



## **Movement Disorders of the Larynx and Pharynx**

Although many neurological diseases can lead to abnormalities in movement, the term “movement disorders” generally refers to diseases hallmarked by either slowness of movement (bradykinesia) or excessive or abnormal movement (hyperkinesia). The most common movement disorders affecting the voice are Parkinson disease, spasmodic dysphonia and other dystonias, and vocal tremor. Less common disorders that will not be discussed include myoclonus and tardive dyskinesia. Additionally, other neurological disorders such as multiple sclerosis and stroke can lead to abnormal movement in the pharynx or larynx, though they are not truly considered movement disorders. A review written by members of the neurolaryngology committee provides an excellent summary of these disorders.<sup>1</sup>

- Merati, A. L., Y. D. Heman-Ackah, M. Abaza, K. W. Altman, L. Sulica and S. Belamowicz (2005). "Common movement disorders affecting the larynx: a report from the neurolaryngology committee of the AAO-HNS." *Otolaryngol Head Neck Surg* **133**(5): 654-665. PMID 16274788

### **Anatomy and Physiology**

- Movement disorders are generally caused by abnormalities in the basal ganglia. However, peripheral mechanisms for both dystonia and tremor have been proposed.
- Anatomical changes within the larynx are not typically seen in movement disorders. The one exception to this is that vocal fold bowing is typically associated with Parkinson disease.
- Laryngeal dystonia has the following subtypes according to the affected muscles and task-specificity: adductor, abductor, and mixed spasmodic dysphonia; respiratory dystonia. Additionally, vocal tremor may accompany dystonia and MS.
- Essential vocal tremor typically has a rate of about 6-8 Hz. It may be further characterized by the affected muscles. Tremor can affect the intrinsic laryngeal muscles in an adduction-abduction tremor. It can also affect the pharyngeal and strap muscles, which have more of an effect on the vocal tract rather than the larynx. Pharyngeal tremor causes changes in the cross-sectional area of the vocal tract, whereas strap muscle tremor leads to vertical motion of the larynx and intermittent shortening of the vocal tract.
  - Blitzer A, et al. “Neurologic Disorders of the Larynx” in: Flint, P. W. and ClinicalKey Flex. (2015). Cummings otolaryngology—head & neck surgery. Philadelphia, PA, Elsevier/Saunders,: 3 volumes (xl, 3207, 3296 pages).

### **Assessment**

- Clinical assessment is based on history, physical examination, laryngoscopy +/- stroboscopy, and voice evaluation. This is described by Merati, et. al., in the article referenced above. It is important to assess for symptoms and signs beyond the larynx that may warrant referral to neurology



- Typical laryngoscopic findings in Parkinson disease include slowed adduction and vocal fold bowing. General neurologic findings include a “pill-rolling” hand tremor, shuffling gait, and cogwheel rigidity.
- When one suspects spasmodic dysphonia, it is important to have the patient read evocative phrases aloud. In contrast, tremor is best heard with prolonged vowels.
- Spasmodic dysphonia is typically diagnosed by auditory-perceptual factors rather than laryngoscopy. However, laryngoscopy is important to rule out other causes of dysphonia.<sup>2</sup>
  - Daraei, P., C. R. Villari, A. D. Rubin, A. T. Hillel, E. R. Hapner, A. M. Klein and M. M. Johns, 3<sup>rd</sup> (2014). “The role of laryngoscopy in the diagnosis of spasmodic dysphonia.” JAMA Otolaryngol Head Neck Surg **140**(3): 228-232. PMID: 24457895

### **Pathophysiology**

- While the details are far more complex, Parkinson’s disease is caused in part by degeneration of the substantia nigra, leading to decreased dopamine. It typically leads to hypokinetic movement throughout the body, and the voice is often affected in this way, leading to a breathy, quiet, and monotonous voice.
- Dystonia is associated with abnormal muscle contraction that is often task-specific. In the larynx, this is most commonly adduction during phonation, which leads to strain or “breaks,” known as phonatory arrests, with vowels or voiced consonants.
- As with dystonia, the effect of tremor on the voice depends on the affected muscles. Intrinsic laryngeal tremor is more likely to cause changes in loudness, whereas vertical (strap muscle) tremor is more likely to cause changes in pitch.
  - Blitzer A, et al. “Neurologic Disorders of the Larynx” in: Flint, P. W. and ClinicalKey Flex. (2015). Cummings otolaryngology--head & neck surgery. Philadelphia, PA, Elsevier/Saunders,: 3 volumes (xl, 3207, 3296 pages).

### **Treatment**

- Parkinson disease: treatment typically focuses on the systemic aspects rather than the voice specifically. Treatments include dopaminergic medications (e.g., levodopa/carbidopa) and deep brain stimulation. These treatments may not be adequately effective for the voice. The first line treatment for the voice is an intensive voice therapy program, LSVT Loud.<sup>3</sup> Additionally, treatment aimed at glottic insufficiency (injection augmentation or type 1 thyroplasty) may have a role<sup>4</sup>. These are described in more detail in sections 54 and 57 of this curriculum.
  - Fox C, Ebersbach G, Ramig L, Sapir S. LSVT LOUD and LSVT BIG: Behavioral Treatment Programs for Speech and Body Movement in Parkinson Disease. Parkinsons Dis 2012; 2012:391946. PMID: PMC3316992
  - Roubeau B, Bruel M, de Crouy Chanel O, Périé S. Reduction of Parkinson's-related dysphonia by thyroplasty. European Annals of Otorhinolaryngology, Head and Neck Diseases 2016; 133:437-439. PMID: 27522148



- Laryngeal dystonia: the mainstay of treatment is botulinum toxin injection of the affected muscle groups (adductor or abductor). Additional treatments include selective adductor denervation-reinnervation for ADSD. The rationale and techniques for each are well describe in the following articles:<sup>5,6</sup>. Botulinum toxin injection is also described in detail in section 58 of this curriculum.
    - Meyer, T. K. (2012). "The treatment of laryngeal dystonia (spasmodic dysphonia) with botulinum toxin injections." *Operative Techniques in Otolaryngology-Head and Neck Surgery* **23**(2): 96-101.
    - Long, J. L. and G. S. Berke (2012). "Selective laryngeal adductor denervation-reinnervation surgery for spasmodic dysphonia." *Operative Techniques in Otolaryngology-Head and Neck Surgery* **23**(3): 183-187.
  
  - Laryngeal tremor: As with SD, the primary local treatment is botulinum toxin injection. The primary role is to decrease the amplitude of the tremor, though it cannot relieve it completely. Systemic medications, most notably propranolol and primidone, are also options.
  - Role of voice therapy in SD and tremor: The role of voice therapy in these disorders is controversial.<sup>7,8</sup> Voice therapy alone is not generally effective in improving laryngeal dystonia or tremor, but it can be helpful in giving the patient strategies to cope with the disorder or to manage the voice following botulinum toxin or other treatment. Additionally, response to therapy may serve a diagnostic role in differentiating muscle tension dysphonia (which would respond to therapy) from strain-dominant ADSD (which would not).
    - Murry T, Woodson GE. Combined-modality treatment of adductor spasmodic dysphonia with botulinum toxin and voice therapy. *Journal of voice : official journal of the Voice Foundation* 1995; 9:460-465. PMID: 8574315
    - Silverman EP, Garvan C, Shrivastav R, Sapienza CM. Combined modality treatment of adductor spasmodic dysphonia. *Journal of voice : official journal of the Voice Foundation* 2012; 26:77-86. PMID: 21292439
  
  - While treatment of the voice in the above conditions can have a great impact on quality of life, it is important to note that some patients may opt for observation.
1. Merati AL, Heman-Ackah YD, Abaza M, Altman KW, Sulica L, Belamowicz S. Common movement disorders affecting the larynx: a report from the neurolaryngology committee of the AAO-HNS. *Otolaryngology--head and neck surgery : official journal of American Academy of Otolaryngology-Head and Neck Surgery* 2005; 133:654-665.
  2. Daraei P, Villari CR, Rubin A Det al. The role of laryngoscopy in the diagnosis of spasmodic dysphonia. *JAMA otolaryngology-- head & neck surgery* 2014; 140:228-232.



3. Fox C, Ebersbach G, Ramig L, Sapir S. LSVT LOUD and LSVT BIG: Behavioral Treatment Programs for Speech and Body Movement in Parkinson Disease. *Parkinsons Dis* 2012; 2012:391946.
4. Roubeau B, Bruel M, de Crouy Chanel O, Périé S. Reduction of Parkinson's-related dysphonia by thyroplasty. *European Annals of Otorhinolaryngology, Head and Neck Diseases* 2016; 133:437-439.
5. Meyer TK. The treatment of laryngeal dystonia (spasmodic dysphonia) with botulinum toxin injections. *Operative Techniques in Otolaryngology-Head and Neck Surgery* 2012; 23:96-101.
6. Long JL, Berke GS. Selective laryngeal adductor denervation-reinnervation surgery for spasmodic dysphonia. *Operative Techniques in Otolaryngology-Head and Neck Surgery* 2012; 23:183-187.
7. Murry T, Woodson GE. Combined-modality treatment of adductor spasmodic dysphonia with botulinum toxin and voice therapy. *Journal of voice : official journal of the Voice Foundation* 1995; 9:460-465.
8. Silverman EP, Garvan C, Shrivastav R, Sapienza CM. Combined modality treatment of adductor spasmodic dysphonia. *Journal of voice : official journal of the Voice Foundation* 2012; 26:77-86.