Common Adult Voice Disorders:
Treatment and Management

Upon completion of the presentation, attendees should be able to:

• Demonstrate knowledge of common adult vocal pathology.
• Apply behavioral intervention techniques in voice therapy.
• Describe the evaluation and therapy of irritable larynx.

Functions of the Larynx

• Biological – serves to protect the airway. Prevents material from entering the lungs and expel to remove irritants or material

• Phonatory – true vocal folds serves as the sound source. Linguistic features convey the meaning of what we say with intonation, prosody, etc. Suprasegmental patterns of pitch, loudness and resonance are produced at the laryngeal level.

• Emotional – conveys our physical and emotional states. Tension in the larynx affects the vertical height of the larynx. Tension of structures including the tongue, jaw, and pharyngeal area can occur with stress, anxiety or illness. Our mood and affective states are often reflected in the voice.
Larynx Within the Skeletal Framework

Subsystems of Voice Production

Resonance

Phonation

Respiration

Respiration and Voice

- Inspiration is an active process – enlargement of the thorax and lungs
- Expiration is mostly passive – voicing extends the expiratory phase allowing for voicing and the amount of air pressure used when producing voice largely determines the intensity of the voice
- 4-5 cm/H2O is required for conversational speech
- Both inspiratory and expiratory muscles provide the power for voicing.
Mid-sagittal View of the Laryngeal Area


Structures of the Larynx

<table>
<thead>
<tr>
<th>Muscles</th>
<th>Cartilages</th>
<th>Joints</th>
<th>Bone</th>
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</thead>
<tbody>
<tr>
<td>Lateral Cricothyroid (2)</td>
<td>Thyroid (1)</td>
<td>Cricoid (1)</td>
<td>Hyoid</td>
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<tr>
<td>Interarytenoid</td>
<td>Cricoid (1)</td>
<td>Cricoid (1)</td>
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<tr>
<td>Two compartments: Transverse (1) Oblique (2)</td>
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<td>Posterolateral Cricothyroid (2)</td>
<td>Cricoid (1)</td>
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<tr>
<td>Thyroarytenoid</td>
<td>Arytenoid (2)</td>
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<tr>
<td>Two compartments: Thyromuscularis (2) Vocalis (2)</td>
<td>Corniculate (2)</td>
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<td>Cuneiform (2)</td>
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Cartilages of the Larynx

Muscles of the Larynx


Neural Innervations of Intrinsic Laryngeal Muscles

VAGUS (CN X)

Recurrent Laryngeal Nerve (RLN) innervates all intrinsic muscles (motor) except the cricothyroids. RLN also supplies all sensory information below the vocal folds.

External branch of Superior Laryngeal Nerve (SLN) innervates the cricothyroid muscles (motor).

Internal branch of Superior Laryngeal Nerve provides all the (sensory) information to the larynx.

Vagus (CN V)

- The vagus nerve has three nuclei located within the medulla.
  - The nucleus ambiguus
  - Motor nucleus of the vagus nerve
  - The dorsal nucleus
    - Efferent fibers of the dorsal (parasympathetic) nucleus innervate the involuntary muscles of the bronchi, esophagus, heart, stomach, small intestine, and part of the large intestine.
    - The nucleus of the tract of solitarius
      - Afferent fibers of the tract of solitarius carry sensory fibers from the pharynx, larynx, and esophagus.
Extrinsic Muscles of the Larynx
Suprahyoids

- Digastric
  - Anterior belly (CN V)
  - Posterior belly (CN VII)
- Stylohyoid (CN VII)
- Mylohyoid (CN V)
- Geniohyoid (CN XII)

Attaches to the hyoid bone and to structures above the hyoid
Raises the larynx in the neck
Suprahyoid muscles

Extrinsic Muscles of the Larynx
Infrahyoids

- Sternohyoid (CN XII)
- Sternothyroid (CN XII)
- Omohyoid (CN XII)
- Thyrohhyoid (CN XII)

Muscles attaching below the level of the larynx
Often called the strap muscles
Lower the larynx

Infrahyoid Muscles
Phonation

- Vocal folds abduct during inhalation and adduct during phonation
- Vibration of the vocal folds create a “buzz” - “sound source” for voicing
- Theories of phonation:
  - Van den Berg’s Aerodynamic Myoelastic (1958)
  - Hirano’s Body-Cover (1970’s)
  - Titze’s Self-Oscillation Theory (1994)

Cover-Body Model


Coronal Schematic Representation of Vocal Fold Vibration

Assessment

- **Voice Handicap Index (VHI)**
  - 30-item questionnaire divided into physical, functional, and emotional categories, 5 point self rating scale.
  - The scale is scored out of total points of 120
    - 0-30 low perception of voice-related handicap
    - 31-60 moderate level of handicap
    - >60 severe level of handicap
  

- **Reflux Symptom Index Score**
  - Pt's perceived type and degree of severity of symptoms
    - 5 point scale
    - RSI >13 is considered to be abnormal

• Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V)
  – Protocol examines vocal features in contexts of sustained vowels, sentences, and connected speech
  – These features are evaluated on a 100 mm horizontal line, where the left of the line indicates a normal voice feature and the right end more severe level


Assessment
• Glottal Function Index (GFI)
  – Pt self-perception of glottal dysfunction
  – 5 pt scale
  • A score >4 reflects problems in vocal function


Assessment
• Oral Peripheral Examination
• Phonatory-respiratory efficiency
  – Maximum sustained phonation
  • Normal values 15-20 seconds for adults
  – s/z ratio
  • 1-1.4 indicates sustained voicing and without voicing is approx. equal.
  • >1.4 indicates voiced sound cannot be sustain for as long and may indicate impaired glottal efficiency

Assessment

- Vocal range
  - Pitch range
  - Loudness range
- Laryngeal function
  - Throat clearing
  - Coughing
  - Laughing
  - Hard glottal attacks

Superior View of the Laryngeal Area


Normal TVF Vocal Folds
Common Vocal Pathologies
• Irritable Larynx
• Cysts
• Vocal fold paralysis
• Carcinoma
• Papilloma
• Granuloma
• Bowing

Vocal Disorders
• Muscle Tension Dysphonia
• Spasmodic dysphonia

Vocal Fold Paralysis
• Causes
  – Malignancy
  – Surgical/traumatic injury
  – Neurological
  – Inflammatory
  – Infectious
  – Idiopathic
  – Intracranial injuries
  – Cranial injuries
  – Neck injuries
  – Chest
Unilateral Superior Laryngeal Nerve Paralysis

- Loss of sensation to the supraglottic area can produce symptoms of frequent throat clearing, coughing, vocal fatigue, foreign body sensations.
- Loss of motor function to the cricothyroid muscle can result in a change in vocal quality with hoarseness and/or diplophonia and decrease in pitch range (especially if trying to sing).

Unilateral Recurrent Laryngeal Nerve Paralysis

- Vocal fold is generally in a paramedial position with loss of abduction.
- Vocal quality is breathy hoarseness.
- Airway is adequate but individuals may complain of shortness of breath with exertion.

Bilateral Recurrent Laryngeal Nerve Paralysis

- Usually both RLN are affected.
- Vocal folds usually in a paramedial position
- Vocal quality is generally good.
- Possible stridor when breathing.
- May need tracheostomy with speaking valve.
- Preservation of airway is most important goal.
Surgical Management of Bilateral TVF Paralysis

- Laser Cordectomy
- Laser Cordotomy

Lateral Manual Compression

- Preoperative assessment for surgical medialization laryngoplasty (Ishiki thyroplasty types I and IV and arytenoid adduction)
- Forceful manual compression of the thyroid and cricoid cartilages modifies the position, shape and tension of the vocal folds.


Management of Unilateral TVF Paralysis

- Injectable materials
  - Can be performed in the operating room with trans-oral injection or in-office percutaneous injection/in-office trans-oral injection
  - Radiesse Voice Gel
  - Synthetically derived polymers and no CaHA ~ 3mo
  - Synthetic Calcium Hydroxylapatite (CaHA) ~ 12mo

- Medialization materials
  - Operative procedure
    - Autologous Fat
    - Gore-Tex
    - Silastic
Voice Therapy for Unilateral Vocal Fold Paralysis

- Relative to the position of the paralysis and compensation
- Goal of therapy is to improve glottal closure without developing undesirable compensatory behaviors such as:
  - Anterior–Posterior compression
  - Ventricular fold constriction
  - Drawing tongue to the back of the pharynx to help with glottal closure
  - Falsseto voice or abnormal pitch for age and sex of pt
  - Muscular tension of the oral or pharyngeal areas

Therapy

- Sustained phonation at comfort pitch, comfort high and comfort low pitch
- Glides up and down
- Vocal Function Exercises
- Resonant Vocal Exercises
- Kazoo exercises – improvement of the intrinsic musculature strength and agility without supraglottic hyper-functioning
- Forward tone focus without tension of the oral and pharyngeal musculature
- Use of abdominal breathing instead of upper chest breathing
- May need to instruct pt to turn head to the side of the paralysis prior to drinking liquids or swallowing food to prevent penetration or aspiration

Irritable Larynx

- Symptoms
  - Chronic cough
  - Muscle tension dysphonia/tenderness in the laryngeal muscles
  - Episodic laryngospasm
  - Globus
  - Increased mucus
  - Dysphonia
Irritable Larynx Syndrome

- Morrison and Ramage (2010)
  - Study of pts meeting criteria for irritable larynx syndrome
    - Findings
      - Usually seen in pts manifesting a broad picture of disorders due to CNS hypersensitivity
      - View the irritable larynx syndrome as a central sensitivity syndrome
      - Pts with central sensitivity syndrome may relate to co-existent gastroesophageal reflux

Management of Irritable Larynx Syndrome

- Acquire baseline data
  - History of onset with noted psychological or emotional issues
  - Medical history
  - Phonotraumatic behaviors
  - Triggers or any exacerbating stimuli
  - Muscle tension patterns
  - Dysphonia
  - Respiratory problems
  - Journal daily incidents of triggers

Treatment of Irritable Larynx Syndrome

- Multifactorial management
  - Address sensory stimuli
    - Minimize/eliminate triggers (i.e. odors, stresses, etc)
    - Medical management of laryngopharyngeal reflux
    - Dietary and behavioral lifestyle changes regarding reflux
    - Treatment for sinusitis/rhinitis if involved
    - Treatment for allergies
    - Asthma treatment
Treatment of Irritable Larynx Syndrome

• Address habituated patterns by re-programming
  – Respiratory retraining and focus on abdominal breathing with sniffing or pursed lips breathing, synchronizing respiration and phonation of prolonged sibilants, humming, counting, spontaneous speech, etc on exhalation
  – Elimination of all throat clearing/coughing with hydration or hard swallow
  – Voice therapy is dysphonic with elimination of hard glottal attacks
  – Vocal hygiene counseling
  – Digital or manual laryngeal massage for musculoskeletal relaxation

• Address psychological – emotional issues
  – Refer to psychologist
  – Medical management for anxiety

• Address hyper sensitive chronic cough medically if physician diagnosis as laryngeal sensory neuropathy from injury or virus
  – Medically treated by physician

Cysts

• Fluid filled sac or semisolid gel like substance
• Blockage of a mucosal duct
• Can protrude and involve the vibratory margin of the vocal fold, increasing mass and stiffness of the cover
• Can cause hoarseness, loss of pitch range, and vocal fatigue
Cysts

- Generally – surgical removal
- Pre-surgical therapy
  - Reduce edema and erythema
  - Hydration program
  - Vocal hygiene counseling
  - Reflux management if needed
  - Eliminate phonotraumatic behaviors
  - Vocal exercises to minimize harsh vocal fold contact

Granuloma

- Mass of tissue consisting of inflammation
- Consists of large amount of blood cells and connective tissue
- Created by fibroblasts during wound healing
- Grows from the base of the wound or injury
- Vocal process granulomas may be the end result of inflammation caused by chronic irritation
- Causes
  - LPR
  - Endotracheal intubation
  - Phonotrauma

Papilloma

- Wartlike growth of the epithelium
  - caused by HPV
- Can be sessile (broad based) or pedunculated (on stalk)
- Can invade the vocal ligament or thyroarytenoid muscle
- Symptoms: hoarseness, difficulty breathing
- Surgical management
- Follow up voice therapy to maximize vocal efficiency
### Bowing

- Creates a spindle shaped glottal closure
- Breathy Hoarseness with decreased intensity and vocal fatigue
- Causes — muscle atrophy, neurological, trauma

May respond to voice therapy
- Injection Laryngoplasty
- Vocal fold augmentation

### Glottic Cancer

- Hoarseness is an early symptom
- Most common site of disease in laryngeal cancer is the vocal folds
- Treated with surgery and/or radiation
- Post treatment voice therapy beneficial to maximize best possible vocal production

### Spasmodic Dysphonia

- Involuntary spasms of the muscles of the larynx
- Thought to be a central motor processing disorder of the basal ganglia
- Types of SD
  - Abductor
  - Adductor
  - Mixed
- Treatment: Botox
- Adjunct to Botox — Voice therapy
Muscle Tension Dysphonia

- Increased muscular tension of the intrinsic musculature
- Whisper or high pitched vocal quality
- Extrinsic muscular tension may be present
- Voice therapy
  - Laryngeal manual therapy
  - Circumlaryngeal therapy
  - Resonant Voice therapy
  - Humming, etc

Treatment for Muscle Tension Dysphonia

- Voice therapy primary treatment
- Combine with myofascial laryngeal release can accelerate outcome and shorten the course of treatment
- Myofascial release is a manual technique to work on areas of laryngeal muscle resistance from least to greatest.

References


