VOICE AND SPEECH DISORDERS

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VOICE AND SPEECH

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Speech is an audible communication and consists of phonation, resonance and articulation.

- **Phonation**

Expired air and pressure induce vocal folds vibrations. Factors affecting phonation include:

- ✓ **Appropriate approximation of vocal folds:**
  - **Too tight closure of vocal folds** needs excessive expiratory force and makes the voice:
    - Strained
    - Harsh
    - Complete aphonia.
  - **Too far apart vocal folds** need increased expiratory airflow volume and voice becomes:

- Weaker and whisper (lack of volume)
- Breathier.

✓ **Three-dimensional shape of vocal folds:** Atrophy of vocal folds may lead to:

- **Concavity in axial planes:** Results in incomplete glottal closure
- **Concavity in coronal planes:** Results in convergent airflow tract.
- **Length and tension of vocal folds:** The control of length and tension facilitates normal inflections in pitch and tone and lack of control may make the voice:
  - **Flat and expressionless:** Lack of voice inflection
  - **Distorted** by uncontrolled pitch breaks.

- **Suppleness of vocal fold mucosa:** It provides free vibrations.

Resonance

- The resonance modifies phonation and produces voice. Unmodified phonated sound of vocal folds is strident and unpleasant noise. The principles of modification consist of selective amplification and dampening of component frequencies. They are used in speech therapy.
  - ✓ **Factors affecting** vocal resonance include:
    - Resonance of head, neck and chest
    - Motor activity of pharynx and oral cavity.
  - ✓ **Causes:** They include:
    - Amyotrophic lateral sclerosis
    - Stroke
    - Guillain-Barré syndrome (acute idiopathic polyneuropathy).

Articulation

Articulation shapes the voice into words with the help of lips, tongue, palate, pharynx and larynx. The impaired motor output (weakness, palsy, or incoordination), cognitive or language defects may cause dysarthria.

CLASSIFICATION OF VOICE AND SPEECH DISORDERS

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Disorders of Speech

- **Dysphasia or aphasia:** Impaired comprehension or production of speech due to a lesion of dominant cerebral hemisphere.
  - ✓ **Receptive (sensory) dysphasia:** Impairment in comprehension of words. Patient appears unaware of deficit. Lesion lies in auditory or visual association areas of cerebral cortex.
    - **Auditory aphasia (word deafness):** Though hearing is normal, patient cannot comprehend spoken word. Spontaneous speech, reading and writing are normal.
    - **Visual aphasia or word (text) blindness or alexia:** Though vision is normal, patient is unable to comprehend meaning of written word.
    - **Jargon aphasia (agrammatism):** Severe sensory aphasia and speech are incomprehensible.

- ✓ **Expressive (motor) dysphasia or Broca's aphasia**
  - **Conduction aphasia:** Skipping or repeating words or substituting one word for another (paraphasia). Patient is aware of deficit.
  - **Nominal or amnesic aphasia (anomia):** Difficulty in naming objects and persons seen, heard, or felt.
  - **Mixed or global or total aphasia:** All aspects of speech and communications are impaired.

- **Dysarthria:** Disturbance of articulation due to faulty working of lips, tongue, palate, pharynx and larynx.
  - ✓ **Supranuclear lesions (corticobulbar tract):** Pseudobulbar palsy, cerebral diplegia, degenerative or ischemic changes.
  - ✓ **Extrapyramidal (Parkinsonism):** Vocal strain, voice arrests, pitch breaks and pitch instability.
  - ✓ **Cerebellar:** Slurring and scanning speech.
  - ✓ **Nuclear lesions**.
  - ✓ **Infranuclear lesions**.
  - ✓ **Muscular lesions**.

Disorders of Voice

- ✓ **Dysphonia:** General change in voice quality.
  - Dysphonia plica ventricularis.
- ✓ **Aphonia:** No sound is emanated from vocal folds when there is lack of vocal cord approximation or lack of air passing through the glottis.
  - Functional (hysterical)
  - Organic.
- ✓ **Diplophonia:** When vocal cords are affected differently they vibrate at two different frequencies.
- ✓ **Puberphonia** (mutational falsetto voice).
- ✓ **Phonasthenia**
- ✓ **Disorders of resonance**
- ✓ **Rhinolalia**
  - Rhinolalia aperta (hypernasality)
  - Rhinolalia clausa (hyponasality)

Hyperfunctional Disorders

- ✓ Stammering (stuttering)
- ✓ Spasmodic dysphonia (SD)
- ✓ Tremors
- ✓ Tic disorders
- ✓ Myoclonus.

Stridor

- It is the noisy (high-pitch) respiration due to turbulent airflow that is caused by an upper airway obstruction

Hoarseness

- Any change in voice quality to harsh, rough or raspy voice to weak voice, is usually referred as hoarseness.

DYSPHONIA PLICA VENTRICULARIS (VENTRICULAR DYSPHONIA)

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In this condition, ventricular folds (false cords) take over the function of true cords.

- **Etiology**
  - ✓ **Secondary:** In cases of impaired function of the true cord (paralysis, fixation, surgical excision, or tumors), ventricular bands try to compensate phonatory function of true cords.
  - ✓ **Functional:** Psychogenic.
- **Clinical Features**
  - ✓ **Voice:** Rough, low-pitched and unpleasant voice.
  - ✓ **In functional cases:** In beginning voice is normal but becomes rough later when false cords take over the function of true cords.

- **Laryngoscopy**
  - ✓ False cords approximate partially or completely on phonation and obscure the view of true cords.
- **Treatment**
  - ✓ **Secondary:** Ventricular dysphonia is difficult to treat.
  - ✓ **Functional Type:** Voice therapy and psychological counseling

FUNCTIONAL APHONIA (HYSTERICAL APHONIA)

FUNCTIONAL APHONIA (HYSTERICAL APHONIA)

- This functional disorder is usually seen in emotionally labile young females.
- The sudden onset aphonia is not associated with other laryngeal symptoms.
- Patient is usually able to whisper.
- **Laryngoscopy**
  - ✓ Vocal cords remain in abducted position and fail to adduct on phonation. The adduction of vocal cords occurs on coughing and sound of cough is normal.
- **Treatment**
  - ✓ Reassurance and psychotherapy

PUBERPHONIA (MUTATION FALSETTO VOICE)

PUBERPHONIA (MUTATION FALSETTO VOICE)

Failure in the change of childhood high-pitched voice to low-pitched male voice after puberty in boys is called puberphonia. However, the boy's physical and sexual development is normal.

- **Pertinent Anatomy**

Until puberty, the larynx of male and female have identical dimensions. Childhood voice has higher pitch. After puberty, male larynx grows rapidly. Increase in length of rima glottidis (vocal cords lengthen) brings change in character of male voice (voice becomes lower pitched). The female larynx changes a little.

- **Risk Factors**
  - ✓ These boys are emotionally immature, feel insecure and show excessive fixation to their mother or sister. Psychologically, these boys try to avoid male responsibilities.
- **Treatment**
  - ✓ Speech therapy and psychotherapy.
  - ✓ Gutzmann's pressure test: In this maneuver, the thyroid prominence is pressed in a backward and downward direction. It relaxes the overstretched cords and low-tone voice is produced. In this way, boy can learn to produce low-tone voice and trains himself to produce syllables, words and sentences.
  - ✓ Prognosis is usually good.

PHONASTHENIA

PHONASTHENIA

This is fatigue of phonatory muscles (especially thyroarytenoid and interarytenoid) and results in weakness of voice.

- **Risk Factors**
  - ✓ Abuse or misuse of voice or laryngitis.
- **Clinical Features**
  - ✓ Easy fatigability of voice.

- ✓ Indirect laryngoscopy findings on saying “eeee”:
  - Elliptical space **(Fig. 1)** between the cords (thyroarytenoid weakness).
  - Triangular gap near the posterior commissure (interarytenoid weakness).
  - Keyhole appearance of glottis **(Fig. 2)** due to combination of both elliptical space between the cords and triangular gap near the posterior commissure (weakness of both thyroarytenoid and interarytenoid).

- **Treatment**
  - Voice rest and vocal hygiene.
  - Periods of voice rest after excessive use of voice.

GLOTTIC INSUFFICIENCY

GLOTTIC INSUFFICIENCY

It refers to inappropriate escape of air during phonation due to incomplete closure pattern of glottis

- **Causes:** Vocal cord lesions, atrophy, scar, paresis or palsy. In sulcus vocalis, vocal cord epithelium is scarred to vocal ligament.
- **Diagnosis (laryngovideostroboscopy):** During phonation, glottis remains in closed phase for more than 45–50% of each vibratory cycle at the mos
  loudness. Less than 45–50% indic
  (GI).

- **Differential diagnosis: Muscle tension dysphonia (MTD)** is usually the result of compensation for the underlying GI.
- **Treatment:** Depending upon the cause and severity, the treatment includes:
  - ✓ **Voice therapy:** It is given by speech language pathologist or voice pathologist for 4–6 weeks. Vocal and breathing techniques retrain the sound production system and instill new muscle memory techniques with least injury. It relieves or "unloads" the larynx of hyperfunctional behavior.
  - ✓ **Injection augmentation:** Autologous fat, calcium hydroxyapatite gel, human acellular dermis, carboxymethylcellulose gel, or hyaluronic acid gel.
  - ✓ **Medialization laryngoplasty:** Insertion of silastic or Gore-Tex(R)

MUSCLE TENSION DYSPHONIA

MUSCLE TENSION DYSPHONIA

It is the most common type of functional voice disorder. Excessive tension in the extrinsic laryngeal muscles affects intrinsic laryngeal muscles and vocal cord mucosa and leads to abnormality in phonatory process. The supraglottic larynx becomes hyperfunctional for attempting to compensate for the GI. MTD has two types: primary and secondary.

- **Primary MTD:** It is common in females. Vocal cords show atypical or abnormal movement during phonation but there is no organic vocal cord pathology. It is associated with excessive supraglottic hyperfunction.

- **Secondary MTD:** It is the result of compensation for underlying GI.
- **Endoscopic supraglottic findings classification:**
  - ✓ **MTD type 1:** Posterior open chink due to hypertonic state of posterior cricoarytenoid muscle; laryngeal isometric contractions.
  - ✓ **MTD type 2:** Adducted vestibular folds.
  - ✓ **MTD type 3:** Anteroposterior contractions bringing epiglottis closer to arytenoids; posterior shift of base of tongue.
  - ✓ **MTD type 4:** Extreme anteroposterior contractions squeeze the supraglottis and larynx cannot be viewed.
- **Differential diagnosis:** For spasmodic dysphonia (see section of spasmodic dysphonia).

VOCAL CORD SCARS OR SULCUS VOCALIS

VOCAL CORD SCARS OR SULCUS VOCALIS

This is common in Indian subcontinent. Irreversible loss of viscoelasticity of SLP (Reinke's space) leads to formation of scar or sulcus vocalis.

- **Etiology:** Not certain
- **Clinical features:** Patient has breathy voice. The characteristic finding is a furrow or sulcus at the free edge of vocal cord leading to abnormal vocal cord vibrations and GI. History of voice abuse is common. Significant loss of tissue can cause GI.

- **Types:** On the basis of depth and shape of the sulcus, it is grouped into three types:
  - ✓ **Type I:** Superficial sulcus with no symptoms
  - ✓ **Type IIa:** With moderate dysphonia
  - ✓ **Type IIb:** With severe dysphonia.
- **Treatment:** Injection augmentation or permanent implant provides vocal projection and volume and may correct GI.

HYPONASALITY (RHINOLALIA CLAUSA)

HYPONASALITY (RHINOLALIA CLAUSA)

Blockage of the nose or nasopharynx results in lack of nasal resonance for "m", "n" and "ing" sounds. Articulation substitutions of "b", "d" and "g" are common.

- **Etiology**
  - ✓ Rhinosinusitis
  - ✓ Allergic and nonallergic rhinitis
  - ✓ Nasal masses such as polyps and tumors
  - ✓ Nasopharyngeal mass and adenoids
  - ✓ Familial or habitual speech pattern
  - ✓ Other causes: Deviated nasal septum (DNS), choanal atresia and turbinate hypertrophy.
- **Treatment**
  - ✓ After treating the cause, the patient is sent for voice therapy.

HYPERNASALITY (RHINOLALIA APERTA)

HYPERNASALITY (RHINOLALIA APERTA)

The failure of the nasopharynx to cut off from oropharynx or undue passage between the oral and nasal cavities results in nasal resonance of all the words.

- **Etiology**
  - ✓ Velopharyngeal insufficiency)/velopharyngeal dys-function:
    - Short soft palate: Congenital or acquired (submucous fibrosis)
    - Cleft palate or submucous cleft palate
    - Paralysis of soft palate
    - Palatal perforation
    - Large nasopharynx
  - ✓ Oronasal fistula
  - ✓ Familial or habitual speech pattern.
- **Treatment**
  - ✓ Treatment of the cause is important. Voice therapy helps in functional causes.

SPASMODIC DYSPHONIA

SPASMODIC DYSPHONIA

Dystonia is characterized by abnormal involuntary movements, which are typically action induced. Sposmodic dysphonia (SD) (focal dystonia of larynx) is an action-induced laryngeal motion disorder.

- **Synonyms**
  - ✓ Spastic dysphonia, spastic aphonia, phonic laryngeal spasm and coordinated laryngeal spasm.
- **Types**
  - ✓ Adductor is caused by irregular hyperadduction of the vocal folds.
  - ✓ Abductor is caused by intermittent abduction of the vocal folds.
  - ✓ Mixed type displays a combination of adductor and abductor signs.

- **Clinical Features**
  - ✓ The vocal cords are usually normal at rest but function abnormally with speaking.
  - ✓ Reduced loudness of voice.
  - ✓ Vocal tremor similar to essential tremor.
  - ✓ Decreased speech intelligibility.
  - ✓ Symptoms worsen when the patient is under stress or on the telephone.
  - ✓ Associated other cranial forms of dystonia may include spasms of the eyelids and contractures of the pharynx, jaw muscles and muscles of the floor of mouth and tongue.

- ✓ Factors improving symptom: Factors, which may improve the symptom temporarily, include the following:
  - Pinching of nose
  - Pressing the hand against the back of the head or into abdomen
  - Pulling on ear
  - Yawning, sneezing, singing, yelling, or humming

- **Adductor Spasmodic Dysphonia**
  - ✓ Abnormal involuntary co-contraction of the vocalis muscle complex results in inappropriate adduction of the vocal folds.
    - Choked, strained strangled and monotonal voice.
    - Abrupt initiation and termination result in short breaks in phonation.
    - Slow and harsh speech.
    - Occasionally, compensatory pseudoabductor SD compensates for severe adductor laryngeal spasms by whispering.

- **Abductor Spasmodic Dysphonia**
  - ✓ Abnormal co-contraction of the posterior cricoarytenoid muscles results in inappropriate abduction of the vocal cords.
    - Breathy and effortful voice
    - Abrupt termination results in aphonic whispered segments of speech.
- **Treatment**
  - ✓ Voice therapy.
  - ✓ Alcohol, sedatives and tranquilizers provide transient improvement. Generally, medical treatment is of little avail.
  - ✓ Sectioning the recurrent laryngeal nerve.
  - ✓ Selective denervation and reinnervation using the ansa cervicalis nerve.
  - ✓ Thyroarytenoid myotomy.
  - ✓ Injections of Botox or collagen.

VOCAL TREMOR

VOCAL TREMOR

The involuntary, rhythmic and oscillatory movements can affect the muscles of speech production and generate rhythmic alterations in pitch and loudness. It has been described as tremulous or wavy voice or tremulous quavering speech.

- **Clinical Features**
  - ✓ Vocal tremor can result in rapid decreases and increases in loudness and pitch.
  - ✓ Tremulous or wavy voice.
  - ✓ Tremulous quavering or slow speech.
  - ✓ Pitch breaks (octave breaks to a lower frequency) affect intelligibility of the speech and may lead to aphonia.
  - ✓ Symptoms increase with emotional stress and fatigue.
  - ✓ Vocal tremor may be associated with essential tremor, Parkinson's disease, cerebellar ataxia, or flaccid dysarthria

- **Treatment**
- Medications: Propranolol, primidone, clonazepam and diazepam may reduce vocal tremor but are not well proved.
- Thalamotomies.
- Chronic electric stimulation of the thalamic nucleus through surgically implanted neuropacers has been reported.
- Local injection of botulinum toxin in the sternohyoid and sternothyroid muscles (5 units in 2.5 unit aliquots are injected on each side). Vocal folds if tremulous are injected at a second session.

STUTTERING

STUTTERING

Stuttering is a neurologic, movement disorder in which abnormal, involuntary and inappropriate use of the speech muscles results in dysfluency. Stuttering is a result of increased muscle tension in the three subsystems of speech (respiratory, phonatory and articulatory). Muscles move too quickly and too far. Other cranial musculature (such as eyelids and muscles of facial expression) may also inappropriately contract.

- **Risk Factors**
  - ✓ Too much attention or reprimands to childhood dysfluency between 2 years and 4 years.

- **Clinical Features**
  - ✓ This disorder of speech fluency is characterized by hesitation to initiate, repetitions, prolongations or blocks in speech flow.
  - ✓ The patient later on may develop secondary mannerisms, which include facial grimacing, eye blink or abnormal head movements
- **Factors Relieving Stuttering**
  - ✓ Emotional arousal or sensory stimuli
  - ✓ Motor actions such as walking
  - ✓ Use of rhythmic patterns such as a metronome or monotone.
  - ✓ Singing or speaking in a sing-song voice
  - ✓ Shouting
  - ✓ Foreign accent or slurred articulation.

- **Factors Aggravating Stuttering**
  - ✓ The factors, which may increase stuttering include communicative pressures such as public speeches, personal interviews, counseling and meaningful neg
- **Treatment**
  - ✓ Speech therapy and training.
  - ✓ Antidepressants though given are of no value.
  - ✓ Small doses of injection botulinum toxin (1 unit or less, bilaterally) produce improvement in 50% cases.
  - ✓ SpeechEasy

MYOCLONUS

MYOCLONUS

Myoclonus is a disease of central nervous system. It consists of sudden, brief, shock-like involuntary movements, which are caused by either muscular contractions (positive myoclonus) or inhibitions (negative myoclonus, asterixis).

- **Laryngeal Features**
  - ✓ Broken speech pattern and respiratory dysrhythmia (ventilatory dysfunction).
  - ✓ Vocal cords often show slow rhythmic adduction and abduction at the same timing and frequency as the palatal, pharyngeal and occasionally diaphragmatic contractions.

- **Treatment**
  - ✓ Pharmacotherapy: Though given serotonin, carbamazepine, clonazepam, tetrabenazine and trihexyphenidyl are generally unresponsive.
  - ✓ Local injection of botulinum toxin into the thyroarytenoid muscles has been tried successfully.
- **Branchial or Oculopalatal Myoclonus**
  - ✓ It presents with involuntary movement of the soft palate and pharynx, jerks affecting the eyes, face, palate, larynx, diaphragm, neck, shoulder and arm.
- **Tinnitus**
  - ✓ Clicking in the ears is caused by contractions of tensor palati muscle

TOURETTE'S SYNDROME

TOURETTE'S SYNDROME

This tic disorder is characterized by involuntary vocalizations of articulate words or inarticulate sounds. It may be associated with multiple tics of several body parts. Lingual tics present as hisses and nasal tics as sniffs and snorts.

- **Clinical Features**
  - ✓ Onset may be in childhood or adolescence.
  - ✓ Obsessive-compulsive behavior.
  - ✓ Laryngeal tics: Inappropriate coughing, barking, throat clearing, hooting and grunting.
  - ✓ The chronic voice abuse may make the voice harsh and results in polypoid changes of the vocal mucosa.
- **Treatment**
  - ✓ Phenothiazines such as haloperidol.
  - ✓ Alpha-2-adrenergic agonist such as clonidine.
  - ✓ Benzodiazepine such as clonazepam.
  - ✓ Local injections of botulinum toxin to manage rapid facial tics and dystonic tics such as refractory loud barking sounds.

BOTULINUM TOXIN THERAPY

BOTULINUM TOXIN THERAPY

Injection botulinum toxin is said to be a safe and effective therapy for laryngeal dystonia. The graded weakening can be achieved using low doses.

- **Types**
  - ✓ Type A (Botox)
  - ✓ Type B (Mycbloc).

Frozen lyophilized toxin is reconstituted with sterile saline to various concentrations, as per the need and the indication.

- **Needle**

Injections are given using a tuberculin syringe with a 27-gauge monopolar polytef-coated hollow electromyography (EMG) recording needle. eating injections achieve optimal weakness.

- **Adductor Laryngeal Injections**

  Encouraging results (90%) are reported in adductor SD but duration of effect lasts between 3 months and 4 months.

  - ✓ **Percutaneous:** They are performed percutaneously through the cricothyroid membrane and into the thyroarytenoid-vocalis muscle complex using EMG guidance for optimum placement.
  - ✓ **Indirect laryngoscopy:** Through an indirect laryngoscopic approach, toxin may be injected into the vocal fold. It does not require special EMG equipment or training.

- ✓ **Side effects:** Patients report improvement in voice within 24 hours followed by:
  - A breathy, hypophonic period lasting 1–2 weeks (45%)
  - Occasionally causing hyperventilation and dizziness when trying to speak
  - Mild choking on fluids for the first several days (22%)
  - Sore throat or coughing up blood-tinged sputum may occur in the first 1–2 days after injection.

- **Abductor Laryngeal Injections**
  - ✓ **Percutaneous:** They are managed with an EMG-guided percutaneous injection. The larynx is rotated away from the side of intended injection. A hollow EMG needle with syringe is placed posterior to the posterior edge of the thyroid lamina. The needle is advanced to the cricoid cartilage and moved out under EMG guidance to the optimum position in the posterior cricoarytenoid muscle. Sniffing maximally uses the posterior cricoarytenoid muscle and shows a burst of activity on the EMG. Then toxin is injected.
  - ✓ **Transcricoid:** This technique is used in the patients who cannot tolerate manual rotation of the larynx. A small amount of anesthetic agent is injected in the subglottic airway via the cricothyroid membrane. The needle is placed through the cricothyroid membrane, traversing the airway until it engages the posterior lamina of the cricoid cartilage. The needle is slowly advanced slightly laterally

through the cartilage under EMG control. The posterior cricoarytenoid muscle is encountered and sniffing shows a burst of electric potentials. Then toxin is injected.

- ✓ **Dosages:** 2.5–10 units of Botox in 0.1 mL of saline per posterior cricoarytenoid muscle.
- ✓ **Unilateral/bilateral:** Unilateral injections minimize the risk of airway obstruction. Flexible fiber-optic examination shows the degree of abduction on the treated side. If there is no impairment in motion, repeat the injection. If impairment in motion is observed without clinical response, bilateral injections may be needed. The contralateral injection is given only after the return of function on the injected side (usually after 3–4 months) and lower dosages (1.0–2.0 units/0.1 mL) administered.

PARKINSON'S DISEASE

PARKINSON'S DISEASE

- **Clinical features:** Voice becomes monopitch, weak or breathy. Speech intelligibility decreases.
- **Treatment: Lee Silverman Voice Therapy** improves vocal quality, intensity and speech intelligibility. Therapy focuses on following five concepts:
  - ✓ Think loud
  - ✓ High effort across the speech system
  - ✓ Intensive therapy
  - ✓ Recalibrate sensory deficits
  - ✓ Quantify improvement.