Speech and Swallowing

Speech / Voice

Broadly speaking, hoarseness is due to an alteration in the voice character resulting from an abnormality within the larynx. REMEMBER, any patient with hoarseness for longer than one month must be considered to have a malignancy until this is excluded. Being able to examine the larynx can simplify the diagnostic dilemma considerably. As a student you are often afforded the opportunity to learn the technique of indirect laryngoscopy.

Functions of the vocal cords

- Protect the lower airways
    - Closing
- Voice production
- Valsalva
    - Lifting heavy objects
    - Cough
- Control of ventilation
    - Opening on inspiration
    - PEEP on expiration

Definitions

- ***Speech*** is the expression of, or the ability to express thoughts and feelings by articulate sounds
- ***Voice*** is often used to refer to speech as a whole. However, when used in the context of voice evaluation, it is generally restricted to the acoustic output resulting from the interaction of vocal fold vibration with the vocal tract in vowel production
- ***Phonation*** is a term used to describe the physical and physiological processes of vocal fold vibration in the production of speech sounds
- Impaired voice production due to abnormal vocal fold vibration is known as ***dysphonia***, while no voice or whispery voice associated with no vocal fold vibration is termed ***aphonia***
- ***Hoarseness*** is a non-specific, general term used to describe any change in voice quality, perceived as rough, harsh or breathy
- ***Dysarthria*** is difficulty in articulating words, caused by impairment of the muscles used in speech (think CVA!)
- ***Dysarthrophonia*** is dysphonia in conjunction with dysarthria, for example after a cerebrovascular accident, head injury or part of a degenerative neurological condition, such as motor neuron disease
- ***Dysphasia*** is impairment of the comprehension of spoken or written language (**sensory dysphasia**) or impairment of the expression by speech or writing (**expressive dysphasia**), especially when associated with brain injury
- ***Odynophonia*** is pain when talking
- ***Psychogenic dysphonia*** is marked by loss of vocal control associated with 'disturbed psychological processes' (such as stressful life events, anxiety or depression and actual conversion)

A generally accepted and pragmatic definition of a normal voice is one described as having the following characteristics:

- It is audible, clear or stable in a wide range of acoustic settings
- It is appropriate for the gender and age of the speaker
- It is capable of fulfilling its linguistic and paralinguistic functions
- It does not fatigue easily
- It is not associated with discomfort and pain on phonation

Normal voice production requires three essential elements:

- A **pressure gradient** across the vocal folds created by the flow of expired air from the lungs against the partly close vocal folds
- **Vocal folds** of appropriate **structure, mass and elasticity** that approximate with appropriate tension to allow them to vibrate at a range of frequencies
- A **resonating chamber**, the vocal tract, whose size and shape can be changed to modulate the acoustic properties of sound generated by the vocal folds
- This creates a fundamental frequency, harmonics add "colour", and the end result is a unique sound produced – "laryngeal imprint"

Pathological voice production

- Abnormalities in the vocal folds, dimensions or structure of the vocal tract and inadequate control or amount of subglottic pressure can all contribute to a pathological voice
- Abnormalities in the mass, elasticity and tensioning of the vocal folds can have two main effects: on the **frequency** rate and on the regularity of **vibration**
    - Alterations in **frequency** may lead to the voice being perceived as being too high or too low in pitch for the speaker's age and gender
    - Irregular **vibration** of the vocal folds, caused by the abnormalities described above, will affect voice quality by producing a less clear fundamental frequency and harmonic structure. This irregularity is perceived as hoarseness and roughness
- If there is a gap between the vocal folds during phonation, air will escape, reducing the relative amount of energy in the harmonic components and increasing the energy in the subharmonic components. This is perceived as both hoarseness and breathiness or a voice **lacking in power (asthenia**)
- Alterations in the relative size, shape and length of the vocal tract, for example from a mass, increased pharyngeal muscle tension or reflective properties of the vocal tract, can all influence the energy levels and harmonic structure of the radiated sound causing the voice to sound **strained or effortful**

There are three main **restrictions**

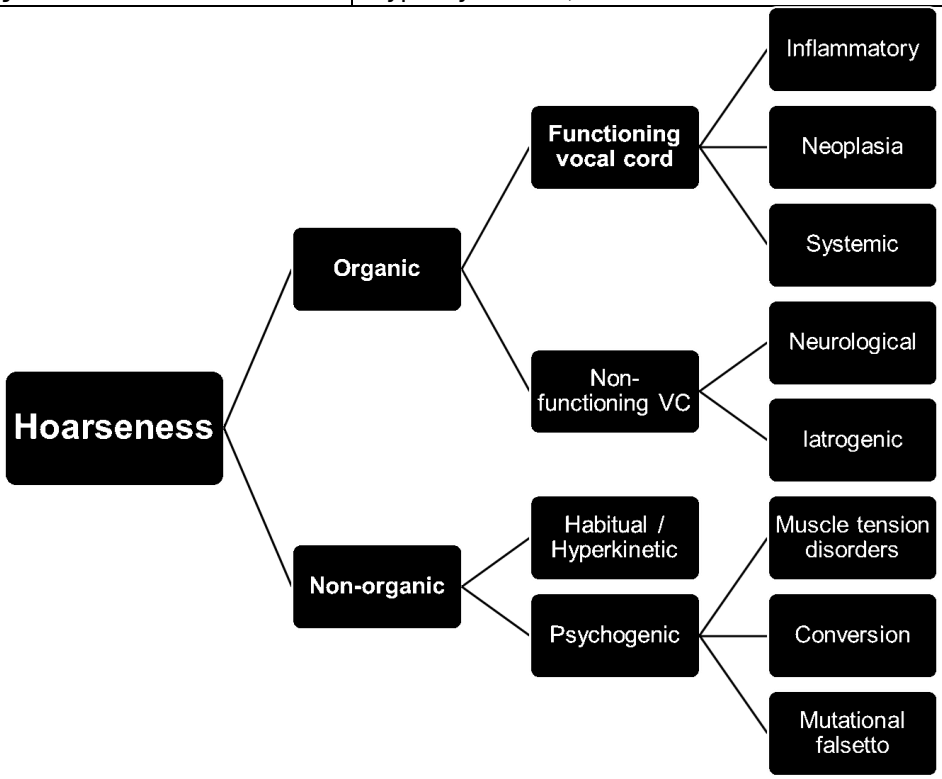
- **Impairment**
    - An alteration in the structure or function of the vocal apparatus (structural abnormality, inflammation, neuromuscular abnormality or muscle tension imbalance) causing symptoms such as hoarseness, a weak voice, pitch change, throat discomfort
- **Limitation in activity**
    - Reduction in vocal range in singing or the voice tiring or becoming hoarse with prolonged use in a noisy environment or if raised
- **Participation restriction**
    - Not being able to work or sing in a choir as a result of the voice problem

Patients' **complaints** may include

- Changes in voice quality (hoarseness, roughness and breathiness)
- Pitch that is increased or decreased which is not appropriate for their age and sex
- An inability to control their voice as required (pitch breaks, voice cutting out, tremor, glottal tightness)
- An inability to raise the voice or make the voice heard in a noisy environment (reduced loudness)
- An increased effort and/or reduced stamina of the voice or one that tires with use
- Difficulties or restrictions in the use of their voice at different times of the day or related to specific daily, social or work-related tasks
- A reduced ability to communicate effectively
- Difficulty in singing
- Throat related symptoms (soreness, pain, discomfort, aching, dryness, mucus), particularly related to voice use
- The consequent emotional and psychological effects caused by the above

Causes of Voice problems

Organic	Cause
Inflammatory	Acute laryngitis, Chronic laryngitis
Neoplasia	Papillomatosis, Cancers
Neurological	CVA, Multiple sclerosis, Guillain-Barre, Myasthenia gravis, Carcinoma of the thyroid / lung / mediastinum, Idiopathic (virus), Spasmodic dysphonia, Muscle tension disorder, Injury to the nerve after surgery or trauma
Iatrogenic	Post surgery – thyroid, neck, carotid, larynx, oesophagus
Systemic	Hypothyroidism, Rheumatoid arthritis



Approach

History

- The nature and chronology of the voice problem
- Exacerbating and relieving factors
- Lifestyle, dietary, and hydration issues
- Contributing medical conditions or the effects of their treatment
- The patient's voice uses and requirements
- The impact on their quality of life, social, and psychological well-being
- Their expectations for outcome of the consultation and treatment

Examination

You as a GP

- ENT examination
- Head and Neck examination
- Mirror examination of larynx

As an ENT

- Rigid or flexible scope examinations
- Stroboscopic examination
- High speed photography
- Voice analysis

- Patient scales
- Perceptual evaluation
  - Auditory
  - Visual
- Measurements
  - Acoustic
  - Aerodynamic

If the diagnosis is not clear from the initial assessment, the patient may undergo one of the following options

- Further in-depth assessment by a voice therapist: to ascertain more background information including exploration of contributing psychological issues
- A trial of vocal hygiene / lifestyle advice or medical treatment
- Laryngeal electromyography
- Objective voice measurements
- 24-hour pH monitoring ± impedance testing or oesophagoscopy
- Diagnostic microlaryngoscopy
- Referral to another voice disorders team or professional
- CT / MRI

Treatment

If treatment is required, it will usually consist of one or more of the following options, depending on the patient's symptoms, vocal requirements and clinical findings

- Vocal hygiene (see below), lifestyle and dietary advice
- Voice (speech) therapy
- Specialist therapy, e.g. singing therapy
- Medical treatment - PPI
- Phonosurgery
  - Phonomicrolaryngosopy
  - Injection laryngoplasty
  - Laryngeal framework surgery
  - Recurrent laryngeal nerve reinnervation
  - Laryngeal pacing

Vocal hygiene (Important)

- An **explanation** of how the voice works
- **The links** between lifestyle, phonatory and non-phonatory vocal activities and stress on voice disorders
- The potentially traumatic effects to the vocal folds of **'vocally abusive behaviors'**, such as talking or singing too loudly, talking too fast, shouting, throat clearing and harsh coughing
- Communicating effectively **without raising** or straining the voice, e.g. using a whistle in the school playground or using amplification devices where practical and conserving the voice where possible or in extreme situations discussing the possibility of changing jobs
- The importance of **adequate hydration** for vocal fold function, i.e. by drinking water and use of steam inhalation, and avoiding excessive amounts of drinks containing caffeine, i.e. coffee, tea and colas
- **Smoking cessation, reducing alcohol** and social drug consumption (particularly spirits, cannabis and cocaine) and avoiding exposure to fumes, dust and dry air
- **Diet and reflux reduction**, e.g. avoiding eating late at night, large or fatty meals, sleeping upright

Diseases

The most common voice disorders seen in secondary practice in a voice clinic are:

- Muscle tension disorder (MTD)

- Laryngitis / MTD secondary to poor vocal hygiene, dietary and lifestyle issues
- Extraoesophageal reflux (laryngopharyngeal reflux)
- Vocal fold nodules
- Vocal fold polyps
- Vocal fold cysts
- Vocal fold palsy and paresis
- Arytenoid granulomas

Less frequently seen conditions include:

- Sulci and mucosal bridges
- Spasmodic dysphonia
- Papillomatosis
- Microvascular lesions
- Laryngeal trauma, including post-surgical causes
- Other neuromuscular causes
- Hyperkeratosis, dysplasia and carcinoma
- Endocrine causes
- Amyloid
- Other laryngeal tumours

MTD

- MTD is therefore a group of conditions characterized by **an imbalance** of the synergist and antagonist muscles affecting the vocal fold position and tensioning relative to one another and also the position of the larynx relative to the rest of the vocal tract
- There are multiple primary aetiologies of MTD, including:
    - Stress, anxiety and depression
    - Conversion disorders
    - Postural and breathing problems
    - Poor vocal hygiene
    - Talking in poor acoustic environments or above background noise for prolonged periods at work or socially
    - Exposure to excessive environmental dust, smoke or fumes
- Symptoms include
    - Pitch of the voice may be too high or too low and reduced in range
    - A sensation of tightness, constriction or lump in the throat
    - Effortful voice production
    - Discomfort on speaking or singing
    - Vocal fatigue
- Treatment
    - Vocal hygiene, dietary and lifestyle advice
    - Voice therapy targeted at specific muscle groups
    - Laryngeal manipulation
    - Behavioural therapy
    - Medical treatment, e.g. of extraoesophageal reflux

Other neurological problems

- Neuro-muscular disease such as
    - Parkinson's
    - Motor neuron disease
    - Myasthenia gravis
    - Multiple sclerosis (MS)
- Spasmodic dysphonia (Botox)
    - Adductor type – Strained, straggled voice

    - Abductor type – Weak, breathy voice
    - Mixed type
    - Tremor

Inflammatory disorders - Laryngitis

- Inflammation of the larynx can be broadly classified into infective and non-infective causes
- Classification
    - Acute
        - Simple - Viral / Bacterial
        - Specific - LTB, Croup, Epiglottitis
    - Chronic
        - Physical
        - Chemical / Environmental
    - Atrophic
    - Granulomatous
    - Fungi
- Sometimes the aetiological factors are easily identified in the history (e.g. hoarseness associated with an **upper respiratory tract infection**). In many other cases the **cause may be less clear** (e.g. in cases of extraoesophageal reflux), may be **multi-factorial**, may require empirical **treatment** or a **biopsy** and microbiological **culture** (e.g. in the case of tuberculosis) or may **resolve spontaneously** without a cause being identified.
- Patients often complain of:
    - Hoarseness
    - Huskiness
    - Reduced pitch
    - Loss of part of the range of the voice
    - Pitch instability
    - An increased effort to speak
    - Vocal fatigue and pain or discomfort on speaking
- Throat symptoms, such as globus sensation and irritation, dryness, throat clearing or chronic cough
- Laryngitis is simply a descriptive term indicating a **variable degree of erythema, oedema, epithelial change** which may include **ulceration, leukoplakia and stiffness** of the mucosa of the vocal fold. There is often an increased amount of **thick mucus** present, which may be white, grey, yellow or green in colour. There may be **associated inflammation** of the rest of the subglottic, supraglottic and interarytenoid areas.

Vocal fold nodules / Polyps / Cysts

- Nodules
    - Less than 3 mm and mostly bilateral
    - Professional voice users
        - Teachers / Singers / Drill sergeants
    - Treatment consists of voice therapy, vocal hygiene, reflux management and rarely surgery
- Polyps
    - More than 3 mm and usually unilateral
    - May resolve spontaneously
    - Otherwise, voice therapy or removal under surgery
- Cysts
    - May be removed under surgery if not resolving

Reincke's oedema

- Condition where the vocal cords become chronically and irreversibly swollen
- See almost exclusively in smokers
- Complains of

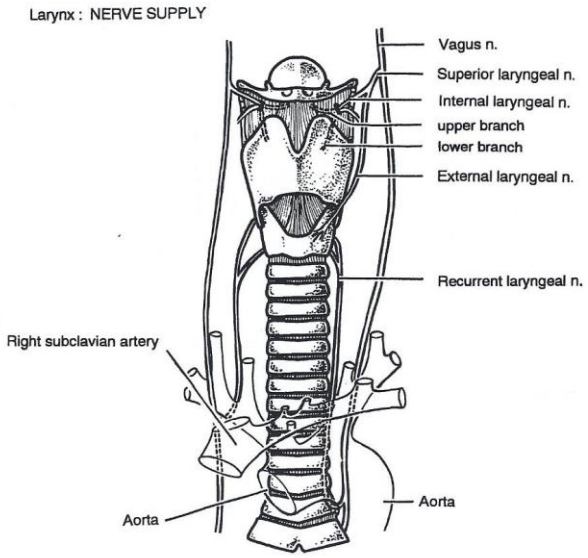
    - Deepening of the pitch of the voice with **women often being mistaken for a man**, particularly on the telephone
    - **Gruffness** of the voice
    - Effortful speaking
    - An inability to raise the pitch of the voice
    - Choking episodes
    - Other symptoms associated with extraoesophageal reflux
- Treatment consists of
    - Vocal hygiene
    - Voice therapy
    - Smoking cessation
    - Surgery

Arytenoid granuloma

- Other terms for them include:
    - Contact ulcer or granuloma / Vocal process granuloma / Intubation granuloma / Contact pachydermia / Peptic granuloma
- These consist of a proliferation of granulation tissue with epithelial hyperplasia. They **result from injury** to the thin mucoperichondrium over the vocal processes from mechanical trauma, either **following intubation** or from repeated high-velocity impact of the vocal processes against each other from **throat clearing, coughing or talking in a habitually low-pitched, creaky, hyperfunctional manner**.
- Men tend to develop granulomas secondary to hyperfunction, while women develop them more commonly as a result of intubation.
- In addition, extraoesophageal reflux is recognized as an important aetiological factor either contributing to the symptoms leading to the mechanical trauma or preventing healing of the damaged mucosa.
- The main treatment principles include reducing the effects of laryngeal irritants, i.e. stopping smoking, improving vocal hygiene, treating any respiratory tract infections, allergies and extraoesophageal reflux
- Voice therapy
- Surgery has a limited role, as does steroids and anti-biotics
- Botox shows promise (injected into the thyro-arytenoid muscle)

Vocal cord paresis / paralysis

Note the anatomical difference between right and left recurrent laryngeal nerves. Vocal cord palsy is more common on the left due to the long intra thoracic course of the left recurrent laryngeal nerve. A vocal cord palsy may result from supranuclear or infranuclear lesions. Infranuclear lesions may involve the trunk of the vagus nerve, the recurrent laryngeal nerves, or the external branch of the superior laryngeal nerves.



Aetiology

- Congenital
- Acquired
    - Vascular
    - Viral
    - Bacterial
    - Neuro-toxic
    - Tumour
    - Trauma
    - Iatrogenic

Pathogenesis

- Thermal
- Stretching
- Direct injury
    - Cut
- Compression
- Vascular

Differential diagnosis

- Classical
    - 1/3 Tumour related
    - 1/3 Post surgery
    - 1/3 Idiopathic
- Detailed
    - Surgery – skull base, thyroid, carotid, neck
    - Trauma – neck, thorax, larynx, CVS
    - Tumour – larynx, thyroid, lung, oesophagus, skull base, mediastinum
    - Mono- and multi-neuropathies – HIV, EBV, CMV, HS, HZ, Drugs, DM
    - CNS – Arnold-Chiari, MS, Myasthenia Gravis, Hydrocephalus, Kernicterus
    - CVS – Cardiomyopathy, Aortic aneurysm
    - Mediastinum / Lung – Mediastinal lymph nodes, Bronchial cancer, Oesophageal cancer

Thyroid surgery

- Hoarseness post thyroid surgery can be due to
    - Recurrent laryngeal nerve injury (RLN) or,
    - External branch of the superior laryngeal nerve (EBSLN) injury
- RLN injury
    - Injury can result in hoarseness of voice (of variable degrees), coughing, micro-aspiration, and several other symptoms that can affect patients' quality of life
    - These changes are especially noticeable in professional speakers and singers; however, all affected patients are susceptible to suffer from voice changes and impaired communication, which can significantly reduce quality of life
    - Rarely an acute bilateral injury will result in severe stridor “on the table” post extubating
    - The incidence of permanent post-operative RLN paralysis is 0.3–3 % and is as high as 2–30 % in revision thyroid surgery
    - Transient paresis occurs in 5-8% of primary thyroid surgeries
        - Transient injuries have different recovery times
        - Usually, it recovers between 4 and 6 weeks but can take up to 12 months
        - Injuries lasting more than 1 year are considered permanent
- EBSLN
    - The reported incidence of EBSLN injury during thyroidectomy varies widely from 0% to 58%, due to the difficulty of assessment
    - Injury to EBSLN increases the risk of aspiration and affects CTM motility, altering the voice quality mainly due to the inability of producing high-pitched sounds and produces a monotonous low tone voice

Symptoms depend on

- Whether the injury is unilateral or bilateral
- Position of vocal cord
    - Median, paramedian, lateral
- If the injury is
    - Temporary vs Permanent
        - Can take up to 12-18 months to recover

Differentiation and treatment

	Lateral	**Median**
Voice	Weak, Hoarseness Reduced number of words per breath	Good Strained
Aspiration	Huge problem, even more so with fluids	Usually not a problem
Airway	Good	Problematic. Can have airway compromise with stridor and reduced exercise capacity
Misdiagnoses	Laryngitis	Asthma type picture
Treatment	Medialise the vocal cord	Create an alternative airway of lateralise the vocal cord
Treatment options	Temporarily – inject vocal with either fat or synthetic material Permanent – External thyroplasty	Cordotomy Lateralisation of vocal cord Tracheostomy

Hoarseness and Vocal Cord paralysis in the Child

In general, it is better to refer these patients to an ENT specialist. Also see the chapter "Congenital conditions in the Head and Neck".

Differential diagnosis

- Congenital vocal cord paralysis
    - Second most common congenital condition of the larynx after laryngomalacia
    - Rarely in isolation and is seen with
        - CNS problems
            - Arnold Chiari malformations
            - Hydrocephalus
        - CVS problems
        - Pulmonary problems
        - Other laryngeal abnormalities
- Congenital laryngeal and tracheal deformities such as
    - Webs
    - Cysts
    - Clefts
    - Stenosis
    - Haemangioma
- Habitual
    - More in boys
        - Due to "screaming" at each other

Swallowing

Physiology

Deglutition is a brainstem reflex controlled by a centre in the medulla. The reflex occurs in three stages, only the first of which is voluntary.

- **Oral stage**
  - The bolus is propelled back into the oropharynx by the contraction of mylohyoid which raises the floor of the mouth
- **Pharyngeal stage**
  - On reaching the posterior pharyngeal wall, the bolus triggers off
    - Closure of the postnasal space by the soft palate
    - Closure of the oral cavity by the faucial pillars and tongue
    - Closure of the laryngeal inlet and cessation of respiration
- **Oesophageal stage**
  - This consists of consecutive pressure changes in three zones
    - Relaxation of the pharyngo-oesophageal junction
    - Generation of a peristaltic wave of contraction down the oesophagus.
    - Relaxation of the oesophago-gastric junction

Definitions

- Dysphagia – difficulty in swallowing
- Odynophagia – painful swallowing
- Odynodysphagia – difficult and painful swallowing
- Aspiration – entrance of any material past the true vocal cords

Background

Dysphagia

- Dysphagia is common: 22% of individuals over 50 are affected
- Aspiration pneumonia is the highest cause of mortality associated with hospital admission
- Stroke is the commonest neurological cause of dysphagia and aspiration
- 76% of HNC patients have been shown to aspirate. This is higher than those with medical, neurological or GI problems
- Dysphagia is a term used to describe difficulty with swallowing. It implies impairment of one or more of the phases of swallowing namely
  - Oral, Pharyngeal, and / or Oesophageal
- It can be divided into oropharyngeal (high) dysphagia and oesophageal (low) dysphagia
- Dysphagia usually arises as a complication of another health condition
- Also classified according to food type
  - Dysphagia towards solids
  - Dysphagia towards liquids
  - Dysphagia to both

Aspiration

- Aspiration is the entry of food or liquid into the airway below the true vocal folds
- It may be due to incompetent or inadequate airway protection, ill-timed, uncoordinated events before, during or after the swallow has triggered
- Silent aspiration is defined as foreign material entering the trachea or lungs without an outward sign of coughing or attempts at expulsion

Causes of Dysphagia and Aspiration

Congenital	Neurological	Infective	Inflammatory	Auto-immune	Trauma	Neoplastic	Motility	Miscellaneous
Cleft lip or palate Cerebral palsy Vascular rings Atresia / Clefts / Fistulas Vocal cord palsies	CVA Parkinson's Multiple sclerosis Motor neuron disease Myasthenia Gravis Vocal cord palsy	Infection of oral cavity, pharynx, larynx, and neck	GERD / LPR Pattersen-Brown-Kelly Sd Eosinophilic oesophagitis	Scleroderma SLE Sjogren's syndrome	Foreign body Food bolus Bruns Caustic ingestion	Benign tumours Malignant tumours	Achalasia Oesophageal spasm Presby-oesophagus	Post HN cancer treatment Medications Globus pharyngeus Pharyngeal pouch

Approach

Patients' complaints may include

- ***Dysphagia***
- ***Aspiration***
- ***Regurgitation***, which can be immediate or delayed, can give an indication as to the level of the problem. Delayed regurgitation of undigested food is typically seen in patients with a pharyngeal pouch
- Symptoms of ***retrosternal discomfort, belching*** and early ***satiety*** indicate gastro-oesophageal reflux disease (GORD)
- ***Odynophagia*** (pain on swallowing), is associated with infection, neoplasia or GORD
- ***Hoarseness*** may indicate laryngeal fixation due to tumour or vocal cord palsy
- ***Choking or coughing***, during or after eating, or frequent chest infections may suggest aspiration
- ***Referred otalgia*** via the IX and X cranial nerves is usually secondary to an head and neck tumour and a poor prognostic sign
- ***Associated neurological symptoms*** such as bulbar dysfunction, dysarthria, diplopia, limb weakness and fatigability can be seen in motor neuron disease and myasthenia gravis. Tremor, ataxia and unsteady gait are features of Parkinson's disease

Examination

- Examination should exclude any obvious **structural cause**, and assessment should be made for signs of **associated systemic or neurological** dysfunction and for **signs of complications** of dysphagia such as weight loss and malnutrition and pulmonary problems due to aspiration
- Lips and Oral Mucosa
    - The lips themselves may be pale suggesting an anaemia due to iron, folate or vitamin B12 deficiency.
    - It is usually easy to diagnose candidal fungal infections by their covering whitish membrane which when removed will reveal a raw area
    - Carious teeth with chronic infection can predispose towards recurrent pharyngitis
- Tongue and Sulci
    - Carcinoma in the tongue is, unfortunately, often of considerable size before being clinically detected
    - Origin is frequently in silent areas such as the bucco-alveolar and the alveolar-glossal sulci
    - Any suspicious areas should be biopsied, and particular attention should be paid to hyperkeratotic white plaques (leukoplakia) or red plaques (erythroplakia) which often precede a carcinoma
- Oropharynx
    - Recurrent pharyngitis is probably the commonest cause of difficulty in eating
    - In the majority of patients, it is of an episodic nature but in some the symptoms can be chronic
    - In the majority, viral infections are responsible and as viruses affect cell types rather than specific areas the whole of the mucosa of the pharynx is usually involved
    - During an acute attack of pharyngitis, the clinical signs are often minimal

    - In some there will be a slight increase in redness and in the gag reflex but in others the pharynx may appear entirely normal
    - When the symptoms are acute, discomfort is fairly predominant
    - In the chronic situation, this is less so and difficulty in getting food beyond the oropharynx is the major complaint
    - The tonsils (although often appearing to), seldom occlude the oropharynx and correspondingly rarely cause dysphagia in adults. They will, however, cause dysphagia if they become inflamed
    - Adenotonsillar hypertrophy can be a cause for dysphagia in children. They typically develop picky eating patterns and prefers soft foods. They will chew "meat" and spit it out
    - Another population where adenotonsillar hypertrophy can cause dysphagia is in the HIV positive group
    - In the oropharynx the tonsils are the most frequent site for carcinoma.
        - As only one tonsil is usually involved, any degree of asymmetry on tonsil size in someone who complains of something there, or food sticking is an indication for biopsy
- Hypopharynx
    - There are three relatively common pathologies that affect the hypopharynx
        - Pharyngeal Pouch
            - Pharyngeal pouches are relatively rare and are thought to be due to secondary swallow in a megapharynx along with a congenital weakness in the pharyngeal muscle layers through which the mucosa herniates
            - The hernia gradually extends into the neck and causes a relative obstruction because of external pressure on the pharyngeal wall from food and retained debris within the pouch
            - As the inlet to the pouch cannot usually be seen either by direct or indirect examination the diagnosis rests on radiological visualization of swallowed barium within the pouch
            - Pouches are usually surgically excised via the neck
        - Muscular incoordination
            - Muscular incoordination is an increasingly recognized entity and can be simply local muscular incoordination or part of generalized neurological disease
            - When part of general disease, such as motor neuron disease or pseudobulbar palsy, there is often overflow into the laryngeal inlet during eating with coughing and aspiration
            - Local muscular incoordination is akin to inability to squeeze a tube of toothpaste consistently along its length to produce a flow
            - Muscular incoordination is diagnosed by seeing an abnormal peristaltic pattern on a video tape recording of a barium swallow, and is difficult to manage, there being no specific therapy
        - Generalized neurological disease such as motor neuron disease or pseudobulbar palsy is usually much more severe and usually fatal.
            - Indirect laryngoscopy often reveals a lax, immobile pharynx with pooling of saliva in the hypopharynx
            - Overflow into the larynx and lungs readily occurs with coughing and aspiration pneumonia
            - Management is extremely disappointing, myotomy and feeding gastrostomy being palliative rather than curative procedures
- **The lower cranial nerves** are assessed for loss of tongue movement, wasting and fasciculation, loss of gag and cough reflexes, loss of pharyngeal and laryngeal sensation and loss of vocal cord mobility
- **The neck** is examined for lymphadenopathy and other neck masses, thyroid enlargement, loss of laryngeal crepitus and the integrity of the laryngeal cartilages
- **General physical and neurology examinations** should look for evidence of malnutrition, weight loss, chest disease, epigastric tenderness and abdominal swellings, loss of coordination, fasciculation, and tremor

Special tests

- Bedside
    - Water swallow test
    - Blue dye test
- Visual documentation
    - Endoscopy / Functional endoscopic evaluation of swallowing (FEES)
    - Videofluoroscopy
- Gastroscopy
- Barium / Gastrografin swallow
- MRI
- Manometry and pH-study

References:

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