Overview

• Laryngeal anatomy and function
• Assessing voice
• Voice disorders
  – Adductor spasmodic dysphonia
  – Abductor spasmodic dysphonia
• SD Treatments
Anatomy: Laryngeal Muscles

Right lateral view

Posterior view
Anatomy: Laryngeal Motion

• Abduction of vocal ligament

Action of posterior cricoarytenoid muscles
Abduction of vocal ligaments
Anatomy: Laryngeal Motion

- Adduction of vocal ligament
Anatomy: Laryngeal Motion

- Tension of vocal ligament
Clinical practice guideline: Hoarseness (Dysphonia)

Seth R. Schwartz, MD, MPH, Seth M. Cohen, MD, MPH,
Seth H. Dailey, MD, Richard M. Rosenfeld, MD, MPH,
Ellen S. Deutsch, MD, M. Boyd Gillespie, MD,
Evelyn Granieri, MD, MPH, MEd, Edie R. Hapner, PhD, C. Eve Kimball, MD,
Helene J. Krouse, PhD, RN, ANP-BC, J. Scott McMurray, MD,
Safdar Medina, MD, Karen O’Brien, MD, Daniel R. Ouellette, MD,
Barbara J. Messinger-Rapport, MD, PhD, Robert J. Stachler, MD,
Steven Strode, MD, MEd, MPH, Dana M. Thompson, MD,
Joseph C. Stemple, PhD, J. Paul Willging, MD, Terrie Cowley,
Scott McCoy, DMA, Peter G. Bernad, MD, MPH, and Miles M. Patel, MS,
Seattle, WA; Durham, NC; Madison, WI; Brooklyn, NY; Wilmington, DE; Charleston,
SC; New York, NY; Atlanta, GA; Reading, PA; Detroit, MI; Uxbridge, MA;
Fort Monroe, VA; Cleveland, OH; Little Rock, AR; Rochester, MN; Lexington, KY;
Cincinnati, OH; Milwaukee, WI; Princeton, NJ; Washington, DC; and Alexandria, VA
Dysphonia

• Alteration in production of voice that impairs social and professional communication
• Nearly 1/3 of population has impaired voice at some point in their lives
• Most often benign but may be presenting symptom of malignant condition
Dysphonia

- 30% of population affected at some point
  - Higher in teachers, telemarketers, aerobics instructors, ie those who use their voice professionally
  - Women 60%, men 40%
  - Children affected 4-23%
  - Elderly 30-47%
- Estimated $2.5 billion in missed work costs
- 6% general population seek treatment
  - 14% teachers
Voice evaluation

- Multi-dimensional. Use of SLP is helpful
- History is critical component
- Patient’s perception of problem is critical
- Perceptual evaluation
  - GRBAS, CAPE-V
- Physical examination
**History**

Table 5: Pertinent medical history for assessing a patient with hoarseness

<table>
<thead>
<tr>
<th>Voice-specific questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did your problem start suddenly or gradually?</td>
</tr>
<tr>
<td>Is your voice ever normal?</td>
</tr>
<tr>
<td>Do you have pain when talking?</td>
</tr>
<tr>
<td>Does your voice deteriorate or fatigue with use?</td>
</tr>
<tr>
<td>Does it take more effort to use your voice?</td>
</tr>
<tr>
<td>What is different about the sound of your voice?</td>
</tr>
<tr>
<td>Do you have a difficult time getting loud or projecting?</td>
</tr>
<tr>
<td>Have you noticed changes in your pitch or range?</td>
</tr>
<tr>
<td>Do you run out of air when talking?</td>
</tr>
<tr>
<td>Does your voice crack or break?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Globus pharyngeus (persisting sensation of lump in throat)</td>
</tr>
<tr>
<td>Dysphagia</td>
</tr>
<tr>
<td>Sore throat</td>
</tr>
<tr>
<td>Chronic throat clearing</td>
</tr>
<tr>
<td>Cough</td>
</tr>
<tr>
<td>Odynophagia (pain with swallowing)</td>
</tr>
<tr>
<td>Nasal drainage</td>
</tr>
<tr>
<td>Post-nasal drainage</td>
</tr>
<tr>
<td>Non-anginal chest pain</td>
</tr>
<tr>
<td>Acid reflux</td>
</tr>
<tr>
<td>Regurgitation</td>
</tr>
<tr>
<td>Heartburn</td>
</tr>
<tr>
<td>Waterbrash (sudden appearance of salty liquid in the mouth)</td>
</tr>
<tr>
<td>Halitosis (“bad breath”)</td>
</tr>
<tr>
<td>Fever</td>
</tr>
<tr>
<td>Hemoptysis</td>
</tr>
<tr>
<td>Weight loss</td>
</tr>
<tr>
<td>Night sweats</td>
</tr>
<tr>
<td>Otalgia (ear pain)</td>
</tr>
<tr>
<td>Difficult breathing</td>
</tr>
</tbody>
</table>

Table 5: Medical history relevant to hoarseness

- Occupation and/or avocation requiring extensive voice use (i.e., teacher, singer)
- Absenteeism from occupation due to hoarseness
- Prior episode(s) of hoarseness
- Relationship of instrumentation (intubation, etc.) to onset of hoarseness
- Relationship of prior surgery to neck or chest to onset of hoarseness
- Cognitive impairment (requirement for proxy historian)
- Anxiety
- Acute conditions
  - Infection of the throat and/or larynx: viral, bacterial, fungal
  - Foreign body in larynx, trachea, or esophagus
  - Neck or laryngeal trauma
- Chronic conditions
  - Stroke
  - Diabetes
  - Parkinson's disease
  - Diseases from the Parkinson’s Plus family (progressive supranuclear palsy, etc.)
  - Myasthenia gravis
  - Multiple sclerosis
  - Amyotrophic lateral sclerosis (ALS)
  - Testosterone deficiency

Table 5: continued

- Allergic rhinitis
- Chronic rhinitis
- Hypertension (because of certain medications used for this condition)
- Schizophrenia (because of anti-psychotics used for mental health problems)
- Osteoporosis (because of certain medications used for this condition)
- Asthma, chronic obstructive pulmonary disease (because of use of inhaled steroids)
- Aneurysm of thoracic aorta (rare cause)
- Laryngeal cancer
- Lung cancer (or metastasis to the lung)
- Thyroid cancer
- Hypothyroidism and other endocrinopathies
- Vocal fold nodules
- Vocal fold paralysis
- Vocal abuse
- Chemical laryngitis
- Chronic tobacco use
- Sjögren syndrome
- Alcohol (moderate to heavy use or abuse)
<table>
<thead>
<tr>
<th>Medication</th>
<th>Mechanism of impact on voice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coumadin, thrombolytics, phosphodiesterase-5 inhibitors</td>
<td>Vocal fold hematoma&lt;sup&gt;51-53&lt;/sup&gt;</td>
</tr>
<tr>
<td>Biphosphonates</td>
<td></td>
</tr>
<tr>
<td>Angiotensin-converting enzyme inhibitors</td>
<td>Chemical laryngitis&lt;sup&gt;54&lt;/sup&gt;</td>
</tr>
<tr>
<td>Antihistamines, diuretics, anticholinergics</td>
<td>Cough&lt;sup&gt;55&lt;/sup&gt;</td>
</tr>
<tr>
<td>Danocrine, testosterone</td>
<td>Drying effect on mucosa&lt;sup&gt;56,57&lt;/sup&gt;</td>
</tr>
<tr>
<td>Antipsychotics, atypical antipsychotics</td>
<td>Sex hormone production/utilization alteration&lt;sup&gt;58,59&lt;/sup&gt;</td>
</tr>
<tr>
<td>Inhaled steroids</td>
<td>Laryngeal dystonia&lt;sup&gt;60,61&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Dose-dependent mucosal irritation&lt;sup&gt;62&lt;/sup&gt;, fungal laryngitis</td>
</tr>
</tbody>
</table>
Voice evaluation

• Physicians usually not experts in voice classification, singing, etc.
• Most often relies on perception of physician
  – Some objective scoring measures
  – Poor inter-rater correlation
• Team approach
  – Speech pathologist, vocal coaches, neurologist, psychiatrist, etc.
<table>
<thead>
<tr>
<th>Part I-F</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>My voice makes it difficult for people to hear me.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>People have difficulty understanding me in a noisy room.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>My family has difficulty hearing me when I call them throughout the house.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I use the phone less often than I would like to.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I tend to avoid groups of people because of my voice.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I speak with friends, neighbors, or relatives less often because of my voice.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>People ask me to repeat myself when speaking face-to-face.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>My voice difficulties restrict my personal and social life.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I feel left out of conversations because of my voice.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>My voice problem causes me to lose income.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

**SUBTOTAL**

<table>
<thead>
<tr>
<th>Part II-P</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>I run out of air when I talk.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>The sound of my voice varies throughout the day.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>People ask, “What’s wrong with your voice?”</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>My voice sounds creaky and dry.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I feel as though I have to strain to produce voice.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>The clarity of my voice is unpredictable.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I try to change my voice to sound different.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I use a great deal of effort to speak.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>My voice is worse in the evening.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>My voice “gives out” on me in the middle of speaking.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

**SUBTOTAL**

<table>
<thead>
<tr>
<th>Part III-E</th>
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<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am tense when talking to others because of my voice.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>People seem irritated with my voice.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I find other people don’t understand my voice problem.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>My voice problem upsets me.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I am less outgoing because of my voice problem.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>My voice makes me feels handicapped.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I feel annoyed when people ask me to repeat.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I feel embarrassed when people ask me to repeat.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>My voice makes me feel incompetent.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>I am ashamed of my voice problem.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

**SUBTOTAL**

**TOTAL**
<table>
<thead>
<tr>
<th>Scale</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional</td>
<td>10.07 (1.99)</td>
<td>12.41 (1.38)</td>
<td>18.30 (1.50)</td>
</tr>
<tr>
<td>Physical</td>
<td>15.54 (1.97)</td>
<td>18.63 (1.37)</td>
<td>22.78 (1.48)</td>
</tr>
<tr>
<td>Emotional</td>
<td>8.08 (2.31)</td>
<td>13.33 (1.61)</td>
<td>20.30 (1.74)</td>
</tr>
<tr>
<td>Total</td>
<td>33.69 (5.60)</td>
<td>44.37 (3.88)</td>
<td>61.39 (4.21)</td>
</tr>
</tbody>
</table>
GRBAS

- No standardized utterances
- Scale from 0(none) to 3(severe)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Hirano Definition*</th>
<th>National Center for Voice and Speech Definition†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade (G)</td>
<td>Overall severity</td>
<td></td>
</tr>
<tr>
<td>Roughness (R)</td>
<td>Psychoacoustic impression of irregular vocal-fold vibration</td>
<td>An uneven, bumpy quality that appears to be unsteady in the short term but stationary in the long term; acoustically, the waveform is often aperiodic, with the modes of vibration lacking synchrony, but voices with subharmonics can also be perceived as rough.</td>
</tr>
<tr>
<td>Breathiness (B)</td>
<td>Psychoacoustic impression of air leakage through the glottis</td>
<td>Containing the sound of breathing (expiration) during phonation; acoustically, breathy voice, like falsetto, has most of its energy in the fundamental, but a significant component of noise is present owing to turbulence in the glottis. In hyperfunctional breathiness, air leakage may occur in various places along the glottis, whereas in normal voice, air leakage is usually at the vocal processes.</td>
</tr>
<tr>
<td>Asthenia (A)</td>
<td>Weakness or lack of power in the voice</td>
<td>A voice that appears too low in effort, weak; hypofunction of laryngeal muscles is apparent.</td>
</tr>
<tr>
<td>Strain (S)</td>
<td>Psychoacoustic impression of a hyperfunctional state of phonation</td>
<td>A voice that appears effortful; visually, hyperfunction of the neck muscles is apparent; the entire larynx seems compressed.</td>
</tr>
</tbody>
</table>

*From Hirano M. *Clinical Examination of Voice*. New York: Springer-Verlag; 1981.
CAPE-V

• Six core parameters
  – Severity
  – Roughness
  – Breathiness
  – Strain
  – Pitch
  – Loudness
• Two sustained vowels
• 6 standard sentences
• 20 seconds of natural running speech
CAPE-V

• Two vowels
  – \(a\) and \(i\)

• Standard sentences
  – The blue spot is on the key again
  – How hard did he hit him?
  – We were away a year ago
  – We eat eggs every Easter
  – My mama makes lemon jam
  – Peter will keep at the peak.

• 20 secs of running speech
  – “Tell me about your voice problem”
Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V)

Name: ________________________________  Date: __________

The following parameters of voice quality will be rated upon completion of the following tasks:
1. Sustained vowels, /a/ and /i/ for 3-5 seconds duration each.
2. Sentence production:
   a. The blue spot is on the key again.  
   b. How hard did he hit him?  
   c. We were away a year ago.  
   d. We eat eggs every Easter.  
   e. My mama makes lemon muffins.  
   f. Peter will keep at the peak.
3. Spontaneous speech in response to: "Tell me about your voice problem." or "Tell me how your voice is functioning."

Legend: C = Consistent  I = Intermittent  MI = Mildly Deviant  MO = Moderately Deviant  SE = Severely Deviant

<table>
<thead>
<tr>
<th>Overall Severity</th>
<th>MI</th>
<th>MO</th>
<th>SE</th>
<th>SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roughness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breathiness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strain</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pitch</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
   (Indicate the nature of the abnormality): _____________
| Loudness         |    |    |    |      |
   (Indicate the nature of the abnormality): _____________

COMMENTS ABOUT RESONANCE:  NORMAL  OTHER (Provide description):____________________

ADDITIONAL FEATURES (for example, diplophonia, fry, falsetto, asthenia, aphania, pitch instability, tremor, wet/gurgly, or other relevant terms):
Physical examination

- Hearing acuity
- Allergic signs
- Neck- masses, thyroid, scars, strap muscle tension and tenderness, laryngeal mobility
- Cranial nerves
- Laryngeal examination
- Be aware of systemic disorders that can affect larynx
  - Neurologic disorders, infectious, autoimmune
Spasmodic Dysphonia

- Spasmodic dysphonia (SD)
  - Focal, adult-onset dystonia of laryngeal muscles
  - Intermittent phonatory breaks during speech secondary to spasms
  - Usually task specific - symptomatic when attempting voluntary speech
  - May be asymptomatic during reflexive phonation (coughing, laughing, crying, yawning)
  - Symptoms may be reduced/absent during singing or whisper
Spasmodic Dysphonia

• Rare (1:100,000)
  – Maybe underdiagnosed
• Often confused with MTD
• Female predominant
  – Up to 80% reported
• Unknown mechanism
• Up to 20% may have another dystonia
Spasmodic Dysphonia

• Adductor SD
  – Most common SD (85-90%)
  – Spasm of adductor muscles causing vocal cords to tightly shut during speech
  – Typically occurs with efforts to voice words beginning with vowels or in vowels in the middle of a word
  – “We eat eggs every day”
Adductor SD Video
Abductor SD

• Less common 10-15% of all SD cases
• Spasm of posterior cricoarytenoid muscle during speech, causing breathy breaks during speech.
• Typically occurs with “f”, “s”, “th”, “h”, “k”, “t” sounds
Abductor SD Video
SD treatment options

- Voice therapy
- Medical therapy
- Surgical therapy
Voice Therapy

• No demonstrated effectiveness in treating SD
• May help:
  – Rule out psychogenic/functional disorder
  – Provide support for those who do not benefit from Botox (mild symptoms)
  – Some patients use it in adjunct to Botox to prolong symptom free period
• Traditional voice therapy approaches for ADSD employ techniques for avoiding overpressure. Breathy voice onsets, reduced speech force, using a head focus, and laryngeal manipulation are aimed at reducing laryngeal tension. Can also use relaxation and respiration training to help gain insight and control of laryngeal tension during speech.
Medical therapy for SD

- No controlled studies demonstrate effective symptom control
- Beta blockers – propranolol
- Anticholinergics – trihexyphenidylHCl (Artane)
- Benzodiazepines – diazepam, alprazolam
- Role has been to provide relief without any demonstrable symptom reduction
Botox injection for SD

• Currently the gold standard for treatment of both AB- and AD-ductor SD
• For adductor type typical injection into bilateral thyroarytenoid muscles.
  – Dosing is patient specific (0.625 to 2.5 unit or more). Initial dosing of 1.25 U/side and titrate
  – Most studies show 90%+ with voice improvement
  – Average length of voice improvement: 3-4 months
  – Initial period of breathiness and possible liquid aspiration from 7-15 days (dose dependent)
• Abductor SD inject into PCA
  – May stage this if concerns about knocking out bilateral PCA – lower dose to second side
  – Higher initial dosing (3.5 U recommended, then 1 unit to contralateral side)
  – Lower response rate (70-80%, only 20-25% if done unilaterally)
  – Adjunctive voice therapy or medication may help
Botox injections

Advantages
• Readily available
• Technically easy
• Minimally invasive
• Repeatable
• Titratable
• Gold standard

Disadvantages
• Not permanent
• Risk of overdose
• Side effects
  – Worsened voice
  – Aspiration
• Rare chance of resistance
Injection technique for Adductor SD
Injection technique for Abductor SD

FIGURE 2. Retrocricoid EMG-guided injection of the posterior cricoarytenoid muscle for abductor spasmodic dysphonia.

FIGURE 3. Transcricoid EMG-guided injection of the posterior cricoarytenoid muscle for abductor spasmodic dysphonia.
Surgical therapy

- Recurrent laryngeal nerve section first proposed by Dedo in 1976
- Uncommonly done, but can be reserved for those failing Botox
- General steps
  - Expose larynx
  - Open window in thyroid cartilage to expose RLN
  - Selective sectioning of nerve along its distal branches
  - Anastomosis of ansa cervicalis to stump
Bottom Line

• Hoarseness and dysphonia is highly prevalent and you will see this patients
• Goal is to rule out something more severe and hopefully come up with distinct diagnosis for treatment
• Stress interdisciplinary approach to treatment
• Certain dysphonias can be helped with intervention


