

Anterior Cervical Discectomy and Fusion by Using Bone Graft and Plate Versus Using Zero Size Peek Cage Filled with Bone Graft and Inbuilt Screws

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ABSTRACT

Objective: The purpose of this study was to compare the clinical and radiological results of employing local bone graft with a PEEK cage vs bone graft and plate in ACDF.

Study Design: Retrospective study

Place and Duration: Department of Neurosurgery, Gomal Medical College DI Khan in the period from June, 2022 to November, 2022.

Methods: There were 80 cases of both genders were included for anterior cervical discectomy and fusion. Detailed demographic information on enrolled cases was recorded after receiving informed written consent. Patients were divided in two groups. Group I received ACDF by using bone graft and plate in 40 cases while in 40 cases of group II ACDF was performed by using zero size peek cage filled with bone graft and inbuilt screws. Outcomes among both groups were compared. SPSS 22.0 was used to analyze all data.

Results: Among 80 cases, there were 46 (57.5%) males and 34 (42.5%) females. Mean age of the patients was 43±18 years. Perioperative mean pain score was 7.5±6.20, mean NDI was 62.4±2.8, mean SF-36 was 29.8±3.15 in group I and in group II mean pain score was 6.9±5.20, NDI was 64.8±3.10 and SF-36 was 30.5±4.13. Significantly reduction in pain score, NDI and increase in SF-36 among both groups were found while in group II outcomes were better than group I. Mean operative time in group I was higher as compared to group II with p value <0.004. There was no any significantly difference in blood loss among both groups. With a p value of 0.003, group II had higher disc space height and segmental interbody angle at the operative segment than group I. Perioperative complication rates in group I was higher with p value <0.05.

Conclusion: In this study, we found that patients undergoing ACDF with local bone graft and a PEEK cage had significantly shorter operating times, fewer perioperative problems, and better radiological outcomes than patients undergoing ACDF with bone graft and plate. A PEEK cage-encased local bone graft seems to be a secure substitute for an ACDF's bone transplant.

Keywords: Cervical spine, Anterior cervical discectomy and fusion, bone graft, Local bone graft

INTRODUCTION

Smith and Robinson first proposed anterior compression of the cervical spine, and Cloward established it as a treatment for cervical disc degeneration disorder (DDD) [1, 2]. Since that time, the standard treatment for single- and multiple-level cervical DDD is anterior cervix disk herniation/decompression and fusion (ACDF) [3]. When compared to discectomy alone, ACDF is thought to have a number of benefits [4]. The lack of a recognized gold standard approach for ACDF, however, is consistent with the dearth of randomized investigations (3). The use of anterior cervical plating during ACDF surgeries is believed to increase stabilization through improvements in implant subsidence, fusion, and cervical alignment [5]. However, there have been reports of complications, particularly in multilevel ACDF, including increased rates of dysphagia and implant-related issues like breakage, loosening of screws, screw penetration to endplate, and fractures [6]. In the recent years, concerns have also been raised over the best ACDF technique [7] and material [8].

The gold standard for a fusion substrate in ACDF has historically been intermediate iliac crest (AIC) bone. AIC graft harvesting has been linked to problems include pseudoarthrosis, subsidence, collapse, angular stretching, protrusion of a bone block, infection, and discomfort or bleeding at the donor site [9]. To maintain the anterior column structurally and prevent these problems, new varieties of bone graft replacements have been created [10].

Bone that was acid-treated to remove its mineralized component while leaving the organic matrix and different growth factors is what is known as demineralized bone matrix (DBM).[11] Collagen and other growth hormones, such as the osteoinductivity-producing bone morphogenic protein (BMP), are components of DBM. DBM does not cause immunological rejection, unlike

allograft bone, because the surface antigenic features are removed during demineralization. However, processing also results in the loss of the bone's osteogenic potential. DBM has been used as a viable alternate option for bone grafting in previously published studies[12], however there is not enough clinical data to support its use as a stand-alone graft material.

In clinical investigations, the polyetheretherketone (PEEK) cage has produced positive outcomes as a bone transplant alternative for patients undergoing ACDF [7]. Standalone strut grafts are more prone to problems such graft subsidence, dislodgment, nonunion, and morbidities at the donor site. Anterior cervical plating also carries some intrinsic risks, such as the possibility of plate loosening, screw withdrawal, breaking, trachea-esophageal irritation, fistula, longer surgery times, and longer hospital stays. Separate titanium/polyetheretherketone (PEEK) cages, also known as Zero-profile (Zero-P) cages, have recently been developed. These cages contain slots for screwing into adjacent vertebral bodies and spaces for autologous cancellous iliac crest bone transplant. The disadvantages of anterior cervical plates, as indicated in the preceding sentence, are believed to be minimized by Zero-P cages because of their low profile and other benefits. As local bone graft is used frequently in lumbar spine surgery, we wondered how a PEEK lock containing regional bone graft would compare to the gold standard iliac bone move in patients receiving ACDF [8], [9]. This study will contrast the two procedures in patients undergoing ACDF in order to evaluate the clinical and radiographic effects of a PEEK cage with neck local bone transplant against lumbar bone graft alone.

MATERIAL AND METHODS

This retrospective study was conducted at Department of Neurosurgery, Gomal Medical College DI Khan in the period from

June, 2022 to November, 2022. and comprised of 80 patients. Detailed demographic information on enrolled cases was recorded after receiving informed written consent. Patients with multiple level cervical disc deterioration, prior surgery on the cervical spine, pre-operative dysphagia, asthma to cage substances, active infection or malignancy, segmental instability, a vertebral fracture in progress, active rheumatic illness, metabolic bone disorders impacting the the cervical spine, pregnancy, a diagnosis of mental illness, or recent use of drugs were excluded.

For inclusion, the following prerequisites have to be satisfied: Adults over the age of 18, cervical radiculopathy, which was identified by an MRI scan on the cervical spine and corresponded with clinical signs, such as arm or neck pain, and having failed no less than six weeks of conservative treatment, are the first two criteria. Single-level cervical disc herniation (IV). Patients were divided in two groups. Group I received ACDF by using bone graft and plate in 40 cases while in 40 cases of group II ACDF was performed by using zero size peek cage filled with bone graft and inbuilt screws. SPSS 22.0 was used to analyze all data. Mann-Whitney U test was used for the duration of stay, and Student's t-test was used for the duration of surgery.

RESULTS

Among 80 cases, there were 46 (57.5%) males and 34 (42.5%) females. Mean age of the patients was 43±18 years and had mean BMI 22.9±4.37 kg/m². There were 35 cases had rural residency and 45 had urban residency. Majority of the cases were illiterate.(table 1)

Table-1: The enrolled cases' demographics

Variables	Frequency	Percentage
Age (years)	43±18	
BMI (kg/m ²)	22.9±4.37	
Gender		
Men	46	57.5
Women	34	42.5
Place of Residence		
Rural	35	43.8
Urban	45	56.2
Education status		
Literate	29	26.2
Illiterate	51	63.8

Mean operative time in group I was higher 115.7±12.88 minutes as compared to group II 97.10±7.67 minutes with p value <0.004. There was no any significantly difference in blood loss among both groups. Hospital stay in group was 5.3±2.33 days and in group II was 3.1±0.9 days. (table 2)

Table-2: Hospitalization and operation time among both groups

Variables	Group I	Group II
Mean operative time (min)	115.7±12.88	97.10±7.67
Mean blood loss (ml)	52.7±13.28	37.6±9.44
Mean hospital stay (days)	5.3±2.33	3.1±0.9

Table-3: Pre and Post-operatively comparison of pain score, neck disability index and short-form health survey questionnaire-36 among both groups

Clinical Outcomes	Group I	Group II
Pre-operative		
Mean pain score	7.5±6.20	6.9±5.20
Mean NDI	62.4±2.8	64.8±3.10
Mean SF-36	29.8±3.15	30.5±4.13
Post-operative		
Mean pain score	3.9±4.17	1.1±0.18
Mean NDI	20.7±3.15	18.6±4.19
Mean SF-36	58.3±16.39	61.2±10.46

Perioperative mean pain score was 7.5±6.20, mean NDI was 62.4±2.8, mean SF-36 was 29.8±3.15 in group I and in group II mean pain score was 6.9±5.20, NDI was 64.8±3.10 and SF-36 was 30.5±4.13. Significantly reduction in pain score, NDI and increase

in SF-36 among both groups were found while in group II outcomes were better than group I.(table 3)

With a p value of 0.003, group II had higher disc space height and segmental interbody angle at the operative segment than group I. table 4)

Table-4: Comparison of radiological outcomes among both groups

Variables	Group I	Group II
At start		
DSH (mm)	3.9±2.6	2.10±6.15
segmental interbody angle	2.8±7.10	3.1±5.27
AT final follow up		
DSH (mm)	5.6±1.16	6.8±8.37
segmental interbody angle	3.7±5.34	4.11±2.17

Complication in group I was found in 11 (27.5%) cases and in group II found in 3 (7.5%) cases.(figure 1)

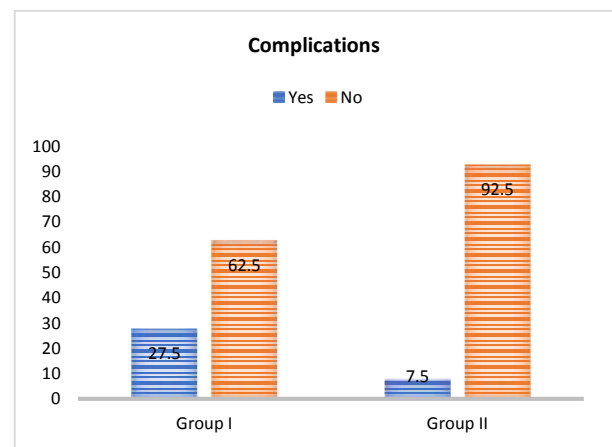


Figure-1: Comparison of post-operative complication among both groups

DISCUSSION

With outstanding outcomes, ACDF is the gold standard procedure for degenerative cervical diseases, cervical trauma, infective spondylodiscitis, and neoplastic lesions. Utilizing an anterior cervical plate implant and cages made of titanium/PEEK and filled with allograft or autograft improves the fusion of two adjacent vertebrae, preserves height, and offers stability. Anterior cervical plates have a number of inherent disadvantages, including the possibility of plate loosening, screw pullout, tracheoesophageal irritation, dysphagia and fistula, and longer recovery times.[16,17] Titanium/PEEK Zero-P cages with slots for screwing into neighboring vertebral bodies and spaces for ACG have recently been designed. Zero-P cages are intended to minimize the disadvantages associated with anterior cervical plates as indicated in the preceding paragraph because of their low profile and the advantages listed above.

In addition, ACDF with anterior cervical plating results in a line of the cervical spine, avoids interbody lock subsidence, and reduces the need over additional surgery [18]. However, complications like tracheoesophageal lesions, elevated rates of dysphagia, and issues related to implants have been noted [19]. Self-locking standalone cervical cages, which lack anterior neck plating and are believed to have resolved the earlier issues, were required as a result of these issues. Numerous studies have reported positive clinical outcomes using the stand-alone cage in clinical practice [20].

In current study 80 patients were underwent for ACDF. There were 46 (57.5%) males and 34 (42.5%) females. Mean age of the patients was 43±18 years. Results were comparable to the stud conducted in past.[21] While the SF-36, neck pain, pain in the arms, and NDI all usually demonstrated substantial improvements in the follow-up phases, group II's

outcomes in the current study outperformed group I's. Consistent and gradual improvement highlights the procedure's long-term effectiveness. It is possible to use individual characteristics of the subjects, which have little clinical significance, to clarify why the NDI at 6 months displays a little higher score than the one at 12 months. It is surprisingly important that both pain severity and standard of life have increased, corroborating the study's main conclusion. Regarding fusion, subsidence, and complications, the findings are surprisingly positive as well as better than those found in the relevant literature.

The latter is backed up by several studies in the field of research. The results were positive, according to Li et al., and there were no significant differences among the stand-alone Fidji the cervical cage and anterior the cervical plate after ACDF in terms of improvement on the SF-36, VAS, NDI, Japanese Orthopedic Organization ratings, disc rise mean combining time, combining rate, adjacent segment degeneration, or repair of cervical lordosis. In addition, the cage group outperformed the plate group in terms of operating hours, blood loss, expenses, and relative simplicity while also having a lower risk of dysphagia following.[22]

In our study, mean operative time in group I was higher 115.7 ± 12.88 minutes as compared to group II 97.10 ± 7.67 minutes with p value < 0.004 . There was no any significantly difference in blood loss among both groups. Hospital stay in group was 5.3 ± 2.33 days and in group II was 3.1 ± 0.9 days. According to the research, a PEEK cage implant offers better clinical performance than a bone graft and plate implant, which has already demonstrated considerable clinical advantages in the prior literature [23]. By contrasting PEEK cages with bone graft and plate cages, Niu et al. [24] found that the PEEK group had a better radiological outcome in terms of interspace height and radiographic fusion. They explicitly attributed the superiority of the results to the cage material, PEEK, which has shown to be free of cytotoxicity and mutagenicity [25], as well as being biocompatible, non-absorbable, corrosion-resistant [26], and, most crucially, having an elasticity modulus similar to that of bone. This characteristic has been linked to a decreased risk of subsidence. When contrasting a PEEK cage with a titanium cage.

Although the estimated blood loss from the stand-alone cage may be significantly lower than that from anterior plating, this difference may not be clinically significant, and the stand-alone cage's overall costs and perioperative outcomes may be comparable to those of anterior plating [27]. With a low rate of adjacent-level ossification, a prospective randomized trial found that the stand-alone anchored PEEK cage is a reliable substitute for plating in ACDF [28].

In our study complications were lower 7.5% in group II (zero size peek cage filled with bone graft and inbuilt screws) as compared to group I 27.5% (bone graft and plate) with p value < 0.002 . This was comparable to the previous study.[29]

CONCLUSION

In this study, we found that patients undergoing ACDF with local bone graft and a PEEK cage had significantly shorter operating times, fewer perioperative problems, and better radiological outcomes than patients undergoing ACDF with bone graft and plate. A PEEK cage-encased local bone graft seems to be a secure substitute for an ACDF's bone transplant.

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