Treatment of Unilateral Adductor Vocal Cord Paralysis

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Outline

- Anatomy
- Vocal Histology and voice production
- Patient Evaluation
- Non-surgical treatment
- Surgical treatment
Anatomy - Cartilage
Anatomy - Muscles

- Thyroarytenoid
- Posterior Cricoarytenoid
- Lateral Cricoarytenoid
- Interarytenoid
- Cricothyroid
Anatomy - Thyroarytenoid
Anatomy - Posterior cricoarytenoid
Anatomy - Lateral cricoarytenoid
Anatomy - Interarytenoid
Anatomy - Cricothyroid
Vocal Fold - histology

- Vocal folds divided into three layers
  - Epithelial layer
  - Lamina propria
    - Superficial
    - Intermediate
    - Deep
  - Muscular layer
Vocal Fold - histology
Vocal Fold - function

- Cover - Body Theory
  - Cover - composed of epithelial layer and superficial connective tissue layer
  - Body - composed of vocalis muscle
  - Cover stiffness largely altered by the cricoarytenoid and thyroarytenoid (vocalis)
Voice Production

- **Initiation - 3 Steps**
  - Tension develops in cords
  - Adduction of cords to midline
    - Phonatory attack phase
  - Production of airflow from lungs
    - Increased subglottic pressure
Voice Production
Laryngeal Functions

- **Respiration**
  - cough production, increase intrathoracic pressure, valsalva maneuver

- **Degluttition**
  - prevents aspiration

- **Phonation**
  - develops subglottic pressure, modifies air flow
Patient Evaluation

- **History**
  - **Chief Complaint**
    - Hoarseness, breathiness
    - dysphagia, coughing, choking, aspiration, stridor
  - **Onset, duration, variability, past vocal problems**
  - **Medical History**
    - allergies, reflux, life stress, diabetes, medication
  - **Surgical history**
    - head and neck surgery, chest surgery, trauma
Patient Evaluation

- **Vocal**
  - Voice demands
  - Singing
  - Episodes abuse
  - Smoking
  - Water intake
  - Caffeine
  - Environmental irritants
Patient Evaluation

- Physical Exam
  - General head and neck examination
    - Important: neck palpation including thyroid
    - Cranial nerve exam
  - Indirect laryngoscopy
    - Evaluate atrophy, movement of vocal cords
    - Assess anterior and posterior glottic gap with adduction
Patient Evaluation

- **Fiberoptic laryngoscopy**
  - Evaluate running speech
- **Direct laryngoscopy**
  - Rule out arytenoid joint fixation
Patient Evaluation
Vocal Evaluation

- Acoustic Evaluation
  - Initial assessment during history
  - Asses for:
    - Breathiness
    - Hoarseness
    - Wet, gurgling voice
Vocal Evaluation

- Videostrobolaryngoscopy
  - Obtain a dynamic view of the vocal cords
  - Useful for
    - Documentation
    - Patient education
    - Pre and postoperative comparison
Vocal Evaluation

- Electromyography
  - Provides prognostic information
  - Determine paralysis vs. re-innervation
  - Results
    - Fibrillations
    - Uni or polyphasic potentials
    - Normal
Unilateral Vocal Cord Paralysis

- **Etiologies**
  - Neoplasm 35%
  - Surgical 25%
  - Idiopathic 15%
  - Inflammation 12%
  - Central 7%
  - Trauma 6%
Unilateral Vocal Cord Paralysis

- **Specific work-up**
  - Important to palpate arytenoids to rule out joint fixation
  - Chest X-Ray
  - CT scan
    - from skull base to mediastinum
  - MRI
    - preferred for children, pregnant women, and suspected central neurologic abnormality
Treatment

- Important to define patient goals
- Voice therapy
  - Eliminates hyperfunctional compensation
  - Perform appropriate exercises
  - Maximize medical treatment prior to surgical intervention
Surgical Evaluation

- Return of function
- Spontaneous re-innervation
- Assess glottic gap
  - Elliptical vs. Triangular
- Lateral manual compression test
Surgical Evaluation

- Lateral manual compression test
  - To determine if patient will benefit from medialization thyroplasty
  - Pressure applied at level of vocal cords
  - If quality of speech improves with pressure, patient will benefit from procedure
  - Limitations: older patients, scarred vocal cords
Manual Compression Test
Manual Compression Test
Treatment Options

- Vocal fold injection
- Medialization Thyroplasty (Type I)
- Re-innervation
Teflon Injection

- First used in 1950s by Arnold
- Utilized in vocal cord paralysis with no expected recovery in terminally ill
- Permanent
Teflon Injection
Teflon Injection
Teflon Injection

Diagram:
- Thyroid cartilage
- Reinke's space
- Vocal ligament
- Atrophic thyroarytenoid muscle
- Cricoid cartilage

Images A and B
Teflon Injection

- Advantages
  - Inexpensive
  - Topical Anesthesia
  - Immediate voice improvement
Teflon Injection

- Disadvantages:
  - Irreversible
  - Disrupts mucosal wave - stiffening
  - Granuloma formation
  - Airway obstruction
  - Migration
Gelfoam Injection

- Effective in temporarily medializing the vocal folds
- Restores voice and improves aspiration symptoms
- Allows for progressive rehabilitation
- Vocal fold irritation
- Lasts 8 - 10 weeks
Collagen Injection

- Derived from bovine collagen
- Histologically similar to deep lamina propria layer
- Host collagen deposition
- Allergic reaction
Fat Injection

- First used by Brandenburg in 1987
- Effective in temporarily medializing the vocal cord for paralysis
- Used in patients with possible return of function
- Effective vocal fold paralysis and vocal fold bowing
Fat Injection
Fat Injection
Fat Injection

- Well tolerated
- Can repeat injections
- Anterior defects corrected better than posterior
- Effective temporary medialization
- Hypoallergenic
Fat Injections

- Hsiung et al. (12) divided failures into two categories
  - Early
    - failure of fat to soften scarred segments
    - large glottal gap
    - large posterior defect
  - Late
    - due to absorption of fat
Type I Thyroplasty

- Introduced by Isshiki in 1974
- Effective for patients with vocal cord paralysis and bowing
- Contraindicated in patients s/p hemi-laryngectomy and laryngeal irradiation
Type I Thyroplasty
Type I Thyroplasty
Type I Thyroplasty
Type I Thyroplasty
Type I Thyroplasty
Type I Thyroplasty

- Variations
  - Cartilage window
  - Inner perichondrium
  - Implant type
    - Carved
    - Pre-made, Hydroxylapatite
    - Gore-tex
Type I Thyroplasty

Benefits

- Restoration of mucosal wave
- Improved glottic closure
- Intraoperative monitoring
- Adjustable
- Reversible
- Primary vs. Secondary
Type I Thyroplasty

- Complications
  - Poor voice quality
  - Graft extrusion
  - Graft migration
  - Airway compromise
  - Hematoma
  - Infection
Type I Thyroplasty

- Persistent posterior glottic gap
  - Most commonly caused by high vagal injury
  - Not well addressed by traditional thyroplasty
  - Two options
    - Implant with large posterior flange
    - Arytenoid adduction
Type I Thyroplasty
Arytenoid Adduction

- Two main indications
  - Large posterior gap
  - Unequal vocal fold levels
- Improves acoustical power and increases sub-glottic pressure
Arytenoid Adduction
Arytenoid Adduction
Re-innervation

- Indicated for vocal paralysis given
  - Lack of arytenoid fixation
  - Intact ansa cervicalis

- Two different procedures
  - Nerve muscle pedicle
  - Ansa - recurrent laryngeal anastomosis
Re-innervation
Re-innervation

Benefits

- Allows for preservation of vocal cord bulk
- Provides tone to vocal fold
- Used well with medialization procedures
Re-innervation
Re-innervation

Controversies

- Patient selection
  - paralysis vs. synkinesis
- Procedure selection
- Hypoglossal nerve anastomosis