



Research Paper

# Injection medialization laryngoplasty improves dysphagia in patients with unilateral vocal fold immobility

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## KEYWORDS

Unilateral vocal fold immobility;  
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**Abstract** *Objective:* To assess patient reported swallowing outcomes before and after injection medialization laryngoplasty in patients with unilateral vocal fold immobility (UVFI).

*Methods:* Case series with chart review of patients with UVFI who underwent injection medialization laryngoplasty at a community laryngology practice by a single clinician between October 2015 and December 2017. Patient-reported validated surveys of swallowing impairment, Eating Assessment Tool (EAT-10), demographics, etiology and duration of symptoms were recorded before and after injection. A paired *t* test was done on EAT-10 surveys before and after IML to assess for statistical significance.

*Results:* Twenty-one patients with UVFI and glottic insufficiency underwent IML between October 2015 and December 2017. Nineteen of 21 patients (90%) presented with dysphagia (EAT-10  $\geq 3$ ). 76% of patients with dysphagia reported improvement in swallowing function after IML. The EAT-10 scores of UVFI patients with dysphagia before and after IML were  $17.0 \pm 14.0$  and  $4.2 \pm 9.6$ , respectively ( $p = 0.004$ ).

*Conclusions:* Nearly all patients with UVFI and glottic insufficiency report associated dysphagia. Three fourths of these patients perceive improvement in their swallowing function after injection medialization laryngoplasty. Patients with idiopathic UVFI may have a more sustained improvement and those with severe preop dysphagia may not benefit. Further research is necessary to refine patient selection and to assess duration of improved swallowing function.

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## Introduction

Unilateral vocal fold immobility (UVFI) is the most common neurologic disorder affecting the larynx.<sup>1,2</sup> Etiologies of UVFI include iatrogenic recurrent laryngeal nerve (RLN) injury, tumors compressing or infiltrating the RLN along its course, mediastinal processes that stretch or compress the RLN, infections, neuromuscular diseases, as well as idiopathic causes. Idiopathic cases comprise about 24% of patients affected by UVFI.<sup>3</sup>

UVFI is a common cause of incomplete glottal closure.<sup>4</sup> Glottal insufficiency impairs swallowing, respiration and phonation.<sup>5,6</sup> Symptoms of glottal insufficiency include a breathy weak voice, reduced cough strength, dysphagia and dyspnea.<sup>4</sup> The detrimental effect of UVFI on phonation has been thoroughly studied whereas the prevalence of dysphagia in patients with UVFI has been addressed less systematically.<sup>4,5,7</sup> Dysphagia has been reported by 60% of patients with UVFI, with 23%–53% of these patients demonstrating aspiration on videofluoroscopy.<sup>1,8</sup>

Both injection medialization laryngoplasty (IML) and type 1 thyroplasty have been shown to be equally efficacious in reducing aspiration with short-term follow up.<sup>2</sup> IML, one of the oldest methods for repositioning of the vocal fold after UVFI, is much simpler and faster.<sup>9</sup> Introduced by Bruennings in 1911, the technique was initially plagued by complications related to the filler material.<sup>9,10</sup> With the development of better fillers and increased clinical experience, IML has gained wide adoption.<sup>11</sup> Awake IML offers the advantages of avoiding general anesthesia and providing the surgeon with direct feedback on glottic closure and voice quality.<sup>7,12,13</sup> The success of IML in repositioning the immobile vocal fold and reestablishing glottic valvular competency has been reported to be over 97% with different injection fillers.<sup>4</sup> The aim of this study is to evaluate the effect of IML on self-reported dysphagia in patients suffering from UVFI with glottic insufficiency in a community laryngology practice.

## Patients and methods

### Patients

After Institutional Review Board approval, a retrospective chart review was performed of all patients with UVFI and glottic insufficiency who underwent injection medialization laryngoplasty by the senior author between October 2015 and December 2017. Patients who did not follow up after IML were excluded. Impairment of swallowing and voice was determined using the validated EAT-10 and Voice-Related Quality of Life (V-RQOL) survey scores respectively, reported by patients preoperatively and on each successive visit.<sup>14,15</sup> Self-reported dysphagia was defined as

an EAT-10 score  $\geq 3$ .<sup>14</sup> Patient demographics, etiology of UVFI, type and amount of filler-material injected, duration of symptoms before IML, and duration between IML and last follow-up were recorded for each patient.

Patients were counselled that the principle goal of injection medialization laryngoplasty was to improve their voice but that their swallowing may also improve. Patients underwent either awake transoral IML or IML under general anesthesia if the awake procedure was not tolerated. Awake transoral IML was performed under indirect magnified laryngoscopy using a 70-degree telescope as previously described.<sup>7,12</sup> IML under general anesthesia was performed after suspension microlaryngoscopy. Injectable filler materials used were carboxymethyl cellulose (CMC) or calcium hydroxyapatite (CaHA) [Merz Neurosciences, Raleigh, NC]. The choice of filler material used was influenced by the duration of vocal fold immobility, the patient's ability to withstand additional IML or transcervical medialization procedures due to medical comorbidities, and patient preference. The amount of filler material injected was commensurate with the glottic gap seen with phonation.

### Statistical analysis

The main outcome measure was change in the self-reported EAT-10 score. The secondary outcome measure was the difference in the self-reported V-RQOL score. Paired Student's *t* test was used to analyze the scores from the EAT-10 and V-RQOL surveys, completed by patients before and after intervention. Statistical significance was determined a priori as  $p < 0.05$ .

## Results

Twenty-one patients with UVFI and glottic insufficiency who underwent IML were identified. The average age was 68 years (range 56–80 years). Ten patients were female (48%). All patients reported characteristic symptoms of UVFI and glottic insufficiency at onset including a breathy weak voice, weak cough, and choking with thin liquids. Nineteen patients (90%) had an EAT-10 score  $\geq 3$ . The etiology of UVFI was idiopathic in 11 patients (52%), iatrogenic in 7 patients (33%) and malignancy in 3 patients (15%). The median time from onset of symptoms to treatment was 4 months (range 1–600 months). For 71% of the patients, the mean time from symptom onset to treatment was 3.7 months. The shortest time between symptom onset and treatment was 1 month for a patient who immediately presented to the hospital within couple of weeks of symptoms. The longest time to treatment was 50 years for a patient who underwent a carotid body tumor removal in 1967.

Twenty patients (95%) underwent awake transoral IML. The injected filler material was CaHA in 10 patients (48%)

and CMC in 11 patients (52%). The amount of injected filler material used was  $(0.71 \pm 0.22)$  ml. The mean time to last follow-up after IML was 5.2 months. The median time to last follow-up was 1.5 months (range 0.5–24 months) after IML. For patients injected with CMC, the last follow-up ranged from 2 weeks to 10 months after IML.

Of the nineteen patients who presented with self-reported dysphagia ( $\text{EAT-10} \geq 3$ ), 2 were lost to follow up and were excluded. Of the remaining 17 patients, thirteen (76%) reported improvement after IML. The mean EAT-10 score before IML was  $17.0 \pm 14.0$  and  $4.2 \pm 9.6$  after IML ( $p = 0.004$ ). The mean V-RQOL score before IML was  $44.0 \pm 19.0$  and  $91.0 \pm 8.2$  after IML ( $p = 0.0002$ ).

Four patients with dysphagia did not have any improvement in their swallowing function after IML. Of these, one underwent adduction arytenopexy and medialization thyroplasty with Gore-Tex. The remaining three did not undergo additional laryngeal procedures.

## Discussion

Dysphagia is a common symptom associated with unilateral vocal fold immobility, and is reported by up to 60% of these patients. In this retrospective pilot study, IML which was done primarily to improve voice resulted in significant improvement in the associated self-reported swallowing impairment. In most previous research on this subject, the time from onset of symptoms to evaluation for treatment is either not explicitly stated or often greater than 6 months.<sup>4,5</sup> This study is unique in that more than two-thirds of the patients with UVFI were evaluated for treatment within 3 months of symptom onset, and the median time to treatment for all patients was 4 months from symptom onset. Additionally, 90% of patients in this study had presenting symptoms which included dysphagia as defined by an  $\text{EAT-10} \geq 3$ , whereas previous studies reported dysphagia in only 50%–60% of patients.<sup>4,5,14</sup> This is likely related to the earlier evaluation of our patients and the strict definition used. Of note, all patients in this study reported some degree of dysphagia at the onset of their dysphonia, with 10% of patients having resolved the dysphagia but still had persistent dysphonia.

Previous research on this topic has been primarily done in tertiary care centers where iatrogenic causes of UVFI make up a significant proportion of the patient cohort.<sup>4,5,16</sup> In contrast, over half of the patients in this study presented with idiopathic UVFI. Seventy-eight percent of patients with idiopathic UVFI presented with clinically significant dysphagia ( $\text{EAT-10}$  was  $15.0 \pm 13.0$ ). Although about two-third of patients with idiopathic UVFI recover vocal function within 6 months, recovery of swallowing deficit in this population remains largely unknown.<sup>17</sup>

Although there may be no improved prospect for neural recovery in idiopathic UVFI patients who undergo injection medialization, these patients do benefit from IML for symptom improvement.<sup>7,12,17</sup> In this study, all patients with idiopathic UVFI and glottic insufficiency had improvement in their dysphagia with IML. The majority of patients with idiopathic UVFI were injected with CMC for symptomatic relief with the understanding that they may require additional procedures at a later point, based upon their

symptoms. Eighty percent of patients with idiopathic UVFI who underwent IML with CMC had persistent symptomatic relief of their dysphagia at last follow up,  $7 \pm 3$  months, well beyond the residence time of CMC within tissues.<sup>11</sup> It is likely that these patients fall into the idiopathic group which recovers symptomatically.<sup>17</sup> A subgroup analysis of the data based on etiology of UVFI could not be done due to the small number.

Though failures in voice rehabilitation after medialization laryngoplasty are often attributed to persistent posterior glottic gaps, their effect and that of corrective arytenoid repositioning procedures on dysphagia have not been well quantified.<sup>18</sup> Seventy-six percent of patients with UVFI from all etiologies in this study had improvement in their dysphagia after IML with a mean reduction in EAT-10 scores of 13. Of the four patients who failed to derive any swallowing improvement, one had a large posterior glottic gap compromising glottic valvular competency. This patient went on to undergo adduction arytenopexy and medialization laryngoplasty, with marked improvement in their symptoms ( $\text{EAT-10}$  was 28 preoperatively,  $\text{EAT-10}$  was 0 postoperatively).<sup>19</sup>

The remaining 3 patients whose swallowing function failed to improve after IML had moderate to severe oropharyngeal dysphagia as noted on preoperative video fluoroscopic studies. One patient had multiple strokes that resulted in baseline dysphagia before undergoing carotid endarterectomy that resulted in UVFI and worsened dysphagia. Another patient had a high-vagal injury from a meningioma resection which was known to result in more significant swallowing dysfunction than distal recurrent laryngeal nerve injuries.<sup>18</sup> The final patient was 93 years old and gastrostomy-dependent months before undergoing IML. The significant neurological deficits in these three patients likely impaired their swallowing to such an extent that reestablishing glottic valvular competency and improving glottic closing pressures was insufficient to counteract the profound pharyngeal weakness accompanying the UVFI.<sup>4,5</sup> Future investigations with a larger number of patients with UVFI and dysphagia treated with IML would help determine preoperative parameters including EAT-10 scores that are predictive of better outcomes and facilitate preoperative counselling.

While currently used injection filler materials are not permanent, patients with UVFI continue to be at risk for dysphagia and aspiration. Because the primary goal of IML in our study was vocal improvement, the choice of CMC, which has an average residence time of 2 months, as an injection material was driven by patient preference and their ability to potentially tolerate framework surgery at a later point. The subset of patients injected with CMC who had follow-up beyond 1 month and continued to derive symptomatic improvement after IML all had idiopathic UVFI. These patients likely recovered glottic competency without regaining vocal cord motion following the natural history of the disease process.<sup>17</sup>

There were several limitations of this study including those inherent to retrospective studies of infrequent clinical pathology. The small number of patients who met inclusion criteria did not allow a sub-group analysis based on etiology of UVFI to be statistically sound. Lack of reliable long-term follow up also impaired ability to assess any

lasting effect on swallowing function after IML. A larger sample size would be best suited to examine dysphagia in patients with idiopathic UVFI. Additionally, a larger study population would allow investigation of different injection filler materials and their efficacy in treatment of dysphagia in UVFI. However, distinctive patient characteristics distinguish this study which adds to the growing body of literature investigating the effect of medialization laryngoplasty on swallowing function in patients with UVFI.

## Conclusions

Nearly all patients with UVFI and glottic insufficiency report associated dysphagia. Three fourths of these patients perceive improvement in their swallowing function after injection medialization laryngoplasty. Patients with idiopathic UVFI may have a more sustained improvement beyond the residence time of the injectable. Patients with large posterior glottic gaps or severe pharyngeal dysphagia may not achieve any benefit to swallowing from IML. A larger study with longer follow-up would be invaluable to confirm these findings and to determine preoperative parameters that are predictive of improved swallowing after IML.

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None.

## Conflicts of interest

The authors have no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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