Pathologies of the Larynx

Functional Voice Disorders
What do we mean by “Functional?”

- Vocal quality that deteriorates in the absence of anatomic and neurologic factors
- The physiology or “function” is disordered, not the anatomy
- Functional disorders arise from the way the larynx is used to produce voice
What do we mean by “Functional?”

- Aberrant voice use can develop into secondary pathological lesions of the larynx; however, because of the underlying etiology we still classify as a functional. E.g.
  - Nodules that occur from chronic vocal abuse
  - Polyp that occurs after yelling/screaming at a football game
  - Reinke’s edema secondary to poor vocal hygiene
Functional Voice Disorders

- The majority of functional voice disorders are related to under- or over- adduction of the vocal folds
  - Account for up to 40% of cases of dysphonia
  - More common in women
  - 90% of children with dysphonia from a vocal fold lesion have an underlying functional dysphonia
There are two general classifications of functional voice disorders based on etiology:

- Excessive muscle tension (i.e. muscle tension dysphonia)
- Psychogenic
Excessive Muscle Tension Disorders
Muscle Tension Dysphonia

• Result of excessive laryngeal and musculoskeletal tension and hyperfunctional VF vibratory pattern

• Can be either:
  • Primary
    • MTD is the cause; absence of organic pathology
    • 40% of voice clinic patients
  • Secondary: MTD is the compensation

• Observed in both children and adults
Muscle Tension Dysphonia

- Some causes:
  - Deviant posture
  - High stress or conflict
  - Excessive, persistent voice use
  - Reflux
Muscle Tension Dysphonia
# Muscle Tension Dysphonia

<table>
<thead>
<tr>
<th>Vocal quality</th>
<th>Complaint</th>
<th>Imaging</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breathy or strained</td>
<td>Episodic pain in larynx &amp; neck</td>
<td>Supraglottic compression during phonation, medial compression, A-P glottic constriction</td>
<td>Behavioral voice tx: relaxation, laryngeal massage, chant-talk, yawn-sigh, chewing, focus, tube phonation, semi-occluded vocal tract exercises</td>
</tr>
<tr>
<td>Vocal fatigue</td>
<td>Psychosocial stress/conflict</td>
<td>Underapproximation of the folds</td>
<td></td>
</tr>
<tr>
<td>Aberrant pitch/loudness</td>
<td>Poor QOL</td>
<td>Contraction of PCA muscles (abductors) during phonation, leading to posterior glottal gap</td>
<td></td>
</tr>
</tbody>
</table>
### Differential Diagnosis: Muscle Tension Dysphonia vs. Adductor Spasmodic Dysphonia

<table>
<thead>
<tr>
<th>MTD</th>
<th>ADSD</th>
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</thead>
<tbody>
<tr>
<td>Hyperadduction of laryngeal structures across all tasks</td>
<td>Intermittent hyperadduction of laryngeal structures</td>
</tr>
<tr>
<td>No difference in voice severity between sustained vowels and connected speech</td>
<td>Voice severity worse for connected speech than for sustained vowels</td>
</tr>
<tr>
<td>Severity is the same for voiced and voiceless sounds</td>
<td>Severity is different for voiced and voiceless sounds</td>
</tr>
</tbody>
</table>

Roy et al., 2005
Ventricular Dysphonia
(Dysphonia Plicae Ventricularis)

- Ventricular folds vibrate
- Diplophonia – loading of ventricular folds on top of true VF
- Compensatory
  - Reaction to true vocal fold dysfunction (paralysis, cancer, polyps, scarring, etc)
- Noncompensatory
  - Habitual – excessive vocal use
  - Psycho-emotional – physical and psychological tension/distress
  - Idiopathic
Ventricular Dysphonia
(Dysphonia Plicaeae Ventricularis)
Ventricular Dysphonia
## Ventricular Dysphonia

### Vocal quality
- Low pitch (large mass of vibrating tissue)
- Hoarse/breathy
- Strained
- Reduced loudness/pitch range
- Diplophonia

### Complaint
- Fatigue
- Dysphonia

### Imaging
- Supraglottic compression during phonation

### Treatment
- Behavioral: Cue higher pitch and loudness (incompatible with ventricular fold vibration)*
- Easy onset
- Pharmacological: Botox, anaesthetic

* As long as true vocal folds can vibrate
Benign Pathologies Resulting from Excessive Muscle Tension
Nodules

- Most common benign lesions in children and adults
  - Women, singers, actors
- Associated with
  - Continuous vocal trauma
  - Reflux
- Inflammatory degeneration of superficial lamina propria, with fibrosis and edema
- 3 types: acute, chronic, reactive nodular change
Nodules

• Acute
  • Result of traumatic, hyperfunctional voice use
  • Gelatinous

• Chronic
  • Firm, callous-like, fixed to underlying mass of mucosa

• Reactive nodular change
  • Occurs in a patient with a polyp, cyst, etc which, because of its presence, creates a contralateral reaction on an otherwise healthy vocal fold
Nodules

initial vocal nodule
# Nodules

<table>
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<tr>
<th>Vocal quality</th>
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<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breathiness</td>
<td>Change in vocal quality, vocal range</td>
<td><strong>Bilateral, white</strong> protuberances on glottal margin (anterior/middle-third junction)</td>
<td>First option is voice therapy: voice facilitating techniques, vocal hygiene</td>
</tr>
<tr>
<td>Hoarseness</td>
<td>Sensation of something in throat, increased throat clearing</td>
<td>“Hourglass” closure, reduced adduction</td>
<td></td>
</tr>
<tr>
<td>Roughness</td>
<td></td>
<td>Reduced mucosal wave (Rarely) up to 4 at once</td>
<td></td>
</tr>
<tr>
<td>Increased muscle tension</td>
<td></td>
<td>May see compensatory ventricular fold compression</td>
<td></td>
</tr>
<tr>
<td>Decreased pitch</td>
<td>Reduced QOL, particularly in children</td>
<td></td>
<td>For large nodules, surgical removal followed by voice tx</td>
</tr>
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</tbody>
</table>
Polyps

- Fluid-filled lesion composed of gelatinous material in superficial layer of lamina propria
  - Same site as nodules, but slightly deeper lesion
- Active blood supply
- Kleinsasser (1982)
  - 80% were smokers or had history of allergy, LPR
  - 75% male
- Once a polyp begins, continued phonotrauma will continue its growth
Polyps
# Polyps

<table>
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<tr>
<th>Vocal quality</th>
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<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoarse</td>
<td></td>
<td>Acute onset after single phonotrauma</td>
<td>Voice rest/conservation</td>
</tr>
<tr>
<td>Breathy</td>
<td></td>
<td>Irritant exposure</td>
<td></td>
</tr>
<tr>
<td>Rough</td>
<td></td>
<td></td>
<td>Surgical removal: goal to preserve superficial layer</td>
</tr>
<tr>
<td>Low pitch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced pitch</td>
<td></td>
<td>Unilateral (but may have reactive lesion on contralateral fold)</td>
<td></td>
</tr>
<tr>
<td>Reduced range</td>
<td></td>
<td>Red (hemorrhagic) or white Sessile (blister-like) or pedunculated (on a stalk)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Voice tx alone: patients with translucent polyps experience more success</td>
</tr>
</tbody>
</table>
Hemorrhage

- Acute traumatic injury to the blood vessels of vocal fold
- Excessive crying, coughing, screaming, high-intensity singing, surgical/medical procedure, blood-thinning medication
- Small capillary breaks and bleeds into superficial lamina propria
Hemorrhage

LTVF Hemorrhage
<table>
<thead>
<tr>
<th>Hemorrhage</th>
<th>Vocal quality</th>
<th>Complaint</th>
<th>Imaging</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe dysphonia/aphonia at time of bleed</td>
<td>Acute onset following vocal trauma</td>
<td>Focal or diffuse discoloration/patchy redness</td>
<td>May cause localized scar tissue</td>
<td>Aggressive voice conservation and rest</td>
</tr>
<tr>
<td>Hoarseness</td>
<td></td>
<td>Reduced mucosal wave</td>
<td></td>
<td>Severe cases: cauterization to stop bleed</td>
</tr>
<tr>
<td>Breathiness</td>
<td></td>
<td></td>
<td></td>
<td>Once healed, injection of fat or collagen to VF to restore vibratory capacity</td>
</tr>
</tbody>
</table>
Psychogenic Voice Disorders
Psychogenic Dysphonia

- AKA: Conversion dysphonia/aphonia, functional, hysterical, hyperfunction, or muscle misuse dysphonia
- Medically unexplained – no underlying anatomical or physiological pathology
- Sapir’s (1995) 3 criteria for differential diagnosis of psychogenic dysphonia:
  1. Symptom psychogenicity: logical link between symptom onset and psychologic stimulus
  2. Symptom incongruity: inconsistent voice symptoms
  3. Symptom reversibility: responds very well to tx
Psychogenic Dysphonia

• Fairly rare
  • Seen in more women than men at a ratio of 10:1 (Verdolini et al., 2006)
• Unexplained symptoms suggest a neurologic/medical condition
  • Laryngeal, neck, shoulder pain; stiffness
  • SOB; depression; extreme vocal fatigue
  • May be aphonic; however, whisper with clarity and sharpness – generally embarrassed and desire help
• Always use imaging to rule out organic cause
# Psychogenic Dysphonia

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<tr>
<th>Vocal quality</th>
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<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable: hoarse,</td>
<td>Acute onset concurrent with stress/</td>
<td>Normal</td>
<td>Psychology input – reduction of emotional factors</td>
</tr>
<tr>
<td>tense, whispered,</td>
<td>interpersonal conflict</td>
<td>May show</td>
<td></td>
</tr>
<tr>
<td>elevated pitch</td>
<td></td>
<td>hyperfunction</td>
<td></td>
</tr>
<tr>
<td>Non-speech tends to</td>
<td></td>
<td>on speech</td>
<td>Can use non-speech tasks to elicit voicing</td>
</tr>
<tr>
<td>be normal (hum,</td>
<td></td>
<td>tasks</td>
<td></td>
</tr>
<tr>
<td>cough, etc)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Masking noise tends</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>to reveal normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>voice</td>
<td></td>
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</tbody>
</table>
Functional Aphonia

- Whispered speech that retains the rhythm and prosody of normal speech
- May occur after a prolonged period of voice rest
- Laryngoscopy to rule out VF paralysis
- Excellent prognosis
# Functional Aphonia

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<tr>
<th>Vocal quality</th>
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<th>Treatment</th>
</tr>
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<tbody>
<tr>
<td>Absence of voluntary voice production</td>
<td>Total loss of voice, often concurrent with illness/stress/interpersonal conflict</td>
<td>Vocal folds too far apart on phonation</td>
<td>Voice facilitation through non-speech phonation (cough, throat clear, hum), masking noise</td>
</tr>
<tr>
<td>Non-speech tends to be normal (cough, throat clear, etc)</td>
<td>Normal VF adduction for swallowing, cough</td>
<td></td>
<td>Psychology input – reduction of emotional factors</td>
</tr>
</tbody>
</table>
Puberphonia

• AKA mutational falsetto/juvenile voice/incomplete voice mutation

• Inappropriate use of high-pitch beyond pubertal age

• Maturational change affecting voice:
  • Males exhibit speaking in falsetto to top of modal
  • Females higher pitch, anterior tongue placement (child-like speech)
# Puberphonia

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<th>Vocal quality</th>
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<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>High pitch</td>
<td>Inappropriate voice/speech – may cause embarrassment (especially males)</td>
<td>High laryngeal position</td>
<td>Behavioral speech therapy – effective quickly</td>
</tr>
<tr>
<td>Low intensity</td>
<td>CT activation causing stretching of VFs</td>
<td></td>
<td>Light digital palpation</td>
</tr>
<tr>
<td>Breathiness</td>
<td>Hyperfunction</td>
<td></td>
<td>Cough followed by phonation</td>
</tr>
<tr>
<td>Nasality</td>
<td></td>
<td></td>
<td>Counseling</td>
</tr>
</tbody>
</table>
Puberphonia

Me doing some voices exercisers i
Inflammatory Voice Disorders
Reinke’s edema

- Also known as polypoid degeneration of the vocal fold
- Chronic, diffuse swelling of the lamina propria
- Collagen architecture is disrupted, thick gelatinous fluid develops in Reinke’s space
  - Usually bilateral, can be more pronounced on one side
- Strongly associated with smoking, chronic hyperuse, reflux or irritation
Reinke’s edema
# Reinke’s edema

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<th>Imaging</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low pitch</td>
<td>Hoarseness</td>
<td>Edema of the membrane covering the muscular portion of VFs <em>bilaterally</em></td>
<td>Smoking cessation</td>
</tr>
<tr>
<td>Hoarseness</td>
<td>Gravelly, “smoker’s voice”</td>
<td>Asymmetric, aperiodic vibration</td>
<td>Elimination of irritant</td>
</tr>
<tr>
<td></td>
<td>May report breathlessness</td>
<td>Complete closure</td>
<td>Behavioral voice tx</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reduced mucosal wave</td>
<td>Phonosurgery usually not a long-term solution</td>
</tr>
</tbody>
</table>
Idiopathic Dysphonias
Paradoxic Vocal Fold Dysfunction

• Vocal fold adduction occurs on inspiration → airway obstruction

• This paradoxic VF motion is also called episodic paroxysmal laryngospasm
  • Sudden attack (episode) that recurs (paroxysmal)
  • “laryngeal cramp”

• Can look like asthma, VF paralysis, laryngeal edema and trigger emergency medical response (intubation, CPR)
## Paradoxic Vocal Fold Dysfunction

<table>
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<tr>
<th>Vocal quality</th>
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<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal during a non-episode</td>
<td></td>
<td>Normal during a non-episode</td>
<td>Differential diagnosis and identification of triggers</td>
</tr>
<tr>
<td>During episode:</td>
<td>Choking sensation</td>
<td>Inspiratory adduction with posterior glottal gap during an episode</td>
<td>Self-awareness</td>
</tr>
<tr>
<td>audible airway obstruction,</td>
<td></td>
<td></td>
<td>Respiratory-behavioral techniques</td>
</tr>
<tr>
<td>wheezing, stridor, dyspnea,</td>
<td>Globus</td>
<td></td>
<td>Upright position</td>
</tr>
<tr>
<td>choking, cough, aphonia,</td>
<td>Dysphagia</td>
<td></td>
<td>Biofeedback with laryngoscopy</td>
</tr>
<tr>
<td>strained-strangled/weak/hoarse/</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>breathy/diplophonic voice</td>
<td></td>
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</tbody>
</table>
Paradoxic Vocal Fold Dysfunction
Role of Personality

• Why is it that there are certain personality traits that more commonly result in voice disorders?
  • Unknown
  • However, think back to what we know about neuromotor control of the larynx (Simonyan et al., 2005; Dietrich et al., 2012)
    • Premotor/M1/SMA/S1 activation has reciprocal projections with limbic regions
Etiology

- Note: Etiologies can be reciprocal (i.e. unilateral vocal fold paralysis → MTD)
Case Examples

• http://emedicine.medscape.com/article/865191-overview


• http://voicedoctor.net/therapy/vocal-hyperfunction-and-muscle-tension-dysphonia