Office-Based Vocal Fold Injection With the Laryngeal Introducer Technique

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**Objectives/Hypothesis:** There are numerous techniques for awake laryngeal injection, each with its limitations and technical challenges. We demonstrate a modification to the thyrohyoid approach for injection that stabilizes needle introduction and allows for consistent placement in a wide variety of larynges.

**Study Design:** Retrospective review at a tertiary care institution.

**Methods:** A retrospective review was performed of the charts for patients consecutively undergoing awake vocal fold injection laryngoplasty in 2013 for glottic insufficiency due to unilateral vocal fold paralysis, vocal fold atrophy, or sulcus vocalis using the laryngeal introducer technique. The consistency of needle placement, ease of technique, and patient tolerance was assessed. The technique utilizes a curved 1.5-inch 18-gauge needle as a laryngeal introducer through the thyroid notch. Laryngeal injection augmentation is then performed using a curved 3.5-inch 25-gauge spinal needle through the introducer.

**Results:** Twenty-one patients were identified who underwent awake vocal fold injection laryngoplasty for glottic insufficiency. All 21 injections were successfully placed. Five of seven injections attempted by resident physicians were able to be completed without attending assistance. Patient experience data demonstrated good tolerance, with a preference for the awake procedure as compared to that performed under general anesthesia.

**Conclusions:** The laryngeal introducer technique is a novel way of performing awake laryngeal injections. It provides a high rate of success, the ability to be consistently performed by inexperienced clinicians, and is well tolerated by patients.

**Key Words:** Vocal fold injection, injection laryngoplasty, office-based, awake procedures, vocal folds, thyrohyoid approach, laryngeal introducer, laryngeal injection.

**Level of Evidence:** 4.

**INTRODUCTION**

Over the past century, injection laryngoplasty has become increasingly more common in the treatment of glottic insufficiency. Since its introduction by Wilhelm Brunings in the early 20th century, the injection technique has been continuously modified and improved. In 1985, an awake transcervical technique was introduced by Paul Ward. This technique allowed the procedure to be performed in the clinic space, offering a more cost-effective alternative that avoided the potential complications of general anesthesia.

At this time, there are four commonly used approaches for office-based injection laryngoplasty in the awake patient: transoral, transcricothyroid, transcartilaginous, and transthyrohyoid. All of these techniques require concurrent visualization with indirect endoscopy of the vocal folds during the injection.

The transoral technique using a curved laryngeal injection needle allows good visualization of needle placement. However, the most significant difficulty encountered is the patient’s ability to tolerate the procedure when a pronounced gag reflex is present. The three transcutaneous approaches to injection-needle placement significantly reduce the potential for gagging and can be technically easier to learn.

The transcricothyroid approach typically does not allow “direct” visualization of the needle placement due to its subglottic trajectory into the underside of the vocal fold or through the paraglottic soft tissues. As a result, precise placement of the needle tip is more difficult to obtain and can require a significant level of experience.

The transcartilaginous approach involves accessing the vocal fold directly through the thyroid cartilage. The needle traverses a shorter distance, and the location of the injection is easier to control. However, this technique is difficult in older patients because ossification of the thyroid cartilage limits needle penetration and can increase patient discomfort during placement.

The fourth approach used for injection laryngoplasty is the transcervical–thyrohyoid approach. The Transcervical–transthyrohyoid approach in the awake unsedated patient was first described by Getz et al. in
then performed using a curved smaller-diameter spinal needle inserted through the introducer (Fig. 1).

This study was performed to demonstrate the feasibility of the laryngeal introducer technique for awake injection laryngoplasty. We hypothesized that it could be successfully and safely performed in patients with glottic insufficiency with good patient tolerance. Secondarily, we believed that its procedural advantages would allow it to be performed by inexperienced resident physicians with a high rate of success.

MATERIALS AND METHODS

Patients and Data

Approval was obtained for this study from the Institutional Review Board at the University of Colorado School of Medicine. We retrospectively reviewed the charts of sequential patients who underwent awake injection laryngoplasty using the laryngeal introducer technique for glottic insufficiency from April, 2013, through October, 2013, at the University of Colorado Hospital. All procedures were performed by the first author (M.S. Clary) in the clinic setting using a KayPENTAX VNL-1070STK chip tip flexible nasolaryngoscope (KayPENTAX, Montvale, NJ) or at the bedside in the inpatient hospital using a Storz 11101 RP2 fiberscope with video tower (Karl Storz Endoscopy, El Segundo, CA). Twenty-one patients were identified who met our criteria.

From the medical records, patient information was gathered, including patient demographics, indication for procedure, type of procedure, and resident participation. Next, information was gathered from the postprocedure questionnaire completed at the end of all of the awake procedures performed by the first author (M.S. Clary). The questionnaire is a modification of that used by Sung et al, as reported in “Single-Operator Flexible Nasolaryngoscopy-Guided Transthyrohyoid Vocal Fold Injections.” The questions “If you were required to have this procedure again, would you prefer it awake or in the operating room?” and “What was the worst aspect of the procedure?” were added. The questionnaire gathers details about the patient’s discomfort related to the procedure, as well as whether the patient would have the procedure done again in a similar manner. A successful procedure was defined as adequate injection of the augmentation agent to permit a subjectively improved voice and vocal fold appearance, as determined by the performing surgeon at the completion of the procedure. Statistical analysis was then performed on the collected data.

Laryngeal Introducer Technique

Preparation. The laryngeal introducer and the spinal needle through which the injection laryngoplasty will be carried out are prepared in advance of the procedure. The introducer needle consists of a 1.5-inch 18-gauge needle with the safety mechanism removed. A gentle curve is placed in this needle with the bevel placed in the direction of the curve. The 3.5-inch 25-gauge spinal needle is also bent with a gentle curve. The terminal 5 mm of the spinal needle is then colored with a sterile marking pen to assist with depth placement in the vocal fold. The spinal needle is then passed through the introducer needle in advance of the procedure to ensure that the curve on the introducer needle is not too steep.

Procedure in detail. The patient’s nasal cavity is topicalized with a 50/50 mixture of 0.05% oxymetazoline and 1% lidocaine without epinephrine. Throughout the remainder of the procedure, 2% lidocaine without epinephrine is used for

2005. It was further popularized by Amin, who demonstrated its efficacy in vocal fold augmentation. This approach allows “direct” visualization of needle placement into the vocal fold, is generally well tolerated by patients, and is a technically more simple approach. The disadvantages of this technique include: inability to access the anterior vocal fold in small larynges, inability to access the posterior vocal fold in large larynges, difficulty passing the needle through a calcified thyrohyoid membrane, and the potential need to pass a needle multiple times into the larynx. Despite its conceptual ease, it still can be technically challenging to perform, especially by operators who perform this technique infrequently or who lack experience. As a result of these drawbacks, there have been multiple attempts at modifying this approach to facilitate injection.

In 2012, Ackhar et al. described altering the needle with a double bend while using a transcervical– transthyrohyoid approach. Two 45-degree bends are placed in the needle, one at the hub and the other approximately 1 cm from the needle tip. These bends allow improved access to the medial and anterior surfaces of the vocal folds. Furthermore, the second bend of the needle, which can be altered, helps the proceduralist obtain the optimal depth of injection. There still are limitations with this modification; specifically limited efficacy in large larynges due to needle length and difficulty with calcified thyrohyoid membranes, as well some complexity advancing a sharply bent needle through the neck tissues.

Given the limitations of the existing awake injection laryngoplasty techniques, we sought to develop a technique that would decrease patient-related limitations while increasing the technical ease of the procedure to allow operators who perform this technique infrequently to perform it effectively and safely. The laryngeal introducer technique for injection laryngoplasty was developed to incorporate the strengths of the existing techniques. It employs a curved large-bore needle as a “laryngeal introducer” through a transcervical–transthyrohyoid approach. The injection augmentation is

![Fig. 1. Needles used for performing laryngeal introducer technique. [Color figure can be viewed in the online issue, which is available at www.laryngoscope.com.]](image-url)
is then removed from the neck, and the procedure is complete.

is removed from the vocal fold. The laryngeal introducer needle
and injection is then performed accordingly. The spinal needle
into the vocal fold using the terminal marking as a depth guide,
anteriorly or posteriorly. The spinal needle is then advanced
needle can be advanced or retracted to facilitate placement
laterally or medially, whereas the spinal
ment of the spinal needle. The introducer needle can be rotated
airway (Fig. 2). The introducer needle and the spinal needle
previously bent 3.5-inch 25-gauge spinal needle. The spinal nee-
dle is then inserted through the introducer needle and into the
preparation can be removed and the introducer remains in place.

Once the introducer needle is placed into the endolarynx,
approximately 2 mL of lidocaine are slowly dripped onto the
vocal folds using a laryngeal gargle technique. Once adequate
anesthesia is achieved, the 5-mL syringe can be reconnected to the introducer
needle, and additional lidocaine can be applied as needed for
patient comfort. Stroboscopy can be performed with the intro-
ducer needle still in place. If greater augmentation is desired,
the spinal needle can be replaced through the introducer needle
and injection is repeated.

**DISCUSSION**

This study supports that the laryngeal introducer

**RESULTS**

Twenty-one injection laryngoplasties using the
laryngeal introducer technique were attempted during the
study period, with all being completed successfully—
as deemed by the primary surgeon based on subjective
improvement in patient voice and vocal fold position.
Twenty procedures were with Radiesse Voice Gel and
one procedure was with Radiesse Voice (Merz Aesthetics
Inc., San Mateo, CA). Seventeen procedures were unilateral
(13 left-sided, 4 right-sided) injections and four
procedures were bilateral injections. There were 17 males
and four females included, with an average age of 58.1
years (range 21–78 years). The causes of glottic insuffi-
ciency were: paralysis in 14 patients, atrophy in five
patients, and sulcus deformity in two patients. Seven
procedures were attempted by resident surgeons, with
five being successfully performed without assistance
from the attending surgeon. The two unsuccessful resi-
dent attempts were due to difficulty identifying the thy-
rohyoid space properly and attempting needle placement
through the cricothyroid membrane. There were no com-
lications other than the difficulties encountered by the
resident physicians.

Nineteen of the 21 patients completed the post-pro-
cedure questionnaire. Two questionnaires were not com-
pleted due to logistical reasons. The average overall
discomfort during the procedure was 4.53 ± 1.82 (scale
from 1–10, with 10 being the worst), decreasing to
2.58 ± 1.60 immediately after completion. The average
nasal discomfort during the procedure was 2.74 ± 1.80,
whereas throat discomfort during the procedure was
reported as 3.74 ± 2.05. The sensation of gagging was
reported by seven of 19 patients (36.8%). Seventeen of
19 patients (89.5%) stated that they would repeat the
procedure if needed. Four of 19 patients (21.1%), how-
ever, would prefer the procedure performed under gen-
eral anesthesia to being awake. Of the four patients
preferring general anesthesia, they stated that the worst
aspects of the procedure were the endoscope in the nose,
the laryngeal gargle, gagging, and the expansion of the
vocal fold during injection, respectively. Overall, the
most uncomfortable parts of the procedure were cited to
be the actual expansion of the vocal fold during injection
by five patients, the endoscope in the nose by five
patients, the endoscope in the throat by four patients,
and the laryngeal gargle by two patients.

**Intraprocedure adjustments.** Throughout the pro-
cedure, the 5-mL syringe can be reconnected to the introducer
needle, and additional lidocaine can be applied as needed for
patient comfort. Stroboscopy can be performed with the intro-
ducer needle still in place. If greater augmentation is desired,
the spinal needle can be replaced through the introducer needle
and injection is repeated.
recorded by postprocedure questionnaires and a willingness to repeat the procedure 89% of the time if needed. Resident physicians were able to perform the procedure successfully 71.4% of the time.

The high success rate can be explained by the technique’s ability to circumvent many of the shortcomings of current widely employed techniques. Use of the laryngeal introducer requires puncture of the laryngeal mucosa only once, reducing the risk of bleeding and patient discomfort. Along with the added ability for the patient to cough and swallow with the introducer in place, this leads to improved visibility during the procedure. The gentle bend of the laryngeal introducer needle facilitates ease of insertion while allowing access to the anterior vocal fold. Insertion of the 3.5-inch spinal needle through the introducer needle, with its added length, provides access to the posterior larynx even in large larynges. The ability to manipulate the introducer needle independently of the injection needle provides access to the entire larynx under “direct” visualization of the needle tip. The use of an 18-gauge needle for the laryngeal introducer provides increased rigidity during insertion. The insertion of a 25-gauge spinal needle through the introducer for the actual injection allows placement of injectables with a wide range of viscosities while also minimizing trauma to the vocal fold.

Patient experience, as assessed by the post-procedure questionnaire, suggests good patient tolerance. The average reported overall, nasal, throat, and post-procedure discomfort values (4.53, 2.74, 3.74, and 2.58, respectively) are all comparable with the similar data collected by Sung et al. using the double-bend technique with a 25-gauge needle using a transthyrohyoid approach (4.38, 2.44, 4.38, and 2.31, respectively).9 Gagging was reported to be an issue in seven of 19 patients (36.8%), which also is similar to 31.2% in the Sung series.9 This is reassuring given the large size of the laryngeal introducer needle (18-gauge vs. 25-gauge) and the assumption that its laryngeal insertion would be less comfortable than smaller needles used to perform injection laryngoplasty. This is reinforced by the fact that no patient complained of the laryngeal introducer insertion as the worst part of the procedure. It is perhaps surprising that nine of 19 patients (47.4%) stated that endoscope-related discomfort was the most unpleasant part of the procedure.

Awake injection laryngoplasty procedures can be challenging and can have a steep learning curve for proceduralists who perform this technique infrequently or who lacks experience. We attempted to assess the ability of inexperienced resident surgeons to perform this procedure as a proxy for the ease by which to learn and perform the procedure. Five of seven resident-attempted injection laryngoplasties were successful. The two procedures that required attending completion were a result of difficulty finding the appropriate anterior neck landmarks, which is independent of the percutaneous method used.

There are multiple shortcomings of this retrospective study—and correspondingly multiple areas for future investigation. The retrospective nature of this study did not permit the desired sample size nor population heterogeneity; there were only 21 procedures performed and only four female larynges in the study. Thus, it is more challenging to confidently verify the technique’s versatility. This study also made no assessment of the quality of the injection as compared to other techniques. It would be useful to assess the learning curve in a larger population of residents. The small sample size was impacted by the relatively recent development of the technique, as well as patient specific factors. Lastly, this study investigated the use of the laryngeal introducer technique for injection laryngoplasty alone. Evaluation of this technique for other forms of laryngeal procedures will ultimately be advantageous.

CONCLUSION

The laryngeal introducer technique for awake injection laryngoplasty is a viable alternative to current commonly used techniques. It is well tolerated by patients. It can be successfully performed without many of the limitations of other similar techniques, allowing proceduralists who perform this technique infrequently or who lacks experience to offer this treatment modality to their patients.

BIBLIOGRAPHY