Neurologic Disorders of the Larynx and Videostroboscopy

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Introduction

- scientific and technological advancements
- improvements in diagnosis of voice disorders
- better understanding of laryngeal function
- laryngeal mechanism subject to highly complex, extensive neural control
- mostly a neglected topic
Anatomy of Phonation

- functions as biological valve for phonation, respiration, and swallowing
- lies between the 3rd and 6th cervical vertebra
- arises from paired branchial arches III, IV, and VI
- development begins during third week of embryonic growth
Anatomy of Phonation

- **unpaired cartilages**: thyroid, cricoid, and epiglottis
- **paired cartilages**: arytenoids, corniculataes, and cuneiforms
- **intrinsic muscles**: cricothyroids, posterior cricoarytenoids, lateral cricoarytenoids, transverse arytenoid, oblique arytenoids, and thyroarytenoids
- **extrinsic muscles**: strap muscles
Anatomy of Phonation

- innervation by vagus
- superior laryngeal nerve: internal and external branches
- recurrent laryngeal nerve: anterior and posterior branch
- blood supply: superior and inferior laryngeal artery
- vocal fold arrangement - mucosal wave
Physiology of Phonation

➤ begins in cerebral cortex

➤ precentral gyrus to motor nuclei then coordinated activity

➤ phonatory cycle:
  ➤ vocal folds approximated
  ➤ infraglottic pressure builds up
  ➤ pressure opens folds from bottom up
  ➤ upper portion with strong elastic properties
Parameters of Voice

- quality, loudness, and pitch
  - quality: depends on symmetrical vibration at the midline of the glottis
  - loudness: influenced by subglottic pressure, glottic resistance, transglottic air flow, and amplitude of vibration
  - pitch: alterations in length, tension, and cross-section mass of folds
Patient Evaluation

- review of history and comprehensive exam
- history to include - ”I MADE A SPEECH”
  - Impressions of Dysphonia
  - Medical /Surgical History
  - Abusive Voice Patterns/Allergies
  - Dysphagia/Aspiration
  - Esophageal Reflux
Patient Evaluation

➤ “I MADE A SPEECH”
  ➤ Auditory Acuity
  ➤ Shortness of Breath/Stridor/Speech Difficulties
  ➤ Patient’s Perceptions of Voice Difficulty
  ➤ Emotional Status of Patient
  ➤ ETOH Consumption and Tobacco Use
  ➤ Clearing the Throat and Coughing
  ➤ History of Voice Difficulty
Patient Examination

- ears - hearing acuity
- conjunctiva - allergies, anemia, jaundice
- nose - obstruction
- oral cavity - dental patterns, xerostomia, enamel
- neck - thyroid and muscle tension
- cranial nerve - gag reflex, palatal deviation
- laryngeal exam - IDL
Videostroboscopy

- allows routine, slow-motion evaluation
- detect vibratory asymmetries, structural abnormalities, submucosal scars
- illuminates different points on consecutive vocal folds
- desynchronize light and frequency of vocal fold vibration
Neurologic Voice Disorders

➤ Flaccid neural
➤ Spastic neural
➤ Ataxic neural
➤ Hypokinetic neural
➤ Hyperkinetic neural
➤ Mixed neural
➤ Vocal tremors
➤ Spastic Dysphonia
Flaccid Neural Disorders

- damage or disease to component of motor unit causing laryngeal muscle paralysis
- type and extent depends on lesion site
  - bilateral complete - total weakness, aphonic
  - bilateral incomplete - partial, SOB, fatigue
  - bilateral recurrent - abductor paralysis, median
  - unilateral recurrent - hoarse, breathy voice
- Myasthenia Gravis
Myasthenia Gravis

- autoimmune disease with reduced availability of Ach receptors
- severe muscle deterioration
- inhalatory stridor, breathy voice, hoarseness, flutter, and tremor
- decreased loudness
- restriction in pitch range
- dysphagia, VPI, hypernasality
Spastic Neural Disorders

- unilateral or bilateral upper motor neuron damage, release of inhibition
- hyperadduction of true and false cords
- low-pitched voice with little variation in loudness or pitch
- strained-strangled voice, periodic arrests
- prolonged glottic closure, hyperactive supraglottic activity, retarded wave
Ataxic Neural Disorders

- follows cerebellar damage
- typically struggle with uncontrolled loudness and pitch outbursts
- mild to moderate tremors of laryngeal inlet during phonation
- vocal folds without anatomic abnormalities
- usually has accompanied dysarthria
- Friedreich’s Ataxia
Hypokinetic Neural Disorders

➤ related to Parkinson’s Disease
➤ depletion of dopamine in substantia nigra
➤ reduced loudness, monopitch, breathy, rough, hoarse, tremorous
➤ widespread hypertonicity and rigidity
➤ recruitment of ventricular folds not uncommon
Hyperkinetic Neural Disorders

- associated with EPS, Huntington’s Chorea
- loss of neurons in caudate nucleus
- irregular pitch alterations and voice arrests
- hypotonic limbs and respiratory muscle incoordination
- inappropriate loudness variations
- harsh, strained-strangled quality
Mixed Neural Disorders

- damage or disease to multiple subsystems

- ALS - flaccid and spastic, depends on lesion

- dysphagia, airway obstruction

- harsh quality, hypernasal, variable pitch

- restricted intensity, breathy, stridor

- MS - spastic and ataxic

- impaired loudness control, harsh, breathy

- inappropriate pitch and rate
Vocal Tremors

- essential tremor most common disorder
- head and hands involved, +/- voice
- cause unknown
- quavering or tremulous speech, most noticeable on vowel prolongation
- pitch breaks and voice arrests
- larynx moves at rest and during phonation
- predominant involvement of TA muscles
Spastic Dysphonia

- unknown cause - psychogenic or neuromuscular
- three forms - adductor, abductor, mixed
- adductor most prevalent
- strained-strangled quality, periodic arrests
- limited pitch and volume control
- prolonged vocal fold closure and reduced amplitude of vibration
Treatment

- Surgical: NSGY or laryngeal surgery
- Medical: drugs that treat the motor symptoms
- Speech pathology: behavioral treatment
- Use of augmentative or alternative communication devices
Case Report

- 72 y/o male with 12 mo. h/o progressive dysphonia
- signs and symptoms of Parkinson’s
- referred by neurology for speech difficulties and occasional aspiration of thin liquids
Case Report

- 38 y/o female with 6 mo h/o strained-strangled voice, worse over past two months
- 20 pack year history of smoking
- h/o heroine and cocaine addiction
- Intermittent arrests in phonation, lapsed into whispered speech patterns
Case Report

- 55 y/o female with h/o CVA 18 mo ago that resulted in dysarthria w/o apraxia or aphasia
- CT - hypodense lesion in internal capsule
- MRI - infarct in right anterior corona radiatum
- Speech unintelligible
- Imprecision, hypernasal, strained-strangled