

Original Article

Improvement and Complications after Two-Level ACDF Surgery at a Tertiary Care Facility: A Retrospective Study

Sajid Khan¹, Akram Ullah¹, Bakht Jehan², Arif Hussain¹, Syed Muhammad Hamza Zafar¹
Aafaq Ahmad Qarnain Khalil¹, Mumtaz Ali¹

Departments of ¹Neurosurgery and ²Neurology, Prime Teaching Hospital, Peshawar – Pakistan

ABSTRACT

Objective: To assess immediate and long-term outcomes and complications of two-level ACDF in patients with degenerative cervical disc disease.

Materials & Methods: A retrospective study was carried out in the Department of Neurosurgery at Prime teaching hospital, Peshawar. Patients with symptoms of cervical radiculopathy and radiculomyelopathy with two-level cervical disc disease were included. Patients with trauma, single-level disease, and those who had cervical corpectomy were excluded. Age, gender, Nurick Grading, level of involvement, and post-op outcomes were recorded.

Results: 27 cases among which 18 were males and 9 females were studied. 21 patients had radiculopathy while 6 had radiculomyelopathy. The mean age was 46 years. Nurick grade was from 2 to 6. ACDF was chosen as the procedure of choice. Follow-up involved the immediate post-op period for dysphagia, hoarseness of voice, and any neurological deficit, at 6 months and one year for outcomes of pain relief, improvement in paresthesia, and spasticity.

Conclusion: ACDF is a safe and recommended procedure for 2-level cervical disc disease in terms of pain relief, paresthesia, and spasticity with acceptable complications.

Keywords: ACDF, cervical spondylotic myelopathy, spasticity.

Corresponding Author: Sajid Khan

Department of Neurosurgery, Prime Teaching Hospital,
Peshawar – Pakistan

Email: utmanxai@gmail.com

Date of Submission: 15-04-2023

Date of Revision: 15-06-2023

Date of Acceptance: 20-06-2023

Date of Online Publishing: 30-06-2023

Date of Print: 30-06-2023

DOI: 10.36552/pjns.v27i2.860

INTRODUCTION

Degenerative cervical myelopathy is a common type of cervical spine problem in elderly patients that results in disability and affects the quality of life.¹ Patients with degenerative cervical spine are at risk of developing spondylotic radiculopathy or myelopathy. Cervical radiculopathy is a condition in which a cervical nerve root is compressed in the cervical spine, which causes pain or numbness and/or sensory or motor deficit in the upper

limbs,² whereas cervical myelopathy is a condition in which there is compression on the cervical spinal cord causing sensory or motor deficit in the upper or lower limbs depending on the severity of compression.³ The possible causes of cervical radiculopathy or myelopathy can be spondylosis, disc herniation, hypertrophy or ossification of ligaments or calcifications, bony spur, and facet hypertrophy.⁴ Cervical degenerative disc disease is more common in elderly males and is found in patients mostly after their late 40s with a mean age of 47 years (range is 21 – 72 years).⁴⁻⁵ The common presenting complaints are neck pain, weakness of limbs, radiating pain, paresthesia, stiffness in the upper or lower limbs, gait abnormalities, and/or bladder dysfunction.⁶ Clinical examinations including tone, power, reflexes, sensory examinations, gait assessment, and specific maneuvers like Hoffmann's sign, Spurling, and Lhermitte's sign are carried out to reach a diagnosis.⁷ Visual analog scale (VAS) for arm and neck pain and Nurick grading scale was used to grade myelopathy.⁷⁻⁸ Anterior cervical discectomy and fusion (ACDF) and Anterior cervical corpectomy and fusion (ACCF) are two effective procedures to decompress the spinal cord in patients with significant spinal canal stenosis and restore cervical lordosis.⁹ In cases where cord compression is secondary to a disc pathology, ACDF is preferred over ACCF because there is less blood loss, a short hospital stay, and lesser complications. However, when the compression area involves the vertebral body, ACCF is the procedure of choice because the outcome is more satisfactory.¹⁰ Two-level cervical degenerative disc disease is effectively treated with ACDF as with one-level cervical degenerative disc disease.¹¹ Polyetheretherketone (PEEK) cages and allografts are commonly used in ACDF. However, in our study, we have used PEEK cages only.⁸ ACDF using a stand-alone PEEK cage with two screws fixed in the superior and inferior vertebral body is considered a safe and effective treatment option for fusion in patients with two

levels of cervical degenerative disc disease.¹²

We aimed to assess the two-level ACDF procedure as a better alternative to ACCF in cases with two-level cervical degenerative disc disease.

MATERIALS AND METHODS

Study Design

This was a retrospective study conducted at Prime Teaching Hospital in Peshawar between January 2019 and December 2021.

Inclusion Criteria

Individuals of all ages and both genders who had two-level cervical disc degeneration on MRI and symptoms of degenerative cervical radiculopathy and radiculomyelopathy were included.

Exclusion Criteria

Patients with a previous cervical corpectomy, traumatic myelopathy, and illness at one level or more than two levels were excluded from the study.

Surgical Management

From hospital notes and patient records, the pertinent demographic and clinical information were taken. All patients underwent Anterior Cervical Discectomy and Fusion (ACDF) at two levels. The degree of neurological impairment was evaluated using the Nurick grading system.

Data Collection & Analysis

Descriptive statistics were employed to describe the variables, and percentages were used to provide improvement and complication information.

Data Collection

Data were collected from medical records of patients who underwent two-level anterior

cervical discectomy and fusion (ACDF) between January 2019 and December 2021. The variables collected included age, gender, primary symptoms, duration of symptoms, Nurick grading, and immediate and long-term outcomes (pain relief, improvement in numbness and spasticity) and complications (new neurological deficits, infection, CSF leakage, dysphagia and hoarseness of voice).

Statistical Analysis

The data were analyzed using descriptive statistics in SPSS Version 22.0. The frequency, percentages, mean, and median were calculated and presented. The immediate and long-term outcomes were expressed as percentages.

RESULTS

Age & Gender Distribution

7 cases were included in this study. The Nurick grading was from grade 2 to grade 6. The mean age is 46 years. 18 were male and 9 were female patients.

Clinical Features

Primary symptoms were neck pain radiating to one or both upper limbs and lower limbs along with numbness and spasticity for a mean duration of 7 months. Among 27 cases, 21 had radiculopathy and 6 had radiculomyelopathy.

After neurological examination and investigations including MRI Cervical Spine and Flexion Extension X-rays, Anterior cervical discectomy and fusion (ACDF) were chosen as the procedure of choice. these patients were followed at the immediate post-op period for dysphagia, hoarseness of voice, and breathing complications and 6 months and one-year intervals for clinical outcomes in terms of pain relief, improvement in numbness and spasticity results shown in Figures 1 to 3, and Tables 1 to 6.

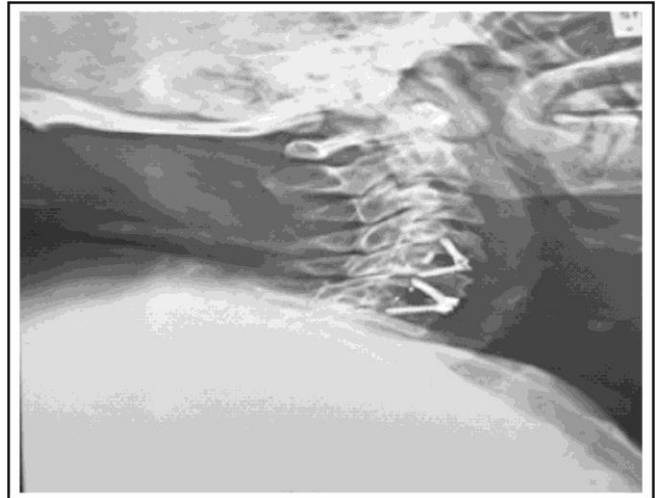


Figure 1: Post-operative x-ray of two-level ACDF with peek cage. C4 – C5 and C5 – C6 (Used with the patient's permission).

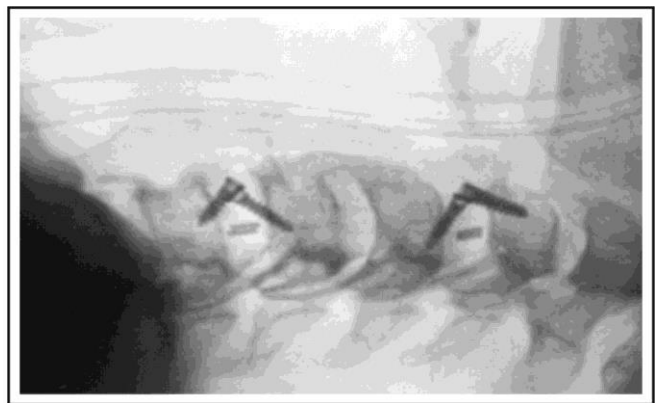


Figure 2: Per operative image of two-level ACDF. C3 – C4 and C5 – C6 (Used with the patient's permission).

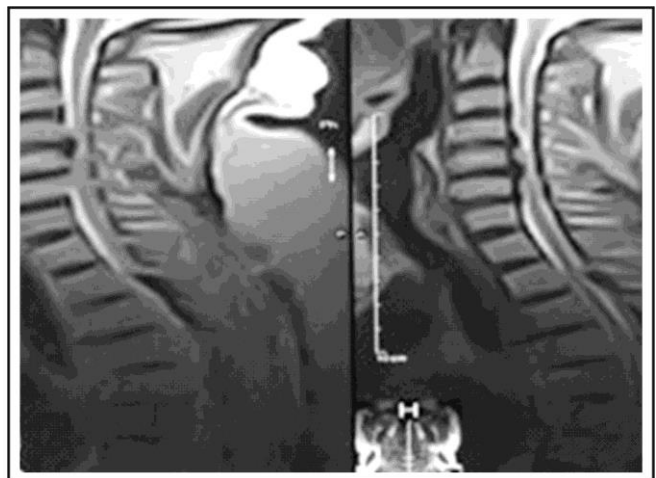


Figure 3: MRI image of two levels of disc prolapse C4 – C5 and C5 – C6 (Used with patient's permission).

Table 1: Immediate and long-term outcomes of two-level ACDF.

Outcome	Number	Percentage (%)
Dysphagia	5	(18.5)
New neuro-deficit (weakness)	0	None
Hoarseness of voice	1	(3.6)
Breathing complications	0	None
Pain relief	23	(85.2)
Improvement in numbness	22	(81.5)
Improvement in spasticity	14	(51.8)

Table 2: Nurick Grading Before And After Two-Level ACDF.

Nurick Grading	Number (%) Before	Number (%) After
2	2 (7.4)	1 (3.7)
3	10 (37.0)	6 (22.2)
4	7 (25.9)	7 (25.9)
5	5 (18.5)	10 (37.0)
6	3 (11.1)	3 (11.1)

Table 3: Average Nurick grading improvement.

Grade	Average Improvement (%)
Grade 2	13 (50%)
Grade 3	11 (40%)
Grade 4	0
Grade 5	3 (10%)
Grade 6	0

Table 4: The original complaint and its improvement.

Original Complaint	Number with Improvement (%)
Neck pain	21 (100)
Upper limb pain	16 (76.2)
Lower limb pain	9 (42.9)
Numbness	14 (66.7)
Spasticity	14 (51.8)

Table 5: Postoperative Complications.

Complication	Frequency
Hematoma	3 (11.1)
Infection	2 (7.4)
Staten screw	2 (7.4)

Table 6: Length of Hospital Stay.

Length (Day)	Frequency (%)
1 – 2	7 (25.9)
3 – 5	14 (51.8)
6 – 10	6 (22.2)

DISCUSSION

A stand-alone PEEK cervical cage was used for 26 ACDF patients. All patients were followed up for two years. After a careful assessment of these patients, Odom's criteria indicated that 10 had great clinical outcomes, 15 had good, 1 had average, and none had negative. All patients solidified at 4.5 months. This surgery may restore intervertebral height, simplify radiologic follow-up, reduce discomfort, and provide good results. Two-level Anterior cervical discectomy and fusion (ACDF) in patients with cervical spondylotic radiculopathy, radiculomyelopathy, or myelopathy had a good immediate and long-term surgical outcome, as shown by pre- and post-operative VAS and Nurick grade scores.² This study shows that two-level ACDF with anterior plating for radiculopathy is safe, effective, and has a faster recovery period than standard ACCF surgery.³ Patients resumed unrestricted work sooner, lowering short-term impairment. Rigid internal fixation may save patients and disability insurers money.⁴ ACDF demonstrated reduced postoperative cervical instability but greater graft subsidence than ACCF.⁵ Another research revealed that ACDF improved neck, and arm mobility and quality of life ratings with little problems and reoperations. This research has many limitations as we did not include cases of degenerative disc disease in short-necked patients, patients with lordosis, compression of more than three levels, and posterior longitudinal ligament ossification. ACDF has been linked to greater rates of adjacent-level degeneration, which may need further surgery.⁸

ACDF reduces neck and arm discomfort, improves spinal stability, and restores nerve

function.⁹ Fusion rate: most patients have a firm fusion within 6 to 12 months following ACDF.⁹ ACDF is typically safe, however, some studies have shown a higher risk of infection, nerve damage, and dysphagia.¹⁰ Most patients show long-term improvement in pain and function after ACDF.¹¹ Alternative treatments: ACDF has been compared to physical therapy, non-surgical approaches, and minimally invasive procedures. These studies suggest that ACDF may work better for certain patients based on their symptoms and medical history.¹² It is vital to highlight here that surgery results differ from patient to patient and that ACDF's long-term outcomes require further long-term follow-ups.¹³ This research compares ACDF with ACCF for cervical disc disease.¹⁴ This study also evaluates pain alleviation, neurological improvement, and immediate post-op complications.¹⁵ This study comprehensively evaluates anterior cervical discectomy and fusion (ACDF) for symptomatic two-level cervical disc disease. It may assist healthcare policymakers choose the right procedures. This may assist doctors choose the best technique for each patient based on symptoms and medical history. This study will improve cervical disc disease therapy and patient care. In conclusion, anterior cervical discectomy and fusion (ACDF) is a common surgery as compared to ACCF for cervical herniated discs, spinal stenosis, and degenerative disc disease and based on our study, can be used as an alternate procedure for two-level cervical disc disease. Our study suggests that ACDF reduces neck and arm discomfort, improves spinal stability, and restores nerve function⁹. It also shows that ACDF for two-level cervical discs excludes the need for an Iliac Crest graft in ACCF surgery which itself is a painful procedure.¹⁹ However, ACDF may cause infection, nerve damage, and dysphagia, and further studies are required to understand its long-term consequences.¹⁰ Overall, our study gives essential insights into the comparative efficacy of this surgery and has substantial implications for

improving cervical disc disease therapy and patient care.¹³

CONCLUSION

This retrospective study assessed the short- and long-term effects of two-level ACDF surgery in patients with two-level cervical spondylotic myelopathy and radiculopathy. The risk of dysphagia, pain, numbness, and stiffness was shown to be lower than ACCF. This study provides evidence that ACDF is safe and effective for treating cervical spondylotic myelopathy symptoms for two-level disc degeneration compared to ACCF where Iliac crest graft is in itself a painful procedure.

REFERENCES

1. Eminovic S, Vincze G, Eglseer D, Riedl R, Sadoghi P, Leithner A, Bernhardt GA. Malnutrition as predictor of poor outcome after total hip arthroplasty. *International Orthopaedics*, 2021; 45: 51-6.
2. Kadoya S, Iizuka H, Nakamura T. Long-term outcome for surgically treated cervical spondylotic radiculopathy and myelopathy. *Neurologia Medico-chirurgica*. 2003; 43 (5): 228-41.
3. Zhang Y, Yang G, Zhou T, Chen Y, Gao Z, Zhou W, Gu Y. Efficacy and safety of anterior cervical discectomy and fusion (ACDF) through mini-incision and posterior laminoplasty (LAMP) for treatment of long-level cervical spondylosis: a retrospective cohort study. *BMC Surgery*, 2022; 22 (1): 1-0.
4. McLaughlin MR, Purighalla V, Pizzi FJ. Cost advantages of two-level anterior cervical fusion with rigid internal fixation for radiculopathy and degenerative disease. *Surgical Neurology*, 1997; 48 (6): 560-5.
5. Wu, x., Ye, x., Wang, Z., & Zou, D. Anterior cervical discectomy and fusion versus anterior cervical corpectomy for cervical spondylotic myelopathy: a meta-analysis. *World Neurosurgery*, 2017; 98: 719-727.
6. Fogelson JL, Kerezoudis P, Alvi MA, Goncalves S, Krauss WE, Bydon M. Management of

- postoperative complications in spinal surgery patients with osteoporosis. In *Seminars in Spine Surgery*, 2018 Mar. 1; Vol. 30, No. 1: pp. 59-63. WB Saunders.
7. Wang W, Huang Y, Wu Z, Hu X, Xiang P, Liu H, Yang H. Comparison of 3-level anterior cervical discectomy and fusion and open-door laminoplasty in cervical sagittal balance: A retrospective study. *Frontiers in Surgery*, 2022; 9: 937479.
 8. Fahmy FM, Mahmoud AR, El Ghazawy SS. Adjacent segment degeneration after anterior cervical discectomy and fusion, a systematic review and meta-analysis. *Ain Shams Medical Journal*, 2021; 72 (1): 59-70.
 9. Kapetanakis S, Thomaidis T, Charitoudis G, Pavlidis P, Theodosiadis P, Gkasdaris G. Single anterior cervical discectomy and fusion (ACDF) using self-locking stand-alone polyetheretherketone (PEEK) cage: evaluation of pain and health-related quality of life. *Journal of Spine Surgery*, 2017; 3 (3): 312.
 10. Yee TJ, Swong K, Park P. Complications of anterior cervical spine surgery: a systematic review of the literature. *Journal of Spine Surgery*, 2020; 6 (1): 302.
 11. Buttermann GR. Anterior cervical discectomy and fusion outcomes over 10 years. *Spine*, 2018; 43 (3): 207-14.
 12. Kim LH, D'Souza M, Ho AL, Pendharkar AV, Sussman ES, Rezaii P, Desai A, Rezaii PG. Anterior techniques in managing cervical disc disease. *Cureus*, 2018; 10 (8).
 13. Zuckerman SL, Devin CJ. Outcomes and value in elective cervical spine surgery: an introductory and practical narrative review. *Journal of Spine Surgery*, 2020; 6 (1): 89.
 14. Wang Z, He M, Jiang C, Zhang F, Du S, Feng W, Zhang H. Matrix solid-phase dispersion coupled with homogeneous ionic liquid microextraction for the determination of sulfonamides in animal tissues using high-performance liquid chromatography. *Journal of Separation Science*, 2015; 38 (23): 4127-35.
 15. Fisher-Owens SA, Soobader MJ, Gansky SA, Isong IA, Weintraub JA, Platt LJ, Newacheck PW. Geography matters: state-level variation in children's oral health care access and oral health status. *Public Health*, 2016; 134: 54-63.
 16. Young BR, Nguyen TH, Alabaster A, Greenhow TL. The prevalence of bacterial meningitis in febrile infants 29–60 days with positive urinalysis. *Hospital Pediatrics*, 2018; 8 (8): 450-7.
 17. Impellizzeri FM, Bizzini M. Systematic review and meta-analysis: A primer. *International Journal of Sports Physical Therapy*, 2012; 7 (5): 493.
 18. Maharaj MM, Mobbs RJ, Hogan J, Zhao DF, Rao PJ, Phan K. Anterior cervical disc arthroplasty (ACDA) versus anterior cervical discectomy and fusion (ACDF): a systematic review and meta-analysis. *Journal of Spine Surgery*, 2015; 1 (1): 72.
 19. Goldstein ZH, Boody B, Sasso R. Two-level anterior cervical discectomy and fusion versus cervical disc arthroplasty—long-term evidence update. *International Journal of Spine Surgery*, 2020; 14 (s2): S36-40.

Additional Information

Disclosures: Authors report no conflict of interest.

Ethical Review Board Approval: The study was conformed to the ethical review board requirements.

Human Subjects: Consent was obtained by all patients/participants in this study.

Conflicts of Interest:

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

Financial Relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

Financial Relationships: None.

AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Sajid Khan	1. Study design and methodology.
2.	Afaq Ahmad	2. Paper writing.
3.	Akram Ullah	3. Data collection and calculations.
4.	Arif Hussain Hamza	4. Analysis of data and interpretation of results.
5.	Bakht Jehan	5. Literature review and referencing.
6.	Mumtaz Ali	6. Editing and quality insurer.