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Original Article

Surgery Section

Anterior Cervical Microdiscectomy and Fusion using Stand-Alone Polyetheretherketone Cage: A Retrospective Study

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ABSTRACT

Introduction: Anterior Cervical Discectomy and Fusion (ACDF) constitutes the standard mode of treatment for cervical disc herniation due to degeneration. Stand-alone cage can be considered as effective treatment for single and two level disc prolapse.

Aim: To examine the clinical outcomes of ACDF using stand-alone Polyetheretherketone (PEEK) cage in a single centre.

Materials and Methods: This retrospective study was conducted from July 2015 to Dec 2020 in 224 consecutive patients who underwent successful ACDF using self-locking stand-alone PEEK cage, study was done at Shri Dharmasthala Manjunatheshwara tertiary care hospital, Dharwad, Karnataka, India for radiculopathy or myelopathy due to cervical degenerative disc disease. Data analysis was done upto March 2021. The patients were analysed with Visual Analogue Scale (VAS) pain score for neck and arm pain and Nurick grade preoperatively and at 3 months postoperatively. Patients underwent preoperative and postoperative clinical, neurological evaluation. This study was statistically analysed using the Statistical Package for the Social Sciences (SPSS version 13.0) (IBM, Chicago, IL).

Results: Out of 244, (73%)164 patients underwent single level ACDF and sixty (27%) two-level ACDF. The mean age of patients was 45.86±12.07. It included 146 (65.2%) males and 78 (34.8%) female patients. In this study, the mean VAS neck score preoperatively was 4.04 and at 3 months postoperatively was 1.66 which was statistically significant ($p<0.001$). Even in VAS arm scores, there was a statistical significant difference ($p<0.001$) between preoperative (7.25) and 3 months postoperative (1.63) scores. The mean Nurick grade preoperatively was 1.46 vs 0.40 postoperatively which was statistically significant ($p<0.001$). No implant related complications or adjacent level disease was noted.

Conclusion: This study demonstrated that treatment of cervical degenerative disc disease by ACDF withstand alone PEEK cage is an effective and safe method.

Keywords: Anterior cervical discectomy and fusion, Cervical disc degenerative disease, Cervical spine

INTRODUCTION

Smith and Robinson introduced anterior decompression of the cervical spine and was established by Cloward as a treatment of the cervical disc degenerative disease [1-3]. Anterior Cervical Discectomy and Fusion (ACDF) is used as the standard procedure for the treatment of single and multiple level cervical disc degenerative disease [4]. Overall clinical outcomes associated with the surgical treatment of degenerative disc disease by ACDF have been excellent. There are many studies comparing the different types of cage materials with autologous implants of iliac bone[3-6]. The different types of cages available for ACDF are titanium, carbon fibre and polyetheretherketone (PEEK) cages.

Since several studies suggested that adding an anterior plate in fusion procedure to enhance stabilisation leads to increase in fusion rates, and it was preferred by many surgeons [7-9]. As complications started to arise from the use of ACDF by an interbody cage with anterior cervical plating, researchers started to examine new systems so that such problems can be prevented [10]. With passage of time, new variant of self-locking stand-alone PEEK cage without plates and screws has been designed which has antimigration teeth. These teeth act similar to a plate and screws offering immediate stabilization. Studies have also shown that restoration of cervical lordosis can be done and complications associated with plate can be prevented by using these cages [10,11]. In this study, authors examine the clinical outcomes of ACDF using stand-alone PEEK cage in a single centre.

MATERIALS AND METHODS

This was a retrospective study conducted from July 2015 to December 2020 in Shri Dharmasthala Manjunatheshwara tertiary care hospital, Dharwad, Karnataka, India wherein 224 consecutive patients who underwent ACDF for cervical disc herniation from C3-C4 to C6-C7 were selected. Data analysis was done upto March 2021. Institutional Ethical Committee clearance was taken. Written informed consent was taken from all the patients mentioning the indication for surgery, technique of surgery, complications and different treatment options.

Patients presenting with cervical radiculopathy/myelopathy who had fulfilled indications for ACDF were enrolled in the study. Both single level and multiple level ACDF patients were enrolled. All the procedures were performed in a single institution.

Inclusion criteria: All patients above 18 years of age who presented with cervical myelopathy/radiculopathy or both with Magnetic Resonance Imaging (MRI) findings and with the clinical features.

Exclusion criteria : Patients with the history of trauma; uncontrolled diabetes (defined as Random Blood Sugar (RBS) >250 on 3 or more occasions); patients with previous cervical surgery; and cervical Ossified Posterior Longitudinal Ligament (OPLL) were excluded from the study.

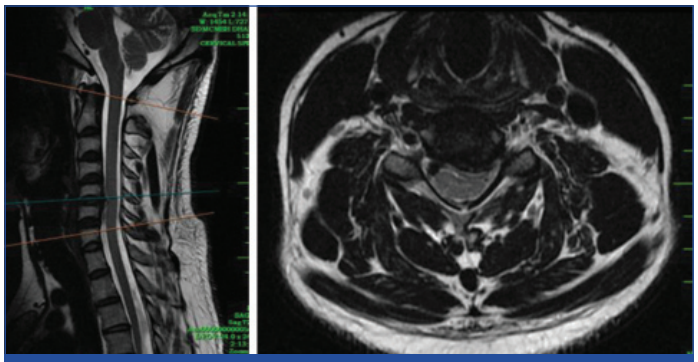
The instrumentation involved octacage stand-alone PEEK cages. Cage with 5.5 mm height was the most frequently used. The patients were analysed with Visual Analogue Scale (VAS) pain score for neck and arm pain, Nurick grade [12] preoperatively and at 3 months postoperatively was assessed.

Surgical Technique

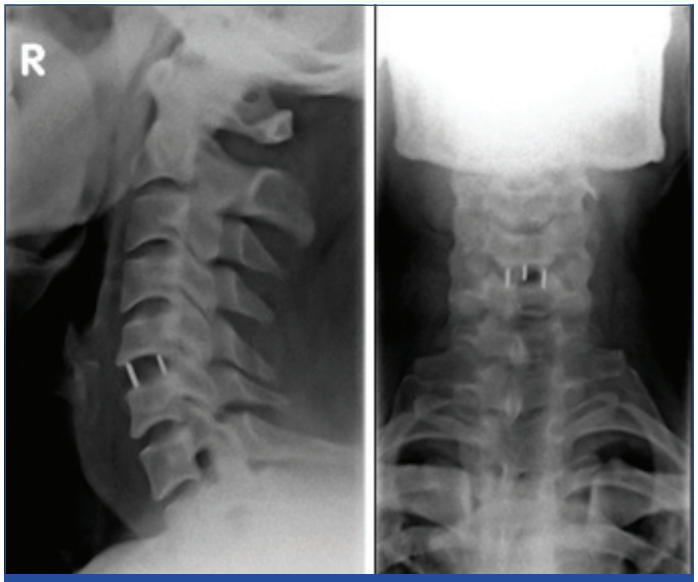
A standard anterior Smith-Robinson approach was performed. Neck incision of choice was a right sided transverse incision under general anaesthesia. A good surgical exposure with retraction of trachea and esophagus medially and retraction of carotid sheath

laterally was done so as to clearly visualise vertebral bodies and discs. The level was confirmed intraoperatively using C-Arm. Microscopic discectomy and end-plate preparation was done, which was followed by removal of posterior longitudinal ligament, residual disc and osteophytes. Cord decompression was done. A stand-alone Octacage PEEK cage was inserted at the disc space. Optimal implant position confirmed using C-arm. Wound was closed in layers without drain insertion. Postoperative hard cervical collar was used.

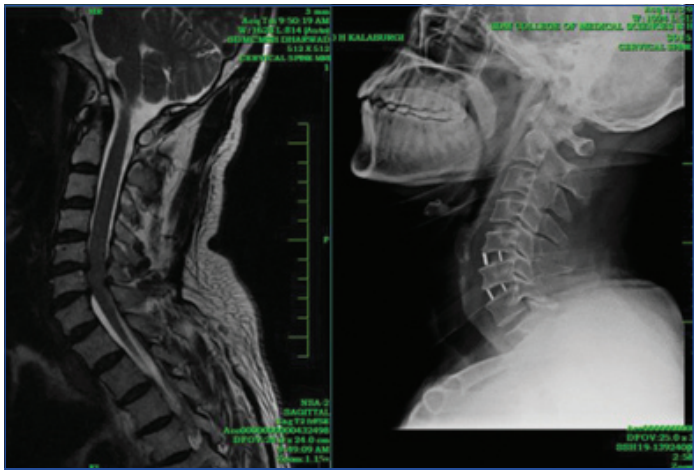
Clinical outcomes were evaluated with VAS score and Nurick grade preoperatively, postoperatively and at 3 months follow-up. Preoperative clinical evaluation was done with documentation of neck pain, radicular pain and neurological deficits. Preoperative and postoperative radiographic evaluation included MRI cervical spine and cervical spine X-rays [Table/Fig-1-3].



[Table/Fig-1]: Preoperative MRI of sagittal and axial T2WI showing C5-C6 prolapsed intervertebral disc.



[Table/Fig-2]: Postoperative X-ray of Single level ACDF of C5-C6 level.



[Table/Fig-3]: Preoperative MRI sagittal T2WI showing C5-C6, C6-C7 PIVD and postoperative X-ray of 2 level ACDF.

STATISTICAL ANALYSIS

This study was statistically analysed using the Statistical Package for the Social Sciences (SPSS, version 13.0) (IBM, Chicago, IL). The clinical values were expressed as mean±Standard Deviation (SD). The data were analysed using Wilcoxon matched pairs test. A p-value of <0.001 was considered as statistically significant.

RESULTS

Total 164 (73%) patients underwent single level ACDF and sixty (27%) patients underwent two-level ACDF. The mean age of patients was 45.86±12.07. The patient sample consisted of 146 (65.2%) male and 78 (34.8%) female patients. Age-wise distribution is as shown in [Table/Fig-4].

Age group (years)	Frequency (n)	Percentages (%)
18-30	23	10.3
31-40	57	25.5
41-50	70	31.2
51-60	49	21.9
61-70	18	8.0
71-80	7	3.1

[Table/Fig-4]: Age-wise distribution.

The mean VAS neck score preoperatively was 4.04 and 3 months postoperatively was 1.66 which was statistically significant (p<0.001) [Table/Fig-5]. Even in VAS arm scores, there was a statistically significant difference (p<0.001) between preoperative (7.25) and 3 months postoperative (1.63) scores [Table/Fig-6]. The mean Nurick grade preoperatively was 1.46 vs 0.40 postoperatively which was statistically significant (p<0.001) [Table/Fig-7].

Treatment time	Mean	SD	Median	IQR	% of effect	Z-value	p-value
Preoperative	4.04	0.77	4.00	2.00	59.05	12.9759	<0.001
3 months postoperative	1.66	0.93	2.00	1.00			

[Table/Fig-5]: Comparison of preoperative and 3 months VAS scores in NECK by Wilcoxon matched pairs test.
p-value of <0.001 was considered as statistically significant

Treatment time	Mean	SD	Median	IQR	% of effect	Z-value	p-value
Preoperative	7.25	1.19	7.00	2.00	77.51	12.9761	<0.001
3 months postoperative	1.63	0.86	2.00	1.00			

[Table/Fig-6]: Comparison of preoperative and 3 months VAS scores in ARM by Wilcoxon matched pairs test.
p-value of <0.001 was considered as statistically significant

Treatment time	Mean	SD	Median	IQR	% of effect	Z-value	p-value
Preoperative	1.46	0.90	1.00	1.00	72.86	11.9843	<0.001
3 months postoperative	0.40	0.59	0.00	1.00			

[Table/Fig-7]: Comparison of preoperative and 3 months Nurick Grades by Wilcoxon matched pairs test.
p-value of <0.001 was considered as statistically significant

Transient hoarseness of voice was encountered in 7 patients (3.1%) in immediate postoperative period which recovered completely after 4-6 weeks. Mid-scapular pain was noted in 6 patients (2.6%) patients which recovered after 3 months. There were no implant-related complications or adjacent level disease.

DISCUSSION

The treatment of choice for cervical disc herniation as a result of degenerative disc disease is ACDF. Initially, autologous iliac bone grafts were used to facilitate bony fusion. In order to avoid autograft harvesting related complications, cervical cages were introduced. Usage of cage with plate was associated with certain complications

like neck pain, hoarseness of voice, difficulty in swallowing etc. Bazaz R et al., found a high dysphagia incidence of 50.2%, 32.2%, 17.8%, and 12.5% at 1,2,6, and 12 months postoperatively, respectively [13]. This led to development of self-locking stand-alone cervical cages, which has given successful clinical results as reported in many studies [14-16]. In present study, neck pain, arm pain and Nurick grade showed notable improvement in the follow-up period. No implant related complications or adjacent level disease was noted. These outcomes were in accordance with the results of recent studies which present the equality or even supremacy of stand-alone cages over plating [16,17].

In a similar study, Azab W et al., reported a noteworthy reduction in neck pain and pain in the arm, as well as, neck pain and disability scale maintenance over 12 months with no complications associated with implants and radiological fusion by 3 months in all patients treated with a zero-profile implant. No patients had dysphagia when assessed after 3 months of post-surgery [17]. Similarly, Kapetanakis S et al., reported gradual and constant improvement of neck pain, arm pain with best scores presenting at 12 months after surgery [16]. ACDF with stand-alone spacers has resulted in similar clinical and radiologic outcomes as compared with plate and spacers and may help minimize dysphonia in the postoperative period [18]. This study provides useful information with regard to the use of stand-alone PEEK cages in the treatment of cervical degenerative disc disease.

Limitation(s)

Limitations of the present study include lack of long-term follow-up to properly evaluate implant related complications and adjacent level disease.

CONCLUSION(S)

The clinical outcome of this PEEK cage system was satisfactory after a minimum of 3 months follow-up in terms of Nurick grade, VAS score and suggests that stand-alone PEEK cage for ACDF is an effective and safe method in treating cervical disc degenerative disease.

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