, ligament hypertrophy and osteophyte formation. Radiographs were assessed Preop for osteophytes and canal stenosis (Pavlov ratio) and instability. Post op radiographs were assessed for curvature, alignment, fusion status and subsidence of the cage. Pain was graded on Visual Analog Scale (VAS) pre-op and at each visit.

Myelopathy was graded as per Nurick grade and mJOA grading.

Surgery was done by Southwick Robinson approach from the Right side. An oblique or transverse incision was used depending on the number of levels to be operated on. Dissection was limited to the involved level. Appropriate size Poly Ethyl ether ketone (PEEK) cages were used either prefilled with beta TCP or with bone nibbled from anterior border of proximal vertebra. Cage placement was checked in C-arm for size and facetal distraction. Suction drain was not used in any of the patients. Immobilization using Philadelphia collar was done for 6 weeks.

**Results**

9 men with ages ranging from 34 to 65years underwent the procedure out of which 3 patients had myelopathy correlating with myelomalacia changes in the MRI and 6 patients had radicular symptoms.

**Table 1:** Age distribution

	18-38 years	39-60 years	>60 years
Radicular Group	1	4	01
Myelopathy Group	1	1	01

**Table 2:** Myelomalacia changes pre-op and post-op

	Pre-op		Post-op	
	Cord changes present on MRI	Cord changes absent on MRI	Cord changes present on MRI	Cord changes absent on MRI
Radiculopathy group	0	6	1	5
Myelopathy group	3	0	3	0

**Table 3:** Time from onset of symptoms to surgery

	0-3 months	3-6 months	6-9 months	9-12 months	>12 months
Radicular Group	0	4	1	0	1
Myelopathy group	2	1	0	0	0

Two patients had double level surgery one each from radiculopathy and myelopathy group, others were operated for single level disc.

**Table 4:** Visual Analogue Score

	0-3	4-6	>6
PRE-OP	0	1	8
POST-OP	7	1	1

**Table 5:** Pre & Post op Visual Analogue Score

	N	Mean	Std. Deviation	Minimum	Maximum
VAS Preop	9	8.22	.667	7	9
VAS Postop	9	2.33	2.500	0	8

**Table 6:** Pre & Post op Neck disability index(NDI)

	N	Minimum	Maximum	Mean	Std. Deviation
Pre-op NDI	6	Moderate(19)	Complete(37)	(Severe)29.3	5.888
Post-op NDI	6	No(0)	Moderate(21)	(Mild)8.17	8.612

p-value is 0.03 which is <0.05 so There is statistically significant difference between NDI score before and after surgery.

**Table 7:** Pre & Post operative mJOA

	N	Mean	Std. Deviation	Minimum	Maximum
Pre-Op mJOA	3	(Severe)10.33	2.517	(Severe)8	(Moderate)13
6 month follow up	3	(Mild)18.00	.000	(Mild)18	(Mild)18

p-value is 0.006 which is <0.05, Hence, There is significant difference between MJOA score before and after surgery.

**Table 8:** Pre & Post operative EMS

	N	Mean	Std. Deviation	Minimum	Maximum
Pre EMS	3	(Grade2)11.67	2.082	((Grade2)10	(Grade1)14
Post EMS	3	(Grade1)16.00	.000	((Grade1)16	(Grade1)16

p-value is 0.02 which is <0.05, Hence, There is significant difference between EMS score before and after surgery.

**Table 9:** Pre & Post operative Nurick score

	0-1	2-3	4-5
Pre-op	0	3	0
Post-op	3	0	0

There is significant difference between Nurick score before and after surgery.

**Table 10:** Pre & Post operative Pavlov Ratio

	N	Mean	Std. Deviation	Minimum	Maximum
PrePav	9	.8122	.09536	.68	1.00
PostPav	9	.8500	.10283	.66	1.00

p-value is 0.04 which is <0.05, Hence, There is significant difference between Pavlov Ratio before and after surgery.

**Table 11:** Pre & Post operative Angle of Lordosis

	N	Mean	Std. Deviation	Minimum	Maximum
Pre AL	9	18.7778	9.16212	2.00	34.00
Post AL	9	22.3333	9.27362	3.00	35.00

p-value is 0.01 which is <0.05, Hence, There is significant difference between angle of lordosis before and after surgery.

**Table 12:** Subsidence rate

	0-1mm	2-3mm	>3mm
Decrease in segmental height	6	1	2

Significant subsidence(>3mm) rate was found in 22.2%(2 out of 9) of patients

## Discussion

ACDF has been the standard treatment modality for cervical disc disease with compression due to the prolapsed disc fragment. After discectomy tricortical bone graft/graft substitute or cage is inserted to restore segmental height and to augment fusion. There is a risk of graft displacement anteriorly or posteriorly which may cause compression and neurological symptoms. Plate is added to provide stability and to prevent graft slippage but this leads to an increased incidence of implant related complications and is an additional economic burden on the patient and the health care system.

Although autografts provide better fusion rates, because of donor site complications and the fact that it increases surgical time, cage and artificial grafts are preferred.

There have been reports in the literature of standalone cage use with comparable results and similar or higher fusion rates as compared to plating.

In our study fusion was seen in all patients using PEEK cages which were either prefilled with beta-TCP or packed with nibbled anterior body bone.

We have used the visual Analogous Scale, Neck Disability Index for patients with radiculopathic symptoms and Nurick score, mJOA score and European myelopathy score as a primary outcome measure for cervical myelopathy.

In the Myelopathy group improvement was seen on the Nurick's grade, mJOA scale and EMS in all patients at final follow up. All the patients could return back to their respective occupations and the change was significant statistically. Preoperative Spinal cord MRI changes suggesting myelomalacia persisted postoperatively irrespective of the final outcome.

In the Radiculopathy group in VAS and NDI, 5 patients showed improvement while 1 patient had neurological worsening post-operatively.

Post op MRI done for that patient showed cord edema but the decompression was adequate. This may be due to manipulation of the neck during intubation or intra operatively. He later developed myelomalacia changes on MRI and myelopathy symptoms. This patient couldn't return back to his previous occupation. All the other patients could resume their previous jobs and showed functional improvement in the follow up which was statistically significant.

Maximum patients in Radiculopathy group were in 39-60yrs age group and patients in myelopathy group were evenly distributed in all the three age groups. Age of onset or Number of levels involved/operated had no bearing on surgical outcome.

As per Odom's criteria 5 patients showed excellent outcome without any complaint referable to cervical disease and were able to perform daily occupation without impairment. 2 patients had good outcome with intermittent discomfort with no significant work impairment. 1 patient had fair result with physical activity significantly impaired and 1 patient showed worsening.

PEEK cages have inbuilt lordosis which helps in preserving segmental height and angle of lordosis. PEEK cages have metal pins which help in anchoring the cage in vertebral bodies hence decreasing the chances of slippage. 2 out of total 9 patients showed significant decrease (>3mm) in segmental inter vertebral height with Subsidence rate of 22.2% In previously published case series with stand alone PEEK cage use subsidence rates ranged from 8% to 32% [12, 13, 14].

Barsa *et al.*, reported 19 of 144 inserted cages (13.2%)

subsided in his series [14] while Bartels *et al.*, noticed an incidence of 29.2% in series of 69 patients [15].

Studies that have compared PEEK with titanium cages have shown significantly higher subsidence rates with the later. This may be explained by the difference in modulus of elasticity of the two materials. We have used only PEEK cages which were in hospital supply so did not get a chance to compare. An advantage of PEEK cage is MRI compatibility and radiolucency.

In this study, the overall postoperative complication rate was (22.2%) which included post operative neurological worsening in two cases aged 42 and 55, of which the later improved in the follow up period without any residual symptoms.

The incidence of minor complications were (22.2%) including, residual pain in one case and persistent axial neck pain in another case which is comparable with the cohort study by Fehlings *et al.* [4].

## Conclusion

As per our study we could conclude that standalone cages give equally good results as compared to plating but we need bigger sample size to reach any definite conclusions.

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