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Dysphagia After Anterior Cervical Spine Surgery

A Prospective Study Using the Swallowing–Quality of Life Questionnaire and Analysis of Patient Comorbidities

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Study Design. Prospective study of 29 patients who underwent anterior cervical (AC) or posterior lumbar (PL) spinal surgery. A validated measure of dysphagia, the Swallowing–Quality of Life (SWAL-QOL) survey, was used to assess the degree of postoperative dysphagia.

Objective. To determine the degree of dysphagia preoperatively and postoperatively in patients undergoing AC surgery compared with a control group that underwent PL surgery.

Summary of Background Data. Dysphagia is a well-known complication of AC spine surgery and has been shown to persist for up to 24 months or longer.

Methods. A total of 18 AC patients and a control group of 11 PL patients were prospectively enrolled in this study and were assessed preoperatively and at 3 weeks and 1.5 years postoperatively using a 14-item questionnaire from the SWAL-QOL survey to determine degree of dysphagia. Other patient factors and anesthesia records were examined to evaluate their relationship to dysphagia.

Results. There were no significant differences between the AC and PL groups with respect to age, sex, body mass index, or length of surgery. The SWAL-QOL scores at 3 weeks were significantly lower for the AC group than for the PL group (76 *vs.* 96; $P = 0.001$), but there were no differences between the groups preoperatively or at final follow-up. Smokers, patients with chronic obstructive pulmonary disease, and women had lower SWAL-QOL scores at one or more time point.

Conclusion. Patients undergoing AC surgery had a significant increase in the degree of dysphagia 3 weeks after surgery compared with patients undergoing PL surgery. By final follow-up, swallowing in the AC group recovered to a level similar to preoperative and comparable to that in patients undergoing lumbar surgery at 1.5 years. Smoking, chronic obstructive pulmonary disease, and female sex are possible factors in the development of postoperative dysphagia.

Key words: dysphagia, anterior cervical surgery, lumbar surgery, SWAL-QOL. **Spine 2011;36:1387–1391**

The anterior Smith-Robinson approach to the cervical spine is a commonly used approach in the treatment of cervical conditions, including radiculopathy and myelopathy as a result of both congenital and degenerative conditions. During the 1990s, more than 500,000 anterior cervical (AC) discectomy and fusion (ACDF) procedures were performed in the United States.[1] Postoperative dysphagia after AC spinal surgery is a common cause of postoperative morbidity and has received increasing attention in recent literature. A review of the literature yields an incidence of postoperative dysphagia between 2% and 60%, with such a wide range likely due to the varied methods for measuring dysphagia and differences in study design.[2–8] Perhaps more important than the initial postoperative presentation of dysphagia is its persistence for years after surgery. A recent report showed persistent dysphagia in 35% of patients at an average 7.2 years after ACDF,[9] while another recent study highlights the fact that postoperative dysphagia is likely underreported by the surgeon.[10]

The purpose of this study was to utilize the Swallowing–Quality of Life (SWAL-QOL) survey, a validated tool for assessment of dysphagia,[11–13] to determine the preoperative and postoperative degrees of dysphagia in patients undergoing AC spinal surgery. These patients were then compared with a cohort of patients undergoing posterior lumbar (PL) surgery as a control for the effect of intubation. Other patient factors, including, age, body mass index (BMI), sex, history of hypertension, diabetes mellitus, gastroesophageal reflux disease, chronic obstructive pulmonary disease (COPD), rheumatoid arthritis, coronary artery disease, cancer, smoking, Mallampati score, and number of intubation attempts were examined to evaluate their relationship to dysphagia. Anesthesia records were reviewed to determine length of the surgery and whether

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any patient had a traumatic intubation or was classified as a "difficult airway."

MATERIALS AND METHODS

Study Design

This study was performed with approval of the institutional review board at the University of Pittsburgh. Two cohorts of patients were recruited to determine the degree of dysphagia and factors associated with it. Patients undergoing AC surgery were the target of this investigation, while patients undergoing PL surgery were enrolled as a control group to determine the effect of the intubation itself on postoperative dysphagia. All patients included in this study were operated on by one of the senior authors (J. Y. L., J. D. K, W. F. D.) between October 2005 and April 2006. Patients were recruited for the study during their preoperative office visit. Individuals in the AC group included patients undergoing AC surgery for spondylotic disease, patients with radiculopathy and/or myelopathy, patients undergoing ACDF, and patients undergoing AC corpectomy and fusion (ACCF). Patients undergoing revision surgery for junctional stenosis or symptomatic hardware were also included. The PL group included patients undergoing PL decompression with or without posterolateral fusion for degenerative conditions of the lumbar spine. Excluded from the study were patients undergoing a surgical procedure for a condition resulting from trauma, patients with a history of head and neck surgery other than cervical spinal surgery, and those patients with incomplete or missing preoperative or postoperative SWAL-QOL data.

An institutional consent form was signed by all participants and the preoperative SWAL-QOL questionnaire was completed either during that office visit or on the day of surgery. Three-week follow-up data were obtained at the first postoperative office visit by having the patients complete the SWAL-QOL questionnaire. The final follow-up data were obtained either at a subsequent postoperative office visit or via a telephone interview. Information regarding medical history and medical comorbidities was included as part of the SWAL-QOL questionnaire and was provided by the patients upon completion of the preoperative questionnaire. For instances in which this section of the questionnaire was not completed, medical history was obtained from review of the patient's medical records. Information regarding Mallampati score, number of intubations or difficult intubation, anesthesia time, and BMI was obtained from a review of the anesthesia records.

SWAL-QOL Questionnaire

The SWAL-QOL questionnaire is a validated patient-based measure of dysphagia.[11–13] Included in the complete SWAL-QOL questionnaire are categories regarding the impact of dysphagia from the patient's perspective: burden, eating duration, eating desire, symptom frequency, food selection, communication, fear, mental health, social, fatigue, and sleep. For the purposes of our analysis, we concentrated on a 14-item portion, which is meant to assess symptoms frequently associated with dysphagia (Table 1). The items in this portion of the SWAL-QOL were scored 1 to 5, corresponding to symptoms occurring almost always, often, sometimes, hardly ever, or never.

TABLE 1. The Swallowing–Quality of Life Questionnaire

Symptoms	Almost Always	Often	Sometimes	Hardly Ever	Never
Coughing	1	2	3	4	5
Choking when you eat food	1	2	3	4	5
Choking when you take liquids	1	2	3	4	5
Having thick saliva or phlegm	1	2	3	4	5
Gagging	1	2	3	4	5
Drooling	1	2	3	4	5
Problems chewing	1	2	3	4	5
Having excess saliva or phlegm	1	2	3	4	5
Having to clear your throat	1	2	3	4	5
Food sticking in your throat	1	2	3	4	5
Food sticking in your mouth	1	2	3	4	5
Food or liquid dribbling out of your mouth	1	2	3	4	5
Food or liquid coming out of your nose	1	2	3	4	5
Coughing food or liquid out of your mouth when it gets stuck	1	2	3	4	5

Patients are asked how often in the past month they experience these symptoms and to then circle the answer choice that best applies. A lower score indicates an increased degree of dysphagia.

Surgical Technique

All patients underwent AC surgery by a left-sided Smith-Robinson approach. Deep retractors used by the senior authors included self-retracting caspar AC retractors. Discectomy or corpectomy was performed as indicated on the basis of the patient's presentation and preoperative studies, with removal of all involved osteophytes. The posterior longitudinal ligament was taken down at the discretion of the surgeon. Freeze-dried fibula strut graft or tricortical iliac crest autograft was used per surgeon preference. Anterior plating was performed in all ACDFs and in selective ACCFs using Atlantis, Zephyr, and Orion plating systems (Medtronic; Minneapolis, MN). An additional posterior cervical procedure was performed in select cases to protect a long fibula strut allograft after multilevel corpectomy. Patients underwent PL surgery using a standard posterior approach and were positioned prone on a Jackson table for the duration of the procedure.

Data Management and Analysis

To obtain the dysphagia score from the SWAL-QOL questionnaire, the scores of the 14 items were summed and transformed to a scale that ranged from 0 to 100, with lower scores indicating more frequent symptoms of dysphagia.

Data analysis began with calculation of descriptive statistics including frequency counts for categorical variables such as sex and measures of central tendency (means, medians) and dispersion (standard deviation, range) for continuous variables such as age and the SWAL-QOL score. We were interested in the effects of the type of surgery over time on the SWAL-QOL score. As such, we performed a two-way repeated measures analysis of variance. The between-groups factor was the type of surgery (AC *vs.* PL surgery) and the within-subjects factor was time (preoperative, 3 weeks, and final follow-up). *Post hoc* analyses included independent *t* tests to detect differences between groups at each point in time and paired *t* tests to detect differences between different points in time. The Bonferroni method was used to control for multiple comparisons during *post hoc* testing.

Differences in patient- and surgical characteristics between groups were determined using chi-square tests for categorical variables and independent *t* tests for continuous variables. Pearson and eta-squared correlation coefficients were used to identify factors that were associated with SWAL-QOL score. Factors that were explored included patient factors such as age, BMI, sex, history of hypertension, diabetes mellitus, gastroesophageal reflux disease, COPD, rheumatoid arthritis, coronary artery disease, cancer, smoking, Mallampati score, and surgical factors such as length of surgery, number of intubation attempts and traumatic intubation, or classification of the patient as a "difficult airway."

RESULTS

Twenty-nine patients had complete preoperative, 3-week, and 1.5-year follow-up data, including 18 patients who underwent AC and 11 patients who underwent PL surgery. The AC and PL cohorts were similar with respect to age (49 yr *vs.* 53 yr; $P = 0.220$), BMI (26 *vs.* 27; $P = 0.535$), length of surgery (226 minutes *vs.* 236 minutes; $P = 0.728$), and proportion of female sex ($P = 0.330$) (Table 2).

TABLE 2. Comparison Between Anterior Cervical and Posterior Lumbar Groups

	Anterior Cervical	Posterior Lumbar	*P*
Patients	18	11	
Age (yr)	49	53	0.220
sex (female:male)	11:7	5:6	0.330
Body mass index	26	27	0.535
Length of surgery (min)	226	236	0.738

The two-way repeated-measures analysis of variance indicated that there was a significant group by time interaction. Further testing indicated that the SWAL-QOL scores within the AC group changed significantly with time. The mean preoperative score was 87 compared with 76 three weeks postoperatively ($P = 0.03$). SWAL-QOL scores at 1.5 years improved to 95, which was significantly different than both the preoperative ($P = 0.018$) and 3-week scores ($P < 0.001$). Within the PL cohort, SWAL-QOL scores remained unchanged with time. Comparison of the SWAL-QOL scores between the AC and PL groups showed no difference preoperatively or at final follow-up, but did show a significant difference at 3 weeks (76 *vs.* 96; $P = 0.001$) (Figure 1).

Analysis of patient factors showed that smokers had lower scores 3 weeks after surgery than the nonsmokers (64 *vs.* 87; $P = 0.002$). Patients with COPD had lower scores preoperatively (63 *vs.* 91; $P = 0.002$), at 3 weeks (45 *vs.* 86; $P = 0.001$), and at 1.5 years (75 *vs.* 96; $P = 0.16$). Female patients had lower scores 3 weeks after surgery (77 *vs.* 91; $P = 0.53$). The SWAL-QOL scores were not related to patient age or BMI. Likewise, there was no correlation with surgical or anesthesia factors such as length of surgery, Mallampati score, or difficult intubation.

DISCUSSION

To our knowledge, this is the first published study in which the SWAL-QOL dysphagia-specific tool has been utilized to

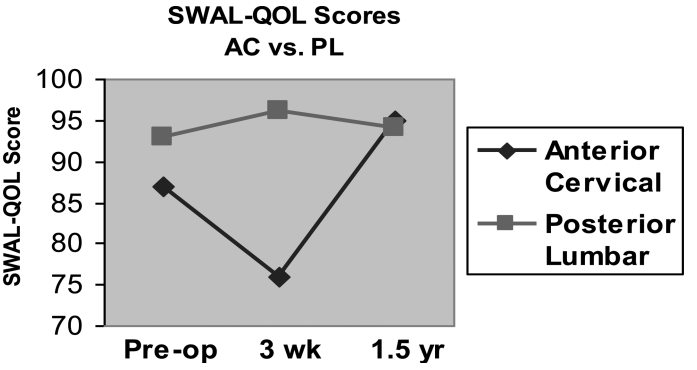

Figure 1. Dysphagia in the anterior cervical and posterior lumbar groups.

assess the degree of dysphagia in patients undergoing spinal surgery. In this study, patients undergoing AC surgery had a significant increase in degree of dysphagia 3 weeks after surgery compared with patients undergoing PL surgery. This implies that postoperative dysphagia is related to the AC procedure and is not due to intubation alone. Furthermore, by final follow-up, swallowing in the AC group recovered to the level of dysphagia similar to before surgery and comparable with those patients who underwent lumbar surgery.

While the true cause of postoperative dysphagia after AC surgery continues to be a matter of debate, recent studies have helped to elucidate its cause. It has been suggested that intraoperative retraction of the esophagus is a contributing factor to postoperative dysphagia. Mendoza-Lattes *et al*[14] showed that patients with dysphagia had a significantly higher esophageal intraluminal pressure and a significantly lower average mucosal perfusion. Although not specifically related to dysphagia, Apfelbaum *et al*[15] found that the rate of vocal cord paralysis decreased with transient release of endotracheal tube cuff pressure after placement of retractors. However, another recent report by Papavero *et al*[16] did not show a correlation between intraoperative pharynx/esophageal retraction and postoperative swallowing disturbances. Finally, Smith-Hammond *et al*[7] compared dysphagia in Veterans Affairs patients undergoing AC, posterior cervical, and PL procedures and found that intubation alone was not a risk factor for postoperative dysphagia.

In addition to having an increased degree of postoperative dysphagia at 3 weeks, the AC group had an increased degree of dysphagia preoperatively than at final follow-up at 1.5 years. This suggests that cervical spondylotic disease might contribute to swallowing difficulty. Moreover, others have shown that AC osteophytes may cause dysphagia.[17,18]

Given the variance in reported incidence, it is not surprising that the exact etiology, as well as specific risk factors for postoperative dysphagia, remains unclear. Postoperative dysphagia is generally associated with increased number of fused levels,[5,6,19] as well as advancing age,[5–7] although other studies, including a series of 454 patients, did not show advancing age as a significant risk factor.[19,20] Female sex and revision surgery have also been associated with postoperative dysphagia.[5,6,16] In this present study of 29 patients, increased degree of postoperative dysphagia was associated with female sex, as well as smoking and COPD. It was hypothesized that those patients with larger necks would lead to more difficult intubations and thus increased degree of postoperative dysphagia. However, in this series there was no correlation with increased BMI, Mallampati score, or difficult intubation.

Limitations of this study include the relatively small sample size, potentially limiting the power of the study. Although the power of this study to detect a change in dysphagia scores at 1.5-year follow-up may be limited, those scores reverted to the preoperative values. In addition, others have utilized videofluoroscopic swallow evaluation or fiberoptic endoscopic evaluation of swallowing to compare a clinical measurement of dysphagia with that reported by the patients.[7] This present study did not provide an objective evaluation of dysphagia in these patients. However, the SWAL-QOL survey has been validated as a dysphagia-specific measure to be utilized in research studies.[11–13]

In conclusion, patients undergoing AC surgery had a significant increase in the degree of dysphagia 3 weeks after surgery compared with patients undergoing PL surgery. This implies that postoperative dysphagia is related to the AC procedure and is not due to intubation alone. In addition, smoking, COPD, and female sex were significant risk factors in the development of postoperative dysphagia.

➢ Key Points

- ❑ Comparison of the degree of dysphagia in patients undergoing AC *versus* PL spinal surgery using the SWAL-QOL survey.
- ❑ Patients undergoing AC surgery had a significant increase in the degree of dysphagia 3 weeks after surgery compared with patients undergoing PL surgery.
- ❑ By final follow-up, swallowing in the AC group recovered to a level similar to preoperative and comparable to that in patients undergoing lumbar surgery at 1.5 years.
- ❑ Smoking, COPD, and female sex are possible factors in the development of postoperative dysphagia.

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