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Clinical Study

Revision rates and complication incidence in single- and multilevel anterior cervical discectomy and fusion procedures: an administrative database study

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Abstract

BACKGROUND CONTEXT: The natural history of cervical degenerative disease with operative management has not been well described. Even with symptomatic and radiographic evidence of multilevel cervical disease, it is unclear whether single- or multilevel anterior cervical discectomy and fusion (ACDF) procedures produce superior long-term outcomes.

PURPOSE: To describe national trends in revision rates, complications, and readmission for patients undergoing single and multilevel ACDF.

STUDY DESIGN: Administrative database study.

PATIENT SAMPLE: Between 2006 and 2010, 92,867 patients were recorded for ACDF procedures in the Thomson Reuters MarketScan database. Restricting to patients with >24 months follow-up, 28,777 patients fulfilled our inclusion criteria, of which 12,744 (44%) underwent single-level and 16,033 (56%) underwent multilevel ACDFs.

OUTCOME MEASURES: Revision rates and postoperative complications.

METHODS: We used the MarketScan database from 2006 to 2010 to select ACDF procedures based on Current Procedural Terminology coding at inpatient visit. Outcome measures were ascertained using either International Classification of Disease version 9 or Current Procedural Terminology coding.

RESULTS: Perioperative complications were more common in multilevel procedures (odds ratio [OR], 1.4; 95% confidence interval [CI], 1.2–1.6; p<.0001). Single-level ACDF patients had higher rates of postoperative cervical epidural steroid injections (OR, 0.88; 95% CI, 0.8–1.0; p=.01). Within 30 days after index procedure, the multilevel ACDF cohort was 1.6 times more likely to have undergone revision (OR, 1.6; 95% CI, 1.1–2.4; p=.02). At 2 years follow-up, revision rates were 9.13% in the single-level ACDF cohort and 10.7% for multilevel ACDFs (OR, 1.2; 95% CI, 1.1–1.3; p<.0001). In a multivariate analysis at 2 years follow-up, patients from the multilevel cohort were more likely to have received a surgical revision (OR, 1.1; 95% CI, 1.0–1.2; p=.001), to be readmitted into the hospital for any cause (OR, 1.2; 95% CI, 1.1–1.4; p=.007), and to have suffered complications (OR, 1.3; 95% CI, 1.1–1.5; p=.0003).

CONCLUSIONS: In this study, we report rates of adverse events and the need for revision surgery in patients undergoing single versus multilevel ACDFs. Increasing number of levels fused at the time of index surgery correlated with increased rate of reoperations. Multilevel ACDF patients requiring additional surgery more often underwent more extensive revision surgeries.

Keywords: MarketScan; ACDF; Complications; Outcomes; Database study

FDA device/drug status: Not applicable.

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EVIDENCE & METHODS

Context
Single and multiple level ACDF are thought to have different complication and revision rates. In this study, the authors used a large insurance database to assess these parameters.

Contribution
The group found that patients undergoing multiple level ACDF procedures were more likely to undergo revision surgery, have complications, and require rehospitalizations.

Implications
This paper puts large numbers behind what is commonly assumed. Database studies are becoming more popular as the datasets are more readily available. Unfortunately, they are most often low quality case series reports. ICD and CPT codes are often insufficiently specific so detailed diagnoses and techniques are not captured. Further, there is little (or no) ability to accurately match groups, which limits the ability to validly compare them (such as in this study where the patient populations are, as defined by the procedure they underwent, metaphorically apples and oranges).

—The Editors

Introduction

Anterior cervical discectomy and fusion (ACDF) is a common surgical procedure. The decision to include greater than one level in operative treatment must consider complication and surgical revision risk profiles. Although institutional studies have reported higher frequencies of overall complication and reoperation rates in multilevel ACDF procedures, the risk of adjacent segment disease (ASD) has been demonstrated to be lower following multilevel procedures [1]. Controversy remains as to whether single- or multilevel ACDF procedures produce superior long-term outcomes.

A national database study into the relationship between single versus multilevel ACDF and the need for operative revision may provide insight to the impact of arthrodesis on the natural history of cervical degenerative disease. We used the MarketScan Research Database to investigate demographics, clinical outcomes, complications, revisions, and reoperation rates in patients undergoing single versus multilevel ACDFs with a minimum of 2-year follow-up.

Methods

We performed a retrospective observational administrative database study of patients in the United States who underwent ACDF procedures from 2006 to 2010. Inpatient and outpatient longitudinal data for this study was obtained from the Thomson Reuters MarketScan Commercial Claims and Encounters and Medicare Supplemental and Coordination of Benefits databases from 2006 through 2010. These annual datasets include data from 100 payers and comprised inpatient, outpatient, and pharmacy services from large employers, health plans, governmental, and public organizations.

Cohort selection

Table 1 contains Current Procedural Terminology (CPT) and International Classification of Disease version 9 Clinical Modification (ICD-9-CM) codes used in this study and not defined elsewhere as part of established comorbidity assessment. Single- and multilevel ACDF procedures were identified using CPT coding from inpatient encounters. Anterior instrumentation was identified using CPT codes on the same encounter. Patients undergoing concurrent posterior surgical or osteotomy procedures were excluded from the study to

Table 1
Current Procedural Terminology and ICD-9 coding used for cohort selection, comorbidity assessment, and postoperative outcome analysis

Single-level ACDF (CPT)	22554 or 22551
Multilevel ACDF (CPT)	22585, 63076
Anterior decompression (CPT)	63075
Anterior instrumentation (CPT)	22845, 22846, 22847, or 22851
Posterior surgical and osteotomy procedures (CPT)	63001, 63015, 63050, 63051, 63020, 63045, 63040, 63035, 63048, 63043, 22210, 22220, 22216, 22226, 22326, 22590, 22595, 22600, 22614, 63250, 63265, 63270, 63275, 63280, 63285
One or two level instrumentation (CPT)	22845
Three or greater levels of instrumentation (CPT)	22846
Tobacco use (ICD-9-CM)	305.1, V15.82, 989.84, 649.0
Tobacco treatment or referral (CPT)	99406-7, S907.5, S945.3, 99381-97, 96150-5, 99078
Osteoporosis (ICD-9-CM)	733, V17.81, 731.3, V82.81
Degenerative cervical disease (ICD-9-CM)	721.0, 721.1, 722.0, 722.4, 722.71, 723.0, 723.4, 722.81, 723.1, 723.7, 738.2
Degenerative thoracic/lumbar disease (ICD-9-CM)	722.1, 722.5, 722.7, 724.2, 721.3, 721.4, 738.4
Postoperative infection (ICD-9-CM)	998.5
Wound dehiscence (ICD-9-CM)	998.3
Chronic pain (ICD-9-CM)	338.2, 338.4
Pulmonary embolism (ICD-9-CM)	451.1
Deep vein thrombosis (ICD-9-CM)	453.4
Dysphagia (ICD-9-CM)	787.2
Cervical epidural injection (CPT)	62281, 62310

CPT, Current Procedural Terminology; ICD-9-CM, International Classification of Disease version 9 Clinical Modification; ACDF, anterior cervical discectomy and fusion.