



Voice Dysfunction in Neurologic Disorders

There are numerous neurologic disorders that can result in voice dysfunction. The most common conditions that might be seen by the otolaryngologist are spasmodic dysphonia (SD), essential tremor, and Parkinson's disease. If a neurodegenerative disorder is suspected, it is important to arrange a neurologic evaluation for appropriate testing and management of the underlying condition.

SPASMODIC DYSPHONIA

Anatomy & Physiology

- Spasmodic dysphonia (SD) is a focal, action-specific dystonia characterized by intention -induced spasms. In a patient with suspected SD, the vocal tract should be evaluated to identify any abnormalities.

Assessment

- Voice assessment should include reading of a phonetically balanced passage such as the “rainbow passage”, as well as phrases that can trigger a strained/ strangled quality (i.e. “We eat apples and eggs”) or breathy breaks (i.e. “Harry hit the hammer hard”). Studies have shown that auditory cues are more likely to result in correct diagnosis of SD in comparison to video cues.
 - Daraei P, Villari CR, Rubin AD, et al. The role of laryngoscopy in the diagnosis of spasmodic dysphonia. *JAMA Otolaryngol Head Neck Surg.* 2014; 140(3): 228-232. PMID: 24457895.

Pathophysiology

- SD has classically been thought of as a disorder of central motor processing and is categorized into three major groups: adductor which comprises 80% of affected patients, abductor, and mixed. Adductor SD affects the thyroarytenoid-lateral cricoarytenoid (TA-LCA) complex while abductor SD affects the posterior cricoarytenoid (PCA) muscles.
 - Blitzer A, Brin MF, Stewart CF. Botulinum toxin management of spasmodic dysphonia (laryngeal dystonia): a 12-year experience in more than 900 patients. *Laryngoscope.* 1998; 108(10):1435-41. PMID: 9778279

Treatment



- The most commonly utilized treatment is botulinum toxin. This causes a temporary denervation of the TA-LCA complex in adductor SD or the PCAs in abductor SD. The injection is repeated once the botulinum toxin effect fades (generally around 3 months).
 - Blitzer A, Brin MF, Stewart CF. Botulinum toxin management of spasmodic dysphonia (laryngeal dystonia): a 12-year experience in more than 900 patients. *Laryngoscope*. 1998; 108(10):1435-41. PMID: 9778279
- EMG-guided botulinum toxin injections are the most common approach but there are other approaches utilizing fiberoptic assistance that can be performed in the absence of an EMG.
 - Rosen CA, Simpson CB. *Operative techniques in Laryngology*. 1st ed. Leipzig: Springer; 2008. Chapter 35, Botulinum toxin injection of the larynx. p.221-227.
- Supraglottic botox has shown good voice outcomes with decreased breathiness post-injection.
 - Simpson CB, Lee CT, Hatcher JL, Michalek J. Botulinum toxin treatment of the false vocal folds in adductor spasmodic dysphonia: functional outcomes. *Laryngoscope*. 2016; 126(1): 118-121. PMID: 26467807
- Selective laryngeal adductor denervation-reinnervation is an alternative to botox that has demonstrated good voice outcomes and long-lasting results.
 - Chhetri DK, Mendelsohn AH, Berke GS. Long-term follow-up results of selective laryngeal denervation-reinnervation surgery for adductor spasmodic dysphonia. *Laryngoscope*. 2006; 116(4): 635-642. PMID: 16585872

ESSENTIAL TREMOR

Anatomy & Physiology

- Essential tremor typically involves the head and limbs but can also involve various parts of the vocal tract including the palate, pharynx, and larynx. The tremor is regular and not-task specific with a frequency between 4-12 kHz.
 - Louis ED. Essential tremor. *Lancet Neurol*. 2005; 4:100-110. PMID: 15664542

Assessment

- All portions of the vocal tract (palate, pharynx, and larynx) should be assessed during a fiberoptic exam by having the patient hold out a sustained “ee”. Jaw tremor should also be noted as this can significantly impact the voice.

Pathophysiology



- Disease presentation appears to be bimodal with a small percentage of these cases manifesting in the first two decades of life. In some patients, there also appears to be a familial association with transmission in an autosomal-dominant pattern with variable penetrance.

- Louis ED. Essential tremor. *Lancet Neurol.* 2005; 4:100-110. PMID: 15664542

Treatment

- Treatment options include voice therapy or botulinum toxin injections to the thyroarytenoid-lateral cricoarytenoid (TA-LCA) complex and/or strap muscles.
 - Barkmeier-Kraemer J, Lato A, Wiley K. Development of a speech treatment program for a client with essential vocal tremor. *Sem Speech Lang* 2011. 32; 43-57. PMID: 21491358
 - Blitzer A, Brin MF, Stewart CF. Botulinum toxin management of spasmodic dysphonia (laryngeal dystonia): a 12-year experience in more than 900 patients. *Laryngoscope.* 1998; 108(10):1435-41. PMID: 9778279
- Primidone and beta-blockers can improve limb tremor, but some patients have shown improvement in vocal tremor with high doses of propranolol.
 - Justicz N. et al. Comparative effectiveness of propranolol and botulinum for the treatment of essential voice tremor. *Laryngoscope.* 2016; 126(1):113-117. PMID: 26198384

PARKINSON'S DISEASE

Anatomy & Physiology

- Parkinson's disease is characterized by the triad of rigidity, tremor, and bradykinesia. In the larynx, it can impact the structure of the vocal folds. Vocal fold atrophy is a very common finding in this disease.
 - Blumin JH, Pcolinsky DE, Atkins JP. Laryngeal findings in advanced Parkinson's disease. *Ann Otol Rhinol.* 2004; 113: 253-258. PMID: 15112966

Assessment

- Voice assessment will typically reveal a weak and monotone voice quality. Dysarthria and tremor may also be present.
- A fiberoptic exam should be performed to evaluate for atrophy which can be suggested by vocal fold bowing, prominent vocal processes, and deep ventricles. Mobility should also be assessed as this can be affected in certain neurodegenerative disorders.



- If stroboscopy is available, this can help assess glottic closure and competency.

Pathophysiology

- Parkinson's disease is caused by degeneration within the nigrostriatal tracts of the basal ganglia ultimately leading to a decrease in the release of dopamine. It can present at any age but most commonly is seen in the 5th or 6th decade of life.
 - Hoehn MM, Yahr MD. Parkinsonism: onset, progression and mortality. *Neurology* 1967;17:427–442. PMID: 6067254

Treatment

- Lee Silverman Voice Treatment has shown good improvement in voice with benefits that can last up to 2 years. Therapy is directed at improving vocal fold adduction and respiratory effort.
 - Mahler LA, Ramig LO, Fox, Cynthia. Evidence-based treatment of voice and speech disorders in Parkinson disease. *Curr Opin in Otolaryngol Head Neck Surg.* 2015; 23(3): 209-215. PMID: 25943966
- Deep brain stimulation (DBS) or pallidotomy is sometimes used in medically refractory cases of PD, however, there has been some data suggesting that DBS may actually negatively impact voice outcomes.
 - Wertheimer J, Gottuso AY, Nuno M, et al. The impact of STN deep brain stimulation on speech in individuals with Parkinson's disease: the patient's perspective. *Parkinsonism Relat Disord.* 2014; 20:1065-1070. PMID: 25048615
- In certain cases, injection augmentation or medialization laryngoplasty can be performed in order to alleviate glottic insufficiency symptoms.
 - Berke GS, Gerratt B, Kreiman J, Jackson K. Treatment of Parkinson hypophonia with percutaneous collagen augmentation. *Laryngoscope* 1999;109:1295-1299. PMID 10443836