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Inpatient injection laryngoplasty for vocal fold immobility: When is it really necessary?☆

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ABSTRACT

Purpose: To compare pulmonary and swallow outcomes of injection laryngoplasty when performed in the acute versus subacute setting in head & neck and thoracic cancer patients presenting with new onset unilateral vocal fold immobility.
Materials and methods: Case series with chart review at an academic cancer center over a 2 year period. Based on swallow evaluation, patients diagnosed with vocal fold immobility were grouped into an unsafe swallow group, injected as inpatients, and a safe swallow group, for whom injection laryngoplasty was delayed to the outpatient setting or not performed. Rates of pneumonia, diet recommendations, and swallow outcomes were compared between groups.
Results: 24 patients with new-onset vocal fold immobility were evaluated. 7 underwent injection in the inpatient setting, 12 in the outpatient setting, and 5 did not undergo injection. There was no perceived difference in speech and swallow outcomes between the inpatient and outpatient injection groups.
Conclusions: Injection laryngoplasty shows promise as an effective intervention for reducing aspiration risk and improving diet normalcy in patients with dysphagia as a result of unilateral vocal fold immobility. In patients determined to have a safe swallow, delay of injection laryngoplasty is not detrimental to swallow outcomes.

1. Introduction

Unilateral vocal fold immobility (UVFI) represents a source of potentially devastating morbidity in patients with head & neck and thoracic malignancies. Surgical procedures such as esophagectomy, lobectomy, pneumonectomy and mediastinoscopy carry considerable risk to the recurrent laryngeal nerve [1]. Compression or invasion of the nerve from local or metastatic disease may also produce transient neurapraxia or permanent dysfunction [1]. The glottal incompetence that may follow UVFI predisposes patients to weakened tussive reflex, laryngopharyngeal sensory dysfunction, and varying degrees of swallow impairment [2]. While the incidence of UVFI varies considerably in the literature, there is certainly a consensus that these patients are at an increased risk for penetration and aspiration events [2]. Given this increased risk, the otolaryngologist consultant is often called upon to evaluate patients in the inpatient setting who are suspected to have UVFI. Quite often, this is accompanied by a request for an "urgent" medialization procedure with the intention of minimizing aspiration-related complications.

The optimal management algorithm for UVFI remains controversial. Severity of the patient's symptoms, potential for nerve recovery of function, patient comorbidities, willingness of the patient to undergo additional procedures in the postoperative period, and overall life expectancy are but a few of several variables that affect the timing and type of intervention offered [1].

Injection laryngoplasty has been demonstrated to be an effective means of restoring glottic competence in the acute setting, thus potentially reducing the risk of aspiration [3]. Advances in technique and injectable materials have allowed for the ubiquitous adoption of percutaneous injection laryngoplasty by many laryngologists, facilitating rapid intervention at bedside for inpatients or in the office for outpatients [4]. Not only does this intervention bypass a costly trip to the operating room, but it also avoids the danger of putting patients with aerodigestive tract disease under general anesthesia. Several studies have also demonstrated the ability of flexible endoscopic evaluation of swallowing to reliably and consistently identify penetration or aspiration events in patients diagnosed with UFVI, allowing clinicians to expeditiously quantify the degree of swallow impairment, thus providing objective swallow data upon which management decisions may be based [2,5,6].

The purpose of this study was to compare clinical outcomes with relation to the occurrence of pulmonary complications (i.e., pneumonia)

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in patients who undergo IL in the acute inpatient versus the delayed outpatient setting in patients presenting with new onset UVFI. We hypothesize that a subset of patients are able to tolerate deferral of IL to the outpatient setting without increased aspiration-related complications. We purport that the presence or absence of aspiration during functional endoscopic evaluation of swallowing (FEES) assessment is an effective tool in determining the appropriate and safe timing of the IL procedure.

2. Materials and methods

A retrospective chart review was undertaken for patients diagnosed with UVFI between January 1, 2014 and January 1, 2016 at an academic cancer center. Institutional review board approval was granted by Fox Chase Cancer Center for abstraction of data. UVFI was confirmed via flexible laryngoscopic examination by an attending otolaryngologist, and those patients who underwent consideration for IL were included in this study. The degree of aspiration/penetration was characterized by speech pathology using functional endoscopic evaluation of swallowing (FEES) and scored using the Dysphagia Outcome and Severity Scale (DOSS), which is a 7-point scale used to rate the functional severity of dysphagia based on objective assessment, where 7 reflects ability for normal oral intake and 1 reflects recommendation for strict nil per os [7]. Patients were grouped into either an unsafe swallow group (aspiration or penetration that was unable to be controlled via diet or postural compensation) or a safe swallow group (aspiration or penetration either absent or controlled via diet or postural compensation) based on FEES. Within the safe swallow group, a distinction was made between those who received IL as an outpatient, and those for whom IL was not performed. Pneumonia rates, diet and behavioral modifications, and subjective perception of voice and swallow were recorded and compared between groups. A paired samples *t*-test was used to compare DOSS scores at the time of UVFI diagnosis and at initial follow up following IL in the unsafe and safe swallow groups. DOSS scores for the patient group for whom IL was deferred were analyzed by using the paired *t*-test to compare DOSS score at the time of diagnosis to DOSS score at the time of first follow up. Patients who were lost to follow-up or had incomplete pre- and post-injection data were excluded from the study.

3. Results

24 patients met inclusion criteria for the study. Descriptive data including age, gender, side of UVFI, and etiology of UVFI are detailed in Table 1.

Table 1
Patient descriptive data (n = 24).

Patient characteristics		% (n)
Age in years, median (range)		68 (35–91)
Gender	Female	50% (12)
	Male	50% (12)
Laterality of paralysis	Left	87.5% (21)
	Right	12.5% (3)
Etiology	Surgery	70.8% (17)
	Locoregional malignancy	25% (6)
	Metastatic invasion	4.2% (1)
Diagnostic interval[a], median (days)	Unsafe swallow	2.0
	Safe swallow	61.5
	Deferred injection laryngoplasty	30

[a] Diagnostic interval refers to the time interval in days from diagnosis of unilateral vocal fold immobility to injection laryngoplasty (for safe and unsafe swallow groups) or to first follow up visit (for deferred injection laryngoplasty group).

3.1. Group 1 – unsafe swallow injection group

There were 7 patients included in the unsafe swallow group with a mean ± SD pre-IL DOSS score of 2.1 ± 1.5. There was a statistically significant improvement in mean DOSS score at the first post-injection follow up visit corresponding to 5.1 ± 1.6 ($p = 0.002$) (Fig. 1). 4 out of 7 (57.1%) patients in this group were diagnosed with pneumonia (PNA) prior to injection, with only 1 out of 7 (14.3%) presenting with persistent PNA at their first follow up visit. Subsequent speech evaluation also revealed improvement in vocal quality, specifically noting decreased breathiness, increased loudness, and increased maximum phonation time (MPT) in all patients.

3.2. Group 2 – safe swallow injection group

12 patients were included in this group with a mean ± SD pre-IL DOSS score of 5.4 ± 0.67. As in the unsafe swallow group, a statistically significant improvement in DOSS score was noted following injection laryngoplasty, corresponding to 6.4 ± 0.90 ($p = 0.015$) (Fig. 1). No patients in this group were diagnosed with PNA prior to undergoing injection laryngoplasty. Of note, one patient in this group did develop PNA following IL, however this patient underwent a subsequent thoracic procedure which was thought to contribute to the development of PNA. Subjective improvement of vocal quality was also noted in all but one patient in this group, with improvements in breathiness, loudness, and MPT.

3.3. Group 3 – no injection performed

5 patients diagnosed with UVFI declined injection laryngoplasty; in all cases this was due to patient preference. The mean ± SD pre-IL DOSS score in this group was 5.4 ± 0.55. In contrast to the previous two groups, no statistically significant improvement in DOSS score was noted within the follow up period, corresponding to 5.8 ± 0.84 ($p = 0.178$) (Fig. 1). No patients were diagnosed with PNA during the mean follow up period for this group. The majority of patients in this group also reported diminished vocal quality, citing a rough, breathy quality, decreased loudness, and decreased cough strength.

4. Discussion

UVFI has been recognized as a relatively common complication in patients with head & neck and thoracic malignancies, particularly following thoracic surgical procedures [8]. While there is certainly a consensus that patients diagnosed with UVFI are at an increased risk for pulmonary complication, the role and appropriate time window for medialization procedures in rehabilitation of swallow dysfunction for these patients is less clear [9]. While improvement in the glottic valve should improve airway protection, there is little in the literature to guide decision-making surrounding appropriate patient selection and timing.

Advances in technique and injectable materials have allowed for the safe and efficacious performance of vocal fold augmentation via IL at bedside for inpatients, or in the office for outpatients [10]. Though seemingly readily available, several factors complicate the decision to perform expeditious vocal fold medialization in these patients. These include severity of the patient's symptoms, presence of active pulmonary infection, perioperative fluid management issues, medical comorbidities, and reluctance of the patient to consent to further surgical procedures [8].

Several studies have examined the timing of injection laryngoplasty in patients with UVFI as it relates to specific patient outcomes or the need for laryngeal framework surgery in the future, though none of these investigations comment on swallow safety at the time of UVFI diagnosis. Bhattacharyya et al. compared rates of PNA and patient length of stay (LOS) between patients diagnosed with UVFI who underwent