Clinical Outcomes following 3- and 4-level anterior cervical discectomy and fusion (ACDF)

Andrew Clark BA; Stanley Hoang MD; Fassil B. Mesfin MD PhD
University of Missouri School of Medicine

CNS 2018 ANNUAL MEETING
HOUSTON, TEXAS
OCTOBER 6-10, 2018

Introduction

The anterior cervical discectomy and fusion (ACDF) is one of the most commonly performed surgical procedures for cervical spine diseases. Overall one and two level ACDFs are well tolerated compared to three or 4-level ACDFs. However, the outcome data for 3- and specifically 4-level ACDF procedures are lacking in the literature, with concerns raised over their relative safety in comparison to 1- and 2-level procedures. This study aims to provide a comparison of perioperative complications and clinical outcome data between 3- and 4-level ACDF procedures.

Methods

A retrospective review of all adult neurosurgical patients undergoing elective ACDF for degenerative disc disease at a single institution between 2013 and 2018 was performed. The inclusion criteria for the study were patients who underwent first-time 3- or 4-level ACDF. The exclusion criteria were patients lacking 90-day minimum follow-up and those undergoing ACDF following non-elective circumstances. Outcome measures included perioperative complication rates, need for revision surgery, Nurick scores, Odom's criteria, and specific symptom resolution.

TABLE 1. Demographics of all patients undergoing 3- and 4-level ACDF*

Parameters	ACDF (4-level)	ACDF (3-level)	p-Value
No. of patients	20	44	
Mean age (yrs)	59.8 ± 8.1	57.2 ± 8.8	0.137
Male Sex	11 (55.0)	22 (50.0)	0.711
Comorbidities			
Diabetes Mellitus	5 (25.0)	10 (22.7)	0.842
Obesity	9 (45.0)	23 (52.3)	0.590
Hypertension	12 (60.0)	21 (47.7)	0.363
Smoking history	11 (55.0)	28 (63.6)	0.512
Presenting Symptoms			
Neck pain	18 (90.0)	42 (95.5)	0.403
Radiculopathy	20 (100.0)	43 (97.7)	0.497
Myelopathy	15 (75.0)	37 (84.1)	0.388
Objective weakness	12 (60.0)	35 (79.5)	0.101
Sensory deficit	18 (90.0)	39 (88.6)	0.871
Bladder dysfunction	2 (10.0)	5 (11.4)	0.871
Mean Pre-Op Nurick Grade	1.1 ± 1.0	2.0 ± 1.2	**0.009**
Mean Pre-Op pain	5.5 ± 3.0	5.8 ± 3.0	0.693

* Values are presented as the number of patients (%) unless indicated otherwise. Mean values are reported as the mean ± SD. Boldface type and shaded cells indicate statistical significance.

TABLE 2. Intraoperative characteristics of all patients undergoing 3- and 4-level ACDF*

Parameter	ACDF (4-level)	ACDF (3-level)	p-Value
No. of patients	20	44	
Treated levels			
C2-C3	0 (0.0)	0 (0.0)	
C3-C4	20 (100.0)	16 (36.4)	**<0.001**
C4-C5	20 (100.0)	44 (100.0)	
C5-C6	20 (100.0)	20 (100.0)	
C6-C7	20 (100.0)	28 (63.6)	**0.002**
C7-T1	0 (0.0)	0 (0.0)	
Iliac Crest Autograft	0 (0.0)	0 (0.0)	
Allograft	20 (100.0)	44 (100.0)	
Mean estimated blood loss (mL)	47 ± 33	33 ± 20	**0.042**
Surgery time (minutes)	141 ± 21	118 ± 21	**<0.001**

* Values are presented as the number of patients (%) unless indicated otherwise. Mean values are reported as the mean ± SD. Boldface p-Value indicates statistical significance.

Results

Forty-four patients who underwent 3-level ACDF and 21 patients who underwent 4-level ACDF were identified. The 4-level ACDF group was found to have significantly higher mean estimated blood loss (47±33 mL) compared to the 3-level group (33±20 mL; p=0.042). The 4-level group was found to have a significantly higher mean procedural duration (141±21 mins) compared to the 3-level group (118±21 mins; p=<0.001). No differences were identified between the 4- and 3-level groups with regard to perioperative complications. Within the 4-level group, the rates of dysphagia (35.0%), laryngeal nerve palsy (15.0%) and infection (5.0%) were all found to be comparable to the 3-level group rates of dysphagia (45.5%; p=0.433), laryngeal nerve palsy (2.3%; p=0.051) and infection (2.3%; p=0.561). Post-Operative symptomology in terms of Nurick scores was found to be comparable between the 4-level (0.7±1.2) and the 3-level group (0.6±1.3; p=0.787). Rates of revision surgery for the 4-level group (16.7%) were not found to be significantly different compared to the 3-level group (4.5%; p=0.112). Outcome classification according to Odom's criteria was comparable between the 4-level and 3-level groups (p=0.061).

Learning Objectives

By the conclusion of this session, participants should be able to: 1) Be able to recognize and discuss the 4-level ACDF as a safe option for patients with degenerative disc disease, 2) Consider the use of an anterior approach for long segment fusion.

TABLE 3. Outcomes of all patients undergoing 3- and 4-level ACDF*

Parameter	ACDF (4-level)	ACDF (3-level)	p-Value
No. of patients	20	44	
PeriOp Complications			
Vertebral artery injury	0 (0.0)	0 (0.0)	
Transient C-5 Palsy	1 (5.0)	1 (2.3)	0.561
Deep Wound Infection	1 (5.0)	1 (2.3)	0.561
Laryngeal Nerve Palsy	3 (15.0)	1 (2.3)	0.051
Dysphagia	7 (35.0)	20 (45.5)	0.433
CSF Leak	0 (0.0)	1 (2.3)	0.497
Hematoma	2 (10.0)	1 (2.3)	0.175
Mean length of stay (days)	1.5 ± 0.7	1.5 ± 1.0	0.860
Need for revision surgery	3 (16.7)	2 (4.5)	0.112
Symptoms at last FU			
Neck pain	8 (40.0)	19 (43.2)	0.811
Radiculopathy	2 (10.0)	11 (25.0)	0.167
Myelopathy	4 (20.0)	4 (9.1)	0.221
Objective weakness	2 (10.0)	3 (6.8)	0.660
Sensory deficit	1 (5.0)	4 (9.1)	0.572
Bladder dysfunction	0 (0.0)	0 (0.0)	
Mean Nurick last FU	0.7 ± 1.2	0.6 ± 1.3	0.787
Odom's Criteria			0.061
Excellent	7 (35.0)	22 (50.0)	
Good	11 (55.0)	13 (29.5)	
Fair	1 (5.0)	9 (20.5)	
Poor	1 (5.0)	0 (0.0)	
Mean FU time (days)	483 ± 463	518 ± 458	0.783
Mean Imaging FU (days)	334 ± 414	250 ± 234	0.307

FU = follow-up
* Values are presented as the number of patients (%) unless indicated otherwise. Mean values are reported as the mean ± SD. Boldface p-Value indicates statistical significance.

Conclusion

Compared to those who underwent 3-level ACDF, patients who underwent 4-level ACDF had only significantly higher mean estimated blood loss and mean procedural duration. No significant differences were found between groups in post-operative symptomology, revision surgery, Nurick scores, or Odom's criteria. These findings suggest 4-level ACDF procedures do not lead to increased morbidity or worsened outcomes when compared to 3-level procedures.

References

De la Garza-Ramos, R., Xu, R., Ramhmdani, S., Kosztowski, T., Bydon, M., Sciubba, D. M., . . . Bydon, A. (2016). Long-term clinical outcomes following 3- and 4-level anterior cervical discectomy and fusion. J Neurosurg Spine, 24(6), 885-891.

Veeravagu, A., Cole, T., Jiang, B., & Ratliff, J. K. (2014). Revision rates and complication incidence in single- and multilevel anterior cervical discectomy and fusion procedures: an administrative database study. Spine J, 14(7), 1125-1131.