

Posterior Cervical Fusion for the Treatment of Symptomatic Pseudoarthrosis After ACDF

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Introduction

Pseudoarthrosis occurs after ~2-20% of ACDF procedures; it is unclear if posterior versus anterior revision should be pursued. In this study, we evaluate the outcomes in 22 patients with pseudoarthrosis following ACDF and revision via posterior cervical fusion (PCF).

Methods

22 patients with pseudoarthrosis after ACDF, between 1995 and 2013, were retrospectively reviewed. Demographics, symptoms and operative data were collected. The time to fusion failure, symptoms of pseudoarthrosis and revision method were assessed. Neck pain was evaluated via a visual analog scale (VAS). Fusion was radiographically examined. Clinical outcome was determined at last follow-up (LFU).

Table 1. Baseline Demographics

Patient Characteristics	All patients (N=22)
Age at index ACDF, years, median (range)	51 (33-67)
Sex, female, n (%)	13 (59)
BMI, kg/m ² , median (range)	29 (21-42)
Smoking history, n (%)	7 (32)
Index ACDF Characteristics	All patients (N=22)
ACDF at an outside institution, n (%)	7 (32)
Indication for index ACDF, n (%)	
DDD/disc herniation/spondylosis	15 (68)
ASD	6 (27)
Revision for prior pseudoarthrosis	1 (5)
Symptoms/signs at original presentation, n (%)	
Neck pain	20 (91)
Myelopathy	9 (41)
Radiculopathy	17 (77)
Number of ACDF levels, median (range)	2 (1-4)
Graft/plate used, n (%)	
Graft only	8 (36)
Plate only	1 (5)
Both	13 (59)
EBL, median (range)	50 (30-100)
Collar at discharge, n (%)	8 (36)
Postoperative complications, n (%) ^a	2 (9)
Pseudoarthrosis Characteristics	All patients (N=22)
Time to pseudoarthrosis from index ACDF, months, median (range)	11 (3-151)
Highest level of involvement, n (%)	
C1/C2	0 (0)
C2/C3	0 (0)
C3/C4	3 (14)
C4/C5	3 (14)
C5/C6	7 (32)
C6/C7	9 (41)
Single vs. Multilevel, n (%)	
Single	17 (77)
Multiple	5 (23)
Number of levels, median (range)	1 (1-4)
Method of pseudoarthrosis diagnosis, n (%)	
X-ray	9 (41)
CT	11 (50)
Intraoperatively	2 (9)
ASD at time of pseudoarthrosis, n (%)	11 (50)
Symptoms/signs at presentation of pseudoarthrosis, n (%)	
Neck Pain	20 (91)
Myelopathy	4 (18)
Radiculopathy	13 (59)
Pre-PCF VAS neck pain score, median (range)	8 (0-10)

Results

Thirteen females (59%) and nine (41%) males experienced pseudoarthrosis at a median of 11 (range: 3-151) months after ACDF. Median age at index surgery was 51 (range: 33-67) years. All patients with pseudoarthrosis presented with progressive neck pain, with median VAS of 8 (range: 0-10), and/or myeloradiculopathy. Patients with pseudoarthrosis <12 months, compared to >12 months, after index surgery were older (p=0.013), had more frequent preoperative neurological deficits (p=0.064), and lower baseline VAS (p=0.006). Pseudoarthrosis was corrected in all patients via PCF of a median of 4 (range: 1-8) levels. Fusion was successful after PCF in all patients, with mean time to fusion of 9.2 (2-14) months. Eighteen patients fused anteriorly and posteriorly, two patients fused anteriorly only, and two patients fused posteriorly only. Median VAS was 4 (range: 1-8), at a median of 12 (range: 2-146) months follow-up; significantly improved from the time of pseudoarthrosis (p=0.012). Symptoms completely resolved/improved in 18 (82%) patients by LFU.

Table 2. Operative Information for Revision PCF after Pseudoarthrosis

Perioperative Characteristics	All patients (N=22)
Time to revision PCF from index ACDF, months, median (range)	14 (5-155)
Procedure performed, n (%) ^a	
Lateral mass screws	20 (91)
Wiring	1 (5)
Decompression	19 (86)
Number of levels fused, median (range)	4 (1-8)
BMP used, n (%)	2 (9)
Bone graft type, n (%)	
Local autograft	20 (91)
Allograft	14 (64)
DBM	12 (55)
Collar used, n (%)	16 (73)
Bone growth stimulator used, n (%)	4 (18)
EBL, cc, median (range)	388 (50-1200)
Length of hospitalization, days, median (range)	4 (1-8)
Complications, n (%) ^b	
Intraoperative	0 (0)
Postoperative	3 (14)
Post-PCF neck pain VAS at discharge, median (range)	7 (4-10)

Conclusions

While uncommon, pseudoarthrosis may occur after ACDF. All patients achieved successful fusion after subsequent posterior cervical fusion, with 91% fusing a previous anterior pseudoarthrosis after posterior stabilization. Neck pain significantly improved by last follow-up in the majority of patients in this study.

Table 3. Surgical Outcomes

Outcome variable	All patients (N=22)
Successful fusion, n (%)	
Anterior only	2 (9)
Posterior only	2 (9)
Both	18 (82)
Time to fusion, months, median (range) ^a	10 (2-14)
Method of fusion determination, n (%)	
X-ray	15 (68)
CT	7 (32)
ASD diagnosed after PCF, n (%)	4 (18)
Time to diagnosis of ASD after PCF, months, median (range)	24 (11-146)
Surgery for ASD required, n (%)	1 (5)
Length of follow-up after index ACDF, months, median (range)	33 (16-167)
Length of follow-up after PCF, months, median (range)	12 (2-146)
Status at last follow-up, n (%)	
Stable	3 (14)
Improved	18 (82)
Worsened	1 (5)
Neck pain VAS at last follow-up, median (range)	4 (1-8)

Table 4. Comparison of Patients with Pseudoarthrosis <12 months versus >12 months after ACDF

Pre-PCF Variables Analyzed	Pseudoarthrosis <12 months after ACDF	Pseudoarthrosis >12 months after ACDF	p-value
Age at index ACDF, years, median (range)	53 (40-67)	45 (33-54)	0.013
Sex, female, n (%)	5 (45)	8 (73)	0.387
Smoking history, n (%)	7 (64)	8 (73)	1.000
Symptoms/signs at original presentation, n (%)			
Neck pain	9 (82)	11 (100)	0.476
Myelopathy	6 (55)	3 (27)	0.387
Radiculopathy	9 (82)	8 (73)	1.000
Number of ACDF levels, median (range)	2 (1-4)	2 (1-4)	0.926
Collar at discharge, n (%)	4 (36)	4 (36)	1.000
Length of Hospitalization after ACDF, days, median (range)	2 (1-5)	1 (1-3)	0.163
Time to pseudoarthrosis from index ACDF, months, median (range)	6 (3-10)	16 (12-151)	<0.001
Pre-revision neurological deficit, n (%)	6 (55)	1 (9)	0.064
Pre-revision neck pain VAS, median (range)	7 (0-10)	8 (5-10)	0.006
ASD at time of pseudoarthrosis, n (%)	4 (36)	7 (36)	0.395
PCF Variables Analyzed			
Time to PCF revision from index ACDF, months, median (range)	8 (5-14)	19 (13-155)	<0.001
Number of levels revised, median (range)	4 (1-7)	4 (1-8)	0.727
Time to Fusion after PCF, months, median (range)	9 (4-13)	11 (2-146)	0.105

Learning Objectives

By the conclusion of this session, participants should be able to: 1) Describe the management of pseudoarthrosis following ACDF; 2) discuss the expected outcomes of a posterior revision for ACDF pseudoarthrosis.