

Outcome of Anterior Cervical Discectomy with PEEK Cage Fixation for Single Level Cervical Disc Disease

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ABSTRACT

Objective: To assess the outcome of anterior cervical discectomy and fusion (ACDF) with PEEK cage.

Material and Methods: This prospective study was conducted in the Departments of Neurosurgery Prime Teaching Hospital and Irfan General Hospital Peshawar. Patients undergoing one level ACDF with PEEK cage fixation were enrolled in the study. Patients who needed multiple level ACDF or corpectomy with plating and redo cases were excluded from the study. A proforma, which included age, gender, address, level of prolapsed disc, sign and symptoms, pain score, MRI findings were filled. All patients were assessed on day of discharge and on follow-up visit after one month. Data was analyzed with SPSS version 22.

Results: Total 95 patients were included out of which 58 (61%) were male and 37 (39%) were female. Range of patients' Age was from 27 years to 64 years with 50.4 years mean age. Most patients (65%) had C6 radiculopathy. 58 patients (61%) had right sided radicular pain. 5 patients (5.26%) had radiculomyelopathy. C5 – C6 was the most common level operated (68 patients). Excellent results were achieved in 75 patients (79%) while satisfactory results in the rest of patients using Odom's criteria. Bony fusion occurred in 92% of patients at 6 months.

Conclusion: ACDF with PEEK cage fixation is a safe and beneficial procedure in one level cervical prolapse disc disease.

Keywords: Anterior cervical discectomy and fusion, PEEK (polyether ether ketone) cage, radiculopathy, radiculomyelopathy.

INTRODUCTION

Cervical disc prolapse is a common disorder in neurosurgery practice.¹ Common presentation of which is radiculopathy with an incidence of 1.79 per 1000 persons per year.² Common modality of investigation in symptomatic patients is MRI cervical spine.³ Most of these patients can be managed with conservative treatment, however, patients with severe symptoms and prolonged duration or any neurological deficit need surgery.⁴ Different approaches have gained wide acceptance in neurosurgery of which Cloward and Smith Robinson are notable.^{5,6} Anterior cervical discectomy with or without fusion is a topic of

controversy due to lack of multicentric randomized controlled trials.⁵ Iliac crest graft (autologous bone) has been used for fusion, but due to donor site morbidity and graft collapse have lead the surgeons to use titanium and PEEK cages for fusion.^{6,7} While both these cages are in wide usage, PEEK cage has high rates of fusion and maintenance of cervical disc height.⁷ The use of cervical plates has demonstrated increased fusion rates in comparison to ACDF without cervical plate's augmentation.⁸ In this study, we share our two years' experience of anterior cervical discectomies with PEEK cage and fixation with mini plates.

MATERIAL AND METHODS

Study Design

This Prospective study was performed at the Departments of Neurosurgery Prime Teaching Hospital and Irfan General Hospital Peshawar from 15 November 2017 to 15 November 2019.

Inclusion Criteria

After taking approval from ethical committee and taking consent from Patients having radiculopathy or radiculomyelopathy due to single level cervical disc prolapse that underwent anterior cervical discectomy with peek cage fixation were included in this study.

Exclusion Criteria

Patients who needed two or more level ACDF and corpectomy with plating were not included in the study. Patients operated for the second time and other patients who needed posterior stabilization after ACDF with PEEK cage fixation were also excluded from this study.

Data Analysis

Data was collected on a proforma containing age, gender, sign and symptoms, level of prolapsed disc on MRI cervical spine and comorbidities. These patients were assessed again on the day of discharge and after 1month using visual analogue score for pain and improvement using Odom's criteria. Fusion was assessed by lateral x-ray of cervical spine. Data was analyzed using SPSS version 21.

Surgical Technique

All patients were positioned supine after general anesthesia. Sand bag was placed under the shoulders and Halter traction applied. Adhesive taps were used to pull down shoulders to get a clear lateral x-ray c-spine. A horizontal skin incision was given and platysma muscle was cut. A plan of dissection was made medial to sternocleidomastoid and carotid artery was approached. Further dissection was carried out medial to the carotid artery and lateral to the trachea. Longus colli muscles on both sides of vertebral body were exposed. LP needle was used to identify the level. Microscope was introduced. Intervertebral distractor was used in all cases. Intervertebral disc and any osteophyte if present were removed using high speed drill, curettes, 1-mm Kerrison rongeur and pituitary rongeur. Posterior intervertebral fascia was excised to see the Dura. After complete decompression, a PEEK cage with autologous bone graft was inserted into the disc space and micro plates were fixed on to this. After this wound, was irrigated and closed in layers. All patients used Philadelphia collar in post-operative period.

RESULTS

Gender Incidence

Total 95 patients undergone anterior cervical discectomy with PEEK cage fixation during our study period 58 were male (61%) and 37 were female (39%).

Age Incidence

Patients' age was ranging from 27 to 64 years, with 50.4 years as mean.

Table 1: Frequency of Cervical Nerve Roots Involvement.

Neurological Intact Patient	No Sensory or Motor Deficit	12	12.6%
Sensory Deficit	C6 dermatome	51	53.7%
	C7 dermatome	13	13.7%
	C5 dermatome	9	9.47%
	C4 dermatome	6	6.31%
	T1 dermatome	4	4.21%
Motor Deficit	Deltoid (C5 nerve root)	3	3.15%
	Biceps, forearm flexion (C6 nerve root)	22	23.15%
	Triceps, forearm extension (C7 nerve root)	16	16.84%
	Hand intrinsic (C8 & T1 nerve root)	7	7.37%
Absent or Diminished Reflexes	Biceps	14	14.73%
	Brachioradialis	18	18.94%
	Triceps	15	15.79%

Clinical Presentation

Most patients had C6 radiculopathy followed by C7 radiculopathy (Table 1). Radicular pain was more on the right side in 62 patients (65.26%). Spurling sign was positive in 35 patients (36.84%), while the Hoffmann sign was positive in 4 patients (4.21%).

Pain score was 7/10 or above on the **visual analogue score** in 37 (38.95%) patients. 5 patients had radiculomyelopathy. Myelopathy

was graded using **Nurick grading** (2 patients were grade 2, 2 were grade 3 and 1 patient was grade 4). The outcome was assessed by using **Odom's criteria** and visual analogue score for arm and neck pain. All surgeries were performed by the same surgical team. Duration of surgery was 2 to 3 hours, with a mean of 140 minutes. Most common level operated was C5 – C6 (68 patients, 71.57%), followed by C6 – C7 (13 patients 13.68%), C4 – C5 (9 patients, 9.7%), C3 – C4 (2 patients, 2.1%) and C7 – T1 (3 patients, 3.15%). When these patients were assessed at discharge and after 1 month post operatively, following results were obtained (see table 2). Fusion was assessed using lateral x-ray cervical spine for bridging trabecular bone and the absence of radiolucent gap. Flexion and extension cervical spine x-ray were also taken to see any motion between vertebral bodies and interspinous gap. Fusion rate was 92% at 6 months. An interspinous gap of ≤ 1 mm difference on flexion and extension x-ray was considered good fusion.

Table 2: Outcome based on Odom's Criteria after.

Excellent	Improvement in every preoperative symptom and sign	75 (79%)
Good	Persistence of minimal preoperative symptoms (No symptoms except tenderness in neck). Improved Abnormal findings.	16 (16.8%)
Fair	Definite improvement in some preoperative symptoms, others slightly improved(residual root irritation with transient pain)	4 (4.21%)
Poor	No change or worsening of Symptoms and signs.	0 (0%)

Apart from difficult intubation, no other intraoperative complication (surgery or anesthesia related) was noted. Dysphagia was the most common post-operative complication followed by subcutaneous hematoma and wound infection.

Table 3: Post-operative Complications.

Dysphagia	15 (15.8%)
Post-operative hematoma	4 (4.21%)
Wound infection	1 (1.05%)
Horner syndrome	1 (1.05%)
Dural tear, recurrent laryngeal nerve injury, esophageal injury	0 (0%)

DISCUSSION

Anterior cervical discectomy with and without fusion has been a work horse for cervical disc diseases^{9,10}. Initially iliac crest and fibular autologous bone graft alone were used for fusion without plating¹¹ but fusions rates were better with usage of anterior cervical plates, which lead the neurosurgeons to use these for single and multiple level discectomies^{12,13}. Significant donor site morbidity and graft collapse resulted in introduction of titanium and PEEK cages for fusion^{12,13}. The efficacy of both these implants is well established with slightly better results for PEEK cages¹⁴⁻¹⁶.

Use of titanium and peek cage has increased the fusion rates with good postoperative pain relief^{14, 17}, but recently, the use of titanium cage has been discouraged¹⁴. Cho et al has published their experience of Peek cage for ACDF compared to autologous bone graft for single and multiple level disc diseases. The results with peek cage are superior in terms of bony fusion, disc height maintenance and good neurological outcome^{18,19}. In another paper Cho et al examined the effectiveness of PEEK cages compared to autologous iliac crest graft with and without plating. Results are favorable for PEEK cage and autologous bone graft with plating for single and multiple level anterior cervical discectomies and fusion. PEEK cages have lesser complications and less blood loss compared to Autologous iliac bone graft²⁰.

In our study, most patients had C6 radiculopathy and most common level of surgery is C5-C6 followed by C6 – C7 which are similar to that Ofchen et al²⁰. Our Outcome in terms of pain relief and symptomatic improvement based on Odom's criteria is comparable to study undertaken by L. Mastronadi et al²¹. Excellent results were achieved in 79% compared to their 80.5% and good results in 16.7% to their 16%.

Fusion rates of 92% at 6 months in our study are comparable to 93.33% in the study undertaken by Kulkarni at National university Hospital, Singapore²². Fusion was assessed on radiological criteria as mentioned in the result section, though our study was mainly focused on outcome based on Odom's criteria.

Post-operative complications in our study were transient dysphagia (15.8%), wound hematoma (4.21%) and wound infection (1.05%). These are comparable to another study by Fountas et al where these complications are 9.5%, 5.6% and 0.1% respectively²³. Other less common complication of

Dural tear, recurrent laryngeal nerve palsy and esophageal perforation in their series doesn't occur in our study and it may be due to large sample size of their study (1015 patients compared to our 95 patients).

CONCLUSION

Management of Cervical disc disease has gone through a historic evolution. Even today different surgical techniques and material for bone fusion is used. Anterior cervical discectomy with PEEK cage fixation is an effective and safe treatment option for single level cervical disc disease with good outcome regarding pain and neurological functions.

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Additional Information

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Conflicts of Interest:

In compliance with the ICMJE uniform disclosure form, all authors declare the following:

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