

Clinical Study

There is no increased risk of adjacent segment disease at the cervicothoracic junction following an anterior cervical discectomy and fusion to C7

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Abstract

BACKGROUND CONTEXT: Anterior cervical discectomy and fusion (ACDF) is a very common operative intervention for the treatment of cervical spine degenerative disease in those who have failed non-operative measures. However, studies examining long-term follow-up on patients who underwent ACDF reveal evidence of radiographic and clinical degenerative disc disease at the levels adjacent to the fusion construct. Consistent with other junctional regions of the spine, the cervicothoracic junction (CTJ) has significant morphologic variations. As a result, the CTJ undergoes significant static and dynamic stress. Given these findings, there has been some thought that ACDF down to C7 may experience additional risks for adjacent segment degeneration/disease (ASD) when compared with ASDs that are cephalad to C7.

PURPOSE: The goal of this study is to evaluate the rate of radiographic and clinical ASD in patients who have undergone single- or multilevel ACDF, down to C7.

STUDY DESIGN: This is a retrospective cohort study.

PATIENT SAMPLE: The sample included consecutive patients from a single orthopedic surgeon at one quaternary referral medical center who underwent an ACDF between January 2008 and November 2014. Indications for surgery included radiculopathy, myelopathy, or myeloradiculopathy in the setting of failed conservative treatments. Patients were excluded if they had an ACDF of which the caudal level was cephalad to C7 or if they had undergone a previous cervical fusion.

OUTCOME MEASURES: Radiographic diagnosis of ASD was determined by the presence of disc space narrowing >50%, new or enlarged osteophytes, end plate sclerosis, or increased calcification of the anterior longitudinal ligament (ALL). Postoperatively, data were collected on the presence of new radicular or myelopathic symptoms indicative of pathology at C7–T1, indicating a diagnosis of clinical ASD.

METHODS: Demographic information was collected for all patients, which included age, sex, body mass index, smoking status, and Charleston Comorbidity Index (CCI). Several radiographic parameters were measured preoperatively, immediately postoperatively, and at the last follow-up: C2–C7 lordosis, sagittal vertical axis (SVA), thoracic inlet angle (TIA), and T1 slope C2–C7 lordosis were measured using the Cobb angle between the inferior end plate of C2 to the inferior end plate of C7. Radiographic and clinical factors associated with ASD were analyzed postoperatively.

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RESULTS: Four patients (4.8%) presented with clinical evidence of ASD, all of whom also showed signs of radiographic ASD and improved with conservative measures. No patients underwent reoperation for ASD at the C7–T1 junction. Thirty patients (36.1%) presented radiographic evidence of ASD. These were generally older (54.4 vs. 48.4 years; $p=.014$). There were neither significant differences in radiographic parameters nor between single- versus multilevel ACDFs and the development of ASD.

CONCLUSIONS: The cervicothoracic junction may present with vulnerability to ASD given the junctional biomechanics. However, this study provides evidence that an ACDF with the caudal level of C7 does not incur additional risk of ASD, showing similar outcomes to ACDFs at other levels. © 2017 Elsevier Inc. All rights reserved.

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Introduction

Anterior cervical discectomy and fusion (ACDF) is a very common operative intervention for the treatment of cervical spine degenerative disease in those who have failed non-operative measures [1]. Although other motion-preserving procedures have shown success in addressing the symptoms related to cervical spine disease, ACDFs remain a highly used surgery [2–6]. However, studies examining long-term follow-up on patients who underwent ACDF reveal evidence of radiographic disc degeneration at the levels adjacent to the fusion construct, often resulting in clinical symptoms.

Described as adjacent segment degeneration/disease (ASD), Hilibrand and Robbins estimated that more than one-quarter of patients who underwent an ACDF would develop this radiographic degeneration at the adjacent levels, with approximately two-thirds of those requiring additional surgery for radiculopathy/myelopathy at those levels [7]. Several other studies have highlighted the development of ASD following an ACDF with varying rates of presentation [8–15]. The etiology of radiographic ASD defined as degenerative findings at the adjacent segments found on imaging modalities and clinical ASD, defined as symptoms thought to be related to degenerative changes, remains a debate [10,16,17]. In vitro biomechanic studies have further evaluated the kinematic changes that occur at the adjacent levels [2,12,18,19]. These authors contend that eliminating the motion of spinal segments from a prior fusion leads to increased forces, stresses, and motion at the unfused, adjacent segments, resulting in accelerated degeneration of the motion segments. However, other groups have recently claimed that the adjacent disc degeneration may simply be part of the natural progression of cervical spondylosis [9,12,20–22].

Consistent with other junctional regions of the spine, the cervicothoracic junction (CTJ) has significant morphologic variations due to the transition from the fairly mobile, lordotic cervical spine to the more rigid, kyphotic thoracic spine [23–27]. As a result, the CTJ experiences significant static and dynamic stresses [25]. Multiple groups have suggested therefore that higher rates of ASD at C7–T1 may occur in patients who undergo an ACDF stopping at C7 [24,26,27]. To mitigate this risk, some surgeons cross the CTJ during multilevel ACDF regardless of the condition of the C7–T1 disc.

The goal of this study is to evaluate the rate of radiographic and clinical ASD in patients who have undergone a single- or multilevel ACDF that includes C7. We hypothesize that radiographic and clinical ASD rates are not significantly increased in ACDFs that extend caudally to C7 compared with published ASD rates in ACDFs that end cephalad to C7. Additionally, we sought to identify radiographic parameters that may be predictive or protective of ASD following ACDF down to C7.

Materials and methods

Patient population

Following institutional review board approval, we retrospectively reviewed the records of consecutive patients who underwent an ACDF between January 2008 and November 2014. All patients were operated on by one orthopedic surgeon at a single quaternary referral medical center. Indications for surgery included radiculopathy, myelopathy, or myeloradiculopathy in the setting of failed conservative treatments. Patients were excluded if they had an ACDF in which the caudal level was cephalad to C7, if they had undergone a previous cervical fusion or concomitant posterior surgery, or if follow-up was less than 12 months. Of the 170 patients originally identified who underwent an ACDF, anterior/posterior fusion, or revision procedure, 96 were found to fulfill the above criteria. However the C7–T1 junction was not clearly visible on the lateral cervical plain radiographs of 13 patients; thus, they were excluded. In total, 83 patients were included in the study.

Surgical procedure

The surgical procedures were carried out using a standard Smith-Robinson anterior approach via a transverse left-sided incision. Cephalad and caudal dissection was performed subperiosteally and did not extend beyond the midpoint of the supra- and subjacent vertebral bodies. A complete discectomy was performed at each level of interest and adequate neural decompression of the dura and nerve roots was achieved. The cartilaginous end plates were removed, with care taken to not violate the subchondral bone. Posterior annular attachments were removed from the posterior

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