

The Recurrence of Symptoms After Anterior Cervical Discectomy and Fusion

Review began 05/13/2023

Review ended 05/19/2023

Published 05/21/2023

© Copyright 2023

Alzahrani et al. This is an open access article distributed under the terms of the Creative Commons Attribution License CC-BY 4.0., which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Basil A. Alzahrani ¹, Faisal S. Alsharm ², Hassan K. Salamatullah ¹, Hani H. Sulimany ³, Mohammed A. Kashab ³, Muhammad A. Khan ⁴

1. Orthopedics, King Saud Bin Abdulaziz University for Health Sciences College of Medicine, Jeddah, SAU 2. Orthopedics, King Saud Bin Abdulaziz University for Health Sciences College of Medicine, Jeddah, SAU, Jeddah, SAU 3. Orthopedic Surgery: Orthopedic Spine Surgery and Arthroscopy, King Abdulaziz Medical City / Ministry of National Guard - Health Affairs, Jeddah, SAU 4. Medical Education, King Saud Bin Abdulaziz University, Jeddah, SAU

Corresponding author: Basil A. Alzahrani, basilzah@gmail.com

Abstract

Objectives

This study aimed to evaluate the recurrence symptoms rate after anterior cervical discectomy and fusion (ACDF) for one year and seek the common cervical vertebral disk affected in a tertiary center in Saudi Arabia over the past five years.

Methods

This is a single-center, cross-sectional study conducted on patients followed in our center from January 2016 to December 2022. All patients who were older than 18 and underwent ACDF were included.

Results

Out of 77 patients, 43 (55.8%) have experienced a recurrence of symptoms after the ACDF operation. The highest rate of recurrent symptoms was neck pain 22 (28.6%), left upper limb numbness 20 (26%), and right upper limb numbness 16 (20.8%). It was found that shoulder pain recurred after one level of ACDF in six patients out of 10 (60%), and only one (10%) patient experienced shoulder pain after two-level ACDF.

Conclusion

ACDF has a high rate of recurrence of symptoms, and the most common type of ACDF was two levels. Most symptoms were neck pain and upper limb radicular pain. However, there is a lack of studies. We recommend conducting more studies on the secondary management of recurrent symptoms post-ACDF.

Categories: Neurosurgery, Orthopedics

Keywords: symptoms, recurrence, fusion, discectomy, cervical, acdf

Introduction

The spinal column comprises cervical, thoracic, lumbar, and sacral vertebrae. Intervertebral discs (IVDs), consisting of an inner gelatinous material called the nucleus pulposus surrounded by outer annulus fibrosis, occur between these vertebrae. The IVD maintains spine mobility and acts as a shock absorber [1,2]. Cervical disc injuries are characterized by the disruption of the IVD structure. The two most common cervical disc pathologies are degenerative disc diseases and herniations. Cervical degenerative disc disease results from reduced water composition in the IVD, whereas cervical disc herniation occurs due to acute traumatic injury to the neck or aging [1,2]. Neck pain is the most frequent presentation of cervical disc injuries. Magnetic resonance imaging is the preferred imaging modality for these conditions. Treatment options include conservative and surgical management. Conservative management includes nonsteroidal anti-inflammatory drugs, steroids, medial branch blocks, collar immobilization, and traction. Surgical procedures are indicated when medical management fails. Surgical options include anterior cervical discectomy and fusion (ACDF), posterior lamina foraminotomy, and cervical disc arthroplasty [1,2].

ACDF is the gold-standard surgical approach for treating cervical disc conditions [3]. Its main indications include cervical disc herniation, degenerative disc disease, and cervical spondylosis [3,4]. Briefly, the procedure is performed by making an incision in the neck anteriorly directly at the level of the injured cervical spine for easy access. The affected disc is removed, and the adjacent vertebrae are fused [4].

Due to its relatively low complication rate, ACDF is considered safe [5,6]. However, several serious complications can persist for long [5]. Dysphagia, hematoma, progressive myelopathy, recurrent laryngeal nerve palsy, cerebrospinal fluid leaks, wound infection, radiculopathy, Horner's syndrome, respiratory insufficiency, esophageal perforation, and instrument failure are the most frequently reported ACDF-

How to cite this article

Alzahrani B A, Alsharm F S, Salamatullah H K, et al. (May 21, 2023) The Recurrence of Symptoms After Anterior Cervical Discectomy and Fusion. Cureus 15(5): e39300. DOI 10.7759/cureus.39300

associated complications [7]. Multiple conditions, such as older age and longer operative time, are risk factors for an increased incidence of postoperative complications [8]. Some complications may lead to reoperation after ACDF. As previously reported, the early reoperation rate, mainly due to a postoperative hematoma, was 2.1%, whereas the late reoperation rate, mainly due to adjacent segment disease, was 3.6% [9].

This study aimed to evaluate the symptom recurrence rate one year after ACDF and identify the common cervical vertebral disk affected in a tertiary care center in Saudi Arabia.

Materials And Methods

This single-center, cross-sectional study included patients aged >18 years who underwent ACDF and were followed up at a tertiary center between January 2016 and December 2022. The study was approved by the center’s Institutional Review Board (IRB), approval number NRJ22J/215/08 by King Abdullah International Medical Research Center. Patients who underwent posterior cervical decompression, disc replacement, or previous surgery in the cervical spine were excluded. All eligible patients (n=77) who met the inclusion criteria were included in the study.

Age, sex, operation type, cervical level, and patient symptoms before and after surgery were some of the factors obtained from the patient’s computerized medical records and entered into the data collection sheet. Data were analyzed using the IBM Statistical Package for Social Sciences (IBM Corp., Armonk, NY) version 20.0. Categorical variables were presented as frequency and percentages while continuous variables as mean ± standard deviation (or median and interquartile range as appropriate). When comparing categorical variables, the chi-square test, Fisher’s exact test, or McNemar’s test was used as needed. Statistical significance was set at P<0.05.

Results

Seventy-seven patients were eligible based on the inclusion and exclusion criteria. Approximately half of the patients were males (39; 50.6%). The mean patient age was 53.1 years. Diabetes mellitus and hypertension were the most prevalent comorbidities among the included patients (31 (40.3%) and 32 (41.6%) patients, respectively). Furthermore, the median time to symptom recurrence after ACDF surgery was six months. Most ACDF surgeries were performed at the C5 and C6 cervical spine levels in 62 (80.5%) and 57 (74%) patients, respectively. However, no ACDF procedures were performed at the level of the first cervical spine, and only one (1.3%) was done at the C2 level.

Most patients (20; 26%) underwent ACDF. Spinal spondylosis 15 (19.5%) and cervical disc herniation 13 (16.9%) were common indications for an ACDF operation in the included patients. The type of ACDF operation was divided into one-, two-, and more than two-level ACDF. Thirty-five (45.5%) patients underwent two-level ACDF while 21 (27.3%) patients underwent one-level or more than two-level ACDF. Demographic data are presented in Table 1.

Variable	N= 77
Age (mean ± SD)	53.1±11.33
Gender (n = 77)	
Female	38 (49.4%)
Male	39 (50.6%)
BMI (mean ± SD)	31.3±5.71
Comorbidities (n = 77)	
Diabetes mellitus	31 (40.3%)
Hypertension	32 (41.6%)
Ischemic heart disease	8 (10.4%)
Cancer	4 (5.2%)
Smoker	15 (19.5%)
Time of symptoms recurrence by months (median and IQR)	6 (3-11.5)
Level of ACDF (n = 77)	
C1	0 (0%)

C2	1 (1.3%)
C3	19 (24.7%)
C4	39 (50.6%)
C5	62 (80.5%)
C6	57 (74%)
C7	20 (26%)
Reason for ACDF	
Degenerative disc disease	20 (26%)
Spinal spondylosis	15 (19.5%)
Cervical disc herniation	13 (16.9%)
Spinal stenosis	10 (13%)
Cervical disc prolapse	8 (10.4%)
Cervical fracture	4 (5.2%)
Cervical myeloma	3 (3.9%)
Spinal stenosis + degenerative disc disease	1 (1.3%)
Spinal stenosis + spinal spondylosis	1 (1.3%)
Cervical spondylopathies	1 (1.3%)
Spinal synostosis	1 (1.3%)
Type of operation	
One-level ACDF	21 (27.3%)
Two-level ACDF	35 (45.5%)
> Two-level ACDF	21 (27.3%)

TABLE 1: Basic characteristics of the patients

ACDF: anterior cervical discectomy and fusion

Of the 77 patients, 43 (55.8%) experienced complaint recurrence after ACDF. There was no significant association between recurrence, demographic data, and ACDF operation type. However, those who experienced symptom recurrence tended to be older (mean age, 54.2 years) than patients with no symptomatic recurrence after ACDF (mean age, 51.6 years). Moreover, patients with recurrent symptoms had a higher body mass index (mean, 32.1 kg/m²) than those with no recurrent symptoms (mean, 30.3 kg/m²). One- and more than two-level ACDF showed a higher recurrence rate than the two-level ACDF (Table 2).

Recurrence					
		Yes	No		P-value
		n=43	%	n=34	%
Age (Mean \pm SD)					0.312
		54.2 \pm 10.70		51.6 \pm 12.07	
BMI (Mean \pm SD)					0.161
		32.1 \pm 5.66		30.3 \pm 5.69	
Gender					0.414
	Male	20	51.3	19	48.7
	Female	23	60.5	15	39.5
Smoker					0.827*
	No	35	56.5	27	43.5
	Yes	8	53.3	7	46.7
HTN					0.384*
	No	27	60.0	18	40.0
	Yes	16	50.0	16	50.0
IHD					>0.99**
	No	38	55.1	31	44.9
	Yes	5	62.5	3	37.5
DM					0.884*
	No	26	56.5	20	43.5
	Yes	17	54.8	14	45.2
Cancer					0.316**
	No	42	57.5	31	42.5
	Yes	1	25.0	3	75.0
Type of Operation					0.502
	One-level ACDF	13	61.9	8	38.1
	Two-level ACDF	17	48.6	18	51.4
	> Two-level ACDF	13	61.9	8	38.1

TABLE 2: Recurrence of symptoms after ACDF by the basic characteristics of patients

*chi-squared test; **Fisher's exact test

ACDF: anterior cervical discectomy and fusion

All symptoms had significantly lower recurrence rates after ACDF (Table 5). The symptoms with the highest recurrence rates after ACDF were neck pain, left upper limb numbness, and right upper limb numbness in 22 (28.6%), 20 (26%), and 16 (20.8%) patients, respectively. In contrast, the latter symptoms markedly decreased after ACDF compared to before ACDF ($P<0.001$).

Before ACDF	n=77	%	After ACDF	n=77	%	p-value
Neck pain			Neck pain			<0.001
No	7	9.1	No	55	71.4	
Yes	70	90.9	Yes	22	28.6	
R upper limb numbness			R upper limb numbness			<0.001
No	32	41.6	No	61	79.2	
Yes	45	58.4	Yes	16	20.8	
L upper limb numbness			L upper limb numbness			<0.001
No	34	44.2	No	57	74.0	
Yes	43	55.8	Yes	20	26.0	
R upper limb pain			R upper limb pain			<0.001
No	41	53.2	No	65	84.4	
Yes	36	46.8	Yes	12	15.6	
L upper limb pain			L upper limb pain			0.002
No	47	61.0	No	65	84.4	
Yes	30	39.0	Yes	12	15.6	
Loss of grabbing by hands			Loss of grabbing by hands			0.017
No	57	74.0	No	69	89.6	
Yes	20	26.0	Yes	8	10.4	
Shoulder pain			Shoulder pain			<0.001
No	48	62.3	No	67	87.0	
Yes	29	37.7	Yes	10	13.0	

TABLE 3: Recurrence of symptoms before and after ACDF

ACDF: anterior cervical discectomy and fusion

There was a significant association between shoulder pain recurrence and the type of ACDF. Shoulder pain recurred after one-level ACDF in six (60%) out of 10 patients and only one (10%) experienced shoulder pain after two-level ACDF. No patients who underwent one-level ACDF had this manifestation and five (45.5%) patients experienced it after more than two-level ACDF. Moreover, 11 (55%) of 20 patients complained of left upper limb numbness after two-level ACDF; however, the association was not significant. Table 4 illustrates the recurrence rates of the different manifestations according to the type of ACDF surgery.

Type of operation							
	One-level ACDF		Two-level ACDF		> Two-level ACDF		P-value
	n=21	%	n=35	%	n=21	%	
Neck pain after ACDF							0.235*
No	12	21.8	27	49.1	16	29.1	
Yes	9	40.9	8	36.4	5	22.7	
R upper limb numbness after ACDF							>0.99**
No	17	27.9	27	44.3	17	27.9	
Yes	4	25.0	8	50.0	4	25.0	
L upper limb numbness after ACDF							0.572*
No	16	28.1	24	42.1	17	29.8	
Yes	5	25.0	11	55.0	4	20.0	
R upper limb pain after ACDF							0.209**
No	18	27.7	27	41.5	20	30.8	
Yes	3	25.0	8	66.7	1	8.3	
L upper limb pain after ACDF							0.922**
No	17	26.2	30	46.2	18	27.7	
Yes	4	33.3	5	41.7	3	25.0	
Loss of grabbing by hands after ACDF							0.313**
No	17	24.6	33	47.8	19	27.5	
Yes	4	50.0	2	25.0	2	25.0	
Shoulder pain after ACDF							0.015**
No	15	22.4	34	50.7	18	26.9	
Yes	6	60.0	1	10.0	3	30.0	

TABLE 4: Recurrence of different symptoms after ACDF by type of operation

*chi-squared test; **Fisher's exact test

ACDF: anterior cervical discectomy and fusion

Discussion

Symptoms were significantly reduced after ACDF in this study. Srikhande et al. found similar results, where most symptoms (neck pain, radicular pain, limb weakness, paresthesia, and limb stiffness) improved significantly after surgery [10]. Furthermore, a similar finding was reported in a study of 235 patients, which measured health-related quality-of-life outcomes, such as the visual analog scale (VAS) for neck pain and the neck disability index, and found that both were significantly reduced after ACDF [11]. Our study showed a significant decrease in arm pain after surgery. This was consistent with the findings of Stulley et al. [11]. However, 36 four-level ACDF patients displayed a lower, yet insignificant, reduction in the VAS score for arm pain [12]. This could be insignificant because of the minority of patients with predominant radiculopathy compared to our cohort. In the present study, neck pain (28.6%) was the most common recurrent symptom after ACDF. This is consistent with Srikhande's 100 participants study, in which the most common recurrent symptoms were neck pain and bladder symptoms (39%) [10].

Regarding the type of ACDF, Vaccaro et al. performed a one-level ACDF on 140 patients and followed them up for 24 months. They found that 72.2%, 67.6%, and 70.4% of the patients developed neck, left arm, and right arm pain, respectively, compared to our one-level ACDF results, which showed 40.9%, 33.3%, and 25%

cases of neck, left arm, and right arm pain, respectively [13]. A study conducted by Fountas et al. showed that only 0.2% of patients who received one- to three-level treatment (1,015 patients, 549 men, and 466 women) had their underlying myelopathy deteriorated; most of them (305) had a single-level treatment and only 158 had three-level treatment [14]. This was supported by a study by Flynn, which showed that 0.4% of the patients had deteriorated underlying myelopathy. However, this older study did not mention the cervical level of the surgery [15]. In contrast, Emery et al. and Wang et al. reported the pseudarthrosis rates for non-plated three-level discectomies as 44% and 37%, respectively [16,17]; however, this was only three-level ACDFs. In a study by Tohamy et al. on three-level ACDFs, of 16 patients followed up for 37 months, only seven had postoperative pseudarthrosis [18]. However, the sample size in this study was small. In our study, 13 of 21 patients showed recurrence. The causes of declining fusion rates with increased operation levels are unclear. It makes sense that the larger the number of surfaces that need to heal, the higher the expected patient-level pseudarthrosis rate. Since these vertebral bodies are vascular, the local blood supply should not be affected by the number of operational levels. Yoo et al. revealed higher contact stress at graft-body interfaces when operational levels increased, supporting the idea that altered biomechanics likely play the most critical role [19].

Regarding the level of cervical procedure, most patients in our study underwent two-level ACDF (35 out of 77 patients); a systemic review reported similar results as our study, with 20 out of 32 patients having the cervical procedure at the C4, C5, and C6 levels [20]. A study by Epstein showed that out of 60 patients, 29 had the procedure done at the C5-C6 and at the C6-C7 level for 20 patients. However, this was a single-level ACDF procedure [21]. In this study, 22 of 24 patients underwent ACDF at the cervical levels C5 or C6, or both [22].

Our study was retrospective, with all the weaknesses and limitations of retrospective studies. This single-center study included all patients; hence, the results cannot be generalized to a larger population. Some files had missing data and were difficult to include, which made our sample smaller. Furthermore, no medications or secondary management was mentioned after the recurrence of symptoms. Additionally, we did not compare ACDF with other procedures.

Conclusions

ACDF has a high symptom recurrence rate, and the two-level ACDF is the most common type. The most common symptoms were neck and upper limb radicular pain. The C5 level appeared to be the most common cervical level. Studies on symptom recurrence after ACDF are lacking. We recommend doing more studies on secondary management of recurrent symptoms post ACDF. Furthermore, the outcomes of different types of operations should be compared.

Additional Information

Disclosures

Human subjects: Consent was obtained or waived by all participants in this study. King Abdullah International Medical Research Center (KAIMRC) issued approval NRJ22/215/08. Please be advised that the above-mentioned research proposal received in this office has been reviewed, received a favorable decision based on scientific merit, and hereby granted scientific approval. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **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.

References

1. Pencle FJ, Mesfin FB: Cervical Disc Injuries. StatPearls [Internet], Treasure Island (FL); 2022.
2. Sharrak S, Al Khalili Y: Cervical Disc Herniation. StatPearls [Internet], Treasure Island (FL); 2022.
3. Karasin B, Grzelak M: Anterior cervical discectomy and fusion: a surgical intervention for treating cervical disc disease. AORN J. 2021, 113:237-51. [10.1002/aorn.13329](https://doi.org/10.1002/aorn.13329)
4. Mazas S, Benzakour A, Castelain JE, Damade C, Ghailane S, Gille O: Cervical disc herniation: which surgery?. Int Orthop. 2019, 43:761-6. [10.1007/s00264-018-4221-3](https://doi.org/10.1007/s00264-018-4221-3)
5. Al Eissa S, Konbaz F, Aldeghaither S, et al.: Anterior cervical discectomy and fusion complications and thirty-day mortality and morbidity. Cureus. 2020, 12:e7643. [10.7759/cureus.7643](https://doi.org/10.7759/cureus.7643)
6. Kelly MP, Eliasberg CD, Ajiboye RM, McAnany SJ, SooHoo NF: Reoperation and complications after anterior cervical discectomy and fusion and cervical disc arthroplasty: a study of 52,395 cases. Eur Spine J. 2018, 27:1432-9. [10.1007/s00586-018-5570-8](https://doi.org/10.1007/s00586-018-5570-8)
7. Epstein NE: A review of complication rates for anterior cervical discectomy and fusion (ACDF). Surg Neurol Int. 2019, 10:100. [10.25259/SNI-191-2019](https://doi.org/10.25259/SNI-191-2019)
8. Narain AS, Hijji FY, Haws BE, Khechen B, Kudravalli KT, Yom KH, Singh K: Risk factors for medical and surgical complications after 1-2-level anterior cervical discectomy and fusion procedures. Int J Spine Surg. 2020, 14:286-93. [10.14444/7038](https://doi.org/10.14444/7038)

9. Shousha M, Alhashash M, Allouch H, Boehm H: Reoperation rate after anterior cervical discectomy and fusion using standalone cages in degenerative disease: a study of 2,078 cases. *Spine J.* 2019, 19:2007-12. [10.1016/j.spinee.2019.08.003](https://doi.org/10.1016/j.spinee.2019.08.003)
10. Srikhande NN, Kumar VA, Sai Kiran NA, et al.: Clinical presentation and outcome after anterior cervical discectomy and fusion for degenerative cervical disc disease. *J Craniovertebr Junction Spine.* 2019, 10:28-32. [10.4103/jcvjs.JCVJS_87_18](https://doi.org/10.4103/jcvjs.JCVJS_87_18)
11. Stull JD, Goyal DK, Mangan JJ, et al.: The outcomes of patients with neck pain following ACDF: a comparison of patients with radiculopathy, myelopathy, or mixed symptomatology. *Spine (Phila Pa 1976).* 2020, 45:1485-90. [10.1097/BRS.0000000000003613](https://doi.org/10.1097/BRS.0000000000003613)
12. Charalampidis A, Hejrati N, Ramakonar H, Kalsi PS, Massicotte EM, Fehlings MG: Clinical outcomes and revision rates following four-level anterior cervical discectomy and fusion. *Sci Rep.* 2022, 12:5339. [10.1038/s41598-022-09389-1](https://doi.org/10.1038/s41598-022-09389-1)
13. Vaccaro A, Beutler W, Peppelman W, et al.: Clinical outcomes with selectively constrained SECURE-C cervical disc arthroplasty: two-year results from a prospective, randomized, controlled, multicenter investigational device exemption study. *Spine (Phila Pa 1976).* 2013, 38:2227-39. [10.1097/BRS.0000000000000031](https://doi.org/10.1097/BRS.0000000000000031)
14. Fountas KN, Kapsalaki EZ, Nikolakakos LG, et al.: Anterior cervical discectomy and fusion associated complications. *Spine (Phila Pa 1976).* 2007, 32:2310-7. [10.1097/BRS.0b013e318154c57e](https://doi.org/10.1097/BRS.0b013e318154c57e)
15. Flynn TB: Neurologic complications of anterior cervical interbody fusion. *Spine (Phila Pa 1976).* 1982, 7:536-9. [10.1097/00007632-198211000-00004](https://doi.org/10.1097/00007632-198211000-00004)
16. Emery SE, Bolesta MJ, Banks MA, Jones PK: Robinson anterior cervical fusion comparison of the standard and modified techniques. *Spine (Phila Pa 1976).* 1994, 19:660-3.
17. Riew KD, Rhee JM: The use of titanium mesh cages in the cervical spine. *Clin Orthop Relat Res.* 2002, 394:47-54. [10.1097/00003086-200201000-00006](https://doi.org/10.1097/00003086-200201000-00006)
18. Tohamy MH, Osterhoff G, Abdelgawaad AS, Ezzati A, Heyde CE: Anterior cervical corpectomy and fusion with stand-alone cages in patients with multilevel degenerative cervical spine disease is safe. *BMC Musculoskelet Disord.* 2022, 23:20. [10.1186/s12891-021-04883-5](https://doi.org/10.1186/s12891-021-04883-5)
19. Lee SH, Oh KJ, Yoon KS, Lee ST, Pandher DS: Three-level anterior cervical discectomy and fusion in elderly patients with wedge shaped tricortical autologous graft: a consecutive prospective series. *Indian J Orthop.* 2008, 42:460-5.
20. Cao J, Qi C, Yang Y, Lei T, Wang L, Shen Y: Comparison between repeat anterior and posterior decompression and fusion in the treatment of two-level symptomatic adjacent segment disease after anterior cervical arthrodesis. *J Orthop Surg Res.* 2020, 15:308. [10.1186/s13018-020-01834-z](https://doi.org/10.1186/s13018-020-01834-z)
21. Epstein NE: Efficacy and outcomes of dynamic-plated single-level anterior diskectomy/fusion with additional analysis of comparative costs. *Surg Neurol Int.* 2011, 2:9.
22. Wang MY, Green BA: Laminoplasty for the treatment of failed anterior cervical spine surgery. *Neurosurg Focus.* 2003, 15:E7. [10.3171/foc.2003.15.3.7](https://doi.org/10.3171/foc.2003.15.3.7)