Introduction

- Changes in vocal quality and speech can be the presenting symptom of underlying neurological disorders (e.g., PD, MG, MS, ALS)
- Neurologic dysfunction of the larynx is difficult to diagnose, even when it is part of a generalized disease process (e.g., PD)
- Neurologists focus on functional assessment but lack techniques for observing the larynx (e.g., strobe)
- Can co-exist w/ a organic or functional voice problem

If it walks like a duck.....
... beware of the dual pathology

**Patient History**

- Laryngeal symptoms may be manifestation of previous medications (e.g., tardive dyskinesia), trauma (CHI), or previously diagnosed neurologic disorder (e.g., PD)
- Family history (e.g., Huntington disease, essential tremor)
- If a pt c/o comorbid dysphagia/drooling, consider a Neuro consult
- What else is going on?... extremity weakness, tremors, gait or balance disturbance, visual problems, cognitive changes, memory, mood, affect, etc.

**The Neuro Trinity**

- Dysphonia
- Dysarthria
- Dysphagia
Dysphonia vs.
Motor Speech Disorder

• Dysarthria, apraxia, and resonance disorders may be mistaken as “hoarseness”
• These reflect deficits of motor control, not laryngeal disease
• Can co-exist (e.g., PD = often present w/ hypokinetic dysarthria as well as hypohonia)

Case #1: NN

• 69 y.o. female w/ 5-6 year h/o “shaky” voice
• Corresponding tremor in hands (R > L) and jaw
• PCP dx w/ essential tremor but no full neuro work-up
• ENT consult = normal VC mobility, no masses, “excessive laryngeal muscle movements”
• Suspect vocal tremor vs. SD
• PMH: GERD (Nexium), HTN, skin cancer

Speech Eval - Hx

• c/o decreased vocal intensity, frequently repeating, difficulty being heard in background noise
• Tried antidepressants to “relax my throat” without benefit
• Social and physically active individual (Elks Club, Zumba, RV social rallies)
Speech Eval - Strobe

- Moderate vocal tremor characterized by perceptually rhythmic modulation in pitch/loudness, slow rate of speech, and reduced intensity
- Laryngeal tremor included rhythmic superior-to-inferior oscillations of the entire larynx as well as rhythmic compression of the lateral pharyngeal walls and ventricular folds
- Magnitude of tremor increased w/ diminishing breath support and loud phonation
- Tremor resulted in intermittent aperiodic vibration and intermittent underapproximation of the VFs

Vocal Tremor

- Essential vocal tremor (EVT) is a neurogenic voice disorder characterized by involuntary laryngeal movements resulting in nearly period changes in pitch and loudness during sustained phonation
- Tremor is action-induced, occurring during voicing. May see no tremor at rest
- Sustained phonation > Connected speech
- Often have co-occurring neurological diagnoses (e.g., essential tremor, dystonia, neurodegenerative disease)

Barkmeier-Kraemer et al. 2011
Treatment of Vocal Tremor

- **Botulinum Toxin Type A** – Used to lessen the magnitude of laryngeal oscillation
- **Speech Therapy** – Goal is not to eliminate the tremor but to teach strategies for minimizing the perception of tremor while speaking
  
  Barkmeier-Kraemer et al. 2011
- **Others** – VF augmentation
  
  Deep brain stim

VTSS

- **Vocal Tremor Scoring System (2006)**
- **Univ of Pitt Voice Center**
- Scoring system used to predict benefit of Botox
- Botox in certain sites (BOT, pharyngeal walls, etc.) = poorer outcomes
- Botox in other sites (interarytenoid muscles, strap muscles, belly of digastric, etc) = better outcomes

Case #1: NN

Pt underwent Neuro consult = started on Primidone, which improved hand/jaw tremor but no change in vocal tremor.

Pt returned for voice tx focusing on:
- Diaphragmatic breathing
- Reduction in laryngeal tension
- Compensatory speech strategies to minimize perception of tremor
Case #2: BC

- 62 y.o. female
- Dx w/ PD in 1990; Currently pt at USF Parkinson’s Disease and Movement Disorder Center
- Sinemet and Selegiline
- Experiences significant dyskinesias with dystonia in the UEs for most hours of the awake day
- c/o difficulty w/ voice and speech; Voice is “weak” and she feels “worn out” speaking

Speech Characteristics in PD

- Reduced loudness
- Hoarse voice quality
- Monotone
- Imprecise articulation
- Vocal tremor

(Darley et al., 1969a; 1969b; 1975; Logemann et al., 1978)

Patients recognize softness of their voice on audio recording but will not automatically adjust intensity due to loss of self-monitoring

Some patients report volume, hoarse voice, or monotone as the first PD symptom

(Aronson, 1990)
Speech Eval

- Mild dysphonia and moderate hypokinetic dysarthria characterized by reduced loudness, monotone pitch and severely rapid/rushed speech rate
- Intelligibility estimated 50% and 70%
- Based on stimulability testing, considered an excellent candidate for the LSVT loud program

Case #3: DG

- 50 y.o. female
- 2-year h/o dysphonia
- ENT Consult = full VC mobility but “excessive adduction of the cords with phonation”
- Rec strob prior to consideration of medical intervention
- PMH: Unremarkable; no additional neuro complaints

Speech Eval - Hx

- Described stoppages of the voice:
  - “my words get broken up”
  - “I sound choppy”
  - “like I’m talking on a cell phone”
  - “only part of a word comes out”
- Worse w/ “stress”
- No additional exacerbating or alleviating factor
- Onset 2 years ago. Initially a progressive worsening but now plateau
Speech Eval - Strobe

- Repeated spasm-like static supraglottic movements and static closure of the true vocal folds during adduction at modal and low pitches, improved at falsetto
- Laryngeal spams-like movements were fleeting and arrhythmic, unlike vocal tremor
- Moderate dysphonia consistent with adductor spasmodic dysphonia (SD)
- Vocalizations primarily characterized by a tight, strained/strangled quality with a halting, staccato voice pattern with sudden stoppages of voicing
- Islands of normal voicing were noted sporadically
- Reasonably clear and continuous vocalizations during singing, humming and falsetto exercises

Spasmodic Dysphonia

- SD, a focal form of dystonia, is a neurological voice disorder that involves involuntary “spasms” of the vocal cords causing interruptions of speech and affecting the voice quality
  - National Spasmodic Dysphonia Association (NSDA)
- Symptoms are action-induced and not apparent at rest
- Certain symptoms may vary during the day, becoming aggravated by certain speaking situations (e.g., talking on the phone, stress)
- Loss of control of the voice
Spasmodic Dysphonia

- Onset 35-55 y.o., mean 45 y.o.
- Hereditary link, often Jewish descent
- Cause is unknown but though to be a CNS disorder and a focal dystonia
- Neurological cause involving abnormal functions of the basal ganglia; an area of the brain which is involved in the control of movement
- May be associated with other focal dystonias (blepharospasm, torticollis)

Adductor Spasmodic Dysphonia (AD-SD)

- Irregular hyper-adduction of vocal folds with excessive glottic closure, which affects the air-flow through the folds
- Tight voice quality, often with abrupt initiation and termination of voicing resulting in a broken speech pattern and short breaks in speech
- Symptoms are most easily heard on vowels, liquids (l and r), or semivowel sounds (w and y)

Abductor Spasmodic Dysphonia (AB-SD)

- Hyper-contraction of the muscles that separate the vocal cords, resulting in a breathy voice pattern
- Usually the voiceless consonants are prolonged and produced with excessive breathiness
- May also present with uncontrolled pitch elevations on vowel initiation, difficulty coordinating breathing with speech, and excessive air loss while speaking
Mixed Spasmodic Dysphonia (Mixed-SD)

- Both elements are present
- Varied presentation – breathy, strained, choppy

Chronic Constricted SD

- Severe “end-stage” SD
- Continuous, strained voice w/ no audible breaks
- SD vs MTD ???
- CC SD responds well to Botox

Treatment of SD

Botox

- Local injections of botulinum toxin into the laryngeal muscles have proven to be the most effective treatment for SD
- Botox weakens the muscles so that spasms are diminished and speech is improved
- Benefits vary for each individual depending on injection technique, dosing, and patient biology, but results can last 6 weeks to 6 months
- The two most common side effects are dysphagia and an increased breathiness. Both usually only last from 6 to 12 days after the injection.
Botox in Treatment of SD

- Not primary tx; can be helpful in differentiating SD vs. MTD or concomitant MTD
- Usually minimally effective in the treatment of SD alone, but more as a complementary form of therapy used in conjunction with Botox injections
- Benefit from Botox is longer in patients who also receive voice therapy aimed at regulating breath support and avoiding excessive glottal adduction
- Vocal therapies include reducing one's vocal effort, loudness, intonation, and rate of utterance while increasing pause time between phrases

Role of Speech Tx in SD

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Case #4: GA

- 69 y.o. male w/ h/o primary lateral sclerosis (PLS) dx 2000 and T-cell leukemia, monitored at MCC
- Admitted Moffitt 2’ increasing weakness, likely r/t progression on PLS
- Clinical swallow eval = mild oropharyngeal dysphagia 2’ weakness and impaired mastication. Also, noted to be severely dysphonic → ENT consult recommended
- ENT = L VCP
- Pt d/c home w/ Hospice given PLS progression. ENT recommended VC medialization injection to hopefully improve communication and QOL
Speech Eval - Strobe

- Severe dysphonia 2° L VCP AND concomitant severe dysarthria 2° progressive PLS
- LVF fixed in paramedian position w/ bowing
- Persistent central glottic gap despite significant supraglottic compression
- Pharyngeal secretions
- Supported recommendation for medialization injection

Treatment in Unilateral VCP

- Medical management (e.g., medialization injection, thyroplasty)
- Speech Therapy
- Dual approach
Contraindications for Speech Tx

• Speech therapy for UVFP is considered to be of limited value when:
  • Severe breathiness is present
  • Significant glottic insufficiency despite significant supraglottic squeeze
  • There are level differences between the vocal folds
  • The patient is aphony, not stimulable for voice
  • > 6 dB loudness is required for successful communication

(Stewart & Allen, 2006)

Questions?

References


Lee Silverman Voice Therapy (LSVT), www.LSVTglobal.org

National Spasmodic Dysphonia Association (NSDA), www.dysphonia.org