



VOICE DISORDERS

**VOICE DYSFUNCTION IN
NEUROLOGICAL DISORDERS**

Voice Dysfunction in Neurological Disorders: Highlights

Voice Symptom Is Clue to Neurological Disorder

Voice disturbance can be the first sign of a neurological disease.

Neurological Voice Disorders Accompanied by Other Symptoms

Although a change in voice can be the primary component of a neurological disease, other accompanying signs and symptoms are usually present as well.

Key Clues Obtained From History and Physical Examination

Neurological voice problems are primarily diagnosed via patient history and physical examination.

Treatment for Neurological Voice Disorders Aimed at Improving Voice Function

Usually, there is no specific cure for the underlying neurological disease; treatment is typically aimed at minimizing symptoms and improving function. Treatment may involve care from a speech-language pathologist and an otolaryngologist.

Improving Voice and Speech Function Can Improve Quality of Life

As patients' life expectancy and prognoses from the neurological disease improve, quality of life issues such as voice and communication become more important problems to address.

Red Flag

Any and all airway problems require immediate attention.

Overview of Voice Dysfunction in Neurological Disorders

What are neurological problems of the voice?

Normal speech production requires precise control and coordination of the muscles of the voice box, throat, palate, jaw, tongue, and lips. Neurological disorders are due to abnormalities of the brain and/or the nerves of the body. These abnormalities result in impaired control of the muscles of the voice box, throat, palate, jaw, tongue, or lips, causing a variety of voice and/or speech problems.

Coordination Problems Affecting Voice and Speech Functions

- A **neurologic voice** abnormality is an abnormality of the coordination, control, or strength of the voice box muscles.
- A **speech disorder** is the result of a malfunction of the tongue and lip muscles that causes abnormal articulation of words or parts of words.
- **Dysarthria**, or difficulty in forming words, is a neurological problem commonly seen in stroke patients.

Voice Problems in Neurological Diseases – Different Underlying Problems

The type of voice problem varies with the underlying disease process and the specific muscles and actions that are affected.

- **Weakness of voice box muscles:** When neurological voice disorders lead to weakness of the voice box muscles, the voice may be very weak, breathy, and subject to fatigue.
- **Spasm of voice box muscles:** A harsh and strained voice may be present due to vocal fold spasms caused by an underlying neurological condition.
- **Weakness of palate muscles:** The voice may also sound too nasal as a result of weakness of the palate muscles.
- **Weakness of tongue/jaw/lip muscles:** Speech patterns may be slurred or monotonous from neurological problems affecting the tongue, jaw, and/or lip muscles.

What are the symptoms of neurological voice disorders?

- Isolated hoarseness is usually due to a problem within the larynx, but could be a sign of neurologic disease affecting the muscles of the larynx.
- Neurologic hoarseness is usually accompanied by other symptoms, such as:
 - Speech distortion
 - Swallowing problems
 - Choking when drinking liquids
 - Neurological problems elsewhere in the body (i.e., arm or leg weakness or tremor)
- The onset of difficulty forming words in adults virtually always indicates a neurologic problem. These problems are usually the result of a stroke.
 - Poor control of the muscles that shape words (dysarthria) – symptoms may range from slurring of speech to imprecise consonants to completely incomprehensible speech
 - Stuttering or stammering (**dysfluent speech**)
 - Know what you want to say, but inability to the words out (**aphasia**)
 - Inability to remember words
- A change in resonance, such as an overly "nasal" sounding voice, often indicates impaired control of throat or palate muscles.
- A shaking, tremulous voice indicates a tremor, which is seen in a variety of neurological disorders.
- Abrupt voice spasms are also signs of neurological dysfunction, although sometimes patients with emotional problems could

have similar changes in voice sound.

- Difficulty breathing can be a sign of an underlying neurological disease and may be due to weakness or paralysis of both vocal folds, which results in a narrow, compromised airway.

What are some of the more common neurological diseases that affect the voice?

The more common neurological diseases that affect the voice are:

- Stroke or cerebrovascular accidents
- Parkinson's disease
- Myasthenia gravis
- Benign essential tremor
- Amyotrophic lateral sclerosis (ALS), also known as Lou Gehrig's disease
- Multiple sclerosis
- Spasmodic dysphonia

Because of the complex and diverse nature of neurological voice disorders, the more common conditions will be covered individually, addressing the following areas:

- Cause and risk factors for voice dysfunction
- Voice symptoms
- Diagnosis of voice dysfunction
- Treatment of voice dysfunction

What is the role of the voice care team in neurological disorders with voice dysfunction?

Addressing Quality of Life Issues as Disease Prognosis Improves

Traditionally, many progressive degenerative neurological diseases have not been referred to laryngologists or other voice specialists because clinicians believed that voice improvements could not be achieved. In reality, as patients' life expectancy and prognoses improve, quality of life issues such as voice and communication become more important problems to the patient.

Improving Voice and Speech Function can Contribute to Quality of Life

Many excellent minimally invasive treatments currently exist to treat both vocal fold spasms (Botox) and vocal fold weakness (injection laryngoplasty/medialization laryngoplasty). In addition, in many cases, a speech-language pathologist can help the patient significantly improve speech, voice, and/or swallowing, thus enhancing quality of life.

Stroke

What is the cause of stroke? Who is at risk?

Stroke results from interrupted blood flow to the brain or brainstem and is generally seen in males above the age of 50. The risk factors for stroke include high blood pressure, high cholesterol levels, and vascular disease.

What are the typical symptoms of voice dysfunction in patients with stroke?

Voice Dysfunction in Strokes That Affect the Brainstem

- Vocal symptoms typically consist of a hoarse, breathy voice when the brainstem is involved in stroke; these symptoms are due to paralysis of the vocal fold muscles on one side.
- Often, the patient will also experience swallowing difficulties as well as coughing/choking (especially when drinking liquids); these symptoms can be quite severe and debilitating.
- The combination of a paralyzed vocal fold, poor airway protection, weakened swallowing muscles, and loss of feeling/sensation in the throat probably explains the severe nature of swallowing problems in some stroke patients.
- Occasionally, a weak palate will cause a hypernasal voice.

Voice Dysfunction When Stroke Affects Cerebral Cortex (Brain)

- Vocal symptoms with cerebral cortex strokes are more often related to articulation disorders (slurred speech, or **dysarthria**) rather than hoarseness.
- Some patients may have loss of speaking ability (**aphasia**) when the dominant brain hemisphere is affected.

Red Flag

Voice/speech disturbances are *not* initially the dominant symptoms in stroke. Dominant symptoms can include weakness or paralysis of the arms and/or legs, incoordination (ataxia), numbness in the arms/legs, partial/total loss of vision, and loss of consciousness/coma.

How is stroke diagnosed?

Generally, a specialist in nerve/brain disorders (neurologist) is the most appropriate physician for the diagnosis and treatment of stroke. An MRI or CAT scan is generally ordered to locate the area of the brain affected, but a good history and physical examination often pinpoints the diagnosis.

How is stroke treated and what is the prognosis?

- New clot-dissolving drugs, when administered early during the emergence of stroke symptoms, can make a huge difference in minimizing the dysfunction caused by stroke.
- The overall prognosis of stroke varies considerably; in general older patients face a worse prognosis for recovery of function. Vocal and swallowing difficulties often persist and can be so severe that the patient is dependent on a feeding tube for nutrition and is unable to communicate.
- Speech and swallowing therapy with a speech/language pathologist is essential in the rehabilitation process for many stroke patients. These services can significantly improve the stroke patient's ability to communicate, swallow, and cope.

Parkinson's Disease

What are the typical symptoms of voice dysfunction in patients with Parkinson's disease?

Parkinson's disease patients typically have a low-volume voice with a monotone (expressionless) quality. The speech pattern is often produced in short bursts with inappropriate silences between words and long pauses before initiating speech. The speech may also be slurred. A small percentage of patients (about 15 percent) may also have a tremulous voice.

Key Information

As with most neurological disorders, voice and speech disturbance are merely a small fraction of Parkinson's disease symptoms. Tremor in the hands, slow, shuffling gait, and other movement disturbances dominate the picture and often appear long before vocal difficulties arise.

What is the cause of voice dysfunction in Parkinson's disease? Who is at risk?

The cause of Parkinson's disease is not fully understood. Loss of nerve cells in select areas of the brainstem occurs through an unknown mechanism. The disease is more common in men (3:2 male-to-female ratio), and the age of onset is usually above the age of 50. No risk factors are known.

How is Parkinson's disease diagnosed?

A neurologist diagnoses Parkinson's disease via patient history and physical examination. MRI and/or CAT scans are often obtained to help rule out other conditions.

Difficulties in Diagnosis: Disorders That Can Mimic Parkinson's Disease

Exposure to certain toxic substances, such as carbon monoxide, and side effects from certain anti-seizure medications can cause symptoms similar to Parkinson's disease.

How is Parkinson's disease treated?

- A team approach with involvement of specialists in neurology, speech pathology, and otolaryngology is recommended. Rehabilitation of speech, voice, and swallowing ability is typically handled by a speech pathologist.
- Medication (levodopa) is commonly used for the motor manifestations of Parkinson's but may have little effect on the voice and speech.
- The main treatment of communication problems (slurred speech and soft, weak voice) involves the use of a specialized voice therapy treatment method called [Lee Silverman Voice Treatment \(LSVT\)](#). Prior to LSVT, speech therapy for Parkinson's disease patients had very little success. Recent research, however, has shown significant improvement in quality of life, speech, and vocal function following the LSVT program. *(For more information, see Voice Therapy.)*
- An otolaryngologist may be consulted to suggest surgical treatments that can help a patient enhance voice volume. Typically, medialization laryngoplasty or injection laryngoplasty (with fat, collagen, and a variety of other substances) is used to "bulk" up the weakened vocal folds. However, results of these procedures are often disappointing due to the global nature of the voice problem.
- Deep brain stimulation has been used to treat Parkinson's disease; unfortunately, voice symptoms may not improve, and may actually worsen with this treatment.

Key Information

In the late 1990s, patients with Parkinson's disease felt some hope that medialization laryngoplasty or injection laryngoplasty

would cure their vocal difficulties. Unfortunately, such a cure has not been found. Injections of collagen (autologous or bovine) do result in improved vocal fold contact, but most laryngologists believe this results in little to no benefit in the patient's voice.

The primary problem with Parkinson's patients' voices is due to the hypokinetic nature of their disease (reduced effort, reduced airflow) rather than any loss of muscular tissue in the vocal folds. This probably explains the disappointing results with collagen injection and medialization laryngoplasty.

Benign Essential Tremor (BET)

What is benign essential tremor?

Tremor from Abnormal Muscle Contraction

BET is a neurologic disease that involves abnormal control of muscle contraction. The result is a "tremor" or shake of the involved muscle(s) either at rest or when the muscle(s) are in use. This often causes a periodic "shake" in the hand with and/or without use.

Voice Wobble or Shake in BET

BET can occur in the muscles of the palate, tongue, throat, and vocal folds. The result is an inability to keep the voice steady. Thus, the sound of the voice has a periodic (regular) wobble or shake.

What are the typical symptoms of voice dysfunction in patients with BET?

BET is one of the more common neurological disorders that can affect the voice. The symptoms that may be present are:

- Tremor in the hands
- Tremor involving the head
- Shaky or tremulous voice

All three symptoms may be present, or only one may dominate.

What is the cause of BET?

Who is at risk?

As with most neurological disorders, the cause is not fully understood. BET is more common in females and often does not present until age 40 to 50. It may be hereditary in certain instances. No other risk factors are known.

How is BET diagnosed?

The diagnosis is most often made by careful history and physical examination by a neurologist.

Difficulties in Diagnosis

- Without a laryngological examination, BET may be misdiagnosed by a neurologist if only vocal tremors are present and head and hand tremors are absent. In these cases, a fiberoptic laryngoscopy exam by a laryngologist/voice specialist may be needed to make the diagnosis.
- Other neurological disorders may have tremor as a component and be mistaken for BET, especially in the case of adductor spasmodic dysphonia with tremor. (*For more information, see Spasmodic Dysphonia.*)
- Other disorders such as Parkinson's disease, ALS, and cerebellar ataxia may have vocal tremor as a component of the voice disorder but are rarely mistaken for BET.

How is BET treated?

Medications such as propranolol are sometimes employed to control the tremor, however they usually only have a mild effect on the vocal tremor. Botulinum toxin injection into the vocal folds may be attempted, but success is generally lower than that achieved for spasmodic dysphonia patients (usually 50 to 75 percent).

Amyotrophic Lateral Sclerosis (ALS or Lou Gehrig's Disease)

What are the typical symptoms of voice dysfunction in patients with ALS?

ALS is a progressive neurological disease that may present initially with speech/voice difficulties as the primary symptoms in up to 10 to 15 percent of patients, including:

- Spastic/strained voice
- Slurred speech
- Hypernasal voice

Eventually, other symptoms, such as weakness and spasms of the limbs, will appear and predominate. Most patients, however, notice weakness or non-coordination in their arms or legs before they begin to have vocal changes.

What is the cause of the disease?

Who is at risk?

- The cause of ALS is unknown and no risk factors have been identified in most patients.
- A small percentage (5 to 10 percent) of cases run in families.
- The average age of onset is between 50 to 60 years of age.

How is ALS diagnosed?

A careful history and physical examination by a neurologist, along with blood tests and X-rays to rule out other (rare) causes, will suffice in making the diagnosis.

Difficulties in Diagnosis: Challenges in Identifying ALS

- Early stages of ALS can easily be missed. Vocal difficulties associated with ALS can mimic spasmodic dysphonia (if vocal spasms predominate) or vocal fold paresis (if vocal fold weakness and flaccid symptoms predominate). Patients who have only voice/speech problems may be sent to an otolaryngologist for care.
- Typically, within weeks to months ALS progresses to involve the arms/legs, at which point the diagnosis becomes more obvious. A consultation with a neurologist should result in a correct diagnosis.

How is ALS treated and what is the prognosis?

- There is no cure for ALS – only supportive care.
- The disease is variable, but half of ALS patients die from respiratory failure within three years of onset of symptoms.
- With some slowly progressive forms of the disease, patients may live for 10 years. In these select cases, an otolaryngologist may perform the following:
 - Injections of Botulinum toxin, type A into the vocal folds, to relieve vocal spasms
 - Framework surgery that brings the vocal folds together to improve vocal fold vibration during sound production ([medialization laryngoplasty](#)), to relieve a breathy voice

Myasthenia Gravis (MG)

What are the typical symptoms of voice dysfunction in patients with MG?

- The typical symptoms of myasthenia gravis involve the eyes, specifically double vision and drooping eyelids. The symptoms usually arise after repetitive tasks (due to muscle fatigue) and improve with short periods of rest.
- Voice and speech-related symptoms include:
 - Hoarseness
 - Vocal fatigue
 - Difficulty with controlling the pitch of the voice
 - Hypernasal voice
 - Mildly slurred speech
 - Monotone voice
 - Swallowing difficulty
 - Weakness of the jaw muscles

What is the cause of MG?

Who is at risk?

- Myasthenia gravis is an autoimmune disease affecting the nerve-muscle interface.
- The disease is more common in women (2:1). It typically presents between the ages of 30 and 40 in females and between the ages of 60 and 70 in males.
- No known risk factors exist.

How is MG diagnosed?

- The most reliable method of diagnosis is a blood test that detects the abnormal antibodies to the nerve-muscle receptor. Some investigators have pointed out that these antibodies may be undetectable in cases of isolated laryngeal MG.
- Another method is the so-called "tensilon test." The muscle in question is fatigued by a repetitive task and edrophonium (tensilon) is given to dramatically, but temporarily, reverse the fatigue.
- Other tests look at the muscles' electrical firing (EMG) during repetitive tasks and their response to tensilon.

Difficulties in Diagnosis

- The most common pitfall is a failure to recognize the often subtle symptoms of myasthenia gravis.
- Because vocal fatigue is such a common component of many other voice disturbances, an otolaryngologist may misdiagnose the patients' condition as muscle tension dysphonia, paresis of the vocal folds, or voice overuse/abuse.
- Evaluation by a neurologist should be obtained in unclear or unusual cases of vocal fold weakness or fatigue to rule out myasthenia gravis.

How is MG treated and what is the prognosis?

- MG is treated with medications called anticholinesterases (pyridostigmine or Mestinon), which restore muscle strength and reduce the tendency toward fatigue.
- In young patients recently diagnosed with MG or adult patients with a thymoma (a benign tumor in the thymus gland of the

upper chest), a thymectomy may help control symptoms or lead to remission of the disease.

- With the current therapeutic options, myasthenia gravis is a disease that can be reasonably controlled without any effect on the patients' life expectancy.

Red Flag

Myasthenia gravis is felt by most laryngologists to be a rare cause of isolated hoarseness. Some laryngologists have described "isolated" MG of the larynx with hoarseness, vocal fatigue, reduced loudness, difficulty with pitch, and lack of vocal clarity – without any of the other eye, neck, jaw, or facial muscular weakness. These cases of "isolated" MG were mostly seronegative, meaning that the blood test for MG was negative. Many of the patients had improvement in their voice symptoms on MG medications, and subjective changes in their EMG testing that are somewhat compelling.

It remains to be seen whether MG is a more common cause of isolated voice problems.

Overview

What are the typical symptoms of voice dysfunction in patients with multiple sclerosis (MS)?

- MS is a chronic neurological disease characterized by episodes of dysfunction of the nervous system that increase and decrease (remit and recur) over several decades. Commonly, long periods of normal function occur in between these episodes.
- Voice symptoms may include hoarseness and poor control of volume and pitch.
- Speech problems are more common and have been characterized as "scanning speech," in which each syllable is produced slowly and hesitantly with a pause after every syllable.
- Other important symptoms of MS include dizziness (vertigo) and altered vision.

What is the cause of MS? Who is at risk?

The cause of MS is unknown, but it is thought to be viral in origin. The process involves loss of the protective sheath around nerves in the brain/brainstem. The disease is more common in females, higher socioeconomic groups, and at northern and southern latitudes (more rare at the equator). Onset of disease most frequently occurs in young adulthood.

How is MS diagnosed?

Diagnosis of MS may take years. MS is characterized by multiple signs and symptoms, with remissions and exacerbations of the disease. CT or MRI scans may show the characteristic scar changes in the brain, and fluid from spinal tap may also help in the diagnosis.

Difficulties in Diagnosis

Because of the long latent periods (periods where disease is not present) and the waxing and waning of symptoms, MS is easily missed. Repeated examinations and clinical suspicion by a neurologist will help make the diagnosis.

How is MS treated and what is the prognosis?

- There is no cure for MS at this time. Care is directed towards controlling symptoms.
- Speech therapy plays an important role in improving quality of life in patients.
- Medical therapy includes corticosteroids for acute exacerbations of MS symptoms.
- For chronic treatment of MS, interferon and chemotherapeutics such as Novantrone have been used to slow the progression of the disease.

Voice Dysfunction in Neurological Disorders: Vocabulary

Neurological Voice Disorders

Voice problems caused by abnormal control, coordination, or strength of voice box muscles due to an underlying neurological disease such as: stroke, Parkinson's disease, multiple sclerosis, myasthenia gravis, or ALS

Dysarthria

Difficulty forming words – presenting with imprecise consonants and hard-to-understand speech as seen with stroke patients

Speech Disorder

Malfuction of the tongue and/or lip muscles resulting in garbled words or parts or words

 **Advisory Note**

Patient education material presented here does not substitute for medical consultation or examination, nor is this material intended to provide advice on the medical treatment appropriate to any specific circumstances.

All use of this site indicates acceptance of our Terms of Service.