Hoarseness

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Disclosure

• No commercial relationships to disclose

Learning Objectives

• At the conclusion of this session, participants will be able to:
  – Recognize the history, physical, and diagnostic studies necessary to formulate a differential diagnosis for a patient with hoarseness.
  – Identify the risk factors associated with hoarseness from neoplasia, vocal fold paralysis, or medications.
  – Develop an appropriate evaluation and management plan including a threshold for referral for surgical or other modalities of care.
Definition of Hoarseness

• the perceived breathiness quality of the voice (Bailey)
• a rough or noisy quality of voice (Dorland)
• a rough, harsh voice quality (Stedman)

Symptom –vs- Diagnosis

• Hoarseness is a symptom of a disease process
• Although hoarseness appears on the ICD9 as a diagnosis (784.49):
  – it is really a symptom resulting from the underlying disease process
  – the underlying disease process is your diagnosis (ex. vocal nodules)

Anatomy: Laryngeal Cartilage
Endolarynx Anatomy

Anatomy: Laryngeal Innervation

Anatomy: Laryngeal Motion

• Tension of vocal ligament
Anatomy: Laryngeal Motion

• Adduction of vocal ligament

Anatomy: Laryngeal Motion

• Abduction of vocal ligament

Histology

• Mucosal layer
  – Pseudostratified squamous epithelium superiorly and inferiorly
  – Nonkeratinizing squamous epithelium at contact surface of medial cord
Histology

- Subepithelial tissues: three layered lamina propria
  - Superficial Layer (Reinke's space)
  - Intermediate layer
  - Deep layer
    - the intermediate and deep layers make up the vocal ligament
- Vocalis and thyroarytenoid muscle

Histology

Physiologic Function

- Prevents aspiration (sphincter)
- Respiratory gateway
- Phonation
- Valsalva Maneuver
  - allows for transmission of pressure to abdominal cavity
  - stabilizes thorax during heavy lifting
Phonation

- Physical act of sound production by means of passive vocal fold interaction with the exhaled airstream

Phonation

- Larynx recognized as critical organ for sound production for centuries
- Husson presented the neurochronaxic hypothesis in 1950
  - Each vibratory cycle caused by separate neural impulse

Phonation

- Currently accepted mechanism
  - Interaction of aerodynamic forces and mechanical properties of laryngeal tissues generate vocal sound
Requirements for Phonation

- Adequate breath support
- Approximation of vocal folds
- Favorable vibratory properties
- Favorable vocal fold shape
- Control of length and tension

Mechanism of Phonation

- Inhalation of air
- Glottic closure

Mechanism of Phonation

- Exhalation increases subglottic pressure until vocal folds displace laterally
Mechanism of Phonation

- Vocal folds return to midline
  - Decrease in subglottic pressure
  - Elastic forces in vocal fold
  - Bernoulli effect of airflow

Body-Cover Concept

- Vibration of the mucosa does not correspond directly to the vocal fold
  - Wave is propagated along mucosa
  - Made possible by Reinke's space which is a gelatin-like layer made of loose connected fibers of collagen and elastin
  - Vocal ligament does not undergo mucosal wave

History

- Onset and duration of vocal symptoms
- Potential causes or exacerbating influences
- Talkativeness
- Other risk factors
  - Tobacco
  - Alcohol
  - LPR
  - Dehydration
  - Medications
  - Allergies
Physical Examination

• Laryngeal mirror
  – **Advantages**: fast, inexpensive, minimal equipment
  – **Disadvantages**: gag, nonphysiologic, no permanent image capability

• Rigid Laryngoscopy (70 or 90-degree telescope)
  – **Advantages**: best optic image, magnifies, video documentation
  – **Disadvantages**: gag, nonphysiologic, expensive

• Flexible fiberoptic nasolaryngoscope
  – **Advantages**: well tolerated, physiologic, video documentation
  – **Disadvantages**: time consuming, expensive, resolution limited by fiberoptics
Physical Examination

- Videostroboscopy
  - Advantages: allows apparent “slow motion” assessment of mucosal vibratory dynamics, video documentation
  - Disadvantages: time consuming, expensive

Videostroboscopy

- Local anesthesia
- Well tolerated
- Can use rigid scope trans-oral or flexible scope trans-nasal
- Can assess vocal frequency, vibratory pattern, and mucosal wave
Physical Examination

• Direct laryngoscopy
  – Available for use with treatment

Operative Laryngoscopy

Operative Laryngology
Causes of Hoarseness

- Benign lesions
- LPR
- Allergy
- Irritants/Smoke
- Thyroid Conditions
- Trauma
- Overuse/abuse
- Neurologic
- Larynx cancer
- Infection
- Lung disease
- Chronic cough
- Iatrogenic injury
- VC paralysis
- Age/hormonal
- Other malignancies
Benign Lesions

LPR / Reflux Laryngitis

Reflux symptoms / signs

<table>
<thead>
<tr>
<th>Symptom / sign</th>
<th>Scale (0-4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heartburn, acid reflux or bloating after eating</td>
<td>0-4</td>
</tr>
<tr>
<td>Gastric symptoms, nausea, vomiting</td>
<td>0-4</td>
</tr>
<tr>
<td>Reflux symptoms, heartburn, acid reflux</td>
<td>0-4</td>
</tr>
<tr>
<td>Erosive esophagitis</td>
<td>0-4</td>
</tr>
<tr>
<td>Hoarseness, dysphagia, or weight loss</td>
<td>0-4</td>
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<tr>
<td>Constant throat irritation</td>
<td>0-4</td>
</tr>
<tr>
<td>Persistent sore throat</td>
<td>0-4</td>
</tr>
<tr>
<td>Voice changes</td>
<td>0-4</td>
</tr>
<tr>
<td>Swallowing difficulty</td>
<td>0-4</td>
</tr>
<tr>
<td>Vocal cord edema</td>
<td>0-4</td>
</tr>
</tbody>
</table>

Note: Scale: 0 = None, 1 = Mild, 2 = Moderate, 3 = Severe, 4 = Very Severe
Left Vocal Process Granuloma Due to Reflux

• Before and After Laryngeal Photos following 4 week treatment with PPI and diet controls

Allergic Laryngitis

• Thick mucous
• Diffuse edema of vocal folds
• Hyperemia and injection of mucosa

Irritants / Smoke

• Severe vocal fold mucosal edema
• Thickening of mucosal cover
• Dryness and crusting of mucosa
Trauma

- Subglottic stenosis following 12 days of intubation for pneumonia
- Before and after laryngeal photos following laser division and balloon dilation

- Right vocal fold with severe atrophy and stiffness
- Patient had a “stripping” procedure 4 years prior for a benign lesion on pathology review

- Patient had a tracheostomy 8 months prior for ventilator dependent respiratory failure
- Retained, internally extruded prolene suture
Trauma

- Right hematoma following baseball injury to the larynx

Vocal Overuse

- Can occur with overuse, misuse, or abuse of voice
- Can result in lesions (typically nodules)
- Patient is a 38 year old football coach, 36 hours after a game

Vocal Abuse

- Vocal fold nodules in a singer
- Bilateral symmetric nodules involving the anterior 1/3 of the membranous vocal folds
- Treated with voice therapy
Neurologic

- Stroke
- Parkinson’s
- Left vocal fold is immobile, lateralized, and atrophic in 78 year old patient with history of CVA

Neurologic

- Botox injection for adductor spasmodic dysphonia, laryngeal spasms, and laryngeal tremors/dyskinesia

Larynx Cancer

- T1a SCC of the right vocal fold
- 46 year old smoker with 3 month history of worsening hoarseness
- Treated with PPI, steroids, antibiotics
Larynx Cancer

• T1a left vocal fold SCC
• Left photo is prior to laser cordectomy
• Right photo is 3 years following the surgical procedure with NED

Larynx Cancer

• Intra-operative photo of T1a SCC of right vocal fold
• Right photo is status post an extended laser cordotomy using the CO2 laser

Larynx Cancer

• Exophytic tumor involving the left arytenoid and left supraglottis
• 5 month history of left unilateral otalgia with a normal otologic exam
Recurrent Larynx Cancer

- Extensive recurrent laryngeal carcinoma following chemo/RT protocol
- Patient with laryngostoma following a salvage total laryngectomy

Infection

- Acute viral is most common
- Top photo is fungal laryngitis secondary to chronic use of steroid inhaler
- Bottom photo is natural course of viral laryngitis (7d)

Infection

- Top photo is a child with acute epiglottitis. Note "cherry red" epiglottis
- Bottom photo is diffuse laryngeal candidiasis in a poorly controlled diabetic patient
Infection

- “hot potato” type voice
- Retropharyngeal abscess noted on cross table lateral x-ray

Vocal Cord Paralysis

- Bilateral, complete vocal cord paralysis immediately following a total thyroidectomy
- Tracheostomy to secure airway
- Left laser arytenoidectomy

Vocal Cord Paralysis

- 54 year old patient s/p left vocal fold teflon injection for medialization 12 years prior.
- Photo demonstrates a classic left vocal fold teflon granuloma.
Iatrogenic surgical injury

- Thyroid surgery
- Parathyroid surgery
- Anterior cervical decompression spinal surgery
- Cardiothoracic surgery
- Esophageal surgery

Age related changes

- 75 year old patient with bilateral vocal fold atrophy/ bowing
- Note glottic gap and incomplete closure with spindle shaped gap.
- Characteristic age related changes occur- presbylarynx

Neck Tumors

- Carotid body tumor splays the internal and external carotid arteries (Lyre sign)
- Glomus Vagale tumor displaces carotid artery anteriorly and medially
Congenital causes of hoarseness

Surgical Treatment

Surgical Technique

- Cold instruments
Surgical Technique

Cold instruments

- Subepithelial injection of saline and epinephrine
  - exaggerates difference of normal SLP from polyp tissue
  - hemostasis

Surgical Treatment

- Lateral Microflap Technique
  - Laterally based incision
    - Surgical scar on superior/lateral aspect of vocal fold
    - Free edge of vocal fold intact
  - Identifies vocal ligament lateral to primary pathology
  - Lesions adherent to vocal fold epithelium medial to incision may require additional incision

Surgical Treatment

- Medial Microflap Technique
  - Incision made adjacent to lesion
  - Avoids extensive dissection of SLP
Surgical Treatment

• Medial – vs- Lateral
  – Medial microflap is method of choice for most benign laryngeal lesions
  – Lateral microflap chosen when vocal ligament may be:
    • Difficult to identify
    • At significant risk of injury

Surgical Technique

Cold instruments
• Epithelial cordotomy

Cold instruments
• Mucosal flap elevated from medial to lateral, off the lesion and over the superior surface of the vocal fold

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**Surgical Technique**

**Cold instruments**
- Lesion separated from the vocal ligament

**Surgical Technique**

**Cold instruments**
- Lesion separated from inferior mucosal flap

**Surgical Technique**

**Cold instruments**
- Up angled scissors used to incise mucosal membrane to be sacrificed with lesion
Surgical Technique

Cold instruments
• Lesion removed and flaps are situated

Surgical Technique
• Microspot CO2 Laser
  – CO2 laser energy is absorbed by water allowing Reinke’s space to act as a natural barrier to protect the vocal ligament
  – Provides excellent hemostasis
  – Thermal trauma can be detrimental

Benign Vocal Fold Lesions
• Polyps
• Nodules
• Varices and Ectasias
• Cysts
• Granulomas
• Polypoid Corditis/Reinke’s Edema
• Papillomatosis
Polyps

- Typically the result of trauma to the SLP and microvasculature
- Size, shape and tissue composition is variable
  - Sessile or pedunculated
  - Vascular, fibrotic, or mixoid
- Commonly found in the middle portion of the musculo-membranous region

Polyps

- Not uncommon to find a smaller traumatic fibrovascular lesion on contralateral vocal fold
- Overlying epithelium is usually normal and can be preserved to some extent

Polyps

- Sessile
  - epithelial microflap
  - Subepithelial resection of polyp contents
- Pedunculated
  - Retraction and amputation
Polyps

- Size
  - Small: 0-3mm
  - Medium: 3-6mm
  - Large: >6mm
- Excision
  - Cold instruments for small and medium polyps
  - Microspot CO2 laser for large polyps
Polyps

Nodules

- Fibrovascular tissue secondary to vocal abuse or inappropriate vocal use
- Strobovideo-laryngoscopy is essential in assessment
- SLP is thinned effecting mucosal wave
- Treatment
  - Vocal rehabilitation is primary
  - Surgery is secondary
Nodules

Varices and Ectasias
• Result from microvascular trauma in SLP
• Most commonly found at middle musculo-membranous vocal fold
  – Situated at lateral extent of mucosal wave excursion- “striking zone”
  – Believed to result from deceleration force

Varices and Ectasias
• Treatment
  – Cold instruments: epithelial cordotomy followed by vascular lesion removal
    • No post-op deterioration of vocal function or mucosal wave flexibility
  – Microspot CO2 laser ablation
    • Heals more slowly
    • Potential for epithelial stiffness
Varices and Ectasias

Cysts

- Arise in SLP
  - Attached to vocal ligament or epithelial basement membrane
  - Freely suspended within SLP
- Size is variable
- Asymmetric spheroid mass on medial surface of vocal fold
- Most arise from obstructed mucus ducts in SLP

Cysts

- Treatment
  - Cold instrument resection
    - Subepithelial infusion of saline and epinephrine is helpful
    - Must retrieve entire cyst wall to prevent recurrence
    - Preserve normal SLP
  - Microspot CO2 laser not as effective due to necessity of delicate tangential dissection
Cysts

- Results
  - Mucosal wave usually improves
  - Does not return to normal if cysts has replaced substantial amount of SLP
    - SLP does not regenerate

Granulomas

- Results from hypertrophic inflammatory reaction due to traumatic mucosal disruption
- Majority found in arytenoid region
- Usually exophytic with narrow base
- Typically arise in patients with LPR
- Seen with endotracheal intubation
Granulomas

- Treatment
  - Vocal therapy including antireflux management
  - Surgical resection
    - conservative management has failed
    - concern of a neoplastic process
    - airway compromise

Granulomas

Granulomas
Granulomas

Polypoid Corditis (Reinke’s Edema)

- Extensive swelling of SLP
- Usually on superior surface of musculo-membranous vocal fold
- Typically bilateral but asymmetric volume
- Multifactorial cause
  - Smoking
  - LPR
  - Vocal hyperfunction
Polypoid Corditis (Reinke’s Edema)

- **Treatment**
  - Smoking cessation
  - Antireflux medication
  - Preoperative vocal therapy
  - Surgery
    - Epithelial microflap elevation with SLP contouring and reduction using either cold instruments, Microspot CO2 laser, or both
    - Vocal ligament should never be visualized
    - Both vocal folds can be treated in one procedure if flap is elevated on superior surface of vocal fold

Papillomatosis

- Human papillomavirus 6 and 11
- Confined to epithelium
  - Excision should preserve SLP
- Most commonly found in musculo-membranous region, but may extend into arytenoid, ventricle, subglottis
Papillomatosis

• Surgical treatment
  – Cold instruments
  – Microdebrider
  – Microspot CO2 laser
• Resection of lesions inhibits recurrence in 30% of chronic patients