Surgical Complications of Anterior Cervical Diskectomy and Fusion for Cervical Degenerative Disk Disease: A Single Surgeon's Experience of 1576 Patients

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Keywords
- Anterior
- Cervical
- Complications
- Diskectomy
- Fusion

Abbreviations and Acronyms
ACDF: Anterior cervical diskectomy and fusion
CDD: Cervical degenerative disk disease
CSF: Cerebrospinal fluid
MRI: Magnetic resonance imaging

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BACKGROUND: **Although anterior cervical diskectomy and fusion (ACDF) is a safe and effective procedure, the complications associated with it cannot be underestimated. The aim of this study was to highlight the potential complications associated with ACDF and the strategies to avoid them.**

METHODS: **A total of 1576 patients was included in this retrospective study from 1995 to 2012. All patients were operated by a single surgeon, who used the standard technique. Data pertaining to the postoperative complications and mortality were collected from the database.**

RESULTS: **The overall ACDF-related complication rate in our series was 8.4% (n = 133). Dysphagia was the most common complication encountered in 3.3 % (n = 52) of our patients. The inadvertent dural tear was encountered in 1.3% (n = 20) of our patients. Hoarseness was seen in 1.2% (n = 19) of our patients. A total of 0.88% (n = 14) of the patients had worsening of myelopathy/radiculopathy in the immediate postoperative period. Superficial wound infection occurred in 0.2% (n = 3) of our patients. Postoperative neck hematoma was seen in 0.1% (n = 2), recurrent laryngeal nerve palsy in 0.1% (n = 2), esophageal tear in 0.1% (n = 1), and graft extrusion in 0.88% (n = 14) of our cases. There was 0.1% (n = 1) mortality in our series. Of all these complications, only dysphagia was significantly correlated with 3-level ACDF as compared to 1- or 2-level ACDF (H = 12.89, df = 3, $P = 0.05$).**

CONCLUSION: **ACDF is a relatively safe procedure with very low morbidity and almost no mortality. In this study, the common complications encountered were postoperative dysphagia, dural injury, and hoarseness.**

INTRODUCTION

Anterior cervical diskectomy and fusion (ACDF) is an effective and well-established surgical procedure for the management of symptomatic cervical degenerative disk disease (CDD). Using the iliac crest graft, Robinson and Smith first described ACDF in 1955 (37, 42). Numerous studies have shown that it is an effective treatment for CDD with good clinical outcome and arthrodesis rate of 94.5% (5, 11, 17, 31, 39, 40). Despite this high success rate, the complications associated with ACDF, such as postoperative hematoma, esophageal injury, vascular injury, dysphagia, and vocal cord paresis, can be potentially debilitating or life-threatening (3, 4, 12, 16, 19, 30, 32, 35, 38, 43, 46). Therefore, the early diagnosis and management of these complications is mandatory to achieve a good outcome.

Most of the complications associated with ACDF are mentioned as case reports and are being under reported in the literature. The incidence of postoperative complications after ACDF is seldom described in large clinical series, and most of these reported series have included patients operated on by different surgeons (3, 12, 16, 30, 43). Therefore, to exclude this variation, in our series we analyzed 1576 consecutively operated patients by a single surgeon (A.N.).

The aim of this retrospective study is to highlight the potential early complications associated with anterior cervical diskectomy and fusion and to compare with those mentioned in the literature. We also review the predisposing factors that might influence the complication rate and the strategies to avoid them.

CLINICAL MATERIALS AND METHODS

This study was performed via the use of a protocol approved by the Institutional review board at the Louisiana State University and in accordance with patient privacy rights protection as enforced by the Health Insurance Portability and Accountability Act. We retrospectively reviewed the inpatient case records, radiographic data, electrophysiological reports, outpatient data, and operation notes of patients on whom anterior cervical diskectomy was performed between 1995 and 2012. All charts were studied for the patient demographics, presenting symptoms, number of levels fused, early postoperative complications (within 72 hours), and mortality. The data were collected and analyzed by the fellow who was not involved in the management of the patients. Complication was defined as an unexpected event during or after surgery that has prolonged the hospitalization or required medical or surgical intervention.

Of 1781 patients who had undergone ACDF for CDD from 1995 to 2012, 1576 patients were included in this study. The criterion for surgery was radicular pain not responding to the conservative management, radiculopathy with progressive weakness/sensory deficits, and features of myelopathy attributable to the disk disease. Patients with traumatic disk herniation (within 4 weeks of trauma), previous neck surgeries, cervical tumor, and infections were excluded from the study. The preoperative evaluation was based on history, neurological examination, and cervical spine magnetic resonance imaging (MRI) scans in all cases. Computed tomography myelogram was performed in cases in which MRI was contraindicated or inconclusive. Electromyography and nerve conduction velocity studies were performed in cases with equivocal imaging findings. Patients with incomplete clinical, surgical, or follow-up data were not included in this study.

Surgical Technique

All patients were operated by the senior author (A.N.), who used an anterior approach to the cervical spine with a right-sided skin incision as originally described by Robinson and Smith (37). After confirming the disk level of interest with intraoperative X-ray, a transverse skin incision was used and deepened down to the platysma. The plane was created between the esophagus and trachea medially and carotid sheath laterally to reach the anterior aspect of the cervical spine. The self-retaining Caspar cervical retractor (Aesculap, Inc., Center Valley, Pennsylvania, USA) was used to maintain the retraction. The longus colli was stripped off and after confirming the desired level with intraoperative X-ray, radical diskectomy was performed. Caspar Distraction Pins (Medfix; Aesculap, Inc.) were used to provide distraction. The disk was removed with a high-speed drill (Midas Rex; Medtronic, Memphis, Tennessee, USA). The microscope was used to achieve the complete decompression of the spinal cord and nerve roots up to the uncovertebral joints.

Fusion was performed by the use of either autologous bone graft (tricortical iliac crest bone graft) in the early part of the series, allograft Cervical Spacers (Musculoskeletal Transplant Foundation; DePuy, Synthes, Inc., West Chester, Pennsylvania, USA) with Demineralized Bone Matrix (Grafton; Osteotech, Inc., Shrewsbury, New Jersey, USA) in most of the cases or with a polyetheretherketone cage (Medtronic). A polyetheretherketone cage was used in multilevel cases or in patients with a history of smoking, osteoporosis, osteopenia, chronic steroid use, and osteomalacia. Anterior cervical plating (DePuy Skyline or Vectra Plate, Synthes, Inc., in most of the cases; Medtronic Atlantis Elite plating system in a few cases) to prevent graft collapse was used in all patients in the later part of the series. Wound drainage was not routinely performed.

Patients usually were discharged within 48–72 hours after surgery unless there were complications that prolonged the duration of stay. First follow-up at the outpatient clinic was conducted at 6 weeks, then at 3 and 6 months after the surgery. Anteroposterior and lateral X-rays of the cervical spine in neutral, flexion, and extension views were evaluated for the alignment and position of the hardware before the patient was discharged. Postoperative dysphagia was defined as pain or difficulty in swallowing or feeling of a sticky sensation in the throat after the procedure. Dysphagia was further classified into none, mild, moderate, and severe according to the scale proposed by Bazaz et al. (2) (**Table 1**).

Table 1. Dysphagia Score as Proposed by Bazaz et al. (2)

	Symptoms	
Severity	**Liquid**	**Solid**
None	None	None
Mild	None	Rare
Moderate	None or rare	Occasionally (only with specific food)
Severe	None or rare	Frequent (majority of solids)

Statsitical Analysis

Statistical analysis was performed with SPSS (version 20, IBM, Inc, Chicago, Illinois, USA) and Microsoft Excel (Microsoft, Redmond, Washington, USA). The outcome difference between two groups was performed using Pearson's χ^2 test. Comparisons were considered significant only if the P value was <0.05. The nonparametric, Kruskal-Wallis H test was used to evaluate the incidence of complication across the different categories of ordinal data.

RESULTS

Between 1995 and 2012, a total of 1576 patients underwent ACDF by the senior author (A.N.).

Patient Characteristics

The demographic data, clinical presentation, levels of procedure, number of fused levels per procedure, and methods of fusion are demonstrated in **Table 2**. The mean age at the time of surgery was 57.8 years (range, 18–104 years), and 56.1% of the patients were female, with a female/male ratio of 1.3:1. A total of 2155 disk levels in 1576 patients were operated upon during the study period. A total of 1544 (97.9%) patients presented with pain radiating to either of the arms or neck pain, 18 (1.14%) patients had pain in combination with weakness, and 14 (0.9%) patients presented with features of myelopathy. A total of 137 (8.7%) patients underwent repeat ACDF at a different level; however, only first surgery was taken into account to evaluate the incidence of surgical complications in such cases (**Figures 1** and **2**).

Complications

The overall complication rate related to the surgical procedure in our series was 8.4%; 133 complications occurred in 128 patients. The incidence of various postoperative complications is demonstrated in **Table 3**.

Dysphagia. Fifty-two of our patients (3.3%) had dysphagia in the postoperative period. These patients presented with mild-to-moderate dysphagia according to the scale proposed by Bazaz et al. (2). None of the patients had severe dysphagia related to the graft extrusion necessitating surgical intervention. A total of 96.1% (50/52) of the patients with dysphagia were relieved of this symptom at the first follow-up visit with no further complications. The other two patients with moderate dysphagia were gradually relieved of this symptom by 3 months postoperatively (**Figure 2**).