GLOTTAL INCOMPETENCE

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Overview

• Physiology of Voice production
• Diagnosis of Glottal Incompetence
• Causes
• Treatments
Physiology of Voice Production

- **POWER** – ENERGY
  - Infraglottic Vocal Tract (Lungs)

- **OSCILLATOR** – SOUND SOURCE
  - Glottic (Vocal Folds)

- **RESONATOR**
  - Supraglottic Vocal Tract (Throat, Nose, Sinuses, Mouth)

- **All shape sound quality**
Stroboscopy = Foundation

- Representation of vibration
- Sync’d with the freq of voice
- Pseudo slow motion
- Visualize mucosal wave across several cycles of vocalization
  - video documentation
Types of Glottal Incompetence

VF motion deficiencies  VF atrophy

Another day, another talk...Scar, lesions, sulcus
Vocal Fold Atrophy

- Mucus/throat clearing, decr. proj.
- Elliptical closure
- Prominent vocal processes
- VF tone/VF Bulk

Expected 30% US population >65 (2030)
Vocal Fold Atrophy
Vocal Fold Paralysis

- Breathy, dysphagia with thins, dysphonia
- Transglottic closure
- VF tone
- Vertical level mismatch
- Appropriate workup
Vocal Fold Paralysis
Glottic Incompetence - Treatment

- Observation
- Voice therapy – work with what ya got
- Surgical options
  - Temporary
    - VF Injection
  - Permanent
    - VF injection
    - Laryngeal framework surgery
VF Injection

- **Temporary Augmentation - Paralysis**
- **Trial Augmentation – Atrophy**

Ideal Injectable

- Biocompatible
- Safe from transmission of infectious disease
- Matched mechanical property to host location (viscosity)
- Stable (inert)
- Use a fine-gauge needle (24 g or smaller)
- “Off the shelf” (minimal prep)
Vocal fold injection

- **Local/MAC**
  - Endoscopic
  - Office/OR
  - Percutaneous

- **General**
  - MSL
  - Endoscopic
= Superior arcuate line
VF Injection Pearls

- If injection needle is passed parallel to longitudinal axis of laryngoscope, the injection location may be too superficial or medial.
  - Best to angle injection needle lateral to vocal fold

- Retract the False Vocal Fold with the laryngoscope or the injection needle

- Place needle ~4-5 mm deep prior to injection
  - Needle has black mark at 5 mm
VF Injection Material: Present

- Gelfoam
- Collagen
- Carboxymethylcellulose
  - Prolaryn™
- Hyaluronic acid – Restylane, Juvederm
- Calcium hydroxylapatite (CaHA)
  - Prolaryn Plus™
- Fat (autologous)
Gelfoam™

- Gelatin
  - Bovine gelatin, Sterile powder (1 gm)

- Longest track-record of laryngeal injectables
  - 30 years (1970s)
  - #1 injectable, ABEA survey, 2004 (Merati)

- Bottom line
  - Lasts 4 weeks
  - Requires preparation
  - 18g needle
  - Poor vibratory properties
  - Limited use today
Collagen-Based Injectables

- **Cymetra**
  - Micronized cadaveric dermis
  - Prion infection transmission risk?
  - Significant preparation required (hassle)

- **Cosmoplast/Cosmoderm**
  - Human engineered collagen
  - No track record

- **Bottom line**
  - Lasts 2-3 months
Prolaryn

- **3 Basic components**
  - Water (82.3%), Glycerin (14.5%)
  - Carboxymethylcellulose
- **Carboxymethylcellulose**
  - Common food additive
- **Gel carrier for Prolaryn Plus™**
  - FDA approved for VF injection
- **Bottom line**
  - Lasts 1-3 months
Hyaluronic Acid

- Glycosaminoglycan (polysaccharide)
- Found in dermis
- Low tissue reactivity
  - Hypersensitivity 0.6%
- Bottom line
  - Duration: 6-9 months
**Calcium Hydroxylapatite**

- **CaHA** – Long-term, successful solid implant in orthopedics and dentistry

**Prolaryn Plus™**
- Spherules of calcium hydroxylapatite (CaHA)
- Suspended in aqueous-based gel
  - CMC, water, glycerin
  - Voice gel component resorbs
    → over-inject ~10%

- FDA approved for VF injection
- **Bottom line**
  - Lasts 1-2 years
Mild Over Injection

Injection
To Midline
Lipoinjection of the Vocal Fold

- Liposuction or open harvest
- Fat preparation
  - Rinse fat, insulin
- Overinjection by 30-50%
- Unpredictable
Lipoinjection

Pre-injection

Post-injection
VFI Materials

- Gelfoam ~ 1 month
- Cymetra ~ 2-3 months
- CMC (Prolaryn™) ~ 1-3 months
- Hyaluronic acid Gel (Restylane/Juvederm™) ~ 6-9 months
- CaHA (Prolaryn Plus™) ~ 1-2 years
- Fat Permanent
Lipoinjection
Complications

**Injection**
- Hemorrhage
- Aspiration
- Overinjection
- Underinjection
- *Injection misadventure*
  - Wrong location
  - Migration

**Office**
- Vasovagal
- Lidocaine toxicity

**Office = OR**

**MSL/Endoscopic**
- Dental injury
- TMJ injury
- Tongue injury

Sulica et al, Laryngoscope 2010
Misadventure
Laryngeal Framework Surgery

• Medialization Laryngoplasty – “Reversible”
  – Type I Thyroplasty
    • Silastic
    • Gore-Tex™

• Arytenoid adduction – “Irreversible”
Type I Thyroplasty
AKA Medialization Laryngoplasty

c. 1974

- Gold standard
- VFP $\rightarrow$ expect improvement
- Implants
  - Silastic
    - Netterville/block
  - VoCom Hydroxyapatite
  - Gore-tex
  - Titanium
Medialization Laryngoplasty

Skin incision

Thyroid cartilage
Medialization Laryngoplasty

Cricothyroid muscle
Medialization Laryngoplasty

Intra-op monitoring

Localization
Medialization laryngoplasty
Pearls of GoreTex ML

- Must have excellent localization of window
- Implant placement
  - *Posterior* (toward muscle process) & *Inferior* (infraglottis)
- Slight over-correction to compensate for peri-op edema
- Timing - 6-12 months
  - Earlier if LEMG shows severe neuronal degeneration or known transection
  - Delayed if LEMG data is equivocal or favorable
# ML: pros / cons

## BENEFITS

- Improved glottic closure
- Intraoperative monitoring
- Adjustable
- “Reversible”

## COMPLICATIONS

- Implant migration
- Implant extrusion
- Implant misplacement
- Under/over-augmented
- Hematoma/edema → airway compromise
- Possible need for revision
Arytenoid Adduction

- **Indications**
  - Large posterior gap
  - Revisions
  - When ML isn’t enough
  - Unequal vocal fold levels
  - Improve tone?

*FIG. 26. Arytenoid adduction for unilateral vocal cord paralysis, as developed by Isshiki.*
(From *Folia Phoniatica* 1980;32:138.)
Complications
• Piriform sinus injury
• Over/Under correct
• Thyroid cartilage fx

Basically...
• All the time
• Never
• Sometimes
• Adds 2 hrs
• Increased risks
  – Technically challenging
VF Injection vs. Thyroplasty

- Both Treat Bulk and Position
- Open Procedure vs. Minimal Approach
- VFI easier to treat both VF’s
  - Bilateral VF Atrophy (aging)
  - Unilateral VFP and Contralateral VF Atrophy
- More 3-D Control with Thyroplasty
- Material more Stable with Thyroplasty
VF Injection vs. Thyroplasty

• Ease of Revision?
  – Reduce – Thyroplasty
  – Increase – Injection

• Patient Factors
  – Prior Neck Surgery?
  – Anti-Coagulation Status?
  – Prior Radiation Rx?

• Direct vs. Indirect Visualization of Defect
Conclusion

- Important to determine cause of glottal incompetence
- Treatment options vary between diagnoses
Thank You!

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