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Short Term Radiological Outcomes Following Anterior Cervical Discectomy and FusionInDegerative Disc

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Abstract

Background*: Anterior cervical decompression and fusion (ACDF) is the standard surgical treatment for radiculopathy and myelopathy.*

Polyetheretherketone (PEEK) has an elasticity similar to bone and thus appears well suited for use as the implant in ACDF procedures. T he aim of this study is to examine the clinical and radiographic outcome of patients treated with standing alone PEEK spacers

Methods *: This retrospective study reviewed 30 patients suffered from radiculopathy due to degenerative disease they were treated by ACDF using PEEK . The Intromed PEEK spacer was used in 30 patients from 3/2017 to 11/2019. The patients were assessed with questionnaire and radiographically.*

Results: *The mean age of our patients was 42.95 ± 9.48 with 9 patients being males and 16 patients females. Total numbers of levels reported were 38 in 30 patients, with 22patients (70%) undergoing single-level ACDF and 8 patients (30%) double-level ACDF. All patients suffered from radiculopathy..*

The mean preoperative VAS was 6.7±1.52, while postoperative VAS was 0.62±0.42 . Continuous bridging bony trabeculae were reported in most of patients .

Conclusion*: The study demonstrates that ACDF with standing alone PEEK cages leads to excellent and good clinical outcomes.*

Keywords: *Cervical disc disease; anterior cervical discectomy; spinal fusion; PEEK;*

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I. Introduction

Surgery for degenerative diseases of the cervical spine is one of the most common procedures in daily neurosurgical practice. Cervical radiculopathy (CR) is a common diagnosis. Symptoms started with pain that radiating from the neck to the arm , may associated with sensory loss and/or weakness of motor function in the affected nerve-root distribution. CR is often self limiting and can be resolved with nonsurgical treatments , when conservative treatment fails and symptoms persist or increase in severity, surgical treatment is considered[(1)]

Anterior cervical discectomy and fusion (ACDF) is the gold standard treatment for cervical disc herniation .It is firstly described by Smith and Cloward in 1958 [(2)], it has high successful rate in reduction of neck and arm pain, restores both vertebral disc height and foraminal height [(2)]

PEEK cages were introduced in 1990s and have been used on a wide scale in cervical spine surgeries due to its radiolucency which permits easy evaluation of fusion, significant power, their ability to resist weariness, and equivalent stiffness to bone which decreases stress shielding. PEEK itself is inactive and has no ability to connect to bone.[(3)]

II. Material and methods

This is a retrospective comparative study on 30 patients with single-level and double level cervical disc herniation, conducted in the period between October 2017 to October 2019.it was multicenter study (Zagazig University hospitals and Nasser Institute hospital)

Inclusion criteria:

1. Patients 20-60 years old.
2. Patients presenting with manifestation of cervical radiculopathy.
3. Radiographically determined disc pathology to include at least one of

the following:

a. Decreased disc height compared to adjacent levels on radiogram

film .

b. Disc herniation on MRI.

4. Failure of conservative treatment for 3 months.

Exclusion criteria:

1. Medical co morbidities that would add a surgical risk.
2. Concomitant cervical pathology e.g. rheumatoid arthritis.

3. Lesions extending posterior to the vertebral body in which corpectomy is the choice for anterior decompression.

4. Myelopathic patient.

5. More than 2 level ACDF.

Surgery

All patients underwent ACDF according to the modified Smith-Robinson technique with the Caspar instruments. The segment was identified preoperatively and verifiedintraoperatively by an image intensifier. The intervertebral space was emptied, and osteophytes were removed with a high speed drill. The cartilage portion of the end plate was removed. The PEEK spacer was placed into the intervertebral space under control of the image intensifier. Nothing was placed inside any of the cages. No patient received plate fixation. Intraoperative fluoroscopy ensured the correct placement of spacers[(9)]

Data Collection

We examined the patient preoperatively , one month , six months and 2 years postoperatively .Clinical evaluation was done by scoring system using Neck disability index (NDI)[(10)]and visual analogue score (VAS) [(11)]

In addition to the clinical examination, radiography of the cervical spine in two planes was made at every follow-up.

Fusion status was evaluated with X-ray. Four planes of X -rays were used, including anterior-posterior, neutral and flexion and extension lateral views. The criteria for bone fusion were either crossing bony speculaes across the fusion level in X -Rays or no change in position of the fused levels on dynamic views (flexion and extension). to assess the fusion(fused, delayed,or not fused) and fus ion rate(poor, average, good and excellent). Interbodyratio ,disc space height , cervical lordosis angles , postion of the cage and cage subsidence (<=2mm). Fusion is considered successful if flexion-extension views showing less than 2 degree movement between the two vertebral bodies[(12)]

III. Statistical analysis

Data collected throughout history, basic clinical examination, laboratory investigations and outcome measures coded, entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) (Statistical Package for the Social Sciences) software for analysis. According to the type of data qualitative represent as number and percentage , quantitative continues group represent by mean ± SD , the following tests were used to test differences for significance;. difference and association of qualitative variable by Chi square test (X2) . Differences between quantitative independent groups by t test paired by paired t or Sign test . P value was set at <0.05 for significant results &<0.001 for high significant result.

IV. Results

In this study 30 patients all cases were treated with anterior cervical discectomy and fusion using PEEK cage. Mean age was distributed as 42.95±9.48 with minimum age 26 and maximum 60 years regard sex distribution male (15 patients) and female (15 patients) distribution were distributed evenly as 1/1 . The surgery was single level in 21 patient (70%) and double level in 9 patient (30%)

Clinical outcome : there was improvement in NDI and VAS score in arm pain . Mean NDI preoperatively 42.4±13.38 and final follow up was 11.12±3.3

Mean VAS was 6.7±1.52 preoperatively and became 0.62±0.42 at last follow up.The postoperative difference was statistically highly significant compared with the preoperative score (p <0.001)

Radiographic results

Intervertebral height preoperative was 3.5±0.89 to became 6.18±0.83 after 6 months follow up and 5.87±0.71 at final follow up . the intervertebral disc height at last follow up were markedly improved compared with those at the preoperative assessment . statistically significant compared with the preoperative score (p <0.001)

All patient had undergone complete radiographic follow up at 2 years after surgery and solid fusion was evident in all cases , based on the absnce of more than 2mm motion and complete formation of a bony bridge between the graft and the vertebral body , as observed on simple dynamic lateral radiogragh, no cases of pseudoarthrosis was observed .

Procedure- related complication

No patient in our series developd a hematoma or wound infectionafter surgery , there were no incidents of verteberal artery injury, recurrent laryengeal nerve palsy, or esoghageal or treacheal laceration . Durind follow up period , there were no cases of hardware failure such as migration or breakage. Therefore , no additional surgical procedures were required during the follow up period

Table (1): Disc height distribution at different times

	Mean± SD	Paired t	P
Disc height pre	3.5±0.82	-16.457	0.00**
Disc height Post1	6.4±0.68		
Disc height pre	3.5±0.89	-12.311	0.00**
Disc height Post3	6.18±0.83		
Disc height pre	3.5±0.89	-10.734	0.00**

Disc height Post6	5.87±0.71		
Disc height Post1	6.4±0.68	1.000	0.333
Disc height Post3	6.18±0.83		
Disc height Post1	6.4±0.68	3.416	0.004*
Disc height Post6	5.87±0.71		
Disc height Post3	6.18±0.83	2.611	0.020*
Disc height Post6	5.87±0.71		

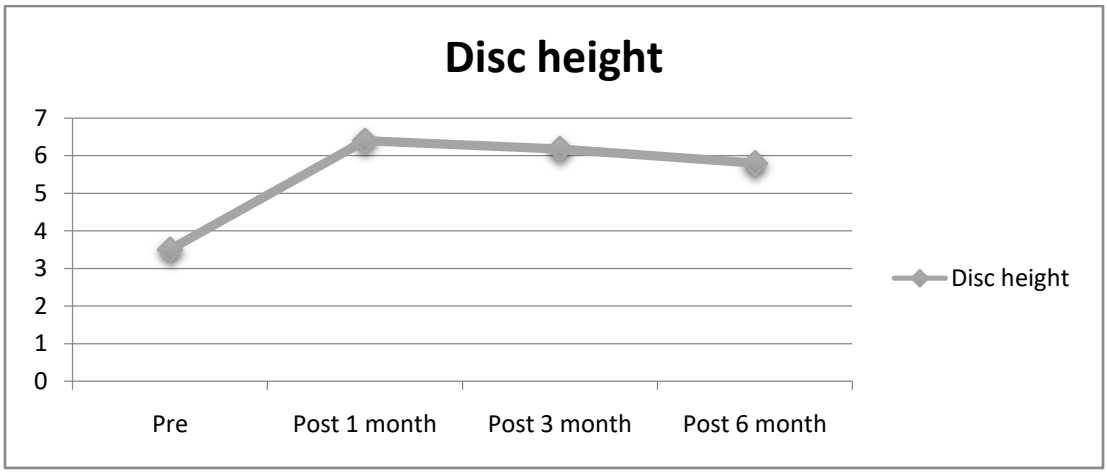

Fig (1) : Disc Height

Table (2): Rate of fusion distribution among studied group

		N	%
Rate of fusion	Average	2	10.0
	Good	14	70.0
	Excellent	4	20.0
	Total	20	100.0

Table (3): Association and predictors with fusion grade

			Good and excellent	Average	T	P
AGE			41.44±8.71	56.5±3.53	-2.374	0.029*
Disc height pre			3.55±0.78	3.0±0.98	0.896	0.382
Operation time			59.44±15.8	65.0±21.8	-.426-	0.675
SEX	F	N	9	1		
		%	50.0%	50.0%		
	M	N	9	1	0.0	1.0
		%	50.0%	50.0%		
DISC affected	C4-5	N	6	0		
		%	33.3%	0.0%		
	C4-5 C5-6	N	2	1		
		%	11.1%	50.0%		
	C5-6	N	6	1	3.06	0.54
		%	33.3%	50.0%		
	C5-6 C6-7	N	2	0		
		%	11.1%	0.0%		
	C6-7	N	2	0		
		%	11.1%	0.0%		
Total		N	18	2		
		%	100.0%	100.0%		

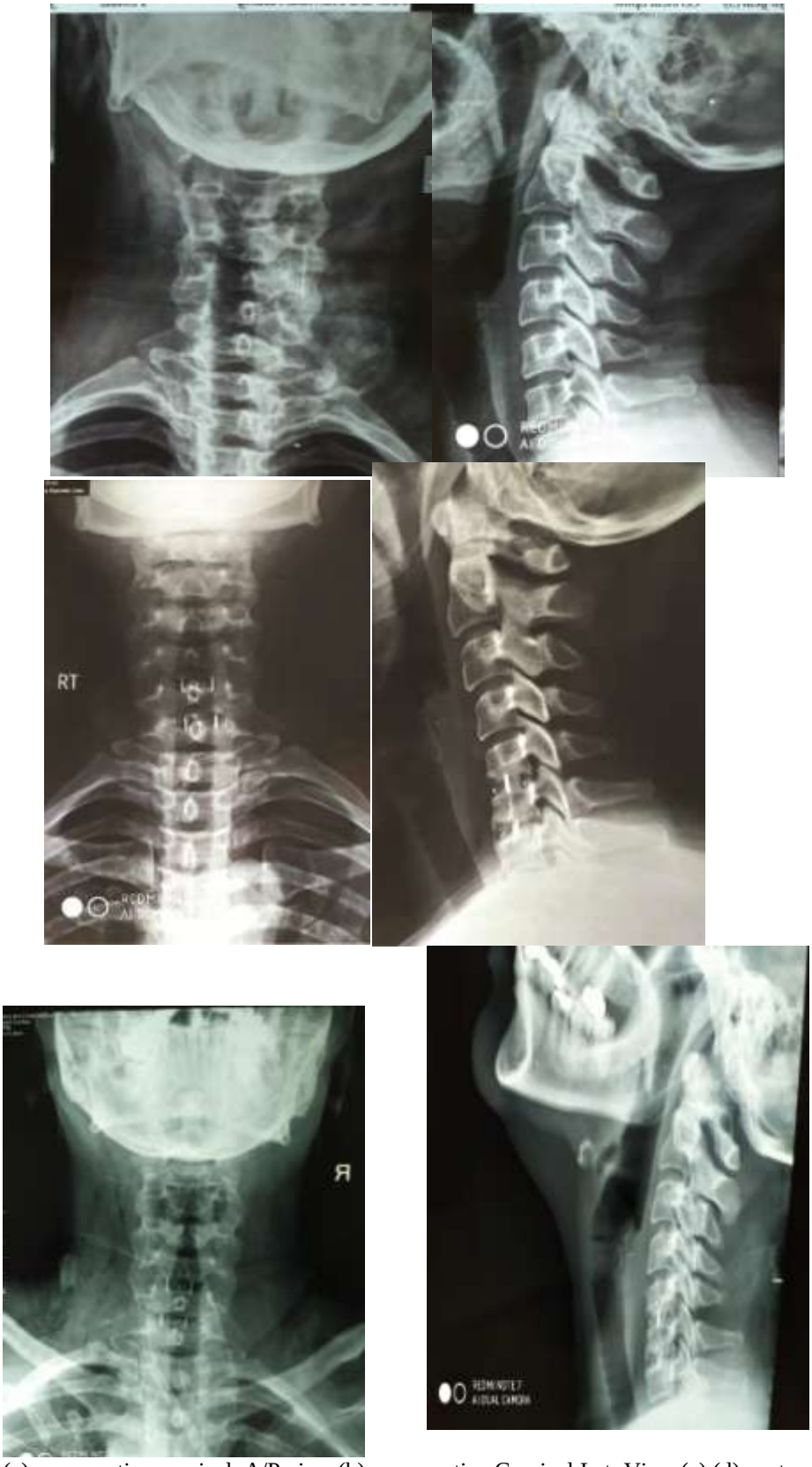

Fig (2) : (a) preoperative cervical A/P view (b) preoperative Cervical Lat. View (c) (d) postoperative A/P and Lat. views after 3 months (e) (f) postoperative A/P and Lat. Views after 6 months

V. Discussion

Surgery for degenerative diseases of the cervical spine is one of the most common procedures in daily neurosurgical practice. Cervical radiculopathy (CR) is a common diagnosis [(1)]

Kim et, al, (2017)" surgical stabilization has been reported using an anterior,posterior or a combined approach; however, the optimal approach remains controversial[(13) (14)]. Although posterior stabilization techniques have been employed with good results, they are associated with several risks such as neurovascular damages, infection, postoperative neck pain with extensive muscle dissection, and blood loss. Moreover, the incidence of disc disruption may be as high as 40% in cases of unilateral facet dislocation and 80% in cases of bilateral cervical facet dislocation. This could cause neurological deterioration, and the additional risk of anterior collapse of the disc space could lead to kyphotic deformity " [(4)]

Anterior cervical discectomy and fusion (ACDF) is regarded as the proper surgical treatment for symptomatic cervical degenerative disc disease of patients when conservative therapy is not effective. In 1958, Smith and Cloward initially introduced ACDF, which provided both neural decompression and spine stability.

Long-term follow-up revealed that ACDF is an effective method but that up to 25% of patients may develop radiculopathic or myelopathic symptoms [(7)]

Autogenous iliac crest graft was the best choice which demonstrates high fusion rate,…., However this surgical procedure has been hampered by iliac crest donor site morbidity, this led to thinking about interbody fusion cages which have same advantages of bone graft with reduction of donor site morbidity [(5).]

PEEK cages were introduced in 1990s and have been used on a wide scale in cervical spine surgeries due to its radiolucency which permits easy evaluation of fusion, significant power, their ability to resist weariness, and equivalent stiffness to bone which decreases stress shielding PEEK itself is inactive and has no ability to connect to bone. Thus, PEEK was added to other substances such as HA which is a perfect candidate as its composition is similar to the inorganic constituent in natural bone. Its combination with PEEK encourages new bone formation from bony walls which achieves implant fusion in little time [(3)]

ACDF with plate has been recommended for two or more level procedures, for instability, for kyphosis, and for patients with smoking history and diabetes.

However, adding of a cervical plate is also associated with plate-related

complications such as material failure and additional cost. [(6)]

Many anterior cervical instruments have been introduced due to the continuous development of surgical methods and devices. The composition of an anterior cervical plate and an interbody cage in ACDF is possible to increase fusion rates compared with the ACDF without anterior plates. Numerous articles have reported the effective use of placing plates to prevent pseudoarthrosis, subsidence, and local kyphosis . However, the addition of a plate may cause softtissue injury, dysphagia, plate fracture, and migration. [(7)]

Burkhardt (2017) compare between ACDF with and w ithout plate fouad that There was no significant difference between ACDF and ACDF + CP according to clinical outcome, repeated procedure for DCDD, and symptomatic ASD. (6)

Few studies have compared the differences between autologous bone graft and synthetic cage in ACDF with plate system ;……, . No differences were observed in the changes in the VAS score of neck pain between the groups. Chronic donor site pain could be eliminated using PEEK cage with DBM in group II.(4)

Anterior cervical decompression and fusion with autologous bone graft has been the standard treatment for CDD for more than 50 years. In recent years, many surgeons have replaced autologous bone grafting with an artificial cage and they report equivalent clinical outcomes after this shift in surgical procedure . Our study confirmed the results of these previous studies. We found no significant differences between the type of fusion in relation to reduction of radicular pain, neck pain, or headache. We have reported the presence of similar complication rates for patients fused with a PEEK cage or with AICG, with the exeption of the absence of donor site morbidity in patients fused with a PEEK cage . The absence of donor site morbidity, the shorter operation time, and the equivalent clinical results associated with the use of PEEK cages lead us to prefer this type of fusion to AICG. (8)

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