Injection Laryngoplasty for Vocal Fold Paralysis and Glottic Incompetence

Redirecting to: https://medicine.uiowa.edu/iowaprotocols/injection-laryngoplasty-vocal-fold-paralysis-and-glottic-incompetence

return to: Unilateral Laryngeal Paralysis or Vocal Cord Paralysis

or Laryngeal Surgery (Benign Disease) Protocols

see excellent discussion of laryngeal injectables and philosophy for choosing injection laryngoplasty: Injectable substances for injection laryngoplasty

see excellent cadaver dissection delineating relevant anatomy: Laryngeal anatomy for external needle placement

Injection Laryngoplasty for Vocal Cord Paralysis and Glottic Incompetence

see videos

Transnasal fiberoptic injection laryngoplasty for vocal cord paralysis

Transnasal Endoscopic Vocal Fold Augmentation (protocol with video)
Fiberoptic Collagen Injection for Laryngeal Paralysis (video with audio)

Transcutaneous - Percutaneous injection (trans-cricothyroid membrane) with fiberoptic transnasal guidance

Cymetra Injection to Paralyzed Vocal Cord In the Clinic Technical Points for Percutaneous Injection
Transcutaneous (percutaneous transcricothyroid membrane) Injection Laryngoplasty for Vocal Cord Paralysis (room set-up, equipment, video)
Percutaneous collagen injection to left vocal cord (video only)
Injection laryngoplasty difficulties
see also (password protected) Transilluminating Obturator

Transoral injection for vocal cord paralysis and for presbylaryngis

Transoral injection with videostroboscopy
Injection Laryngoplasty for Presbylaryngis
Injection Needle (Merz Aesthetics) for transoral vocal cord injection of Radiesse

Microdirect laryngoscopy with injection laryngoplasty under general anesthesia

Injection Laryngoplasty with Microdirect Laryngoscopy Under General Anesthesia
1. **GENERAL CONSIDERATIONS**

1. a. **Indications**
   i. Symptomatic glottic insufficiency
      1. Laryngeal paralysis or laryngeal paresis in patient whose recovery of vocal cord mobility is uncertain. Most patients receiving injection laryngoplasty currently receive a collagen derivative due to perception that Gelfoam is resorbed within four to six weeks.
      2. Glottic insufficiency with mobile vocal folds (ie, presbylaryngis).
   ii. Symptoms: Dysphonia, dysphagia, poor cough

b. **Contraindications**
   i. Inability to perform direct laryngoscopy.
      1. Unstable cervical spine
      2. Unable to obtain exposure of the larynx (ie, retrognathic).
   ii. May consider other approaches
      1. Percutaneous injection through cricothyroid membrane (see Laryngeal Fat Injection for Vocal Cord Paralysis and Glottic Incompetence protocol)
      2. Transoral injection employing indirect mirror exposure or videostroboscopic exposure of larynx (see Transoral injection with videostroboscopy.)
      3. Transnasal Endoscopic approach.
   iii. May consider alternatives to injection laryngoplasty
      1. **Medialization Laryngoplasty- Type I Thyroplasty with ePTFE (Gore-Tex)**
      2. **Arytenoid Adduction (Combined with Medialization Laryngoplasty through Type I Gore-Tex Thyroplasty)**
         a. According to King et al., patients with a glottic gap of 3 mm or greater on phonation (and/or large posterior glottal gaps) would likely benefit from medialization thyroplasty with or without arytenoid adduction instead of injection laryngoplasty.

iii. **Reinnervation procedures**

iv. **Characteristics of long-term/permanent injectable substances**
    *(Injectable substances for injection laryngoplasty)*
    1. **Calcium hydroxylapatite (Radiesse)**
       a. length of effect: 2-5 yrs
       b. FDA approved
    2. **Teflon**
       a. rarely used
       b. Length of effects: Permanent
       c. disadvantages: irreversible, possible vocal fold stiffness, risk of granuloma formation, tends to migrate
    3. **Autologous fat**
       a. length of effect - years to permanent
       b. advantages: patient’s own tissue, over-correction of defect is rare. exhibits viscoelastic properties
       c. disadvantages: time-consuming, morbidity of fat harvest, cannot be done in office, unpredictable duration

v. **Characteristics of temporary glottic bioimplantables/injectables for augmentation.**
    *(Injectable substances for injection laryngoplasty)*
    1. **Gelfoam**
       a. saline diluted gelatin powder
       b. Lasts 4-6 weeks
    2. **Radiesse Voice Gel:**
       a. FDA approved substance for injection augmentation of vocal folds.
       b. Made of carboxymethylcellulose.
       c. Low risk of allergy.
       d. Lasts 2-3 months.
    3. **Radiesse (calcium hydroxyapatite in carboxymethylcellulose carrier**
    4. **Bovine collagen (Zyderm II)**
       a. Potential for allergic response (approximately 3% of patients), can do skin testing (no longer felt to be necessary)
       b. Lasts 4-6 months
c. Note - personal experience (HTH): first injection with zyderm II often lasts 2-3 months, second injection lasts twice as long as first; third twice as long as second
   i. The persistence of the injection likely depends on many factors including location of injection, size of needle hole (may partially extruded), recipient bed (e.g. irradiated or scarred) and other unknowns.
   ii. A single injection may occasionally last for years and may reflect either the persistence of collagen, ingrowth of new collagen, repositioning of the vocal cord by placement of the collagen, or continued reinnervation with adaptation improving glottic closure.

d. Availability of this product is limited in some areas.

5. Human derived collagen (Cosmoplast, Cosmoderm)
   a. Low risk of allergy
   b. Lasts 4-6 months
   c. Caution in patients with preexisting systemic connective tissue diseases
   d. No trials yet done in larynx

6. Micronized Alloderm (Cymetra)
   a. Low risk of allergy
   b. Lasts 2-12 months
   c. Caution in patients with preexisting systemic connective tissue diseases
   d. Possibility for infectious transmission due to use of cadaveric tissue.
   e. Allergy to gentamicin contraindicates use.
   f. Viscosity makes it difficult to inject through small bore needles. Personal experience - this has lead to difficulty with injections.

7. Hyaluronic acid gels (Restylane, Perlane)
   a. Low risk of allergy
   b. Lasts 4-6 months

8. Teflon
   a. see: Teflon Injection for Laryngeal Paralysis
   b. see: Case Example Teflon Injection for Laryngeal Paralysis 29 year followup

9. 2. PREOPERATIVE PREPARATION

c. Evaluation
   i. Essential for most cases
      1. Speech pathology assessment (see Laryngeal diagnostics protocol)
      2. Videolaryngoscopy with voice recording (see Videostroboscopy protocol)
   ii. Consider for selected cases
      1. Trial of voice therapy
      2. Laryngeal electromyography (see Laryngeal EMG Electromyography protocol)
      3. For potential short term augmentation, Cymetra may be used alternatively. There is literature to show that this can be effective for up to 4 months per injection.
   iii. With history of neck arthritis or neck surgery/injury: Lateral neck radiographs in flexion and extension
   iv. Offer to most patients with dentition: Dental prosthetics evaluation preoperatively to fashion a tailored (custom-made) acrylic dental splint
      1. To prevent dental injury more effectively than the standard plastic "gump"
      2. To patients with difficult exposure in whom the acrylic guard will permit a greater degree of force applied to dentition through "fulcrum laryngoscopy" (see suggested reading "Dental Protection During Rigid Endoscopy")

d. Consent
   i. Describe procedure and expected recovery
      1. Identify that the duration of benefit depends on many factors - see types of injectables above
Identify that voice quality will evolve after the injection. Review risks specific to injectable. Some may refrain from bovine or human collagen injections for religious reasons.

### Potential complications
1. Bleeding, infection, reaction to anesthetic
2. Damage to adjacent structures
   a. Lips, teeth, tongue, larynx from direct laryngoscopy
   b. Hoarseness, airway obstruction, continued dysphagia with aspiration

### 3. NURSING CONSIDERATIONS

e. Room Setup
   i. See Panendoscopy Room Setup
      1. Iowa modified suspension
      2. Audio-visual unit
      3. Microscope with a 400f lens

f. Instrumentation and Equipment
   i. Standard
      1. Arnold-Bruening Intraoral Injection Tray
      2. Direct Laryngoscope Tray
   ii. Special
      1. Bronchoscopy Tray, Adult
      2. Freche Monopolar Probe - Cord Instrument Tray (available only)
      3. Laryngoscope Instrument Tray, Microscopic Direct
      4. Lewy Laryngoscope Holder Tray
      5. Ossoff-Karlan Laryngoscope Instrument Tray (available only)
      6. Tracheotomy Tray (available only)
      7. Neurosurgical cottonoids, 1/2 in x 1/2 in
      8. Storz fiberoptic light cable
      9. Storz telescope, straight forward 0°, 5 mm x 6 7/8 in
      10. Xomed Trice Injection system

g. Medications (specific to nursing)
   i. Gelfoam powder, 1 g
   ii. Sodium chloride, 0.9%, preservative-free, 10 cc (use 4 cc to mix with Gelfoam)
   iii. 4% lidocaine
   iv. Cymetra kit, Zyderm or applicable injection material.

h. Prep and Drape
   i. No prep
   ii. Drape
      1. Head drape
      2. Split sheet

i. Drains and Dressings
   i. None

j. Special Considerations
   i. Instrumentation should be set up prior to induction.
   ii. Tracheotomy Tray and supplies should be available for an emergency tracheotomy.
   iii. Bruening syringe with 22-gauge needle (with a backup syringe in case of malfunction)
   iv. Mix the Gelfoam powder (1 gm) with 4 cc of sterile saline in a sterile specimen container.
      1. Be sure to preload the syringe and needle so as to avoid injecting a large volume of air.
   v. 4% lidocaine in syringe with 25-gauge needle to apply topically to laryngeal surface through laryngoscope after Gelfoam injection to reduce chance of laryngospasm.

### 4. ANESTHETIC CONSIDERATIONS

k. General Anesthesia
   i. Communication with anesthesia staff essential
      1. Oral endotracheal intubation with small (5.5 to 6.0) endotracheal tube (MLT tube = microlaryngeal/tracheal tube)
      2. Short-term paralysis (estimate 5-minute case)
      3. Consideration for alternative methods
         a. Jet anesthesia
         b. Apnea
c. Local anesthesia with sedation (see Local Anesthesia for Rigid Endoscopy protocol)

I. Preoperative Systemic Medications
   i. Glycopyrrolate 0.1 to 0.2 mg IM on call to operating room
      1. The drying effect improves exposure; consider avoiding in patients with xerostomia.
      2. Vagolytic effect
   ii. Consider Decadron 8 to 10 mg IV when IV started to diminish edema.
      1. Contraindications: diabetes, ulcer disease, other
   iii. Anti-staphylococcal antibiotics preoperatively and for 5 days postoperatively

m. Positioning
   i. May be done with head toward anesthesia or rotated 90°
   ii. Head of bed elevated 15° to 30°, neck extended with shoulder roll

5. OPERATIVE PROCEDURES - In OR

   iii. a. Flexible fiberoptic exam performed by surgeon pre-operatively

   iv. b. Expose larynx, usually with a Lindholm laryngoscope. Note: the Lindholm laryngoscope has the benefit of not altering the vocal cords since it sits in the vallecula. Alternatively, the dedo may be used; however it's position in the endolarynx may distort the cords depending on placement.
   c. Warming injection material to room temperature can reduce viscosity and aid in injection. Do not use microscope (it gets in the way).
   i. Consider using rigid telescope connected to video equipment to photograph vocal folds. This exposure permits the injection to be done with full imaging (best for teaching purposes).
   ii. Alternatively, inject through laryngoscope under direct vision.
   e. Employ 22-gauge needle without guard (although guarded tip helps to prevent excessively deep injection into the subglottis; it also precludes full view of the needle tip as it is inserted).
   f. Expose vocal folds with tip of laryngoscope at least 3 mm above the anterior commissure to avoid distorting glottis.
   g. Load Gelfoam into a Luer Lock syringe, rotate end of syringe containing Gelfoam onto the proximal end of the Bruening syringe barrel to fill with Gelfoam and assemble Bruening syringe.
   h. Injection
   i. First injection
      1. Insert the preloaded syringe midway between tip of vocal process and anterior commissure at the point of maximum concavity as determined by preoperative and intraoperative assessment.
      2. Use lateral aspect of needle to push false cord laterally and inject deeply into the paraglottic space medial to ventricle.
   ii. Second injection
      1. Immediately lateral to vocal process of arytenoid.
      2. Designed to rotate vocal process medially, not always successful
      iii. Employing large upbiting forceps with the tips closed, manipulate bolus of Gelfoam in the vocal fold from dorsal direction and medial direction to provide smooth contour to vocal fold.
   i. Spray the vocal folds and supraglottis with 2 to 4 cc of 2% lidocaine to prevent laryngospasm.

6. OPERATIVE PROCEDURES - In clinic: Transnasal Endoscopic Vocal Fold Augmentation:

   a. The indications for transnasal fiberoptic vocal cord injection are the same as for vocal cord injection by the percutaneous or transoral route. In some cases, this technique may be more readily tolerated by patients who would not be candidates for the other injection techniques.
   b. Instruments:
      i. A transnasal endoscope designed for in-office esophagoscopy with an outer diameter of 5.1mm is utilized. Air/water insufflation and suction are available with this instrument but are not required for the
procedure. The injection system that we use is the Microvasive “interject” esophageal sclerotherapy needle. The system is available in 23 or 25 gauge needle sizes.

c. Topical and Nasal Anesthesia
   i. Before introduction of the endoscope, we advocate nasal decongestion with plain farina spray followed several minutes later by administration of atomized 1:1 mixture of 4% lidocaine and oxymetazoline. Lidocaine is a vasodilator and when administered alone can induce nasal congestion. Placement of Afrin (without added anesthetic) as the initial treatment to the nose maximizes the nasal decongestion.
   ii. Pledgets soaked in 4% lidocaine/oxymetazoline may be placed into the nasal cavity for 5-10 minutes to obtain further nasal analgesia and decongestion.
   iii. Topical anesthesia of the vocal folds is obtained by dripping on to the epiglottis and glottic larynx 2-3 mL of 4% lidocaine, delivered under direct visualization through a catheter placed into the endoscope port.

d. Injection
   i. In a clinic suite, the operating endoscope is passed transnasally to view the larynx. The retractable needle and catheter system is passed through the port and is visualized at the tip of the endoscope, a distance of 4cm from the end of the endoscope.
   ii. We recommend injecting lateral to the contact surface of the vocal fold at the greatest area of concavity, deep into the thyroarytenoid muscle under direct visualization. (one surgeon controls the endoscope, and the other surgeon manages the injection needle and catheter).

7. OPERATIVE PROCEDURES - In clinic: Transoral Vocal Fold Augmentation:

e. The indications for transoral vocal cord injection using visualization with indirect mirror are the same as for vocal cord injection by the percutaneous or transnasal route. Patients with a hyperactive gag reflex may not tolerate this procedure well.

f. Instruments:
   i. 1 cc Luer syringe
   ii. 10 cc control syringe
   iii. 4x4 non-sterile gauze
   iv. Butane mirror warmer
   v. Orontracheal injection needle
   vi. Orontracheal applicator (dripper)
   vii. Laryngeal exam mirror, preferably size K8
   viii. Head light or head mirror

g. Topical Anesthesia
   i. Administer 100 mg Tessalon Perle (Benzonatate). Let capsule dissolve in mouth, if patient does not have sufficient saliva production to dissolve capsule, have patient bite into capsule. Have patient gargle and swallow. A second capsule is then administered. After administration of second capsule it is important to move promptly through the rest of the procedure.
   ii. Spray oropharynx with Hurricane spray (20% Benzocaine topical spray)
   iii. Drip 4% Lidocaine topical solution onto cords under visualization with indirect mirror.

h. Injection
   i. Position patient, with patient leaning forward, head tilted up, and tongue out. Have patient grasp tongue out with their own hand and hold in place. Visualize the cords with indirect mirror and inject cord using orotracheal injection needle.
   ii. We recommend injecting lateral to the contact surface of the vocal fold at the greatest area of concavity, deep into the thyroarytenoid muscle under direct visualization.

see videos: Transnasal Endoscopic Vocal Fold Augmentation

8. POSTOPERATIVE CARE
i. Procedure is usually done as outpatient
   i. If there is any question about adequacy of the airway, plan overnight
      observation in hospital.
   ii. Consider evaluating larynx with indirect mirror examination or flexible
        fiberoptic laryngoscope before discharge.

j. Begin oral feedings when alert.
   i. If dysphagia with aspiration was an important component of the
      symptoms preoperatively, consider evaluating with a “cookie
      swallow” (OPMS) before feeding.

k. Continue oral antibiotics for 3 to 7 days.

l. Voice rest
   i. Relative for 2 weeks: Employ arm’s length rule wherein the patient
      does not address a person unless they are within an arm’s length
      away.

m. Follow-up individualized based on symptoms
   i. If dysphagia is a significant component, consider “cookie swallow” on
      postoperative day 1.
   ii. If voice is the only concern, then follow up in 2 weeks; with
       videostroboscopic exam 6 weeks postoperatively.

2. 10. SUGGESTED READING
    a. Hoffman HT. Winters P. Sullivan MS. Gelfoam injection for vocal cord
       paralysis prior to radiation therapy. Ear Nose Throat J. 1991;70:385-386.
       1979;8:647-657.
    d. Olsen GT, Moreano EH, Arcuri MR, Hoffman HT. Dental protection during
    e. Schramm VL, Lavorato AS.: Gelfoam paste injection for vocal cord paralysis:
    f. King J, Simpson B: Modern injection augmentation for glottic insufficiency.
    g. Remacle M, Lawson G: Results with collagen injection into the vocal folds for
    h. Trask D, Shellenberger L, Hoffman HT. Transnasal. Endoscopic Vocal Fold
    i. Damrose EJ. Percutaneous Injection Laryngoplasty in the Management of
       Acute Vocal Fold Paralysis Laryngoscope, 120:1582-1590, 2010