

Comparison Of Polyetheretherketone (PEEK) Cage Versus Iliac Bone Graft Undergoing Anterior Cervical Discectomy And Fusion (ACDF): A Multicenter Experience

Soban Sarwar Gondal¹, Saad Javed², Ali Tassadaq Hussain Minhas³, Rana Mohammad Mohsin Khan⁴, Yasir Shehzad⁵, Nadeem Akhtar⁶

¹ Senior Registrar, Department of Neurosurgery, Holy Family Hospital, Rawalpindi Medical University.

² Registrar, Department of Neurosurgery, Rawalpindi Medical University.

³ Senior Registrar, Department of Neurosurgery, Rawalpindi Medical University.

⁴ Senior Registrar, Department of Neurosurgery, Rawalpindi Medical University.

⁵ Associate Professor, Department of Neurosurgery, Rawal Institute of Health Sciences.

⁶ Dean, Professor, Department of Neurosurgery, Rawalpindi Medical University.

Author's Contribution

^{1,2,5,6} Conception of study

^{1,2,3} Experimentation/Study Conduction

^{1,2,4} Analysis/Interpretation/Discussion

^{1,2,3,4} Manuscript Writing

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^{1,2,6} Facilitation and Material analysis

Corresponding Author

Dr. Saad Javed

Registrar

Department of Neurosurgery

Rawalpindi Medical University

Rawalpindi

Email: saadjaved10095@gmail.com

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Abstract

Objective: The aim of the study was to compare the functional and radiological outcomes of polyetheretherketone (PEEK) cages with iliac crest allografts in anterior cervical decompression and fusion (ACDF) in patients of symptomatic Cervical spondylotic myelopathy (CSM).

Methods: In this cohort study, we included 70 (35 in each group) patients of symptomatic CSM having degenerative cervical disc disease who were planned for ACDF from Jan-2017 to Jan-2021 in Rawalpindi Medical University. All procedures were performed under general anesthesia in the supine position, standard ACDF technique was used in all patients. Anterior cervical locked plates were used for the fixation of PEEK cages or the iliac allografts in the intervertebral space. Radiologic and functional outcomes were determined 6 months after surgery.

Results: The baseline study characteristics were similar between the groups. Mean Modified Japanese Orthopedic Association (MJOA) score at 06 months follow-up was the same between the groups; 14.16±4.30 in group A and 13.54±3.24 in group B (p-value 0.49). Disc space height at 06 months follow-up was also similar between the groups; 10.01±0.67 mm in group A versus 10.11±0.70 mm in group B (p-value 0.54). The fusion rate at the final follow-up was 31 (88.6%) in group A versus 30 (85.7%) in group B (p-value 0.72).

Conclusion: PEEK cages have similar functional and radiologic outcomes in comparison to ileal crest allografts. So, PEEK cages can be used as a successful alternative to ileal crest allografts. This will help to reduce donor site morbidity and will reduce longer surgical times associated with graft harvesting.

Keywords: Cervical spondylosis, compressive myelopathy, Allograft, Polyetheretherketone

Introduction

Cervical spondylotic myelopathy (CSM) is a degenerative spinal cord disease that is progressive in nature.^{1, 2} CSM is a common disorder, nearly about 25% population of age <40 years and about 50% of age >40 years have some asymptomatic degree of degeneration.³ CSM-related hospitalization rate is 13.9/1000 patients per year and the number of patients requiring surgical intervention has also increased by seven folds in recent years.⁴ CSM can occur either because of direct spinal cord compression or compression of surrounding blood vessels causing variable symptoms such as motor dysfunction, clumsiness, loss of balance or gait, and abnormal pathologic reflexes.⁵

Anterior cervical decompression and fusion (ACDF) is the gold-standard surgical intervention for the management of degenerative cervical disc disorders. Studies have reported that inter-body disc support is associated with better functional results than discectomy alone. The commonly used inter-body disc support is an allograft obtained from the iliac crest. This allograft has significant positive outcomes but is associated with significant morbidity of the donor site such as post-op pain, hematoma, infections, and longer hospitalization duration, with complications frequency ranging from 9% to 50%.⁶⁻⁸

So to overcome the complications of allografts different artificial materials have been developed e.g. titanium, tantalum, carbon fiber, and polyetheretherketone (PEEK) cages to support inter-body discs.⁹ Among these PEEK cages have gained popularity and are used as preferred implants for ACDF. PEEK material is biocompatible and has elasticity mimicking the bone. The aim of this study is to compare the functional and radiological outcomes of PEEK cages with iliac crest allografts in ACDF in patients of symptomatic CSM.

Materials and Methods

In this cohort study, we included 70 patients of symptomatic CSM having degenerative cervical disc disease who were planned for ACDF from Jan-2017 to Jan-2021. The study proposal was approved by the

hospital ethical committee of Rawalpindi Medical University. All patients signed a written consent for study participation. The choice of procedure was based on the preferences of patients, and the patients were informed about the advantages and drawbacks of both procedures. At the end of the study period, we included equal (35) patients in each group. Patients with neoplasms, trauma, or having ossified posterior longitudinal ligament (OPLL) were excluded.

All procedures were performed under general anesthesia in the supine position. Intraoperative fluoroscopy was done to determine the exact vertebra, and the standard ACDF technique was followed in all patients. Anterior cervical locked plates were used for fixation of the PEEK cage or the iliac allografts in the intervertebral space. Perioperative complications were noted in each patient. The patients were followed for 6 months to determine functional and radiological outcomes. Functional outcomes were measured using Modified Japanese Orthopedic Association (MJOA) scoring. While radiological outcomes were measured by plain radiographs of the cervical region in anteroposterior, lateral, and flexion-extension positions. CT scan was performed at 6 months to determine the fusion. Patients having <1.0 mm motion range between flexion and extension x-rays were labeled to have successful fusion.¹⁰

Data were entered prospectively in SPSS v25. The fusion rate was compared using the chi-square test. For quantitative variables, a comparison unpaired sample t-test was applied taking p-value ≤ 0.05 as a significant difference.

Results

The baseline study characteristics were similar between the groups. Mean age was 52.41 ± 9.7 years in group A and 51.97 ± 10.1 years in group B (p-value 0.85). There was male dominance with 20 (57.1%) male patients in group A and 22 (62.8%) in group B (p-value 0.8). Duration of symptoms was 3.53 ± 2.59 months in group A and 3.71 ± 2.34 months in group. Comorbidities such as smoking, hypertension and diabetes were also not significantly different between the groups (Table 1).

Table-1 Study population demographics.

	Group A (Allograft) (N=35)	Group B (PEEK) (N=35)	P-value
Age	52.41±9.7	51.97±10.1	0.85
Gender			
Female	15 (42.8%)	13 (37.4 %)	0.8
Male	20 (57.1%)	22 (62.8 %)	
Duration of symptoms (months)	3.53±2.59	3.71±2.34	0.76
Smoking	11 (31.4 %)	12 (34.3 %)	0.79
Diabetes	04 (11.4 %)	06 (17.1 %)	0.49
Hypertension	08 (22.8 %)	10 (28.6 %)	0.58

The mean pre-op MJOA score was 12.39±3.70 in group A and 12.89±3.41 in group B (p-value 0.54). The mean MJOA score at 06 months follow-up was the same between the groups; 14.16±4.30 in group A and 13.54±3.24 in group B (p-value 0.49). Similarly, disc space height at 06 months follow-up was also similar between the groups; 10.01±0.67 mm in group A versus 10.11±0.70 mm in group B (p-value 0.54). The fusion rate at the final follow-up was 31 (88.6%) in group A versus 30 (85.7%) in group B (p-value 0.72). The complications rate was also similar between the groups such as dysphagia and implantation site infections were also similar between the groups (Table 2).

Table-2 Comparison of Study Outcomes

	Group A (Allograft) (N=35)	Group B (PEEK) (N=35)	P-value
Pre-op MJOA Score	12.39±3.70	12.89±3.41	0.54
MJOA Score at 6 months	14.16±4.30	13.54±3.24	0.49
Pre-op Disc Space Height (mm)	6.10±0.58	6.13±0.51	0.81
Disc Space Height at 6 months (mm)	10.01±0.67	10.11±0.70	0.54
Fusion Rate	31 (88.6%)	30 (85.7%)	0.72
Dysphagia	3 (8.5 %)	1 (2.8 %)	0.30
Implantation Site Infections	0.0 (0.0%)	1 (2.8 %)	1.0

Discussion

The purpose of surgery in symptomatic CSM is decompression of spinal canal, to reestablish the disc height, and to stabilize the affected area spinal column. The anterior approach ACDF is performed if the cause of CSM is spinal cord compression is due to cervical disc. ACDF has brought excellent functional outcomes and is the most effective treatment of CSM still available.^{11, 12} Despite plethora of published evidence, the choice of ideal support material for body fusion remains controversial.¹²⁻¹⁴ Till date the iliac crest graft is the gold standard, however, the complications of donor site is the major obstacle for its use. Therefore, the alternative synthetic materials are applied to avoid complications of donor site and risk of diseases transmission from donor site can be avoided.¹⁵ Among these the PEEK cage has gained popularity, the comparison of benefits and risk of PAAK in comparison to allografts is not well delineated.

So, in this study, we compared the functional and radiological outcomes of PEEK cage with ileac crest allografts in symptomatic CSM patients. In this study, the functional outcomes were determined using MJOA score. The pre-op MJOA was similar between the groups. At 6 months follow-up, the MJOA score was increased in both groups; 14.16±4.30 in group A and

13.54±3.24 in group B with insignificant statistical difference between the groups. Sharma et al. in a study of 60 patients of symptomatic CSM who underwent ACDF using ileal allografts and PEEK cage, reported MJOA score of 14.17±4.32 using allografts and 13.53±3.23 in PEEK group.¹⁶ Liu et al. in a similar trial, reported MJOA score of 13.90±1.15 in local bone graft supported with PEEK cage versus 13.87±1.12 in ileal allograft group.¹⁴

The disc space height in this study increased to 10.01±0.67 mm from baseline value of 6.10±0.58 mm in group A and in group B the mean disc space height after 6 months increased to 10.11±0.70 mm from baseline value of 6.13±0.51, the difference in baseline and at 6 months height between the groups was not statistically significantly different.

Liu et al. reported similar outcomes, they reported mean disc space height at 6 months follow-up in 10.13±0.66 mm in the PEEK group versus 10.30±0.69 mm in the ileal allograft group.¹⁴

The bone union rate in this study was also similar; 88.6% in group A and 85.7% in group B. Liu et al. reported a 100% union rate between the groups.¹⁴ However, they determined bone union at 1-year follow-up and we only followed patients for 6 months, the higher union rate in their study can be explained because of longer follow-up.

The major limitations of the present study are the small population size and shorter follow-up of only 6 months. Studies with larger population sizes and longer follow-ups are needed to determine the long-term outcomes of PEEK cage grafts in comparison to iliac crest grafts.

Conclusion

PEEK cages have similar functional and radiologic outcomes in comparison to iliac crest allografts. So, PEEK cages can be used as a successful alternative to iliac crest allografts. This will help to reduce donor site morbidity and will reduce longer surgical times associated with graft harvesting.

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