

Four-level Anterior Cervical Discectomy and Fusion

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Allergies: The patient is allergic to omeprazole (hives) and aspirin (AAS).

Toxic Habits: She smokes 1 pack every 3 days and occasionally consumes alcohol.

Personal History:

Hypertension (HTA) No diabetes (DM) or dyslipidemia (DLP) Has experienced renoureteral colics No other relevant personal history (no notable AP) Current Treatment:

Bilaxten 20mg (antihistamine) Paracetamol 1000mg (analgesic) Nolotil 575mg (analgesic and antipyretic) Zaldiar 37.5/325mg (opioid analgesic combined with paracetamol) Fero-Gradumet 105mg (iron supplement) Amlodipine 10mg (antihypertensive) Diazepam 2mg (anxiolytic and muscle relaxant) Current Symptoms: Cervical pain, headache, dizziness, and paresthesias in both limbs.

Scheduled Surgery: Multilevel ACDF (Anterior Cervical Discectomy and Fusion) due to cervical symptoms.



Studies have been retrospective reviews with a wide range of [fusion](#) rates (47%–95%)^{2–6} in patients undergoing 4-level [Anterior Cervical Discectomy and Fusion](#)^{1) 2) 3) 4) 5)}.

2023

Bydon M, et al. use 4-level [Anterior Cervical Discectomy and Fusion](#) very judiciously. The high [pseudarthrosis](#) rates and [dysphagia](#) rates lead them to prefer posterior cervical approaches when patients have the 4-level compressive disease. If a patient needs a 4-level ACDF for ventral kyphotic compression, then consideration may be given to also performing a concomitant posterior fusion to enhance fusion rates⁶⁾.

White et al. retrospectively reviewed patients who underwent 4-level ACDF at a single institution with at least 1-year of radiological follow-up. Fusion was determined by measuring change in interspinous distance at each segment on dynamic radiographs or by the presence of bridging bone on CT scans at minimum 1-year follow-up. Clinical outcomes were assessed using Neck Disability Index and Short Form-36.

A total of 63 patients (252 levels) met the inclusion criteria for the study, with a mean follow-up of 2.6 years. Complete radiographic fusion at all 4 levels was observed in 26 patients (41.3%). Of the 37 patients (58.7%) with radiographic pseudarthrosis, there was a mean of 1.35 nonfused levels. The fusion rate per level, however, was 80.2% (202/252 levels). The most common level demonstrating nonunion was the distal segment (C6-7), showing pseudarthrosis in 29 patients (46.8%), followed by the most proximal segment (C3-4) demonstrating nonunion in 9 patients (14.5%). The mean improvement in Neck Disability Index and Short Form-36 was 15.7 ($p < 0.01$) and 5.8 ($p = 0.14$), respectively, with improvement in both scores surpassing the minimum clinically important difference. One patient (1.6%) required revision surgery for symptomatic pseudarthrosis, and 5 patients (7.9%) underwent revision for symptomatic adjacent-segment disease. Patient-reported outcomes results are limited by the low rate of 1-year follow-up (50.8%), whereas reoperation data were available for all 63 patients.

More than half of patients undergoing 4-level ACDF without posterior fixation demonstrated pseudarthrosis of at least 1 level commonly the distal C6-7 level. One patient required revision for symptomatic pseudarthrosis. Patient-reported outcomes showed significant improvements at 1-year follow-up, but clinical follow-up was limited. This is the largest series to date to evaluate fusion outcomes in 4-level ACDF ⁷⁾

2021

A retrospective review of prospectively collected data regarding the clinical outcomes, complications, and fusion rates of patients who underwent a 4-level (C3-C7) anterior cervical discectomy and fusion (ACDF).

The use of multilevel ACDF for [cervical spondylosis](#) has been controversial. The literature regarding fusion rates and outcomes has been variable. This study intends to evaluate the outcomes following multilevel ACDF in a large cohort of patients.

Between 1994 and 2011, 60 patients underwent a 4-level ACDF by a single surgeon. All patients were followed for a minimum of 12 months, and outcome measures included neurological findings, the presence or absence of radiographic fusion, and complication rates. All patients had radiographic documentation of spinal cord stenosis at 4 consecutive cervical levels as well as myelopathy and/or radiculopathy symptoms.

Forty-eight patients underwent a single anterior procedure, only 5 patients underwent concurrent anterior and posterior fusion, and 7 patients required a second posterior surgery due to new-onset or residual symptoms or hardware complications after undergoing ACDF. Patients most commonly presented with paresthesias and were diagnosed with cervical stenosis. Overall, 18.3% reported early postoperative dysphagia; however, only 2 patients continued to have mild dysphagia symptoms on

long-term follow-up. Other complications included hardware failure (11), residual neck pain (7), residual paresthesias (6), new-onset weakness (3), neck hematoma (1), cellulitis (1), and C5 radiculopathy (1). Overall, 88.3% of patients reported improvement in initial symptoms. Nurick scores were significantly lower following 4-level ACDF. The radiographic fusion rate for all levels was 95%. No patients required reoperation for [pseudarthrosis](#).

In appropriate patients, 4-level ACDF is a safe, efficacious method for treating multilevel cervical spinal cord compression, with acceptable complication rates and the ability to achieve neurological improvement and high fusion rates ⁸⁾.

2016

A retrospective review of all adult neurosurgical patients undergoing elective ACDF for degenerative disease at a single institution between 1996 and 2013 was performed. Patients who underwent first-time 3- or 4-level ACDF were included; patients with previous cervical spine surgery, those undergoing anterior/posterior approaches, and those with corpectomy were excluded. Outcome measures included perioperative complication rates, fusion rates, need for revision surgery, Nurick Scores, Odom's criteria, symptom resolution, neck visual analog scale (VAS) pain score, and persistent narcotics usage. Seventy-one patients who underwent 3-level ACDF and 26 patients who underwent 4-level ACDF were identified and followed for an average of 7.6 ± 4.2 years. There was 1 case (3.9%) of deep wound infection in the 4-level group and 1 case in the 3-level group (1.4%; $p = 0.454$). Postoperatively, 31% of patients in the 4-level group complained of dysphagia, compared with 12.7% in the 3-level group ($p = 0.038$). The fusion rate was 84.6% after 4-level ACDF and 94.4% after 3-level ACDF ($p = 0.122$). At the last follow-up, a significantly higher proportion of patients in the 4-level group continued to have axial neck pain (53.8%) than in the 3-level group (31%; $p = 0.039$); the daily oral morphine equivalent dose was significantly higher in the 4-level group (143 ± 97 mg/day) than in the 3-level group (25 ± 10 mg/day; $p = 0.030$). Outcomes-based on Odom's criteria were also different between cohorts ($p = 0.044$), with a significantly lower proportion of patients in the 4-level ACDF group experiencing an excellent/good outcome. In this study, patients who underwent 4-level ACDF had significantly higher rates of dysphagia, postoperative neck pain, and postoperative narcotic usage when compared with patients who underwent 3-level ACDF. [Pseudarthrosis](#) and deep wound infection rates were also higher in the 4-level group, although this did not reach statistical significance. Additionally, a smaller proportion of patients achieved a good/excellent outcome in the 4-level group than in the 3-level group. These findings suggest a significant increase of perioperative morbidity and worsened outcomes for patients who undergo 4- versus 3-level ACDF ⁹⁾.

32 consecutive patients underwent 4-level anterior cervical discectomy and fusion (ACDF) with cages and plates and were followed up for at least 5 years.

Methods: Records of 19 men and 13 women aged 48 to 69 years who underwent 4-level ACDF with cages and plates for myelopathy ($n=11$) or myeloradiculopathy ($n=21$) at C3 to C7 by a single surgeon and were followed up for a minimum of 5 years were reviewed. Clinical outcome was assessed using the visual analog scale (VAS), Neck Disability Index (NDI), and modified Japanese Orthopaedic Association (JOA) score for pain or myelopathic symptoms. Radiographic evaluation included fusion rate, range of motion, cervical lordosis (C2-to-C7 Cobb angle), and disc height.

The mean follow-up was 66 months. All patients had good recovery of muscle strength and resolution of limb sensory disturbance, except for 4 who still had some numbness. The mean VAS for neck and

arm pain improved from 14.2 to 6.84 ($p=0.012$); the mean NDI improved from 31.62 to 12.17 ($p<0.01$); and the mean JOA score improved from 10.1 to 13.9 ($p=0.027$). The mean percentage of recovery was 62.9. The mean Cobb angle improved from 10.24° to 1.28° ($p=0.019$); the mean disc height improved from 4.12 to 6.58 mm ($p<0.01$). 30 (94%) patients achieved solid fusion.

Multilevel ACDF using PEEK cages and plates is safe and effective for multilevel cervical spondylotic myelopathy and achieves satisfactory mid-term outcomes ¹⁰⁾

2010

Between 1997 and 2006, 34 patients (19 females, 15 males; mean age, 58 years; age range, 38-83 years) underwent 4-level anterior cervical discectomy and fusion with plating based on a surgical database search. Only patients undergoing surgery at 4 contiguous disc levels were included. Data were collected retrospectively. Patients' demographics, symptoms, neurologic findings, and radiographic findings at admission were recorded. Long-term clinical and radiographic outcomes at the last follow-up were analyzed.

Results: Twenty-nine patients (85%) underwent anterior cervical discectomy and fusion with plating at C3-C7. Sixteen patients presented with neurologic deficits, of which 14 (88%) improved. None worsened after surgery. Minor complications occurred in 26 patients, including transient dysphagia in 18 (53%) and hoarseness in 3 (9%). Radiographic outcomes were available in 27 patients (median follow-up, 15 months; range, 4-71 months). The overall fusion rate was 92.6%. Stable fibrous nonunions were present in 2 patients; the chance of nonunion was 1.9% per level and 7% per patient. Adjacent-level disease occurred in 2 patients.

Conclusion: In carefully selected patients, 4-level anterior cervical discectomy and fusion with plating can be associated with high rates of fusion. The technique is safe and effective for managing multilevel cervical spondylotic myelopathy and may obviate the need for circumferential procedures

¹¹⁾

2000

A prospective study of 15 patients who underwent modified Smith-Robinson anterior cervical discectomy and fusion at three or four operative levels stabilized with a uni-cortical anterior plate.

To provide medium-term follow-up data on the surgical success and patient outcome of three- and four-level anterior cervical discectomies and fusions and to determine the effect that plate fixation has on the results.

The success of arthrodesis for anterior cervical fusion depends on several factors, including the number of surgical levels. The arthrodesis rate and outcome for patients having three- and four-level discectomy and fusion procedures are disappointing. Internal fixation putatively improves these parameters.

Fifteen patients (average age, 51 years; range, 35-77), were observed for an average of 42 months (range, 25-73) All had an anterior discectomy, burring of the endplates, placement of an autogenous

tricortical iliac crest graft at three (12 patients) or four (3 patients) levels, and application of a Cervical Spine Locking Plate. All patients had follow-up office visits with examinations and radiographs. Radiographic union, postoperative pain relief, and neurologic recovery were evaluated.

Solid arthrodesis was achieved at all levels in only 7 (47%) of the 15 patients after a single procedure. Of the 8 patients with pseudarthrosis, 3 had sufficient pain to necessitate revision surgery (with pain relief in two), 1 had pain without further surgery, and 4 had no pain. Of the 7 with solid fusion, 3 had persistent pain, and 4 had none. Two in this group had a second procedure. All 4 patients with preoperative myelopathy improved, and 10 of the 11 with radiculopathy had resolution of arm symptoms.

Three- and four-level modified Robinson cervical discectomy and fusion results in an unacceptably high rate of pseudarthrosis. The Cervical Spine Locking Plate alone does not appear to improve the arthrodesis rate ¹²⁾.

1) ¹²⁾

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