Vocal Cord Medialization
Medialization
Laryngoplasty
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Objectives
- Describe the history of the first treatments for vocal paralysis
- Discuss the epidemiology of vocal cord paralysis
- Identify normal anatomy and physiology of the larynx and distinguish when abnormal findings are present.
- Explain the various methods of treatment for vocal cord paralysis to assist the patient’s decision making.
- Illustrate the nursing care appropriate for the patient to assist them through the continuum of care

Overview
- History of Vocal Cord Paralysis
- Epidemiology
- Anatomy of the Larynx
- Function of the Larynx
- Evaluation of Vocal Cord Paralysis
- Treatment options
- Nursing care

History
- 1855 Garcia presented mirror laryngoscopy
- 1857 Development of laryngology by Czmak & Turck
- 1859 Turck demonstrated VC paralysis
- Late 1800s - In US, Knight & Elsberg described VC paralysis

Vocal cord insufficiency
- Vocal cord paralysis
- Vocal cord paresis
- Vocal cord insufficiency

History
- 1937 - Jacksons described galvanic current application
- 1977 - Zealer et al resurrected concept electrical pacing
- 1911 - Brunings introduced injection techniques
- 1950-1960s - Arnold improved techniques
- 1924 - Ballance introduced reinervation while Tucker and Crumley
- 1915 - Payr introduced medialization framework surgery
- 1970s - Isshiki advanced laryngeal framework work
Causes
- Inadvertent injury during surgery - thyroid, carotid, lung, esophagus, heart or large vessels: RLN, head & neck: SLN
- Complication from endotracheal intubation: RLN
- Blunt neck or chest trauma
- Tumors of the skull base, neck, and chest
- Viral infections - vagus nerve or branches: RLN or SLN
- Central neurological conditions
- Aging
- Medications
- Idiopathic

Etiology

<table>
<thead>
<tr>
<th>Cause</th>
<th>Unilateral %</th>
<th>Bilateral %</th>
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<tbody>
<tr>
<td>Surgery</td>
<td>24</td>
<td>26</td>
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<tr>
<td>Idiopathic</td>
<td>20</td>
<td>13</td>
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<tr>
<td>Malignancy</td>
<td>25</td>
<td>17</td>
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<tr>
<td>Trauma</td>
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<td>Neurologic</td>
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<td>13</td>
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<tr>
<td>Intubation</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
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Signs & Symptoms

- Voice Changes
- Airway problems
- Swallowing problems
- Psychosocial

Signs & Symptoms - voice changes
- Hoarseness - croaky or rough voice
- Breathy voice - airy voice, change in pitch
- Effortful phonation - extra effort on speaking
- Air wasting - excessive air pressure required to produce usual voice
- Diplophonia - voice is like a gargle

Signs & Symptoms - airway problems
- Shortness of breath with exertion
- Stridor - noisy breathing
- Ineffective or poor cough

Signs & Symptoms - swallowing problems
- Choking or coughing when swallowing
- Food sticking in the throat
signs & symptoms - psychosocial
- inability to be heard
- singers or professional speakers
- constant strain
- inability to eat or drink comfortably
- exercise intolerance

anatomy & physiology

Anatomy of the Larynx - Cartilages

Anatomy of the Larynx - Cartilages

Anatomy of Larynx - Muscles

Anatomy of Larynx - Muscles
Function of Larynx
- Passage for Respiration
- Prevents Aspiration
- Allows Phonation
- Allows Stabilization of Thorax

Respiration

Phonation

Vocal Cord Paralysis
Preoperative Evaluation & Treatment

Evaluation – Patient History
- Alcohol and Tobacco Usage
- Voice Abuse
- URI and Allergic Rhinitis
- Reflux
- Neurologic Disorders
- History of Trauma or Surgery
- Systemic Illness – Rheumatoid, diabetes
- Duration – Affects Prognosis

Evaluation – Physical Examination
- Complete Head and Neck Examination
- Flexible Fiberoptic Laryngoscopy
- Adequacy of Airway, Gross Aspiration
- Assess Position of Cords
  - Median, Paramedian, Lateral
  - Posterior Glottic Gap on Phonation
Evaluation - Videostroboscopy
- Demonstrates subtle mucosal motion abnormalities
- Video-documentation (not available online)

Evaluation - Electromyography (LEMG)
- Assesses integrity of laryngeal nerves
- Differentiates denervation from mechanical obstruction of vocal cord movement
- Electrode in Thyroarytenoid and Cricothyroid

Evaluation - Electromyography
- Normal Joint Fixation
- Post. Scar
- Fibrillation
- Denervation
- Polyphasic

Evaluation - Imaging
- Chest X-ray - Screen for intrathoracic lesions
- MRI of Brain - Screen for CNS disorders
- CT Skull Base to Mediastinum
- Direct Laryngoscopy - Palpate arytenoids, especially when no L-EMG
- barium swallow

Evaluation – Unilateral Paralysis
- Preoperative Evaluation
- Speech Therapy
- Assess patient’s vocal requirements
- Do not perform irreversible interventions in patients with possibility of functional return for 6-12 months
- Surgery often not necessary in paramedian positioning

Evaluation – Unilateral Paralysis
- Manual Compression Test
Evaluation – Unilateral Paralysis

- Assess extent of posterior glottic gap
- Consider consenting patient for both anterior and posterior medialization procedures

Management – Unilateral Paralysis

- Local – allows patient to phonate
  - Careful administration of IV sedation
- Internal superior laryngeal nerve block at the thyrohyoid membrane
- Glossopharyngeal nerve block at the inferior pole of the tonsils
- Flexible endoscope allows visualization
- Laryngeal Mask

Management – Unilateral Paralysis

Vocal Cord Injection

- Adds fullness to the vocal cord to help it better appose the other side
- Injection technique is similar regardless of material used
- Injection into thyroarytenoid/vocalis
- Injection can be done endoscopically or percutaneously
- Poor correction of posterior glottic gap

Management – Unilateral Paralysis

Vocal Cord Injection

- External landmarks – several mm anterior to oblique line horizontally, midpoint between thyroid notch and inferior thyroid border vertically

Management – Unilateral Paralysis

Vocal Cord Injection
**Management – Unilateral Paralysis**  
**Vocal Cord Injection**

**Vocal Cord Injection - Materials**
- **Teflon**
- **Fat**
- **Collagen**
  - Autologous Collagen
  - Homologous Micronized Alloderm (Cymetra)
  - Heterologous Bovine Collagen (Zyderm)
- **Hyaluronic Acid**
- Calcium Hydroxyapatite gel (Radiance FN)
- Polydimethylsiloxane gel (Bioplastique)

**Teflon**
- The first biosynthetic material specifically designed for implantation.
- **Advantages**
  - Inexpensive and easily administered
  - Immediate voice improvement
- **Disadvantages:**
  - Irreversible
  - Granuloma formation leads to vocal cord stiffening
  - Migration
  - Useful mainly in terminal patients

**Fat Injection**
- Use first reported by Brandenberg 1987
- Overcorrection is necessary – about 50%
- Resorption in months to years

**Homologous Collagen**
- Cymetra (LifeCell Corp.)
- Micronized Alloderm
- Reconstituted with Lidocaine or Saline
- Lasts 3-6 months
- Requires low volume (~2ml) when placed just deep to the vocal ligaments in the vocalis muscle (varies with dilution)

**Early**
- Failure of fat to soften scarred segments
- Large glottal gap
- Large posterior defect

**Late**
Management – Unilateral Paralysis

Vocal Cord Injections

- Heterologous Collagen
  - **Zyderm**
    - Bovine collagen
    - May cause immune reaction in 1-2% of cases
    - Does not last as long as micronized allogenic
      (Cymetra)

- Autologous Cartilage
- Silastic
- Hydroxyapatite
- Gore-Tex
- Titanium

Management – Unilateral Paralysis

Type I Thyroplasty

- Variety of materials used for implants
  - Autologous Cartilage
  - Silastic
  - Hydroxyapatite
  - Gore-Tex
  - Titanium

- Polydimethylsiloxane gel
  - (Bioplastique; Bioplasty)
  - Widely used in Europe, not approved in U.S.
Management – Unilateral Paralysis
Type I Thyroplasty

Advantages:
- Permanent, but surgically reversible
- No need to remove implant if vocal function returns
- Excellent at closing anterior gap

Disadvantages:
- More invasive
- Poor closure of posterior glottic gap

Gore-Tex
Homopolymer of polytetrafluoroethylene in minute beads in a fine fiber mesh
- Minimal tissue reaction
- Cut into long 3mm wide sheet for use
- Thyrotomy window drilled to 6-8mm long using a 2mm burr 1cm posterior to midline and 3 or 4mm above lower edge of thyroid
- Undeminining of perichondrium 4-5mm posterior and inferior to window prior to insertion
Extrusion/Displacement (Intraoperative vs Postop)
- Misplacement – most often superior
- Infection
- Undercorrection – important to overcorrect by 1-2mm

Controversies
- Location of graft placement
- Status of inner perichondrium

Management – Unilateral Paralysis
Type I Thyroplasty
- Many variations have been proposed to address the posterior gap
- When arytenoid is displaced, the implant is permanent because of scarring in the CA joint
- Hong et al:

Management – Unilateral Paralysis
Type I Thyroplasty – Variations

Management – Unilateral Paralysis
Results
(These movies may not be available online)

Arytenoid Adduction
- First described by Ishiki with modifications by Zeitels and others
- Addresses posterior glottic gap by pulling arytenoid into adducted position
- Difficult to predict which patients will benefit preoperatively.
- Most advocate use in combination with anterior medialization

Management – Unilateral Paralysis
Arytenoid Adduction

Management – Unilateral Paralysis
Arytenoid Adduction
Management – Unilateral Paralysis
Arytenoid Adduction – Modifications
- Endoscopic Approaches
  - Suture Placed to Cricoid Cartilage
    - Simulates action of lateral cricoarytenoid
  - Zeitels Modification – Arytenopexy

Management – Unilateral Paralysis
Reinnervation
- Results in synkynetic tone of vocal cord
  - Ansa to Recurrent Laryngeal Nerve
  - Ansa to Omohyoid to Thyroarytenoid

Conclusions – Key Points
- Anatomy
  - TVC positioned at about ½ vertical height of the anterior thyroid cartilage and is anterior to the oblique line
- Causes of Vocal Cord Paralysis
  - Iatrogenic (Surgery and intubation #1)
- Evaluation

nursing care - pre-operative
- professional occupation
- comorbidities
- medication list
- anxiety level

nursing care - intra-operative
- patient assessment
- procedure scheduled
- laterality, implants
- anesthesia planned

nursing care - post-operative
- airway
- voice rest
- swallowing
- follow up
Questions???

Thank you