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## Preoperative laryngoscopic examination in patients undergoing repeat anterior cervical discectomy and fusion

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### Abstract

**Study Background:** Patients who experience a recurrent laryngeal nerve injury (RLI) after undergoing an Anterior Cervical Discectomy and Fusion (ACDF) procedure may eventually become asymptomatic. If patients with an asymptomatic vocal cord abnormality undergo a subsequent ACDF they may be at risk for developing bilateral vocal cord paralysis (VCP). Bilateral VCP is a potentially life threatening problem, requiring emergent tracheotomy in some cases. A program of referring patients for preoperative laryngoscopic examinations (PLE) who were being considered for a revision ACDF was instituted. This study reviews the results of these examinations and determines if the information gained impacted management.

**Methods:** Patients who were referred for PLE prior to revision ACDF were identified from a prospectively maintained database during the period 2004 – 2010. All patients underwent examinations by an Otorhinolaryngologist specialist (ENT) using a nasopharyngoscope in combination with video stroboscopic examination.

**Results:** 23 patients were identified as having a PLE and subsequent revision ACDF. 18 patients underwent a single level ACDF and 5 patients underwent a previous 2 level surgery. Significant findings were found in 4 patients. 2 patients presented with asymptomatic VCP and 2 patients with chronic hoarseness. One was found with VCP and the other with a vocal cord mass. The revision procedures were performed on the same side as the previous ACDF.

**Conclusions:** 17.3% of patients undergoing PLE exhibited abnormalities, affecting decision-making regarding side of approach for revision ACDF. PLE is a simple and effective way of screening patients for abnormalities prior to revision ACDF surgery.

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**Keywords:** Laryngoscopic; Cervical; Cost comparison; Discectomy

### Introduction

Over the past decade, it has increasingly become recognized that many patients who have undergone an anterior cervical discectomy and fusion (ACDF) may require subsequent surgery owing to the interval development of adjacent-level disease (ALD). ALD typically occurs at the level above the site of the original surgery.<sup>1</sup> Patients undergoing *revision anterior cervical spine surgery* (ACSS) are at risk for the development of bilateral vocal cord paralysis if they have an unrecognized asymptomatic or mildly symptomatic vocal cord abnormality, which occurred as a result of the original ACDF.<sup>2,3</sup> If the

*revision* surgery occurs on the opposite side of the vocal cord abnormality and a second Recurrent Laryngeal Nerve Injury (RLI) occurs, the patient is at risk for bilateral RLI. Bilateral RLI is a potentially life-threatening syndrome leading to acute airway obstruction requiring emergent tracheotomy. In some cases, the tracheotomy may be permanent.<sup>3</sup> Moreover, some patients who initially have dysphonia after ACDF may become asymptomatic, thus rendering the clinical examination unreliable.<sup>4</sup> Our study was undertaken to determine if asymptomatic RLI is an unrecognized abnormality in patients undergoing revision ACSS and determine if bilateral RLI in this patient group can be prevented through the use of preoperative laryngoscopic examination.<sup>5,6</sup>

The recurrent laryngeal nerve (RLN) arises from the right vagus in the cervical region leftward at the T1–T2 level or more anterior to the right subclavian. It travels inferior and posterior to the subclavian artery to ascend into

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the cervical region between the trachea and esophagus, behind the right common carotid artery in the tracheoesophageal fascia. The left RLN branches from the left vagus nerve in the thorax. It travels inferior and then posterior to the arch of the aorta to ascend into the neck between the trachea and esophagus. The terminal portion of both RLNs pass superiorly, deep to the inferior border of the inferior pharyngeal constrictor muscle, just posterior to the cricothyroid joint to supply the interarytenoid, posterior cricoarytenoid, and lateral cricothyroid muscles. Through these muscles, the arytenoid cartilage (attached posteriorly to the vocal cords), the thyroid cartilage (attached anteriorly to the vocal cords) vocal tension, abduction, and adduction are mediated. During ACDF surgery, the RLN can be injured owing to traction or crush injury.<sup>7</sup>

### Materials and methods

Because of the life-threatening risk of developing bilateral paralysis of the vocal chords, starting in 2004, a protocol was developed to refer patients who were being evaluated for a revision ACDF procedure for a preoperative laryngoscopic examination. Patients were identified from a prospectively maintained database of all patients undergoing ACDF. Out-patient records were reviewed including results of laryngoscopic examination. All the patients identified as having undergone revision surgery underwent examinations by an Otorhinolaryngologist (ENT) specialist using a flexible nasopharyngoscope in combination with videostroboscopic examination. Nasopharyngoscopy provides the ability to evaluate and exclude pathologies of the nasopharynx (polyps and cancer) in addition to evaluation of the vocal cords. However, laryngoscopic examination alone is also a reasonable alternative if one wishes to evaluate only the vocal cords. The vocal cords typically vibrate at a high rate during speech (80–400 times per second). Stroboscopy recordings afford the ability to examine the vocal cords at a slower rate. A synchronized flashing light is passed through the flexible scope, which is synchronized to the vibrating vocal cord at a slower rate. The synchronization allows the examiner to evaluate the vocal cords in what appears to be slow motion. Moreover, as the examinations are recorded, it allows the ENT specialist to compare follow-up studies. It can provide information regarding subtle abnormalities, such as scar tissue, hemorrhage, or cysts, involving the vocal cord mucosa. The indication for surgery was an interval development of ALD after a previous ACDF. All *revision* surgeries were performed by the senior author (WFY).

### Results

Twenty-three patients were identified as having undergone preoperative laryngoscopy and subsequent revision anterior cervical spine surgery. There were 13 men and 10 women. Eighteen of the patients previously underwent a single-level ACDF and 5 of the patients underwent 2-level

surgery as the original procedure. The mean age was 43.8. Six of the original procedures were performed by the senior author. The initial surgery was performed from the left side in 20 patients and from the right side in 3 patients. One patient developed prolonged dysphagia after the initial surgery (after 2 weeks) and underwent an esophagram, which presented normal results. Preoperative vocal cord examination result was normal in this patient. The indication for surgery in all cases was development of adjacent-level deformity. None of the revision surgeries were performed for psuedarthrosis or painful instrumentation. Postoperative nasopharyngoscopic examination was not performed after the revision surgery. All patients identified in database who underwent revision surgery had preoperative nasopharyngoscopic/videostroboscopic examination. Seventeen of the revision surgeries were 1 level and 6 were 2 level.

Significant findings were found in only 4 patients (17.3%). Two patients (8.6%) presented with asymptomatic vocal cord paralysis and 2 (8.6%) presented with chronic hoarseness after previous ACDF. None of the other 18 patients had complaints of hoarseness before revision ACSS. One of the 2 with chronic hoarseness was found to have a vocal cord paralysis and the other was found to have a vocal cord mass (benign tumor) on the same side as the previously performed ACDF. In these 4 patients, the revision procedure was performed on the same side as the previous ACDF (left side), as opposed to patients with a normal laryngoscopic examination, in which subsequent surgery was performed on the opposite side to avoid scarring from the previous surgery. None of the patients exhibited clinical evidence of a new symptomatic RLI post-operatively. There were no other approach-related complications in these patients.

### Discussion

Smith and Robinson<sup>8</sup> first described the anterior approach to the cervical spine in the 1950s. Since then, anterior spine decompression combined with fusion has become one of the most common procedures in spinal surgery. The use of anterior instrumentation has also become increasingly used to improve the chances of a solid arthrodesis. It has also become recognized that many patients may need to undergo “redo” or revision surgery owing to either development of ALD or psuedarthrosis. The incidence of adjacent-level pathology ranges from 11%–12% at 5 years and develops at a rate of 1.6%–4.2% per year. Whether ALD develops from iatrogenic causes or as a result of natural history is debated.<sup>1</sup> RLI is a rare but significant potential complication of ACDF usually presenting with dysphonia after surgical intervention. Whether RLI is primarily due to direct injury of the nerve during ACDF surgery or results from indirect compression from high endotracheal cuff pressures after intubation is unclear.<sup>9–12</sup> Its incidence ranges from 1%–11%.<sup>13–16</sup> Scar tissue from previous surgery may increase the risk of subsequent RLI.<sup>3,14</sup>

Previous investigators have determined that patients may be asymptomatic with a vocal cord paresis and have symptomatic dysphonia without a vocal cord paresis. In Farrag's study of 340 patients undergoing preoperative laryngoscopic examination before thyroid surgery, 22 patients were found to have preoperative vocal cord impairment, 7 of which (32%) were asymptomatic. These authors concluded that given the medical legal concerns regarding iatrogenic RLI, all patients undergoing thyroid surgery should have a preoperative laryngoscopic examination.<sup>17</sup>

In a study of 120 patients scheduled to undergo anterior cervical spine surgery, Jung et al.<sup>18</sup> enrolled them prospectively in a program in which preoperative and postoperative laryngoscopic examinations were performed to determine the "true" incidence of RLI. They found that the incidence of asymptomatic RLI was 1.6% based on preoperative laryngoscopic examination and 10.8% based on postoperative laryngoscopic examination.

Paniello et al.<sup>19</sup> found that, of 47 patients undergoing screening, 13 (26%) revealed laryngeal abnormalities, including 11 cases (22%) that had a vocal cord paresis, 5 of them were asymptomatic. These authors also concluded that preoperative laryngoscopic examination should be made a standard part of the preoperative evaluation of patients undergoing revision ACDF.

A limitation of our study is the small sample size. However, the fact that it is consistent with the work of previous authors is suggestive that the results are significant. Moreover, given the devastating consequences of bilateral vocal cord paralysis, prevention is important no matter how small the incidence.

## Conclusions

In our series of patients undergoing preoperative laryngoscopic examination before revision ACDF, 17.3% were found to have a vocal cord abnormality. Identification of vocal cord abnormalities affected the decision making regarding our choice of side of approach. We believe this information was valuable in preventing the occurrence of bilateral vocal cord paresis. Preoperative laryngoscopic examination is a simple and effective way of screening patients for abnormalities before revision ACDF surgery and should be a standard part of the perioperative management of these patients.

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