

**A STUDY OF NON NEOPLASTIC LESIONS OF
LARYNX CAUSING VOICE DISORDERS**

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CHENNAI

TAMIL NADU

CERTIFICATE

This is to certify that the thesis titled “**A STUDY OF NON NEOPLASTIC LESIONS OF LARYNX CAUSING VOICE DISORDERS**” Submitted By **DR.SATHIYA BAMA.S** under my supervision & guidance in partial fulfillment for the award of the degree of **Master of Surgery in Otorhnolaryngology** by the Tamil Nadu Dr. M.G.R. Medical University, Chennai, is a bonafide record of the work done by her doing the academic period 2006-2009.

She has evinced keen interest in collecting the cases from the ward and analysing them. I have great pleasure in forwarding it.

Prof. Dr.KR. Kannappan, M.S., D.L.O., M.Ch.,
The Professor & H.O.D
Department of ENT Disease
Madurai Medical College
Madurai

DECLARATION

I hereby declare that this dissertation entitled “**A STUDY OF NON NEOPLASTIC LESIONS OF LARYNX CAUSING VOICE DISORDERS**” has been prepared by me under the guidance and supervision of **DR.KR. KANNAPPAN MS, DLO, M.CH**, Prof. HOD Department of ENT Diseases, Govt Rajaji Hospital, Madurai.

This dissertation is submitted to the Tamil Nadu Dr.M.G.R. Medical University in partial fulfillment of the university regulations for the award of “The Master of Surgery” in Otorhinolaryngology.

This work has not formed the basis of the award of any Degree/ Diploma to me previously by any other university.

PLACE: Madurai

DATE :

Dr. S. Sathiya Bama

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INTRODUCTION

The term voice is often used to refer to speech as a whole. A more precise definition of voice is the acoustic outputs from the vocal tract that are characterized by their dependence on vocal fold vibratory inputs. Phonation refers both to the act of voice production and also to the mechanism of voice production.

Voice is an end product of smooth, balanced, interrelated system involving respiration, phonation and resonance. Voice is natural medium for emotional content, whereas speech is a cultured medium for intellectual content.

Every human voice is unique because of anatomical, physiological, psychological, cultural, sociolinguistic and behavioural factors. The phonetic muscular habitual settings are often learnt behaviours which fulfill the speaker's social, geographical and personal needs.

Voice disorders are fairly common in daily ENT practice. Any disease or disorder interfering with approximation, tension or vibration of cords will cause voice change, and those patients will seek the medical help immediately because speech is the medium to express the feeling. This study is about various non neoplastic lesions causing voice disorders for the patients who attended the department of ENT diseases, Government Rajaji Hospital, Madurai in the period of January 2007 to January 2008.

AIMS AND OBJECTIVES

1. To analyse the etiology of the voice disorders.
2. To analyse the age, sex incidence.
3. Assessing the pattern of clinical presentation, and relevant investigations.
4. To analyse the prognosis and mode of treatment.

HISTORICAL REVIEW

Advent of laryngeal mirror by Manual Garcia in September 1854 in Paris brought a radical change in study of larynx which was negligible till then. Bazzini actually did the first report on mirror visualization of larynx.

Suitable direct laryngoscopes for routine purposes are the Negus Storz varieties. The Dedo-pilling modification is helpful for those with difficult teeth and jaws.

Kleinsasser laryngoscopes and Zeiss microscope have made great advances in endolaryngeal surgery. A high quality operating microscope is employed with a 400 mm focal length lens in place.

The use of Loewy type laryngostat support enables the endoscopist to use both hands in the examination of the patients.

Benjamin laryngoscopes gives excellent access in children. Dr. Brain pollard developed a special endotracheal tube for micro laryngeal surgery.

Fibreoptic illumination invention provided a reliable system of illumination ahead of Negus & Jackson lighting system. The use of 30° & 70° Hopkins rod telescope allows a high resolution view of the larynx.

Ortel first performed stroboscopy in 1878. In the modern application, 2Hz flashes of light 2ms out of synchronization with phonation, are applied to the larynx via an endoscope. Stroboscopy is generally performed with video

equipment for instant replay and frame by frame analysis. Videolaryngostroboscopy gives additional information about the vibratory pattern of the vocal fold mucosa and improves the accuracy of diagnosis.

Photography and videography are increasingly the methods of choice for recording laryngeal abnormalities, especially when combined with stroboscopy. This enables detailed records of laryngeal structures and function that still photography rarely reveals. Colour video printers may now be attached to endoscopic equipment and give instant images for inclusion in patient records.

ANATOMY

DEVELOPMENT

During the fourth week of embryonic development the tracheobranchial diverticulum appears in the ventral wall of the primitive pharynx just below the hypobranchial eminence.

The edges of this groove form the oesophagotracheal septum which fuses caudally, leaving a slit-like aperture cranially into the pharynx.

The resulting tube is lined with endoderm from which the epithelial lining of entire respiratory tract develops. The cranial end of the tube forms larynx and trachea.

Arytenoid swellings appear on both sides of the tracheobranchial diverticulum and, as they enlarge the epithelial walls of the groove adhere to each other and the aperture of the larynx is occluded until the third month, when the lumen is restored. The arytenoid swellings grow upwards and deepen to produce the aryepiglottic folds. The hypobranchial eminence becomes the epiglottis. The glottis forms just above the level of primitive aperture. The thyroid cartilage develops from the ventral ends of the cartilages of the fourth pharyngeal arch. The cricoid cartilage and the cartilage of trachea develop from sixth arch during sixth week with the trachea. The mesoderm of each pharyngeal arch differentiates into the cartilage, muscle and vascular structure of the arch.

Each arch receives an afferent and efferent nerve supply for the skin, muscles and endodermal lining of that arch, which in the case of fourth and sixth arches are the superior and recurrent laryngeal branches of the vagus which supply the larynx.

SURGICAL ANATOMY

The frame work of larynx is made up of:

Hyoid bone:

U shaped bone which provides the upper attachment for many of the extrinsic muscles of the larynx and suspends the larynx in the neck.

Cartilages:

Three unpaired cartilages- epiglottis, thyroid, and cricoid Three paired cartilages - arytenoids, corniculate, cuneiforms and ligaments.

The thyroid cartilage shields the opening of the airway and supports most of the soft tissue fold in the larynx. The angle between the laminae of the thyroid cartilage exhibits sexual dimorphism in adult human with 90 degree angle in male and a 120 degree angle in females. The laminae of thyroid cartilage fuse at the midline symphysis with an intra thyroid cartilage in the midline in infancy. The posterior aspect of isthmus receives cluster of five elastic ligaments a median thyro epiglottic ligament, paired vestibular ligaments and paired vocal ligaments.

The thyroid cartilage has two superior horns which articulate with the cricoid cartilage. The extrinsic muscles attach here that move the larynx or accelerate its movement relative to the adjacent tissues.

The cricoid cartilage is the only complete cartilage ring in the larynx and serves to support posterior structures in the larynx. The anterior portion of the cricoid arch is 5 to 7cm high whereas the posterior lamina is 2 to 3 cms high and is marked by a posterior midline ridge, which receives longitudinal fibres of the oesophagus. The superior aspect of the cricoid lamina has two articular surfaces, which are convex and elliptical passing down to the arch.

The arytenoid cartilages are paired, irregular, three sided pyramids with forward projection, the vocal process, attached to the vocal folds and lateral projection, the muscular process, to which are attached the posterior cricoarytenoid and lateral cricothyroid muscles.

The corniculate cartilages are two small conical nodules of elastic fibrocartilage which articulate through a synovial joint with the apices of the arytenoid cartilages. The cuneiform cartilages are two small elongated flakes of fibro elastic cartilage, one in each margin of aryepiglottic fold.

The articulation of the arytenoids with the cricoid is critical for an understanding of the function of the larynx. The corniculate cartilages are found at the apices of the arytenoid cartilages.

The epiglottis is anchored anteriorly to the posterior surface of the hyoid bone by the hyo-epiglottic ligament. The potential space between the anterior surface of the epiglottis and the inner surface of the thyrohyoid membrane and hyoid bone is described as the “pre epiglottic space”

The muscles of the larynx may be divided into extrinsic which attach the larynx to neighbouring structures and Intrinsic which moves the cartilages of the larynx. The extrinsic muscles are the sternothyroid, thyrohyoid, stylopharyngeus, palatopharyngeus and the inferior constrictor.

The intrinsic muscles between one laryngeal cartilage and another are

1. Abductors of the vocal cords only one on each side. Posterior cricoarytenoid muscle.
2. Adductors of vocal cords there are three on each side
 - a. Lateral cricoarytenoid muscle
 - b. Transverse portion of interarytenoid muscle
 - c. External portion of Thyro arytenoids muscle
3. Tensors of the vocal cords; there are two on each side
 - a. Cricothyroid muscle
 - b. Internal portion of thyroarytenoid (vocalis) muscle
4. Opener of laryngeal inlet
Thyroepiglottic part of thyroarytenoid muscle

5. Closure of the laryngeal inlet
 - a. Oblique portion of interarytenoid muscle
 - b. Aryepiglottic muscles

Extrinsic muscles:

They connect the larynx to the neighbouring structures and are divided into elevators or depressors of larynx.

Elevators: primary elevators act directly as they are attached to the thyroid cartilage and include stylopharyngeus, palatopharyngeus, salpingopharyngeus and thyrohyoid.

Secondary elevators act indirectly as they are attached to the hyoid and include mylohyoid, digastric, stylohyoid and geniohyoid muscles.

Depressors: They include sternothyroid, sternohyoid and omohyoid.

The quadrangular membrane extends from the sides of the epiglottis to the corniculate and arytenoids cartilages, with the mucous membrane covering the upper border of the quadrangular membrane forms the aryepiglottic fold, while the remainder of the membrane forms the wall between the piriform sinus and the larynx. The conus elasticus cricothyroid membrane arises from the upper border of the cricoid cartilage and sweeps medially and upward, the more posterior part attaches to the arytenoids cartilage and its vocal process. While most of the remainder attaches in the vocal ligament of the vocal cord, which

can therefore be regarded as thickened and specially developed free edge of conus elasticus.

The vocal ligament consists of thickened bands of elastic tissue attached anteriorly to the inner aspect of the thyroid cartilage at the midline and posteriorly to the apices of the arytenoid cartilage.

The ventricular bands are two thick folds of mucous membrane covering the ventricular ligament and the upper part of the external portion of the thyroarytenoid muscle.

The laryngeal vestibule lies between the inlet and the edges of the false cords. Ventricle of the larynx is a recess between the false and true vocal cords. It is lined by a mucous membrane which is covered externally by the thyroarytenoid muscle. The glottis is the interval between

- i) the true vocal cord in its anterior three fifths
- ii) the vocal process of the arytenoids cartilages in its posterior two fifths. The subglottic space lies between the true vocal cord and the lower border of the cricoid cartilage.

ANATOMY OF THE VOCAL FOLDS

The vocal cord extend from the middle angle of the thyroid cartilage to the vocal process of the arytenoids cartilage. Each fold is layered structures.

HISTOLOGY OF VOCAL FOLDS

The vocal cords are made up of mucosa and muscle. The mucosa is subdivided into epithelium which is of the stratified squamous type and lamina propria, which consists of superficial, intermediate, and deep layers.

The superficial layer of the lamina propria, referred to as Reinke's space, consists of loose fibrous substance which can be likened to a mass of soft gelatin. It is the layer which vibrates most significantly during phonation. When it becomes stiff due to some pathological state such as inflammation, tumour or scar tissue, its vibrations are disturbed and voice problems result.

The intermediate layer, consisting mainly of elastic fibres, and the deep layer, consisting of collagenous fibres rich in fibroblast, together forms vocal ligament, deep to which is the vocalis muscle which constitutes the main body of the vocal fold.

Blood supply

The blood supply is derived from the laryngeal branches of the superior and inferior thyroid arteries and cricothyroid branch of the superior thyroid artery.

Nerve supply

The motor and sensory nerves of the larynx are derived from the vagus by way of its superior and recurrent laryngeal nerves.

The superior laryngeal nerve arises from the inferior ganglion of the vagus and receives a branch from the superior cervical sympathetic ganglion. It descends lateral to the pharynx behind the internal carotid artery and at the level of the greater horn of the hyoid divides into a small external branch and a larger internal branch.

The external branch provides motor supply to the cricithyroid muscle, while the internal branch pierces the thyrohyoid membrane above the entrance of the superior laryngeal artery and divides into two main sensory and secretomotor branches.

The upper branch supplies the mucous membrane of the lower part of the pharynx, epiglottis, vallecula, vestibule of the larynx and the lower branch descends in the medial wall of the pyriform fossa beneath the mucous membrane and supplies the aryepiglottic fold and the mucous membrane of the larynx down to the level of the vocal folds.

The internal branch of the superior laryngeal nerve also carries afferent fibres from neuromuscular spindles and other stretch receptors in the larynx. The superior laryngeal nerve ends by piercing the inferior constrictor of the pharynx and unites with an ascending branch is called Galen's anastomosis.

The right recurrent laryngeal nerve crosses the right subclavian artery and loops under the artery ascending in the tracheoesophageal groove to reach the larynx. On the left side the nerve originates from the vagus as it crosses the

aortic arch. It then passes under the arch and the ligamentum arteriosum to reach the tracheoesophageal groove.

In the neck both nerves follow the same course and pass upwards accompanied by the laryngeal branch of the inferior thyroid artery. They pass deep to the lower border of the inferior constrictor muscle and enter the larynx behind the cricothyroid joint. The recurrent laryngeal nerve then divides into motor and sensory branches. The motor branch has fibres derived from the cranial root of the accessory nerve which supply all the intrinsic muscles of larynx except the cricothyroid. The sensory branch supplies the laryngeal mucosa below the level of the vocal folds and also carries afferent fibres from stretch receptors in the larynx.

LYMPHATIC DRAINAGE

Supraglottic area drains into preepiglottic and upper deep cervical nodes.

Subglottic area drains into prelaryngeal, pretracheal, paratracheal, lower deep cervical and mediastinal nodes.

Glottic area practically have no lymphatic vessels.

IMPORTANT SPACES OF LARYNX

1. Pre epiglottic space
2. Para glottic space
3. Reinke's space

Pre epiglottic space of Boyer:

It is bounded by upper part of thyroid cartilage and thyrohyoid membrane in front, hyoepiglottic ligament above and infrahyoid epiglottis and quadrangular membrane behind, laterally it is continuous with paraglottic space. It is filled with fat, areolar tissue and some lymphatics.

Paraglottic space:

It is bounded by the thyroid cartilage laterally, conus elasticus inferomedially the ventricle and quadrangular membrane medially and mucosa of pyriform fossa posteriorly. It is continuous with pre epiglottic space.

Reinke's space:

Under the epithelium of vocal cord is a potential space with scanty subepithelial connective tissue. It is bounded above and below by arcuate lines, in front by the anterior commissure, and behind by vocal process of arytenoids.

MECHANISM OF VOICE PRODUCTION

The neuroanatomy of phonation:

Phonation is dependant upon the integrated functioning of many elements of central nervous system and peripheral nervous system. There is evidence of subcortical representation which is responsible for reflex laryngeal function and involuntary phonation.

Periaqueductal grey matter(PAG) a region of midbrain, is crucial site for mammalian voice production.

The motor activity for vocalization appears to be integrated through a projection from the PAG to a column of neurons, known as the nucleus retroambigualis (NRA). This nucleus appears to play a significant role in generating respiratory pressure and laryngeal adduction, which occurs in both vocalization and vegetative manoeuvres, such as coughing.

Functions of larynx:

1. Swallowing
2. Coughing
3. Effort closure

Biomechanics of phonation

Prephonatory inspiratory phase:

Immediately before phonation, the vocal folds rapidly abduct to allow the intake of air.

Vocal fold oscillatory phase:

Subsequently the vocal fold are abducted by the contraction of the lateral cricoarytenoid muscles. The vocal note generated by pulmonic air as it is exhaled between the adducted vocal folds. The vocal fold working together constitute a vibrator activated by the exhaled air.

Repeated vibratory movement of the vocal folds is known as Vocal fold oscillation.

Phonatory phase:

Subglottic pressure increases below the adducted vocal folds until it reaches a level which overcomes their resistance and blows them apart, thus setting in motion the vibratory cycles which result in phonation. Each vibratory cycle of vocal folds consists of adduction, aerodynamic separation and recoil.

VOCAL REGISTER

Loft register (falsetto)

Highest vocal frequencies

Modal register

Range of fundamental frequencies most commonly used in speaking and singing.

Pulse register (glottal fry)

Lowest range of frequencies

OBJECTIVE EVALUATION OF THE VOICE

CURRENT KNOWLEDGE

The more commonly used measures in clinical practice can be categorized into the following groups:

- Perceptual evaluation of voice
- Acoustic analysis
- Electrolaryngography
- Visual assessment
- Aerodynamic measures
- Quality of life measures
- Voice accumulator and tests vocal loading
- Combined measures

Perceptual evaluation of voice:

Overall voice quality is regarded as being determined primarily by four basic perceptual factors:

Loudness, Pitch, Intonation, Timbre.

The perceptual evaluation of the voice refers to the process of assessing and grading the severity of these distinctive qualities in a speaker's voice by expert/trained listener. Numerous schemes have been developed which require the expert listener to rate the voice characteristics using either categorical or visual analogue scales.

World wide the GRBAS scheme is probably the most widely used.

Each dimension is rated on a four point scale, where 0 = no perceived abnormality, 1 = mild, 2 = moderate and 3 = severe abnormality. Other measures are CAPE V and VPA.

Acoustics and electrolaryngograph measures:

Acoustic measure of voice quality the physical characteristics of the sound pressure waveform radiating from lips. For accurate measurements of these acoustic measures across the range of vocal frequencies and intensities a good quality condenser or electret omnidirectional pressure sensitive microphone is required.

Electrolaryngograph :

It consists of two electrodes placed on the skin on either side of the thyroid cartilage. A high frequency current (3MHz) applied between the two electrodes held at a constant voltage and the changes in electrical conductance with vocal fold vibration are recorded. Change from maximal to minimal

conductance reflects the change in contact area between the mucosa of the two vocal folds during vibratory cycle.

Measurement of noise ratio:

Harmonic to noise ratio:

The harmonics to noise ratio is the mean intensity of an average waveform divided by the mean intensity of the isolated noise component for the series of waveforms in the utterance. The greater the noise the lower the HNR.

Normalized noise ratio:

The normalized noise ratio energy assesses the relative level of vocal noise to that of harmonics, but bases the analysis on relatively small number of vocal periods and is therefore much faster to calculate.

Signal to noise ratio:

An alternative approach that avoids the need for harmonic analysis yet effectively achieves the same end result is to calculate the signal to noise ratio.

Visual assessment:

Inspection of the structure and dynamic function of the larynx and the rest of the vocal tract together with the vibratory patterns of the vocal fold during phonation. Using endoscopic laryngoscopy including stroboscopy videokymography and high speed digital cinematography.

Aerodynamic measure:

Indirect measures of the forces that initiate and maintain vocal fold vibration e.g. subglottic pressure and airflow. Clinically, there are three main factors that can be measured which are of interest in voice production: air volume, air pressure, and air flow.

Quality of life measures:

Using self administered validated disease specific or generic questionnaires to assess the patient's perception of the impact of the voice condition on their quality of life in terms of physical complaints and restriction in participation in daily activities.

Voice accumulators and tests of vocal loading:

These are means of sampling the voice or aspects of vocal function either over a prolonged period of time or before and after a specified vocal stress test.

Combined measurements:

Dysphonia symptom index: It is a single quantitative measure that has been derived by multivariate analysis.

Hoarseness diagram: It has been proposed as a means of classifying voices acoustically by their degree of breathiness and roughness.

CAUSES OF VOICE DISORDERS

I. NOSE, ORAL CAVITY, PHARYNX

- Choanal atresia
- Micrognathia
- Pierre robbin syndrome
- Cleft lip or palate
- Tonsil and adenoid hypertrophy
- Macroglossia
- Ankyloglossia

II.LARYNX

Organic lesions

- Reinke's edema
- Vocal nodules
- Granulomas
- Stenosis
- Cysts
- Carcinoma
- Webs
- Laryngocele

- Polyp
- Papilloma

Inflammatory conditions

- a. Paediatric
 - i. Laryngitis
 - ii. epiglottitis
 - iii. laryngotracheitis
 - iv. gastroesophageal reflux
- b. Adult
 - i. laryngitis
 - ii. epiglottitis
 - iii. laryngotracheitis
 - iv. rheumatoid diseases
 - v. allergy

Neuromuscular disorders

- a. Paresis/paralysis
 - i. Trauma
 - ii. Neoplasm
 - iii. Post CVA syndrome
 - iv. Idiopathic

- b. Demyelinating disease
 - i. Multiple sclerosis
 - ii. Amyotrophic lateral sclerosis
 - iii. Guillian-Barre syndrome
- c. Degenerative conditions
 - i. Presbylarynx
 - ii. Myasthenia gravis
 - iii. CNS degenerative syndrome
- d. Movement disorders
 - i. focal dystonias
 - ii. parkinsonism
 - iii. Tremors

Functional voice disorders

- a. Psychogenic syndrome
 - i. conversion aphonia
 - ii. conversion dysphonia
 - iii. Relapsing aphonia
- b. Vocal abuse syndromes
 - i. Acute vocal haemorrhage
 - ii. Screamer's nodule
 - iii. Contact ulcer

c. Vocal misuse syndrome

i. Muscle tension dysphonia

d. Post operative dysphonias

AETIOPATHOLOGY

LARYNGEAL DISORDERS

Chronic laryngitis: Infective and non infective

Laryngitis is a descriptive term indicating variable degree of erythema, edema, epithelial changes which may include ulceration, leukoplakia, stiffness of vocal fold. There is often increase amount of thick mucus present.

The voice is usually hoarse which may be due to impaired vocal fold vibration due to stiffness from inflammatory process or secondary to muscle tension imbalance.

Laryngomalacia :

It is a most common congenital anomaly of the larynx. Insufficient cartilage support of the supraglottis has frequently been cited as the cause. It is characterized by excessive flaccidity of supraglottic larynx which is sucked in during inspiration producing stridor.

Congenital vocal cord paralysis:

Vocal cord paralysis mainly due to birth trauma associated with forceps or breech delivery. It may also be seen with cerebral agenesis, Arnold-Chiari malformation and Hydrocephalus.

Laryngeal papillomas

These are proliferation of stratified squamous epithelium that originate in glottis. Etiology is human papilloma virus. Juvenile laryngeal papilloma is more common. It commonly regress at puberty suggesting some hormonal effect. Papillomas present as early as 2 years of age.

Arytenoid Granuloma

Arytenoid granuloma is a benign inflammatory lesion that arise from the medial surface of the arytenoid cartilages and in particular the vocal process.

Other terms for them include:

- i.contact ulcer or granuloma
- ii.vocal process granuloma
- iii.Intubation granuloma
- iv.contact pachyderma
- v.peptic granuloma

Vocal fold polyps:

A true vocal fold polyp is a benign swelling of greater than 3mm that arises from the free edge of vocal fold. It is usually solitary, but can occasionally affect both vocal cords.

The exact cause of polyp formation not known, but phonotrauma is an important etiological factor. Some polyp have a heamorrhagic appearance, others are more gelatinous and grey.

Vocal fold nodules:

Vocal nodules are bilateral, small swellings that develop on the free edge of the vocal fold at approximately the membranous portion. This is due to edema of subepithelial space of the vocal cords.

The exact incidence and prevalence not known. But may be the voice abuse and over use precipitated to vocal nodule. It is more common in singers and teachers.

Cysts and mucous bridges :

Ventricular cyst affect the voice by prolapsing on to the vocal fold interfering with vibration and causing secondary hyperfunction.

Reinke's edema:

It is a term used to describe the vocal folds when they become chronically and irreversibly swollen. The condition include

- polypoidal vocal cord polypoidal degeneration
- 1. polypoidal hypertrophy
- 2. cordal polyposis.
- 3. chronic edema of vocal folds
- 4. pseudomyxoma or pseudomyxomatous laryngitis
- 5. smokers larynx

Grading of Reinke's edema

1. Marginal edge edema
2. Obvious sessile swelling, thrown over vocalis muscle during phonation
3. Large bag like swelling filled with fluid
4. Partially obstructing lesion medial borders in contact along most of length.

Sulcus vocalis:

A sulcus vocalis is best used to describe a localized invagination of the mucosa of varying depth.

A mucosal bridge may also be found in the presence of sulci and epidermoid cysts. This rare finding thought to arise by rupture through of the deep aspects of two sulci or cysts to form a tubed pedicle of mucosa.

Sulcus vergeture:

It is a unilateral or more commonly bilateral linear adherence of the epithelium to the underlying ligament or muscle along the membranous portion of the vocal fold. Reinke's space exists superolaterally and inferomedially to the vergeture.

Patients with sulcus vocalis and mucosal bridges present with variable degrees of dysphonia and roughness and breathiness, depending on the number of lesions, position and depth of the sulcus, the effect on glottal closure and

degree of associated inflammation and muscle tension dysphonia. Sulcus vergeture patients often have a high pitched monotone, weak breathy and strained voice which is an effort to produce.

Microvascular lesion:

Varices and ectasias are collections of abnormally large and weakened vessels that are most commonly found on the superior or medial aspect of the midmembranous portion of the vocal folds. They are most frequently seen in professional vocalists and are thought to arise secondary to repetitive trauma, hormonal variations or repeated inflammation. The lesion can interfere with the vibratory pattern of the vocal folds, causing lack of clarity of voice, vocal fatigue or sudden dysphonia associated with haemorrhage.

Neuromuscular causes:

An effect on the voice may be the first sign of a more general neuromuscular disorder such as parkinsons disease, motor neuron disease, multiple sclerosis and myasthenia gravis.

Spasmodic dysphonia:

It is an uncommon and frequently overlooked condition.

Classified as

1. adductor
2. abductor

3. mixed

4. tremor

Muscle tension dysphonia or functional dysphonia:

Although it is often a diagnosis of exclusion it often present with inflammatory, structural and neurological conditions as laryngeal muscle try to overcome a deficiency in the voice producing mechanism for example poor respiratory function impairment of normal vocal fold vibration or nasal blockage affecting resonance. It is a group of condition characterized by an imbalance of the synergist and antagonist muscle affecting the vocal fold position and tensioning relative to one another and also the position of larynx relative to the rest of the vocal tract.

Primary etiology:

- ❖ Stress, anxiety and depression
- ❖ Conversion disorder
- ❖ Postural and breathing problem
- ❖ Poor vocal hygiene
- ❖ Talking in poor acoustic environment
- ❖ Exposure to excessive environmental dust, smoke and fumes.

Endocrine causes:

Hormonal excess or deficiency may affect the structure or function of the larynx resulting in dysphonia.

Hyperthyroidism: The vocal fold appear hypervascularised and hyperkinetic.

Hypothyroidism: vocal fold edematous

In **Acromegaly** cartilage cells are hypertrophy and laryngeal mucosa thickened.

Vocal fold palsy

Intracranial: Acute bulbar palsy

Motor neuron disease

Vascular, CVA

Encephalitis

Head injury

Tumours

Extracranial:

Trauma –Road traffic accident

Surgical

Infection

Malignancy

Neuritis

NECK

Trauma—cut throat

Thyroid surgery/Tracheostomy

Malignancy –Thyroid malignancy

Laryngopharynx malignancy

Esophageal malignancy

Apex of lung malignancy

THORACIC:

Cardiovascular lesion--Aneurysm

Carcinoma bronchus

Mediastinal node

MISCELLANEOUS

Poisoning: Mercury, lead, alcohol

Diphtheria, Avitaminosis, Diabetes

Polyarthrititis nodosa, sarcoidosis

IDIOPATHIC

Respiratory system

Tuberculosis :

Tuberculosis is one of the most common disease in India. In the past it commonly developed as sequele of severe pulmonary tuberculosis.

Now the pattern has changed and many patients with laryngeal tuberculosis are seen without pulmonary symptoms. Lesion range from areas of nonspecific inflammation to nodular, exophytic lesion or mucosal ulcerations. Hyperaemia of vocal cords, swelling in the interarytenoid region giving mamillated appearance. Ulceration of vocal cord giving mouse nibbled appearance. Apical lung malignancy produce paralysis vocal cord.

Rheumatoid arthritis:

It is a most common auto immune system disease affect the adult population. The usual age of onset is from 35-45 and women are affected three times than men. Laryngeal involvement is rare. The laryngeal finding is depending on the stage of rheumatoid involvement. There is a initial acute phase in which the larynx may be tender and swollen and in chronic phase in which arytenoids mucosa is thickened, the vocal cord bowed, and the arytenoids fixed to varying degrees.

Gastro oesophageal reflex diseases:

It is defined as the movement of gastric material into the esophagus in absence of belching and vomiting. The esophagus is the conduit for the transfer of materials from pharynx to stomach. It also act as vent for stomach, allowing some normal retrograde flow of gasses and gastric contents. The gatekeepers for the ingrees and egress of material are the upper and lower esophageal sphinters.

The four main constituents of the barrier to reflux are the UES, the LES, esophageal acid clearance and epithelial resistance.

There are two theories to explain the pathophysiology. Firstly, the direct theory with the refluxate from the stomach and oesophagus crossing the upper oesophageal sphincter and causing inflammatory effect on the laryngopharynx.

Secondly, the indirect theory where chronic repetitive throat clearing and coughing is caused by a vagally mediated response secondary to acid in the lower oesophagus.

Amyloidosis:

Of all upper respiratory sites, the Larynx is the most frequently involved area. The lesion is slow growing and has waxy translucent yellow appearance without ulceration. It affects the larynx as a part of primary or secondary process of systemic amyloidosis.

CLINICAL FEATURES AND INVESTIGATIONS

Multiple papilloma larynx:

1. Persistent hoarseness of voice is the usual symptom in children
2. Difficulty in breathing is common.
3. Sometimes the children present with acute dyspnoea.

Investigations

Indirect laryngoscopy show papillomatous mass arising from the vocal cords, ventricular bands and even supraglottic region.

Video laryngoscopy with the help of 30° & 70° Hopkins rod examination of larynx will show the mass very clearly.

Solitary papilloma:

Common in adult male in the age group of 30-50 yrs Hoarseness of voice is the common feature.

Investigations

- ❖ Blood and urine examination
- ❖ Indirect laryngoscopy
- ❖ Direct laryngoscopy
- ❖ Video laryngoscopy

Vocal nodules and fibroma of vocal cord

Usually seen in male children and young adult women. Persons are characterized as talkative,boisterous, or verbally aggressive.

Nodules are the occupational hazard of teachers, telephone operators, entertainers, singers and mothers of young children.

Hoarseness of voice, vocal fatigue and sensations of aching and tiredness to talk.

Investigations :

- ❖ Indirect laryngoscopy
- ❖ Direct laryngoscopy
- ❖ Video laryngoscopy
- ❖ Stroboscopy

Tuberculosis larynx

Hoarseness of voice

Cough with expectoration

Loss of weight

Poor appetite

Pain during swallowing

Investigations :

- ❖ Urine and blood examinations
- ❖ Xray chest
- ❖ Sputum for AFB
- ❖ Indirect laryngoscopy
- ❖ Direct laryngoscopy
- ❖ Video laryngoscopy
- ❖ Stroboscopy
- ❖ Biopsy from granulomatous lesion

Myxoedema causing Reinke's oedema

Hoarseness of voice

Voice fatigue

Investigations :

- ❖ Indirect laryngoscopy
- ❖ Thyroid function tests
- ❖ Video laryngoscopic examination

Intubation granuloma:

Patients presents with change of voice and vocal fatigue, a constant tickling sensation, discomfort or pain localized to the posterosuperior aspect of the larynx with the past history of intubation.

Investigations :

- ❖ Indirect laryngoscope
- ❖ Video laryngoscope
- ❖ CT Neck
- ❖ MRI Neck

VOCAL CORD PALSY

Unilateral vocal cord palsy

Breathy voice,

Investigations :

- ❖ Blood and urine examination
- ❖ Indirect laryngoscopy
- ❖ Direct laryngoscopy: confirms findings, helps to examine vocal cord movement and cricoarytenoid movements.
- ❖ High quality audio recordings
- ❖ Video recording

Position of vocal cord

Median

Paramedian : 3.5mm

Cadaveric : 7.0mm

Gentle abduction : 13.5mm

Full abduction : 19.0mm

Scopy : Nasopharyngoscopy

Oesophagoscopy

Bronchoscopy

Mediostinoscopy

X-ray chest PA view : Associated PT

Mediastinal widening

Left atrial enlargement

Aortic aneurysm etc.,

X-ray skull base: Any secondaries

CT scan, MRI

Laryngogram

Barium swallow

Electrocardiograph

REVIEW OF LITERATURE

1. Evaluation and Management of Laryngopharyngeal Reflux

Charles N. Ford, MD

JAMA. 2005;294:1534-1540.

ABSTRACT

Context Laryngopharyngeal reflux (LPR) is a major cause of laryngeal inflammation and presents with a constellation of symptoms different from classic gastroesophageal reflux disease.

Objective To provide a practical approach to evaluating and managing cases of LPR.

Evidence Acquisition The PubMed database and the Ovid Database of Systematic Reviews were systematically searched for laryngopharyngeal reflux, laryngopharyngeal reflux fundoplication, laryngopharyngeal reflux PPI treatment, and gastroesophageal reflux AND laryngitis. Pertinent subject matter journals and reference lists of key research articles were also hand-searched for articles relevant to the analysis.

Evidence Synthesis Reflux of gastric contents is a major cause of laryngeal pathology. The pathophysiology and symptom complex of LPR differs from gastroesophageal reflux disease. Laryngeal pathology results from small amounts of refluxate-typically occurring while upright during the daytime-causing damage to laryngeal tissues and producing localized

symptoms. Unlike classic gastroesophageal reflux, LPR is not usually associated with esophagitis, heartburn, or complaints of regurgitation. There is no pathognomonic symptom or finding, but characteristic symptoms and laryngoscopic findings provide the basis for validated assessment instruments (the Reflux Symptom Index and Reflux Finding Score) useful in initial diagnosis. There are 3 approaches to confirming the diagnosis of LPR: (1) response of symptoms to behavioral and empirical medical treatment, (2) endoscopic observation of mucosal injury, and (3) demonstration of reflux events by impedance and pH-monitoring studies and barium swallow esophagram. While pH monitoring remains the standard for confirming the diagnosis of gastroesophageal reflux, the addition of multichannel intraluminal impedance technology improves diagnostic accuracy for describing LPR events. Ambulatory multichannel intraluminal impedance assessment allows for identification of gaseous as well as liquid refluxate and detection of nonacid reflux events that are likely significant in confirming LPR.

Although some patients respond to conservative behavioral and medical management, as is the case with gastroesophageal reflux, most require more aggressive and prolonged treatment to achieve regression of symptoms and laryngeal tissue changes. Surgical intervention such as laparoscopic fundoplication is useful in selected recalcitrant cases with laxity of the gastroesophageal sphincter.

Conclusions Laryngopharyngeal reflux should be suspected when the history and laryngoscopy findings are suggestive of the diagnosis. Failure to respond to a 3-month trial of behavioral change and gastric acid suppression by adequate doses of proton pump inhibitor medication dictates need for confirmatory studies.

Multichannel intraluminal impedance and pH-monitoring studies are most useful in confirming LPR and assessing the magnitude of the problem.

2.Laryngeal Tuberculosis:A Report Of Three Cases

Ljiljana Tesic-Vidovic, M.D.Department of Otorhinolaryngology

Milenko Marin Hospital Loznica Serbia & Montenegro

Citation:

Ljiljana Tesic-Vidovic: Laryngeal Tuberculosis: A Report Of Three Cases. *The Internet Journal of Otorhinolaryngology*. 2006. Volume 4 Number 2

Laryngeal tuberculosis (TB) is an uncommon disease usually associated with pulmonary TB. It has been estimated that laryngeal TB accounts for less than 1% of all TB cases. Since the World Health Organization declared tuberculosis as a global emergency in 1993, the incidence of laryngeal TB has been on the rise worldwide. This has been largely attributed to the AIDS epidemic, increased poverty and drug addiction, lack of tuberculosis chemotherapy, development of resistant strains, immigration from TB-affected areas, and decreased immunization coverage [^{2,3}]. Laryngeal TB has gained

interest not only because of its rising incidence but also because of its changing clinical manifestations. Due to uncommon clinical presentations and lack of clinical suspicion, laryngeal TB is frequently confused with other laryngeal diseases such as chronic laryngitis and laryngeal carcinoma [4, 5]. Laryngeal TB is highly contagious and misdiagnosis can pose a serious risk to the public health [6]. Health care staff and other patients are at a particularly high risk of exposure [7]. Recently published studies report that a conventional multiple-drug anti-tuberculosis regimen is an effective therapy for most cases of laryngeal TB. This leads to the conclusion that the successful management of laryngeal TB rests upon prompt diagnosis. Three cases of laryngeal TB with coincident pulmonary TB are presented here. The aim of this study is to contribute to raising the awareness and prompt diagnosis of laryngeal TB.

3. Hoarseness Of Voice In a Patient With Mitral Stenosis And Ortnerâ€™s Syndrome

Abdul Latiff M., and Mollyza M.Z., (2004) *Hoarseness Of Voice In a Patient With Mitral Stenosis*

And Ortnerâ€™s Syndrome. Malaysian Journal of Medical Sciences, 11 (2). pp. 65-68. ISSN 1394195X

Official URL: <http://www.medic.usm.my/publication/mjms/>

Affiliations

Hospital Universiti Kebangsaan Malaysia, Dept. of Medicine

Abstract

Rheumatic mitral stenosis is prevalent in this part of the world and it gives rise to wide array of manifestations. However, hoarseness of voice secondary to recurrent laryngeal nerve paralysis (Ortner's syndrome) is an uncommon manifestation. This case illustrates an uncommon presentation in a common disease. A 29-yearold lady presented with a 2-year history of hoarseness of voice. Physical examination revealed a mid-diastolic murmur and left vocal cord paralysis. Echocardiography confirmed mitral stenosis with pulmonary hypertension. She underwent percutaneous mitral balloon valvotomy in 1991 with return of normal speech after a few months. The recurrent laryngeal nerve paralysis is mainly due to the compression by an enlarged pulmonary artery as initially thought. This complication is rarely seen nowadays due to greater awareness of the disease and earlier intervention. With the advent of percutaneous transvenous mitral valvotomy in the nineties, effective non-surgical intervention is plausible.

4.BMJ 1995;311:1039-1040 (21 October) Functional dysphonia

Not "hysterical" but still seen mainly in women Last year at the Glasgow Royal Infirmary over 190 new patients presented with dysphonia (hoarseness) and were referred to speech and language therapists for voice therapy. Extrapolation from these data suggests that up to 40000 such patients are referred and treated annually in Britain. A substantial proportion suffer from

functional dysphonia, in which there is neither a structural abnormality of the larynx (such as a vocal cord polyp, nodule, or papilloma) nor paralysis. As with most functional somatic symptoms, women are considerably overrepresented, in some series by a factor of eight.¹

Functional dysphonia is a diagnosis of exclusion. It may be confirmed only after specialist examination of the larynx by an otolaryngologist, which means that otolaryngologists see large numbers of patients with functional dysphonia in their outpatient practice. Traditional teaching dictates that hoarseness should remain "unexplained" for only three weeks, especially in smokers.

General practitioners, however, are aware that laryngeal cancer is rare and found predominantly in older patients. Therefore, because most patients with functional dysphonia are young or middle aged adults who are otherwise healthy, roughly 40% are diagnosed presumptively as having laryngitis and receive a trial of antibiotic treatment before being seen as hospital outpatients.

There are two particular problems in diagnosis. The presenting symptom of altered voice quality is subjective, both for the patient and for the clinical observer. Secondly, as with many putative functional symptoms, dysphonia forms part of a range from a barely noticed variant of normality to a major life disability.

Broadly speaking, there are two types of functional dysphonia: disorders of hypofunction, with inadequate apposition of the vocal cords; and hyperfunctional dysphonia, in which accessory laryngeal muscles are used in voicing (this reaches its most extreme variant--dysphonia plicae ventricularis--in middle aged men who recruit the false cords in phonation). The disorder may also be classified according to the amount of residual phonation present: completely mute ("hysterical aphonia"), continually whispered speech, intermittently phonated "whispered" speech, or continually phonated speech. Rare variants of functional dysphonia include puberphonia or mutational falsetto, in which the voice retains an inappropriately high and monotonous quality into adulthood,² and spasmodic dysphonia, which was long held to be of psychogenic origin but in recent years has been thought to be a focal dystonia.³

Aetiology and treatment the role of psychosocial factors in the aetiology of functional dysphonia remains in doubt. Early psychodynamic explanations of hoarseness as a conversion symptom¹ have given way to a search for characteristic personality traits. Dysphonic patients are more introverted and score higher on neuroticism scales than controls.⁴ This may be a non-specific personality diathesis shared with at least one other functional otolaryngological syndrome, globus pharyngis.⁵ Modern conventional treatment is speech therapy, which often includes training in relaxation.

MATERIALS AND METHODS

Fifty two cases with voice disorders who attended the ENT Department, Government Rajaji Hospital, Madurai, from Jan2007 to Jan 2008 were selected for the study. The cases were analysed by etiology, age, sex incidence, clinical features and mode of treatment.

Selection criteria:

- Patients below the age of 55 years.
- Patients with benign vocal cord lesions.
- Vocal cord palsy.
- Rare etiology cases.

Exclusion criteria:

- Patients above the age of 55 years
- All malignant laryngeal lesions
- Gender voice disorder

Investigations

- Routine blood investigation
- X-ray chest
- ECG

- CT Neck, Chest & Brain
- Thyroid profile
- Sputum for AFB
- Indirect and direct laryngoscopic examination
- Video laryngoscopic examination.

MANAGEMENT

The following methods of treatment were used in this study.

1. Microlaryngeal surgical excision
2. Diathermy excision and Laser excision
3. Medical management
4. Speech therapy

1. MICROLARYNGEAL SURGICAL EXCISION:

The aim is to remove pathological tissue and attempt to restore the normal surface contour and layered structure of the vocal fold.

The advantages are

- Binocular vision
- Magnification
- Better illumination
- The ability to use bimanual instrumentation
- The ability to use the carbon dioxide

Procedure :

Under general anaesthesia, direct laryngoscopy (Kleinsasser suspension) was done. The polyp from free margin of the cord was grasped by microlaryngeal cup forceps, pulled medially and carefully trimmed by using the microlaryngeal scissors.

2. LASER EXCISION:

The CO2 Laser has become an important part of the surgeon's armamentarium, and we have applied for excision of intubation granuloma and laryngeal papilloma. Tissue effects of the laser depend on spot size and focus, wattage, duration of beam activation, wave form, mode and surgical precision.

The laryngeal papillomas were excised by using this laser.

General guidelines for initial voice use after vocal fold surgery

Time of surgery	Talking
Days 1 to 4-5	none
Week 1	minimal use
Week 2	”
Week 3	moderate use
Week 4	”
Week 5	normal use

3. MEDICAL MANAGEMENT

Tuberculosis larynx:

Patients were referred to chest medicine and found to be sputum positive for AFB and X-ray chest confirmed the pulmonary tuberculosis, got anti tuberculous drug therapy.

Gastro oesophageal reflex disease:

Patients were referred to medical gastroenterology for management of GERD. Basic management consists of avoiding caffeine, alcohol, and spicy food. Bedtime antacid or H2 blocker, or proton pump inhibitor was advised.

Hypothyroidism :

Hypothyroidism was confirmed with Low T3 & T4 level and high level of TSH . So patients were referred to endocrinology department for medical management and advised to come for follow up.

Functional dysphonia:

Laryngeal pathologies were ruled out by investigations for dysphonia. Since positive history of depression was elicited, patients were referred to psychiatry department for counselling and medical management.

4. SPEECH THERAPY:

The vocal cord nodule cases were managed with the advice of speech therapy. But few patients were failed to attend the follow up.

THE CURRENT KNOWLEDGE ABOUT SPEECH THERAPY

The accent method of voice therapy employs rhythm and intonation, abdominodiaphragmatic breathing exercises and are movements designed to achieve better control speech and voice production and to manage two opposing functional deficits the state of glottal voice production and the state of excessive glottal tightness.

Vocal hygiene is an encompassing term to describe techniques which are routinely incorporated into most voice therapy programmes.

Electromyographic biofeedback training.: It provides monitoring of excessive laryngeal function.

Procedure: EMG recorded from laryngeal area using bipolar surface electrodes placed on the cricothyroid region with the 3rd electrode on the ear lobe. Visual and auditory feedback given together. The subject is instructed to reduce general laryngeal muscle tension while speaking.

Stemple vocal function exercise programme. It is a series of voice manipulations, designed to strengthen and balance airflow to muscular effort and balance laryngeal musculature.

CASE ANALYSIS

S. NO	TYPES OF CASES SELECTED	NO. OF CASES
1.	BENIGN LESIONS OF LARYNX (vocal nodule, vocal cord mucosal polyp, fibroangiomatic polyp and laryngeal papilloma)	27
2.	VOCAL CORD PALSY	10
3.	TUBERCULOSIS LARYNX	6
4.	HYPOTHYROIDISM	4
5.	GERD	3
6.	FUNCTIONAL APHONIA	2
	TOTAL	52

SELECTED BENIGN LESIONS

TYPE	NO OF CASES
Vocal nodule	10
Vocal cord polyp	6
Laryngeal papilloma	5
Intubation granuloma	4
Epiglottic cyst	2

VOCAL CORD PALSY

CAUSES	NO.OF CASES	SIDE OF PALSY
Anuerysm of Aorta	1	Left
Trauma due to thyroid surgery	2	Left & right
Cut throat injury	1	Left
Birth trauma	1	Left
Enlarged left Atrium due to mitral stenosis	1	Left
Idiopathic	4	Left

RESULTS OF MANAGEMENT

Mode of management	No. of cases	Came to the follow up	Voice recovery
Surgery & speech therapy	20	15	98%
Medical	18	16	90%
Speech therapy	12	3	90%

DISCUSSION

A careful attempt has been made to study and analyse the cases of hoarseness of voice who presented to ENT department from January 2007 to January 2008. 52 cases were taken for this study.

Age ratio:

Paediatric - 7%; Adult - 43%

Male / Female Ratio in Adult patients:

Out of 46 cases 28 were male and 18 were female which form 61% and 39% respectively.

Etiological study:

In this study 54% had Benign and other inflammatory lesions, 19% had vocal cord palsy, 9% had Tuberculosis larynx, 8% had Hypothyroidism, 6% had Gastroesophageal reflex disease and 4% had Functional aphonia.

Management :

Surgery & speech therapy	20 cases
Medical management	18 cases
Speech therapy alone	12 cases

Comment

Most of the inflammatory pathology and benign lesions are treated by both medical and surgical methods. Good prognosis achieved by CO2 laser excision in laryngeal papilloma. Microlaryngeal surgery has a valid role in management of benign lesions of larynx. Medical management is useful in systemic diseases affecting vocal cords.

Speech therapy has an important place in post operative period of microlaryngeal surgery cases and also useful in small vocal nodules due to voice abuse.

Vocal nodules are the most common lesions of the vocal cord and it holds 32%. Mucous polyp is 21%. Fibroangiomatic polyp is 7%, Laryngeal papilloma is 10%. Reinke's edema 2%.

Laryngitis due to gastro esophageal reflux disease was mainly diagnosed with the associated symptoms and by ruling out other causes. They got symptomatic relief with proton pump inhibitors.

In vocal cord palsy most common cause is idiopathic.

Tuberculosis larynx more common in males. Most of them had congested mouse nibbling appearance of vocal cord. They were found to be sputum positive for AFB. Some of them had granulomatous lesion in the larynx which mimicked the growth. Tuberculosis lesion was confirmed by biopsy. x-ray chest showed tuberculous lesion in lung.

Psychogenic causes for voice disorder is more common in females.

Follow Up

In Hypo thyroidism patients, early diagnosis and management gave appreciable voice improvement in the early period of treatment itself.

In Tuberculous laryngitis after starting anti tuberculous drug treatment the lesions in larynx responded well and voice also improved gradually.

In gastro esophageal reflex disease after the medical and conservative management the voice has become better.

The speech therapy hold a good place in voice recovery in functional aphonia.

CONCLUSION

- The vocal cord nodule is the most common lesion in the larynx.
- Female preponderance was encountered in thyroid disorders and Male preponderance in tuberculosis.
- This study highlights that the contribution of laryngeal tuberculosis was in significant percentage. This shows that awareness and prompt diagnosis of laryngeal tuberculosis is a must. Among 5 cases, sputum for AFB is positive in 4 cases. So it is highly contagious and misdiagnosis can pose a serious risk to the public health.
- Chronic heart burns, burning pharyngeal discomfort, and nocturnal choking with hoarseness of voice- the gastro esophageal reflex to be ruled out.
- Micro laryngeal surgery and laser surgery have taken an important place in removing benign lesion of larynx and regaining the normal voice.
- Middle age woman without having any laryngeal lesion & sudden onset of hoarseness of voice, thyroid function tests to be done to rule out hypothyroidism.
- Speech therapy have a valid place in the management.

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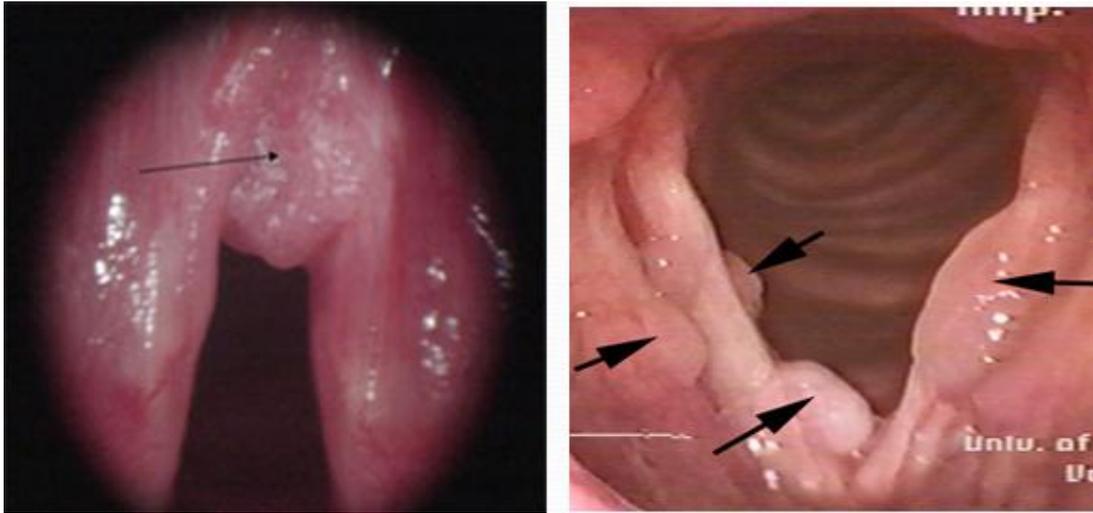
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LASER EXCISION



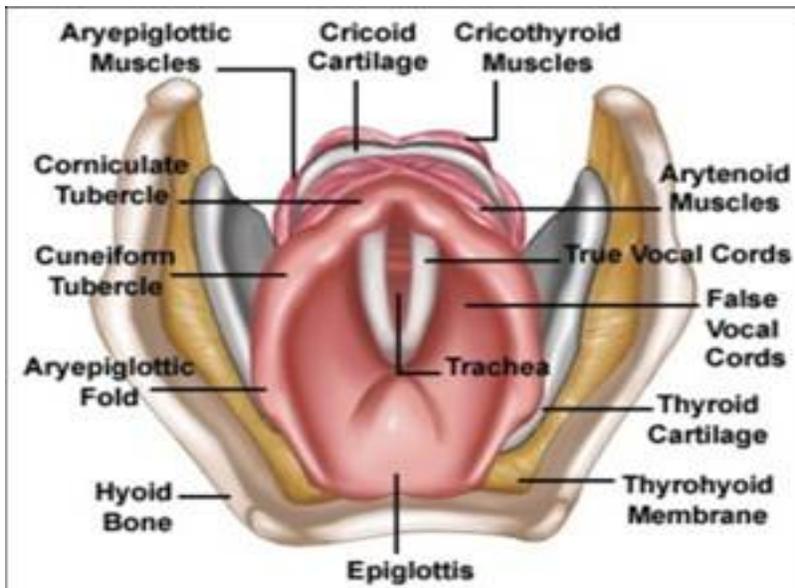
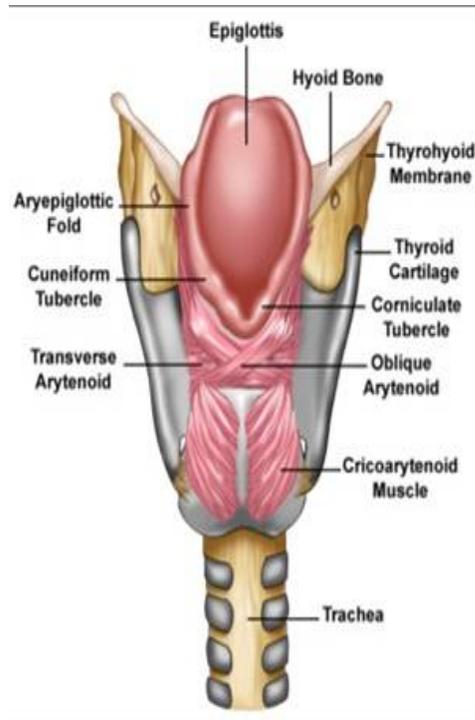
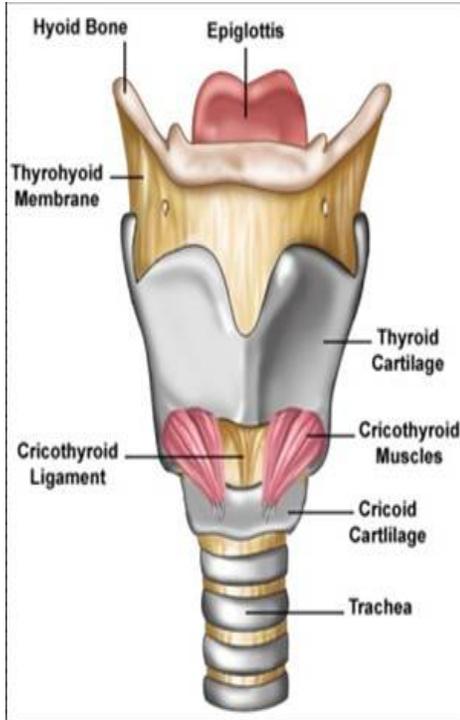
INTUBATION GRANULOMA



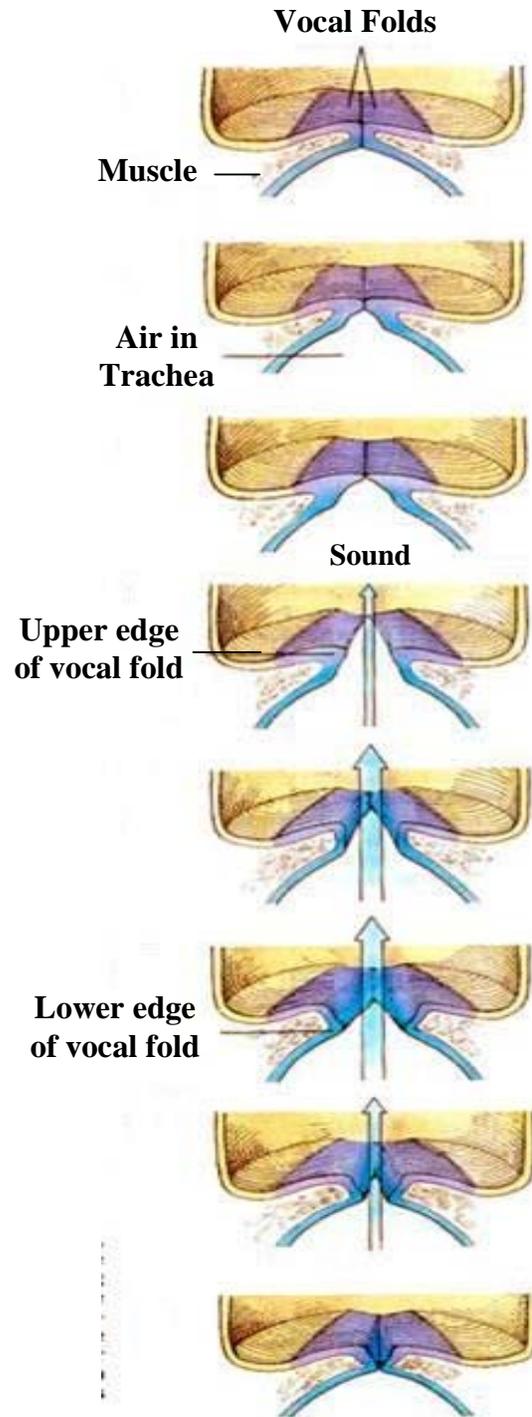
KLENSASSER'S SUSPENSION LARYNGOSCOPE AND INSTRUMENTS USED IN MICROLARYNGEAL SURGERY



ANATOMY OF LARYNX



MECHANISM OF VOICE PRODUCTION



CAPILLARY ECTASIAS



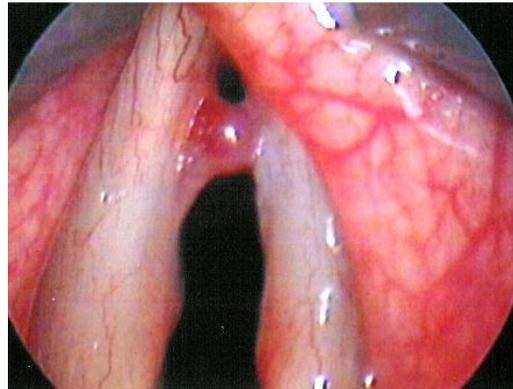
CYST



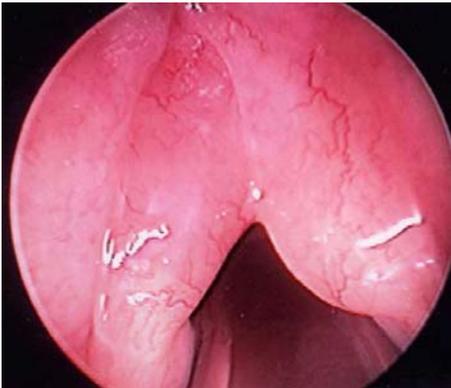
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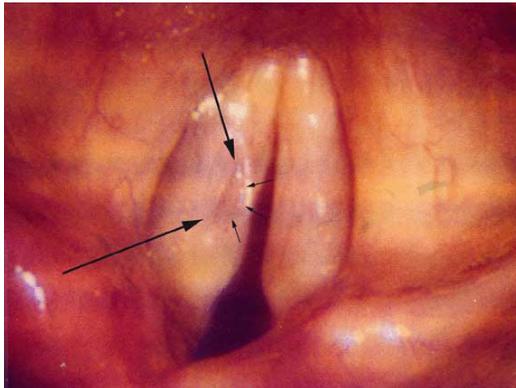
HEMORRHAGIC VOCAL CORD NODULES



REINKE'S OEDEMA



SULCUS



TUBERCULOSIS LARYNX WITH LUNG



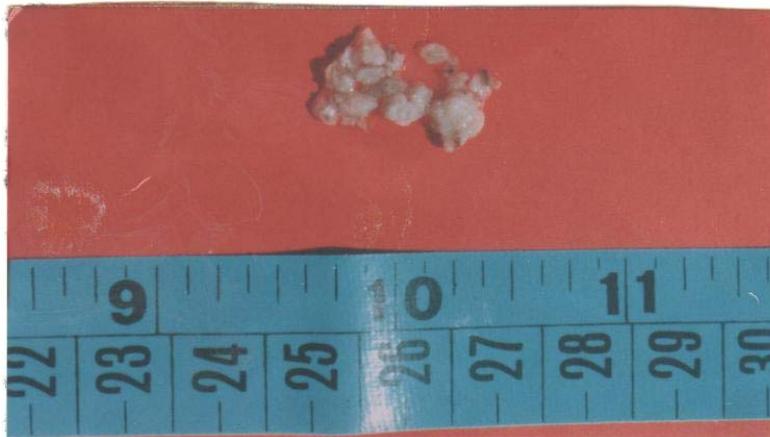
LARYNGEAL PAPILLOMA



ENDO LARYNGEAL EXCISION



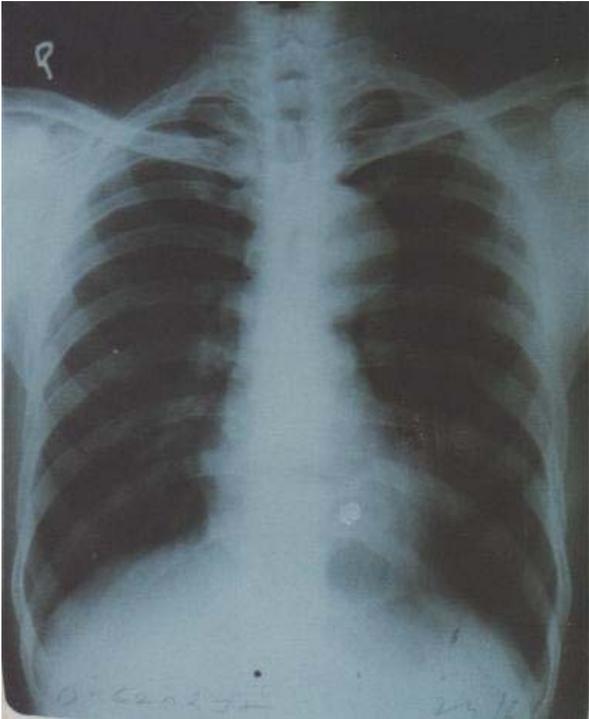
EXCISED PAPILLOMATOUS MASSES



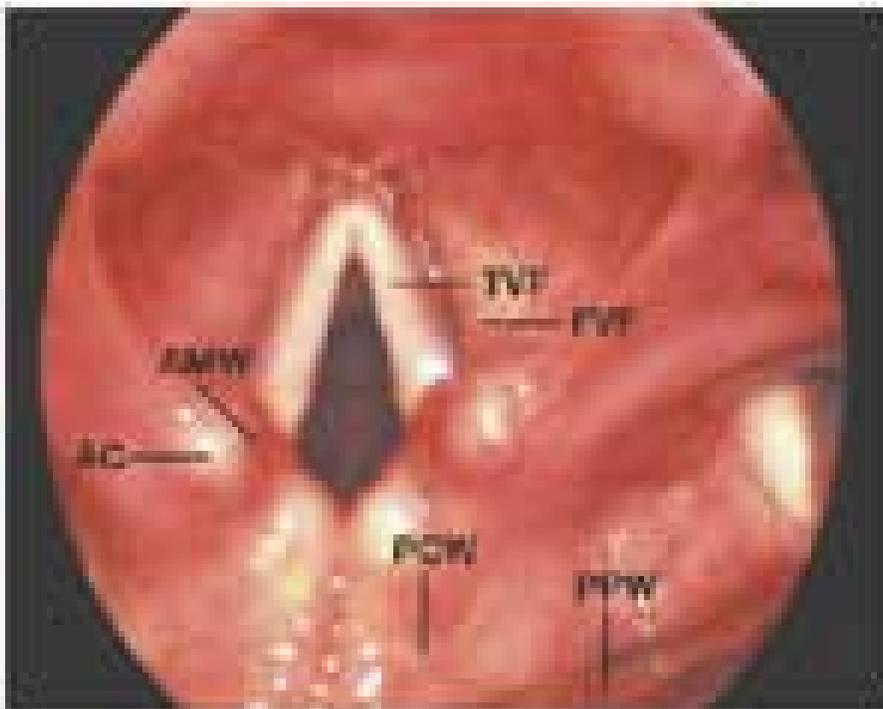
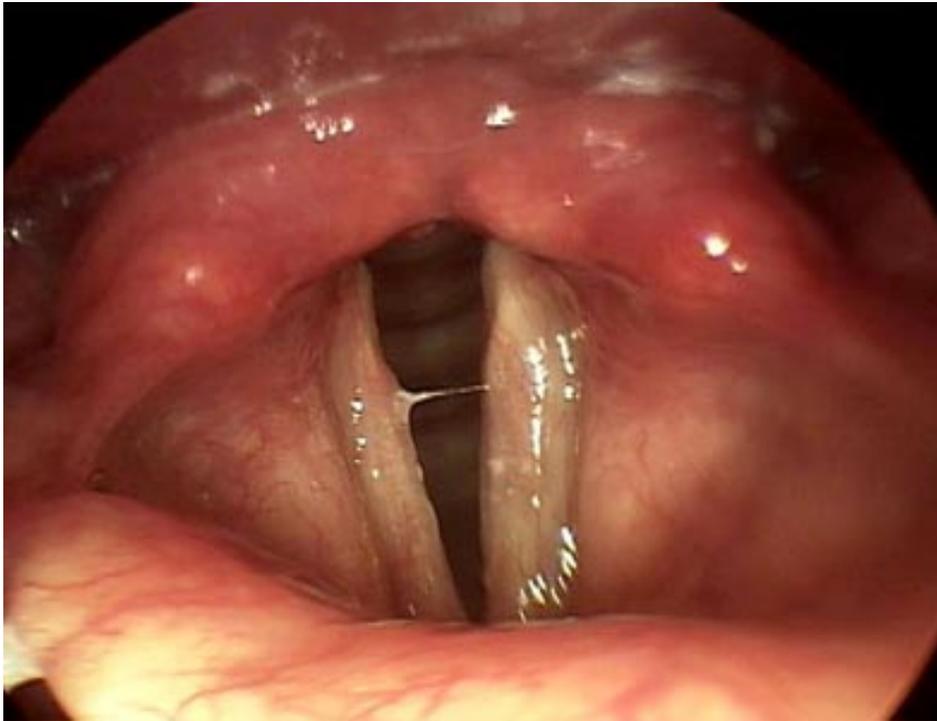
CASE OF AORTIC ANEURYSM WITH VOCAL CORD PALSY



X-RAY SHOWING AORTIC ANEURYSM



LARYNGEAL LESION IN GASTRO OESOPHAGEAL REFLUX DISEASE



POSITIONS OF THE VOCAL CORD IN HEALTH AND DISEASES

