

**ANALYSIS OF VOICE DISORDERS BY
Dr.SPEECH AND ELECTROGLOTTOGRAPHY**

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INTRODUCTION

"One of the important factor which sets man apart from all living organisms which makes him unique, is his ability to communicate using his vocal tones for social interaction" - FISHER

A normal voice is judged according to whether the pitch, loudness, quality are adequate for communication and suit a particular person. A person may use a pitch which is too high or too deep, intensity that is too loud or too soft, or voice quality may be too hoarse, breathy or Harsh.

Hoarseness of voice may be defined as a quality of voice, which is rough, grating, harsh more or less discordant and lower in pitch than normal voice: Hoarseness is purely a relative term.

Setting the vocal cords in vibration by an air column is purely mechanical process. So anything that impairs the perfect working of this Mechanism produces voice disorder.

Mechanical elements in this process are:

1. Approximation of vocal cords
2. Firming / Hardening of vocal cord edges
3. Vibration of the vocal cords

1. Approximation of vocal cords

This may be impaired by

- a. Tumours, secretions, other substances between any parts of the two cords
- b. Fixation or limitation of range of movement of crico-arytenoid joints.

- c. Paralysis or impaired power of movement in the laryngeal musculature.
- d. Cicatric concavity of the edges of either vocal cord.

2. Firming / Hardening of vocal cord edges

This may be interfered by

- a. Thickening of cordal edges
- b. Concavity of the firming muscles
- c. Feebleness of the firming muscles
- d. Excessive approximation of the ventricular bands.

3. Vibration

It may be impaired by

- a. Inflammatory, neoplastic, or other tissue changes in the cord
- b. Secretion of pedunculated tumours acting as damper
- c. Fullness of the muscles
- d. Incomplete approximation
- e. Prior approximation of the ventricular bands.

The main resonators are the cavities or air spaces of lungs, trachea, pharynx, mouth and nasal chamber with paranasal sinuses. Each of these resonators by virtue of their size, shapes, and tissue texture and special properties enable it to make a unique contribution of the modification and reinforcement of the initial laryngeal tone and the production of the final or rich voice that the listener hears.

When the normal voice is affected, their communication becomes difficult, can be a serious handicap and embarrassment to the speaker. When

the voice is in disorder as a result of strings or pathological change, the whole personality suffers which will give rise to feeling of inadequacy and insecurity. So consideration of voice is important. The physiological and financial implications are important. Voice disorder in those who, depend for their live hood like teachers, sales man, singers, and some professional workers, produce obvious anxiety on account of the serious, professional and financial handicap. But in countries like India it is more common to see uneducated people, having more voice disorder.

Now with the advent of high tech computerised assessment facilities and advanced microlaryngeal surgical techniques, early detection of lessions of vocal coards and precise surgical excisions of lesions without causing much trauma to the surrounding tissues become any bodies procedure and voice conservation techniques are far too better. Much advanced procedures like stroboscopy, cineradiography, tape recording, photography spirometry, electroglottography, Dr.Speech, oscillography and Electromyography help in assessing the impairment of the vocal cord movement during the disease process and also in assisting the improvement of vocal cord functions during recovery after the treatment.

In this dissertation voice disorders due to various vocal cord pathologies have been studied and analysed with the help of Dr.Speech and Electro Glotto Graphy before and after treatment procedures. Various predisposing factors and pathological conditions are being correlated with kind of voice disorders including the pitch and quality of voice.

AIMS OF OBJECTIVES OF THE STUDY

1. Voice assessment by Dr.Speech before and after treatment in patients with voice disorders.
2. Categorization of the various disease of the larynx causing voice disorder.
3. Evaluation and recent trends in the age, incidence, sex ratio and occupational factors. To assess the common risk factors causing voice disorder.
4. To bring about awareness amongst the people about the risk factors causing voice disorder like.
 1. Misuse or abuse of voice
 2. Faulty habits of voice
 3. Excessive smoking or alcohol consumption
5. Various diagnostic tools used for evaluation of conditions causing voice disorder.

REVIEW OF LITERATURE

(Historical Review)^{14,39}

Many scientist have worked to know the structures of Larynx, its function, voice production, resonance and articulation, etc. In the following paragraph, a brief account of historical review is given.

B.C. Hippocrates¹⁴ 5th Century, said "Larynx leads to lungs, artery and then to the top of bladder".

Aristotle¹⁴ (358 BC) postulated that the voice was produced in the trachea and larynx by the impact of air.

Claudius Glawu¹⁴ (130 AD) thought that the trachea was central organ acting as flute.

Vesalius described the presence of two arytenoid cartilages.

Fallopio¹⁴ (1532 - 1563) gave the name cricoid to the second major cartilage.

Heironymus Fabricius¹⁴ (1537 - 1619) expressed that "Vocal cords and the gap between them create the voice".

Dudent¹⁴ (1700 AD) proved that the vowel originated in the larynx. He believed that the eddies in the glottis generated the sound.

Boerhave (1688) described the "Cancerous angina".

Morgagni¹⁴ (1732) described the autopsy findings in two cases of laryngeal carcinoma.

Trousseau and Belloc¹⁴ (1873) described about laryngeal pthisis i.e. any chronic alteration of the larynx which may bring on consumption or death in any way.

Trousseau¹⁴ was the first to use the "tracheostomy" for treatment of laryngeal cancer.

Antoine Ferrein¹⁴ (1693 - 1769) who did experiments on animals that the vibration of vocal cords are essential and not of secondary nature.

Manuel Garica¹⁴ A "Father of Laryngology" Spanish teacher discovered the laryngeal mirror for inspection of larynx, turck was the first to apply it to medicine, (Zermak who improved the mirror).

Helmholtz (1875 AD) showed that the glottis is the primary source of the sound generator.

Alfred Kirstein¹⁴ developed the art of direct laryngoscopy.

Wilhelm Brunings¹⁴ described the injection of paraffin into the unilateral paralysed vocal cords.

Pelletan¹⁴ a French surgeon is said have split the larynx as early as 1778 for impacted meat.

Gordon Buck¹⁴ (1851) 1st laryngofissure for treatment of intrinsic carcinoma of larynx.

Patrick Watson of Edinburgh¹⁴ credited with first human laryngectomy for syphilis in 1866.

Billroth¹⁴ (1873) was first to perform laryngectomy for epidermoid carcinoma of the subglottis.

Francis Magaendie¹⁴ (1831) published physiology of voice production.

Helmholtz¹⁴ (1925) synthesized vowel sounds by making as sufficient number of tuning forks to vibrate at selected frequencies with prescribed amplitudes.

Ferriai¹⁴ (1942 AD) was the first man to apply the name "vocal cords" the lips of the glottis and saw in them the principal instruments the modification of voice.

Invention of stroboscope was another achievement in laryngology. It gives idea about the vibration patterns, shape and movement of the vocal cords and the fine relationship between the open and closed phase, even when the patient has a poor ability to hold a given pitch.

Belleau Flasseau¹⁴ (1829 AD) and Austrian Stamper (1852) independently of each other developed the stroboscopic principles.

German Hirler¹⁴ (1852) used in 1852 and experimented examination of the movement of vocal cords on cadavers.

Teepler¹⁴ (1962 AD) performed the stroboscopic examination of human vocal cords under phonation.

Schonhort¹⁴ (1962 AD) stated that the stroboscopic examination is one of the valuable methods in the disease of early lesions of the vocal cords.

Morell Mackenzie (1871 AD) is credited as the most out standing exponent of laryngeal biopsy during the early days of clinical recognition of the laryngeal disease.

Klein Sasser¹⁴ (1961 AD) invented the laryngeal microscope, is particularly applicable in the diagnosis and treatment of laryngeal diseases.

Von Kempier¹⁴ (1791 AD) constructed and demonstrated a maximum elaborated machine for generating connected utterances.

Nendrofer¹⁴ (1858 AD) performed retrograde examination of the subglottis through tracheostomy.

Kiviranter¹⁴ (1966) and Mastenson (1967) did transcoinoscopy for retrograde examinations of subglottis.

Jackson and Norris¹⁴ (1961) & Gron (1966) have published the application of CT and MRI in Laryngology, aided to this is the laryngography. Contrast media has come up by Ogura (1960), Lan (1962), Howell Glidshine & King (1968).

Manguso and Hanfe^{1,14} (1982) have done extensive study of the larynx by using computerised tomography in benign tumours and laryngeal trauma. In cases of tumour extension, CT has made it possible to detect.

- Spread to anterior commissure
- Deep extension to para cordal, para arytenoid areas, pre epiglottic spaces.
- Cartilage invasion.
- Extension of pyriform fossa tumours through the cricothyroid space to involve post cricoid region.

Cummings⁴¹ et al., showed benign vocal fold mucosal disorders (eg. Vocal nodules, laryngeal polyps, mucosal haemorrhage, intracordal cysts, mucosal bridges) caused primarily by vibratory trauma. (Excessive use of voice).

In the author's experience, an expressive, talkative personality correlates most consistently with most of these disorders. Cigarette smoking and liberal

use of voice are cofactors in the formation of smokers polyp also known as Reinke's edema (Polypoid degeneration). Other secondary influences such as infection, allergy, acid reflux also may increase the mucosal vulnerability to vibratory trauma, leading to injury. He showed benign mucosal disorders are more common more than 50% patient's with voice complaints have benign mucosal disorders. Brodnitz reported 45% of 977 patients had diagnosis of nodules, polyps, or polypoid thickening and "Kleinsaeser" (1964 to 1975), reported 50% of 2618 patients had one of these benign entities.

Cummings⁴¹ et al., showed that the malignant tumours of the larynx and Hypopharynx occurs more commonly in 50-60 year old men, closely associated with cigarette smoking and alcohol abuse.

The male to female incidence has dropped from 15:1 to less than 4:1 in 1996, because result of woman obtaining an equal place in the toxic work environment and cigarette smoking. The incidence of laryngeal cancers more common in blacks than the whites.

Factors that correlate with the development of cancer of Larynx and Hypopharynx include, tobacco use, alcohol abuse, sibling with head and neck cancer, and also Human papilloma virus, previous radiotherapy, previous head and neck cancer.

A form of tea known as mate in Latin America and Chimbara in Brazil, Phenols in the Drinks, have calculated a relative risk of 4.9 for Laryngeal cancer showed by De Stefain and others.

Genetic predisposition to cancer also occurred in some who have P53 system.

Chopra H. Kapoor M¹⁰, et (1997), conducted the "study of Benign glottic Lesions undergoing microlaryngeal surgery". They studied about 67 patient with complaint of hoarseness of voice.

In the study majority of the patient were presented between the age group of 20-25 years. Majority of the patient (68.6%) presented within one year of symptoms of hoarseness and 14.9% between 1-2 years of onset of hoarseness.

Highest incidence was seen in housewives, 25.3% followed by 16.4% shopkeeper, 14.9% businessmen; 12% students and 10.4% teachers.

Among various types of benign lesions vocal nodules were found in 33.33% cases, vocal cysts in 17.3%, vocal polyps in 16% and chronic hypertrophic laryngitis in 13.3% etc.

Type of Lesions, Chopra H. et al., (1997)

Sl.No.	Types of lesion	No. of Cases	% age
1.	Vocal nodule	25	33.33
2.	Vocal Cysts	13	17.33
3.	Vocal Polyp	12	16.00
4.	Chronic Hypertrophic Laryngitis	10	13.33
5.	Leukoplakia	5	6.66
6.	Reinke's Edema	4	5.33
7.	Haematoma	3	4.00
8.	Papilloma	3	4.00
9.	Laryngeal webs	1	1.33

Whereas chronic smokers reported with following lesions: vocal polyps in 29.4%, chronic hypertrophic laryngitis in 23.5%, leukoplakia in 17.6%, tubercular laryngitis in 11.7%, other were vocal nodules and cysts.

Various lesion in chronic smokers Chopra H. et al., (1997)

Sl.No.	Lesion in Smokers	No. of Cases	% age
1.	Vocal Polyp	5	29.40
2.	Chronic Hypertrophic Laryngitis	4	23.53
3.	Leukoplakia	3	17.65
4.	Tubercular Laryngitis	2	11.76
5.	Vocal Nodule	2	11.76
6.	Vocal cyst	1	5.90

Benign lesions were diagnosed histopathologically as benign tumour in six cases of various benign lesions.

Males predominated in every category of benign laryngeal lesions except in cases of vocal nodules.

This is in accordance with a study conducted in Chicago in 1977 patients by Paul H., Hollinger and K.C. Johnston (1951) in which 70% of cases were males and 30% females. On the other hand females far exceeded the males in cases of vocal nodules and haematomas.

In another study conducted on 15 patients in AIIMS, New Delhi in 1965 by Sinha A., Kacker S.K. Pramanik K.N. et al., 73% cases were males and 27% were females.

In similar study, by "Kleinsasser" in 900 cases of vocal cord polyps, 76% patients were males and 24% were females.

They concluded that majority presented between age group of 20-25 years. Housewives were commonly affected followed by Shopkeepers, and Businessmen. Vocal nodule is the commonest followed by vocal cyst, vocal polyp etc.

Benjamin B., Croxson G. et al.,¹³ studied series of 16 Vocal cord granuloma in adults and children. Among 13 were males and 3 females from age group of 10 - 69 years with average of 44 years.

Seven intubated patients presented with in 12 months of intubation were diagnosed as "Post Intubation Granuloma" of these two had bilateral granuloma and 4 were chronic smokers. The most common presenting symptom was Hoarseness - 14 patients, sore throat and pain in throat - 4.

The cause of vocal cord granuloma has been questioned over years by many others. Post intubation granuloma on the arytenoid following difficult or prolonged or even routine intubation for GA is an obvious cause. Other predisposing factors are heavy smokers, hard driving, heavy drinkers, public speakers. Removal of granuloma done by endoscopic approach either by microsurgical technique or by use of the CO2 laser, which is the principle treatment. Yet there is no clear cut distinction between the contact ulcer and granuloma of vocal cord.

Smith E.M³⁸. et al., (2000) "Human papilloma virus and laryngeal cancer". Studied relationship between (HPV) infection and 44 squamous cell carcinoma, 10 Leukoplakia and 123 Control Group (Benign laryngeal conditions) between November 1994 and August 1996 at the University of Iowa Health Care.

They showed cancer and Leukoplakia patients are older than controls and patients were to be chronic smokers or alcoholics. Study shows glottic SCC's show a higher human papilloma - high risk oncogene positivity than do the supraglottic SCC's and the hypopharynx shows the lowest positivity rate.

DESCRIPTIVE ANATOMY OF LARYNX

The larynx lies in the anterior midline of the neck extending from the root of tongue to the trachea. It lies opposite to 3rd to 6th cervical vertebra in men while being higher in women and children.

	Males	Female
Length	44mm	36mm
Transverse diameter	43mm	41mm
Ant post diameter	36mm	26mm

There is little difference in the size of larynx in boys and girls until after puberty when the anteroposterior diameter in the male almost doubles.

Laryngeal frame work is formed by

- a. Skeletal frame work of cartilage.
- b. Cartilages are connected by Joints, Ligaments and Membranes.
- c. Cartilage are moved by muscles both intrinsic and extrinsic.
- d. The cavity of larynx is formed by mucous membrane.

Infantile larynx is smaller, narrower, softer than its adult's counterparts.

CARTILAGE OF LARYNX

There are 9 cartilages, 3 are unpaired and 3 are paired

Unpaired cartilages

1. Thyroid
2. Cricoid
3. Epiglottis

Paired cartilages

1. Arytenoid
2. Corniculate
3. Cuneiform

LARYNGEAL CARTILAGE

THE THYROID CARTILAGE

This shield - like cartilage is the longest of the laryngeal cartilages and consists of two lamina which meet in the midline inferiorly, leaving the easily palpable thyroid notch between them above. The angle of fusion of the lamina is about 90° in men and 120° in women. In the male, the fused anterior borders form a projection, again easily palpable, which is the laryngeal prominence or 'Adam's apple'. A small narrow strip of cartilage, the intrathyroid cartilage, separates the two lamina anteriorly in childhood. Posteriorly, the lamina diverge and the posterior border of each is prolonged as two slender processes, the superior and inferior cornu. The superior cornu is long and narrow and curves upwards, backwards, and medially, ending in a conical extremity to which is attached the lateral thyroid ligament. The inferior cornu is shorter and thicker and curves downwards and medially. On the medial surface of its lower end there is a small oval facet for articulation with the cricoid cartilage.

On the external surface of each lamina, an oblique line curves downwards and forwards the superior thyroid tubercle, situated just in front of the root of the superior horn, to the inferior thyroid tubercle on the lower border of the lamina. This line marks the attachment of the thyrohyoid, sternothyroid and inferior constrictor muscles. The inner aspects of the lamina are smooth and are mainly covered by loosely attached mucous membrane. The thyroepiglottic ligament is attached to the inner aspect of the thyroid notch, and below this, and on each side of the midline, the vestibular

and vocal ligaments, and the thyroarytenoid, thyroepiglottic and vocalis ligaments produces the anterior commissure tendon which is of importance in the spread of carcinoma.

The superior border of each lamina gives attachment to the corresponding half of the thyrohyoid ligament. The inferior border of each half is divided into two by the inferior tubercle. The cricothyroid membrane is attached to the inner aspect of the medial portion of the inferior border of the thyrohyoid cartilage.

THE CRICOID CARTILAGE

The cricoid cartilage is the only complete cartilaginous ring present in the air passages. It forms the inferior part of the anterior and lateral walls and most of the posterior wall of the larynx. Likened to a signet ring, it comprises a deep broad quadrilateral lamina posteriorly and a narrow arch anteriorly. Near the junction of arch and lamina, an articular facet exists for the inferior cornu of the thyroid cartilage. The lamina has sloping shoulders, which carry articular facets for the arytenoids. These joints are synovial with capsular ligaments. Rotation of the cricoid cartilage on the thyroid cartilage can occur about an axis passing transversely through the joints. A vertical ridge in the midline of the lamina gives attachment to the longitudinal muscle of the oesophagus and produces a shallow concavity on each side for the origin of the posterior cricoarytenoid muscle. The entire surface of the cricoid cartilage is lined with mucous membrane.

THE ARYTENOIDS AND SMALL CARTILAGES

The two arytenoid cartilages are placed close together on the upper and lateral borders of the cricoid lamina. Each is an irregular three - sided pyramid with a forward projection, the vocal process, attached to the vocal folds, and also a lateral projection, the muscular process to which are attached the posterior cricoarytenoid and lateral cricoarytenoid muscles. Between these two processes is the anterolateral surface which is irregular and divided into two fossa by a crest running from the apex. The upper triangular fossa gives attachment to the vestibular ligament and the lower to the vocalis and lateral cricoarytenoid muscles. The apex is curved backwards and medially and is flattened for articulation with the corniculate cartilage to which is attached the aryepiglottic folds. The medial surfaces are covered with mucous membrane and form the lateral boundary of the intercartilagenous part of the rima glottidis. The posterior surface is covered entirely by the transverse arytenoid muscle.

The base is concave and presents a smooth surface for articulation, with the sloping shoulder on the upper border of the cricoid lamina. The capsular ligament of this synovial joint is lax, allowing both rotary and medial and lateral gliding movements. In man the cylindrical articulating surfaces permit a greater range of gliding than of rotary movement, and the shape of the open human glottis resembles a V. A firm posterior cricoarytenoid ligament prevents forward movement of the arytenoid cartilage.

The corniculate and cuneiform cartilages :

The corniculate cartilages are two small conical nodules of elastic fibrocartilage which articulate as a synovial joint, or which are sometimes fused, with the apices of the arytenoid cartilages. They are situated in the posterior parts of the aryepiglottic folds of mucous membrane. The cuneiform

cartilages are two small elongated flakes of elastic fibrocartilage placed one in each margin of the aryepiglottic fold.

THE CARTILAGE OF THE EPIGLOTTIS

The epiglottis is a thin, leaf - like sheet of elastic fibrocartilage which projects upwards behind the tongue and the body of the hyoid bone. The narrow stalk is attached by the thyroepiglottic ligament to the angle between the thyroid lamina, below the thyroid notch. The upper broad part is directed upwards and back wards; its superior margin is free. The sides of the epiglottis are attached to the arytenoid cartilages by the aryepiglottic folds of mucous membrane which, together with the free edge of the epiglottis, form the anterior boundary to the inlet of the larynx. The posterior surface of the epiglottis is concave and smooth but a small central projection, the tubercle, is present in the lower part. The bare cartilage is indented by numbers of small pits into which mucous glands project. The anterior surface of the epiglottis is free and is covered with mucous membrane which is reflected on to the pharyngeal part of the tongue and on to the lateral wall of the pharynx, forming a median glossoepiglottic fold and two lateral glossoepiglottic folds. The depression formed on each side of the median glossoepiglottic fold is the vallecula. An elastic ligament, the hyoepiglottic ligament, connects the lower part of the epiglottis to the hyoid bone in front. The space between the epiglottis and the thyrohyoid membrane is filled with fatty tissue. The epiglottis is not functionally developed in man in that respiration, deglutition and phonation can take place almost normally even if it has been destroyed. In neonates and infants, however, the epiglottis is omega - shaped. This long, deeply grooved,

'floopy' epiglottis more closely resembles that of aquatic mammals and is more suited to its function of protecting the nasotracheal air passage during suckling.

CALCIFICATION OF THE LARYNGEAL CARTILAGES

The corniculate and cuneiform cartilages, the epiglottis, and the apices of the arytenoids consist of elastic fibrocartilage, which shows little tendency to calcify. The thyroid, cricoid and greater part of the arytenoids consists of hyaline cartilage which begins to calcify in the person's late teens or early twenties. Calcification of the thyroid cartilage starts in the region of the inferior cornu and proceed anteriorly and superiorly until the entire rim is involved. A central translucent window persists into old age. Calcification of the posterior part of the lamina of the cricoid and of the posterior part of arytenoid may be confused at radiology with a foreign body. Calcification of the body and muscular process of the arytenoid begins later but the vocal process tends not to ossify.

THE LIGAMENTS

EXTRINSIC LIGAMENTS

The extrinsic ligaments connect the cartilages to the hyoid and trachea.

The thyrohyoid membrane stretches between the upper border of the thyroid and the upper border of the posterior surfaces of the body and greater cornua of the hyoid bone. The membrane is composed of fibroelastic tissue and is strengthened anteriorly by condensed fibrous tissue called the median thyrohyoid ligament. The posterior margin is also stretched to form the lateral

thyrohyoid ligament which connects the tips of the superior cornua of the thyroid cartilage to the posterior ends of the greater cornua of the hyoid. The ligaments often contain a small nodule, the cartilago triticea. The membrane is pierced by the internal branch of the superior laryngeal nerve and by the superior laryngeal vessels.

The cricotracheal ligament unites the lower border of the cricoid cartilage with the first tracheal ring.

The hyoepiglottic ligament connects the epiglottis to the back of the body of the hyoid.

INTRINSIC LIGAMENTS

The intrinsic ligaments connect the cartilages themselves, and together they strengthen the capsules of the intercartilaginous joints and form the broad sheet of fibroelastic tissue, the fibroelastic membrane of the larynx and creates an internal framework.

The fibroelastic membrane is divided into an upper and lower part by the laryngeal ventricle. The upper quadrilateral membrane extends between the border of the epiglottis and the arytenoid cartilage. The upper margin forms the frame of the aryepiglottic fold which is the fibrous skeleton of the laryngeal inlet; the lower margin is thickened to form the vestibular ligament which underlies the vestibular fold or false cord. The lower part is altogether a thicker membrane, containing many elastic fibres. It is commonly called the cricovocal ligament, cricothyroid ligament or, by a more loose term, the conus elasticus. It

is attached below to the upper border of the cricoid cartilage and above is stretched between the midpoint of the laryngeal prominence of the thyroid cartilage anteriorly and the vocal process of the arytenoid behind. The free upper border of this membrane constitutes the vocal ligament. Anteriorly, there is a thickening of the membrane, the cricothyroid ligament, which links the cricoid and the thyroid cartilages in the midline.

INTERIOR OF THE LARYNX

The cavity extends from the inlet of larynx to the lower border of cricoid cartilage. The inlet of the larynx is oblique looks backwards and upwards and opens in to the laryngopharynx. The sinus or ventricle of larynx is a narrow fusiform cleft between the vestibular and vocal folds. The anterior part of the sinus is prolonged upwards as a diverticulum between the vestibular fold and lamina of thyroid cartilage. This extension is known as saccule of larynx. The saccule contains mucus glands which help in lubrication of the vocal folds.

MUCOUS MEMBRANE OF LARYNX

1. The anterior surface and upper $\frac{1}{2}$ of the posterior surface of epiglottis, upper part of AE fold and the vocal folds are lined by stratified squamous epithelium. The rest of the laryngeal mucus membrane is covered by columnar ciliated epithelium.
2. All parts of mucous membrane are loosely attached to the cartilage except over the vocal ligaments and posterior surface of the epiglottis where it is thin and firmly adherent.

3. Mucous glands are absent over the vocal cords but are plentiful over the anterior surface of epiglottis around cuneiform cartilage and in vestibular folds. In other parts the glands are scattered. Inlet is bounded interarytenoid folds of the mucus membrane and on each side by AE fold.

Within the cavity of larynx there are two folds of mucus membrane of each side of the upper fold is a vestibular fold and the lower fold the vocal fold. The space between the vestibular folds is the rima vestibuli. The space between the vocal folds is the rima glottidis.

The vocal fold is attached anteriorly to the middle of the angle of thyroid cartilage and posteriorly to the vocal process of arytenoid cartilage. Rima glottidis is limited posteriorly by an inter arytenoid fold of mucus membrane. The rim therefore has an anterior intermembranous part $\frac{3}{5}$ th and a posterior inter cartilagenous part. Rima is the narrowest part of the larynx, which is longer (23mm) in males and 17 mm in females.

The vestibular and vocal folds divided the cavity of larynx into :

- a. An upper part of the vestibule of larynx, above the vestibular fold.
- b. Middle part, the sinus (Ventricle of larynx) between the vestibular and vocal folds.
- c. A lower part the infra (sub) glottic part of the larynx below the vocal folds.

MUSCLES

The muscles may be divided into extrinsic which attach the larynx to neighbouring structures and intrinsic which move the various cartilages of larynx.

Extrinsic muscles are :

1. Sternothyroid
2. Thyrohyoid
3. Inferior constrictor
4. Stylopharyngeus
5. Mylohyoid
6. Geniohyoid
7. Stylohyoid
8. Omohyoid

The actions can be summarised into two categories.

Elevators : Thyrohyoid, Stylopharyngeus, Palatopharyngeus,
Mylohyoid, Geniohyoid, Stylohyoid.

Depressors : Sternothyroid, Sternohyoid, Omohyoid.

INTRINSIC MUSCLES OF LARYNX

The can be divided into various groups by their actions :

1. Muscles which open the glottis : Posterior cricoarytenoid.

2. Muscle which closes the glottis : Lateral cricoarytenoid, Transverse arytenoid, Cricothyroid, Thyroarytenoid.
3. Muscles which tense the vocal cords; Cricothyroid
4. Muscle which relaxes the vocal cords : Thyroarytenoid and vocalis.
5. Muscles which close the inlet of larynx : Oblique arytenoids, Aryepiglottic.
6. Muscles which open the inlet of larynx : Thyroepiglotticus.

1. **Cricothyroid** : Which is the only intrinsic muscle of the larynx to lie outside the larynx arises from lower border and lateral surface of the cricoid and fibres pass backwards and upwards to get inserted to the inferior cornu and lower border of thyroid cartilage.
2. **Posterior Cricoarytenoid** : Is a triangular muscle arising from the posterior surface of the lamina of cricoid fibres moving upwards and laterally gets attached to the muscular process of arytenoid.
3. **Lateral Cricoarytenoid** : Arises from the lateral part of upper border of arch of cricoid fibres moving upwards and backwards is inserted to muscular process of arytenoid.
4. **Transverse Arytenoid** : This is an unpaired muscle arising from posterior surface of one arytenoid and the fibres moves

transversely to get inserted into posterior surface of another arytenoid.

5. **Oblique arytenoid and aryepiglotticus** : Arises from one muscular process of one arytenoid oblique fibres move backwards and upwards and is attached to anterolateral surface of arytenoid cartilage. Some fibres are continued as aryepiglottic muscle to the edge of the epiglottis.

6. **Thyroarytenoid, vocalis and thyroepiglotticus** : Arises from thyroid angles and adjacent cricothyroid ligament, fibres moves backwards and upwards and is attached to anterolateral surface of arytenoids cartilage. Some fibres project into the vocal fold and are known as vocalis. Some of the upper fibres of thyroarytenoid curve upwards into the AE fold to reach the edge of epiglottis, these are the thyroepiglottic muscle.

MOVEMENT OF THE VOCAL FOLDS AND ANATOMY OF SPEECH

The understanding of the movements of the vocal folds during phonation was enhanced by the high speed film of bell telephone lab, frontal tomography and stroboscopy, the various position of the vocal cords are :

At quiet respiration, intermembranous part is triangular, inter cartilagenous is rectangular, forced respiration, glottis is rhomboid in shape.

Full abduction caused by posterior cricoarytenoid muscle, glottis is triangular.

Preparation of phonation intermembranous and inter cartilagenous parts of glottis are reduced to a linear chink, by adduction of the vocal folds and adduction and medial rotation of the arytenoid cartilage.

Crude adduction is effected by the cricothyroid and lateral cricoarytenoid muscle and fine tension by thyroarytenoid muscle.

The vocal folds are lengthened by cricothyroid muscle.

The three forces which bring the vocal folds in contact are :

1. Tension in the fold.
2. The decrease in subglottic air pressure
3. Sucking effect of escaping air.

The function of the vocal folds is to produce sound varying only in intensity and pitch. This is then modified by various resonating chambers above and below the larynx and is ultimately converted into phonemes, by the articulating action of pharynx, tongue, palate, teeth and lips.

Blood Supply : Larynx above the vocal folds is supplied by superior laryngeal artery a branch of superior thyroid artery. The superior laryngeal veins drain into the superior thyroid veins.

Below the vocal cords by the inferior laryngeal artery, a branch of inferior thyroid artery. Inferior laryngeal vein drain into the inferior thyroid vein.

Nerve Supply : The innervation to the larynx is through vagus by superior and recurrent laryngeal nerves. All intrinsic muscles of larynx are innervated by the recurrent laryngeal nerve except for cricothyroid which is innervated by external laryngeal nerve.

Sensory by internal laryngeal nerve innervating mucus membrane up to the level of vocal cords. The recurrent laryngeal nerve supplies it below the level of the vocal cords.

Lymphatic drainage : From the upper part up to the vocal cords the lymphatics drain along the superior thyroid vessels to the antero superior group of deep cervical nodes, from the lower part, below the vocal cords the lymphatics drain to the posteroinferior group of deep cervical nodes, a few also drain through prelaryngeal nodes.

PHYSIOLOGY OF LARYNX

The function of the larynx can be broadly classified into :

1. Respiratory air channel and airflow regulation : The larynx is a part of tubal system for the passage of air from the lungs. During normal respiration the cords are relaxed and halfway between adduction and full abduction.

2. Sphincteric function : The primary sphincteric action of the larynx is to protect the tracheobronchial tree during swallowing and vomiting. The sphincters in cephalo - caudal directions are 1. AE fold, 2. Vestibular folds, 3. Vocal folds.

3. Receptive field for reflexes : cough reflex.

4. Phonation and speech : voice is the musical sound produced by vibration of the vocal cords in the larynx by air from the lungs.

PHYSIOLOGY OF VOICE PRODUCTION :

In addition to many important functions, voice production is one of the most important and essential function of the larynx.

Mechanicsm of phonation : Consist of three important factors.

1. Respiratory bellows
2. The vibrating mechanism of larynx
3. The resonating chambers.

The expiratory air stream brings the vocal folds into vibrations. The impressive range of intensities, tonal qualities, and pitch of the human voice is the result of

- a. The movement in the Cricothyroid articulation, which stretch of shorten the vocal ligaments.
- b. The movement of arytenoid cartilage.
- c. The Tendinous membrane that covers the inner surface of the intrinsic muscles of the vocal folds.

The ordinate activity of intrinsic laryngeal muscles cause the vocal folds to take on firmness, a certain length an a degree of closure (firmly or loosely adducted folds during the production of voice sound). The folds act like a flutter valve, they are alternately pushed apart by air pressure and sucked together by air stream. The vibratory cycle consisting of open and close phase repeats itself in rapid succession of 80 to 800 cycles per second. The closing phase is caused by Bernoullis effect. When air speed in the narrowing between the fold is at its highest. The pressure exerted on the walls of glottis is minimal,

giving rise to abrupt closure. It is this shock wave which in the frequency of the glottal tone excites the resonating cavity in rapid succession. The more abrupt or steep the wave the more harmonic tones are generated.

THEORIES OF PHONATION

1. Myoelastic aerodynamic theory of Vandenberg or Tonic theory:

At present still most acceptable theory of mechanism of voice production.

It traditionally describes one cycle of vibration as follows.

- a. The vocal folds are adducted to within the 3 mm of each other by the action of lateral crico - arytenoid and interarytenoid muscle.
- b. Air is forced through the vocal tract from the lungs.
- c. The folds are sucked together in accordance with Bernoulli's aerodynamic theory.
- d. When the folds have been sucked together the flow of air from the lungs continues but flow through glottis ceases the air pressure beneath the folds rises.
- e. When the subglottic pressure is greater than the medial compression of the folds the folds are blown apart and a puff of air is released into the supraglottic cavity.
- f. Subglottic pressure falls.
- g. The vocal folds come to normal position and a second cycle begins.

2. Neuromuscular or clonic or neuro chronaxi theory of Raoul Hussan (1950);

This theory states that every single vibration of the vocal folds was due to an impules from the recurrent laryngeal nerve and that acoustic center in the brain regulates the speed of vocal fold vibration impulse to impulse.

3. Membrane cushion theory of Smith (1975) :

Smith put forward the membrane cushion theory to explain the vertical phase difference between the upper and lower border of vocal fold margins.

4. Stevens two mass mechanical models of vocal folds (1977).

VOICE RESONANCE AND OROPHARYNGEAL CAVITY

The trachea pulls during inspiration when combined with contraction of the pretracheal muscles will result in widening and lengthening of the lower harmonics and is perceived as full and dark sound. This is called covering of voice in contrast to open voice which are produced by the larynx placed in elevated position.

Three important resonators are of special interest. They are :

1. The laryngeal entrance - immediately above the glottis.
2. Middle part with the velopharyngeal valve.
3. Outermost part between the lips.

AETIOLOGY OF HOARSENESS OF VOICE

It is a wide subject to find out the etiology factors of hoarseness of voice. A careful analysis of the history is important. Age, Sex, duration of hoarseness are all important to arrive at the diagnosis and to find out the factors as seen in the classification of hoarseness of voice. There are hundreds of changes for change of voice.

1. NEONATES AND INFANTS

If hoarseness of voice is observed in neonates and infants without other obvious causes, a congenital anomaly of larynx should be suspected, which is many times accompanied by respiratory stridor, the exact etiology of this abnormality are not known. During the development of foetus any change in the normal course of the development of larynx will give rise to these abnormalities.

Inflammatory conditions giving rise to hoarseness of voice in infants and children are common. They may start as upper respiratory tract infections or acute sinusitis, rhinitis and the larynx may be secondarily involved. It is usually a droplet air borne infections and the most active organisms are the haemolytic streptococci; staphylococcus, pneumococci etc. The other agents responsible occasionally are viruses of influenza, measles etc., damp, dusts are predisposing conditions in addition to the lowered general resistance like vitamin deficiency, malnutrition, etc.

Traumatic conditions affecting the recurrent laryngeal nerves may be due to birth trauma, post natal injury, to vocal cords.

Foreign bodies : Among the foreign bodies, vegetative types causes more damage and sharp objects directly injure the vocal cords.

TUMOURS AND CYSTS

Among the tumours recurrent respiratory papillomatosis is the most important one and is caused by human papilloma virus, a small DNA virus, 50 nm in diameter. Human papilloma virus 6 and 11 are the main causal agents and the disease may be transmitted at the time of delivery.

In leukaemias and other malignancies hoarseness is caused by either secondaries of lymph nodes, neighbouring growths pressing on the recurrent laryngeal nerve or infiltration of malignant cells in vocal cords and recurrent laryngeal nerves.

NEOPLASMS OF PAEDIATRIC LARYNX

Neoplasms of the larynx is an uncommon cause of hoarseness of voice, however they present with obstruction of airways. However these lesions often present diagnostic and therapeutic dilemmas.

Benign lesions constitute approximately 98% of the neoplasms of the paediatric airways. Squamous papilloma is the commonest lesions of the benign groups of tumours of connective tissue origin such as haemangioma, and neurogenic origin such as neurofibroma, seems to be the next most commonly encountered.

Sarcoma are the most common malignant tumours of the pediatric larynx. Rhabdomyosarcoma being the most common of these, squamous cell carcinoma is an extremely rare tumour in the pediatric population but still should be considered in the diagnosis.

ETIOLOGY OF HOARSENESS OF VOICE IN ADULTS

Acute Laryngitis

It is usually of infectious origin either bacterial or viral but can also due to exogenous agent.

The disease is often associated with an secondary to an acute inflammation of the nose, throat and paranasal sinuses. Acute perichondritis of the larynx may be due to local or granulomatous inflammation or from a neoplasm. The chronic or granulomatous inflammation or from a neoplasm. The chronic form sometimes follows high tracheostomy or direct external trauma.

Chronic Laryngitis

Any chronic non specific inflammatory reaction of the laryngeal mucosa may be called a chronic laryngitis. It primarily affects middle aged men. Many factors exogenous and endogenous have been incriminated as causative factors.

Exogenous stimuli may be physical, chemical, infective or inhaled irritants notably cigarette smoking.

Infection

Certain individuals are susceptible to recurrent attacks of acute catarrhal laryngitis. Although these inflammations run in subacute form throughout the

winter yearly repetitions of this process may result in permanent changes in mucosa.

Recurrent infections of the nose, PNS, tonsils and teeth may be responsible to have chronic laryngeal infections. Anatomical abnormalities like septal deviation may predispose to the condition.

Chemical and occupational factors

Occupational exposure to dusty atmosphere as in mines, metal industrial fumes or chemical irritants (eg. Benzopyrine and Alcohol) in industries will predispose for chronic laryngitis. Alcohol and tobacco smoking are the major predisposing factors.

Physical factors (Trauma) : Persistent crying, screaming, shouting, vocal abuse or misuse in professional voice users will lead to chronic trauma to vocal cords.

Endogenous factors like, Diabetes, hypothyroidism, Vit-A deficiency renal diseases etc.

Dysphonia Plica Ventricularis

It is the condition in faulty voice users. Here voice is produced by vestibular folds (false cord) which have taken over the function of true cords. Voice is rough, low pitched and unpleasant. Ventricular voice may be secondary to impaired function of true cords such as paralysis, fixation, surgical excision, or tumours. Ventriculars bands in these situations try to

compensate or assume phonatory function of true cords. These conditions treated by speech therapy.

Chronic specific laryngitis

Tuberculosis : usually secondary to pulmonary tuberculosis. Primary lesion is very rare.

Syphilis : It is rare condition now. Only gumma of tertiary stage is sometime seen. Diagnosis by serological tests and biopsy.

Leprosy : Rare condition and is often association with leprosy of the skin and nose. It present as diffuse nodular infiltration of epiglottis, AE folds and arytenoids.

Scleroma : Chronic inflammatory condition caused by Klebsiella rhinoscleromatosis.

Present as a smooth red swelling in the subglottic region. Diagnosis is made on biopsy.

Mycosis : Fungal infections such as candidiasis, histoplasmosis and blastomycosis may rarely affects the larynx. Diagnosis is usually made on biopsy.

Atrophic Laryngitis (Laryngitis Sicca)

It is characterised by atrophy of laryngeal mucosa and crust formation. Condition often seen in women and is associated with atrophic rhinitis and pharyngitis.

Benign Tumours of the larynx : Are not as common as malignant ones. They are divided into non - neoplastic and neoplastic tumours. Benign tumours of Larynx, show H. (1979).

Non - Neoplastic (Mucosal disorders)	Neoplastic
<p>Solid</p> <ul style="list-style-type: none"> - Vocal nodules - Vocal Polyp - Reinke's edema - Intubation granuloma - Contact ulcer - Leukoplakia - Amyloid tumour <p>Cystic</p> <ul style="list-style-type: none"> - Ductal Cysts - Saccular cysts - Laryngocele 	<ul style="list-style-type: none"> - Squamous Papilloma - Juvenile type - Adult onset type - Chondroma - Haemangioma - Granular cell tumour - Glandular tumour - Rhabdomyoma - Lipoma - Fibroma

Non - Neoplastic

They are not true neoplasm but tumour like masses as a result of infection, trauma or degeneration. They are seen more frequently than true benign neoplasms.

1. VOCAL NODULE'S (Singer's nodules)

They appear symmetrically on the free edge of vocal cord at the junction of anterior 1/3rd with the posterior 2/3rd as this is the area of maximum vibration of the cord and thus subject to maximum trauma. Seen more commonly in females than males. They excised by microlaryngeal surgery followed by speech therapy.

2. VOCAL POLYP

It is secondary to vocal abuse. Other contributing factors are allergy and smoking. Commonly affect the males, typically polyp is unilateral arising from ant 1/3rd of vocal cords. It is soft, smooth, pedunculated or sessile. Treatment is microlaryngeal excision followed by speech therapy.

3. REINKE'S EDEMA (Polypoid degeneration of cords)

Due to collection of edema fluid in the subepithelial space of Reinke. Usually cause is vocal abuse and smoking.

4. SQUAMOUS PAPILLOMA

Juvenile Papilloma : The are viral in origin, multiple, often occurs in infants and young children, presents with hoarseness and stridor. Mostly seen on the true and false cords and epiglottis. Appear as glistening white irregular growths, pedunculated or sessile, friable and bleeds easily, known for recurrence and therefore multiple excision may required.

Adult type : usually single, smaller in size, less aggressive and does not recur after removal, common in males (2:1) in the age group of 30 -50 arise from anterior 1/3rd of cords.

Malignant tumours of larynx : Laryngeal carcinoma comprises 2.5% of all malignancies. A slight increase in incidence has been noted in the past two decades. Higher incidence is found in males but this ratio decreasing because of increase in number of female smokers. Post cricoid malignancy seen

commonly in females than males. 80% of the laryngeal carcinoma occurs in elderly in the age group of 5th, 6th and 7th decade of life.

Tumours incidence in different location of the larynx varies. Most lesions occurs in glottic area, followed by supraglottis and subglottic in that order by Powell and Robin 1983.

Glottic	-	76%
Supraglottic	-	19%
Subglottic	-	5%

Etiology : No one factor has been definitely proved to produce laryngeal carcinoma in man. Smoking and excessive alcohol intake are frequently encountered in patient with laryngeal and hypopharyngeal carcinomas.

Some studies have implicated some racial predilection, urban dwellers, Radiation exposure, Asbestos, laryngeal kerotosis and leukoplakia, Air pollution, Unidentified social and possibly genetic factors, and uncommon occupational influences, as a predisposing factors, but convincing proof is lacking.

In Ogura, Powell and Robin (1983) series patients with laryngeal carcinoma are almost always heavy smokers, whereas patients with base of tongue or pharynx lesions frequently are heavy drinkers. Post cricoid malignancy in women is associated with plummer - vinson syndrome. The

incidence of metastases is 5 - 10% the most commonly, synchronous primary being the bronchogenic carcinoma.

Classification¹⁴

Earliest and most important attempts made by Isambert - Krishaber (1976) who separated two main groups.

- a. Intrinsic Tumours
- b. Extrinsic Tumours

The Thomson (1930) suggested four main subdivision

- a. Intrinsic Tumours
- b. Extrinsic Tumours
- c. Subglottic Tumours
- d. Mixed Tumours

The scheme of classification of the laryngeal and hypopharyngeal carcinoma was constituted by two groups - UICC / AJC. Larynx (ICD - 0 161) (Revised 1987). Depending upon sites and region of the tumours of the larynx and hypopharynx by Lederman.

	Regions	Sites
1.	LARYNX	
	A. Supraglottis	
	i. Epilarynx	(including marginal zone) Posterior surface of the suprahoid epiglottis (including the tip Aryepiglottic folds Arytenoids.
	ii. Supraglottis	(excluding Epilarynx) infrahyoid epiglottis Ventricular folds Ventricular cavities.

- | | | |
|----|------------|--|
| B. | Glottis | Vocal folds.
Anterior Commissure
Posterior Commissure |
| C. | Subglottis | Extending from 5mm below the level of
vocal cords to inferior margin of cricoid
cartilage. |
2. **LARYNGOPHARYNX** Pyriform fossae,
Post cricoid area,
Posterior pharyngeal wall.

Histopathology

By far the most type of tumour is the squamous cell carcinoma macroscopically, could be exophytic, (Proliferative), ulcerative, or infiltrative.

Microscopically they graded as, well differentiated, moderately differentiated or poorly differentiated by Broder's classification Glottic tumours are very well differentiated. Other types of malignancy which are rare are :

- * Adeno Carcinoma
- * Adenoid cystic carcinoma
- * Chondrosarcoma
- * Transitional cell carcinoma
- * Malignant lymphoma
- * Fibrosarcoma
- * Plasmacytoma
- * Malignant melanoma

Carcinoma in situ and carcinoma in situ with microinvasion

In carcinoma in situ of larynx there is full thickness replacement of the epithelium by cells with malignant cytologic features but no invasion beyond

basement membrane. Grossly one cannot differentiate from keratosis or keratosis with cell atypia (leukoplakia). If it is left, it may go for invasive carcinoma.

Verrucous Carcinoma (Ackerman's tumour)

This tumour is often large exuberent growth with many heavy broad filiform projections, it is located in glottic cords. Microscopically thickened papillomatous folds covered with well - differentiated keratinizing squamous epithelium. Over invasive squamous cell carcinoma is not found and histologically is benign but clinically malignant. It does not spread by metastasis, destruction of the cartilage may be present.

Treatment surgical excision with complete removal of the tumour with adequate marginal resection.

INVESTIGATION

1 **Direct laryngoscopy and biopsy for the histopathological examination.**

Indications as stated before to confirm the IDL findings & nature of the tumour whether benign or malignant and also the type of malignancy.

2. **Radiological Investigations:**

X-ray chest (PA) and CT scan to look out for pulmonary tuberculosis and malignancy of the lung. Mediastinal tumours, status of the tracheobronchial tree and lungs, status of the neck nodes or laryngopharyngeal mass.

X-ray Barium Swallow - To know about oesophageal malignancy, compression by the thyroid masses and enlargement of the left atrium.

X-ray Neck-Lateral View-To know about the tracheal compression or infiltration by the neck nodes or mass.

X-ray skull base, petrous bone, nasopharynx to rule out skull base tumours.

Endoscopy: Panendoscopy with special emphasis to direct laryngoscopy, pharyngoscopy, oesophagoscopy, and bronchoscopy to detect the synchronous primary (3-13%).

Laboratory analysis: Full blood indices ESR and Sputum AFB for tuberculosis, VDRL for syphilis urine analysis and blood sugar estimation for the diabetes. Total count and differential count to rule out infection of the larynx and pharynx.

Investigation for fitness of surgery or procedure

Blood for - HB %, BT, CT

Blood for - FBS and PPBS

Urine for - Albumin, Sugar, Micro deposit

Blood Urea/Serum Cratinine.

ECG in all leads

Chest screening

Dr.Speech voice assessment and electroglottography

ELECTROGLOTTOGRAPHY

The electroglottography is a device that enables monitoring of variations of vocal fold contact by measuring motion induced variations in impedance of neck tissue in the area of the vocal folds. Electroglottography represents one of the few noninvasive methods available for obtaining useful information about the vibratory patterns of the vocal folds. Since its initial description, the electroglottography has become an increasingly popular clinical and research tool, providing insight into numerous phonatory characteristics including vocal fundamental frequency, the extent of vocal fold abduction during phonation and alterations in laryngeal height during voicing. The purpose of this section is to describe and demonstrate electroglottography, and to examine its use in the clinic and laboratory. This section will: (1) explain the principle of the electroglottography; (2) describe the use of the device; (3) describe attributes of the electroglottography signal; and (4) describe clinical and research attributes of the electroglottography signal; and (4) describe clinical and research application for the electroglottography. The relative strengths and limitations of the device will also be described.

1. Theory of electroglottography measure

Electroglottography (EGG) measures give information about vocal fold contact during voice production. Electroglottography makes use of motion-induced variations in the electrical impedance between electrodes placed on the skin of the neck. In clinical application, the electrodes are placed overlaying the thyroid laminae. A weak, high-frequency voltage is applied to one electrode, and the other electrode picks up the electrical current passing through the larynx. The transverse electrical impedance varies with the opening and closing of the glottis, and results in a variation of the electrical current in phase with the vibratory phase of the vocal folds. More current is passed when the glottis is closed than the glottis is partially or completely open.

2. Electroglottography Waveform

The waveform of the glottal cycle has been designated EGG. It shows an example of EGG during sustained phonation by a normal male. In this particular illustration increasing impedance is downward in the display. Hence, upward movement of the curve indicated more vocal fold contact (Closure). There is no agreed upon convention about this, and the literature depicts EGG waveform with vocal fold opening upward or downward.

Fig. 1 is an example of an EGG waveform. The following measures can be obtained from the EGG display; contact phase (Closed of the vocal fold) and the period of one cycle of vocal fold vibration.

EGG waveform is of interest in itself. Its importance lies in the vocal fold behaviour it represents. Considerable research effort has been devoted to establishing what the important features of the waveform are and what they correspond to. As mentioned above, it is very clear that the curve does not reflect glottal size but rather vocal fold contact area. Because of the complex behavior of the free edges of the vocal fold during the phonatory cycle, the contact area function is a very complicated one too. The EGG waveform conveys little information about the open phase in any case. It is generally conceded the EGG is useful primarily for its representation of closure events and of the overall duration of the closed phase.

3. The use of Electroglottography

Although specific details of implementation differ according to the particular Electroglottography being used, the technique of Electroglottography is straightforward. The measuring electrodes are attached according to the following recommendations. There is no firm rule for the exact location of the electrodes, but in general they should be lateral to the thyroid cartilage at a level that approximates the position of the vocal folds. Positioning is optimized by watching the waveforms generated during trial phonations and moving the electrode until the best signal is obtained. It should have maximal amplitude, be free of extraneous noise, and have a moderately stable baseline. Although all EGGs have circuitry designed to reject nonphonatory signals and compensate for baseline drift, to some extent they are all still sensitive to movement artifacts. Therefore, the patient should be positioned (preferably with a head support) so as to minimize movement during testing.

In the application of this technique, the following items must be taken into account and controlled for.

Electrode placement

Signal-to-noise ratio is optimized when the electrodes are positioned at the level of the vocal folds.

Skin-electrode resistance:

There is some impedance introduced at the electrode-skin interface. If the electrode impedance remains constant, it constitutes no problem. Slow drift will be filtered out by the high-pass characteristics of the EGG Mode. Relatively fast changes of electrode resistance will introduce artifacts into the data. Consequently, electrodes must be clean and firmly fixed at a properly prepared site.

Fat tissues:

Fat tissue is a very poor conductor. A substantial fatty layer under the skin can degrade the EGG signal badly. The presence of significant fat may explain why electroglottography has not been particularly successful with very young children, although other factors may also be responsible.

Vertical larynx height:

Vertical larynx height changes for different articulations and phonational qualities, especially for F0. This results in a change in the relationship of the electrodes to the vocal folds and thereby influences the electroglottography waveform. If phonations at different pitches are to be compared, caution in interpretation is advisable.

Head movement:

Head movement alter the relationship of neck structures and may compromise the data output. The high-pass filtering of EGG will eliminate much of the baseline shift, but some artifact may remain. It is important that the subject's head be stabilized with a headrest.

About the electroglottography, the following conclusions are justified in light of our present understanding:

- (1) It provides far more information about the closed phase of the glottal cycle than about the open phase. In particular, it provides some level of insight about vertical contact changes.
- (2) It is not possible to determine the exact instant of opening or closing of the vocal folds. It is clear, however, that a minimum-resistance peak represents maximal closure. Onset of closure is usually signaled by a rapid fall of resistance.
- (3) Quantification of phase of the vocal fold cycle on the basis of EGG may be relevant to evaluation of vocal disorder.
- (4) EGG may permit qualitative descriptions of laryngeal actions, especially when used in conjunction with other types of measures.

There are three major categories of vocal register: Vocal fry (or pulse), modal register and falsetto (or loft). The classification is based upon the quality of the glottal sound determined by the vibratory pattern of the vocal folds. In general, the vocal register is closely related to the fundamental frequency of phonation. Along the fundamental frequency from low to high, the register is put in the order of vocal fry, modal and falsetto. The modal register can be further divided into three: Chest, Mid, and Head register.

EKG waveforms for sustained/ae/with different vocal qualities. All productions are by the same normal male: increasing resistance (less contact, greater opening) is downward in each case. Glottal closure is marked by a sharp rise of the waveform (sudden increase in vocal fold contact) while the opening phase is more gradual, with a more moderate slope. There is a distinct "knee" in the waveform during the opening phase (arrows) that has been found to correspond to the onset of glottal airflow. The vocal folds therefore must have begun to separate at this point in the EKG cycle. The relatively flat segment of the wave signifies an open glottis.

Breathy voice is signaled by a very long open phase, shown as a prolongation of the relatively flat bottom of the waveform. It is possible, of course, to produce extremely breathy voice with almost no vocal fold contact. The clearly indicated sharp drop in resistance (upward excursion) of the waveform shows that this was not the case for the production illustrated.

Vocal fry (or pulse) register (vocal phonation is characterized by irregularity of vocal fold vibration. In this example, the open phase is fairly long compared to the closed phase, which is not necessarily typical of phonation in this register.

Falsetto (or loft) register, presents significant problems. The EKG wave characteristically is very small, and sinusoidal in appearance. This reflects the thinning of the vocal folds and possible failure to achieve full closure that is characteristic of loft register.

Electroglottography has attracted a great deal of interest and has been used as a method to probe the function of the normal larynx. It is also being used for the diagnosis of pathology and as a tool in vocal therapy.

4. Quantitative Aspects of Electroglottography

EGG can be "read" to provide an estimate of normality as the following points; (1) Uniformity of EGG amplitude is associated with low perturbation. (2) A rapid and sharply defined closing phase indicates good vocal tract acoustic excitation and efficient vocal production. (3) the closing phase takes less time than the opening phase. (4) Long closure duration is correlated with relatively undamped spectral peaks.

Shown below is ten EGG parameters that are usually cited in describing normal and pathological voices and can be obtained from Vocal Assessment program from Tiger DRS, Inc.

Fundamental frequency (EGG-FO)

EGG FO is a measure of the rate of quasi-periodic vibration of the vocal folds.

EGG-FO Statistical Report:

Standard deviation of EGO-FO is a measure of the variability in statistical sampling of EGG-FO.

Max.EGG-FO is a measure of maximum EGG-FO.

Mn. EGG-FO is a measure of minimum EGG-FO.

Mode EGG-FO is measure of most frequent EGG-FO, (or called habitual EGG-FO)

EGG - JITTER

EGG - Jitter is the cycle-to-cycle variability of the fundamental pitch (or fundamental frequency) in the EGG signals.

EGG-SHIMMER

EGG-Shimmer is the cycle-to-cycle variability of peak-to-peak amplitude, in the EGG signals.

Contact Quotient (CQ)

CQ is a measure of the degree of vocal fold approximation during phonation. The calculation of CQ is defined as

$$CQ = \frac{CQ}{t}$$

Where op = Contact phase, and t = the period of one cycle of vocal fold vibration.

Contact Index, CI

CI is indication of the symmetry of the EGG contact phase during vocal fold vibration. The calculation of CI is defined as

$$CI = \frac{ccp - cop}{cp}$$

Contact Quotient Perturbation

The CQP measure is the cycle-to-cycle variability of the CQ.

Contact Index Perturbation (CIP)

The CIP measure is the cycle-to-cycle variability of the CI.

EGG-FO Tremor an EGG-Amp Tremor

A 1-15 Hz modulation of a cyclic parameter (e.g. frequency or amplitude) from the EGG signal, either of a neuralgic origin or an interaction between neurological and biomechanical properties of the vocal fold.

EGG measures are chiefly related to laryngeal behaviour that occur during vocal fold contact. As a result, the CQ, CI and CIP measures provide unique information about vocal fold behaviour; CQ reveals the degree closure, CI gives information about the symmetry of vocal fold vibration. CQP and CIP reveal the regularity of vocal fold vibration.

5. Clinical Implications of Electroglottography Measures

The EGG measurement as indicators of vocal function was investigated. Some of the conclusions are summarized below:

1. EGG measures reflect the glottal condition better during the closed phase than during the open phase. EGG measures are chiefly related to laryngeal behaviour that occurs during vocal fold contact.
2. The presence or absence of glottal vibrations can be determined from the EGG signal.
3. CQ reveals information about degree of closure, CI gives information about symmetry of vocal fold vibration.
4. CQP and CIP reveal the regularity of vocal fold vibration, the cycle-to-cycle variability of vocal fold contact phase and vocal fold vibratory symmetry.

EGG often shows pathology by the absence of normal features or by their modification rather than by clear - cut pathologic signs. There may be a decrease or increase in the EGG - derived OQ. On the whole, EGG is qualitatively evaluated for voice disorders. The electroglottography displayed on an oscilloscope or in the computer screen has also been found to be useful as biofeedback tool in the therapeutic management of many types of dysphasia.

DR.SPEECH - VOICE ASSESMENT

Vocal Assessment software is a real-time voice and Electroglottographic (EGG) assessment system designed specifically for speech-language pathologists, otolaryngologists, Voice scientists and voice researchers. Vocal Assessment helps to analyze, document, teach, reinforce and report voice waveform in various application.

VOICE PARAMETERS

The perception of normal human voice quality is a multidimensional function dependent upon the interactions among several acoustic apartments that result from variations in laryngeal or superlaryngeal behaviour during voice production. Normal Voice qualities are usually dependent on one or more of the following five aspects of the voice signal:

1. fundamental frequency
2. amplitude
3. richness of spectral harmonics
4. amount of glottal noise
5. formant frequencies.

Acoustic analyses of pathological voices have provided one of the most attractive methods for assessing vocal function. Acoustic analyses have not only the advantage of being non-invasive, but also provide quantitative information for assessment of voice function (Davis, 1976). Shown below are several acoustic parameters that are usually cited in describing normal and pathological voices (Huang, & Hu, 1988; Huang, Minifie, & Lin, 1994, 1995; Huang 1995b; Kasuya et al., 1983; Titze et al., 1991).

FUNDAMENTAL FREQUENCY (F0)

FO is a measurement of the rate of quasi-periodic vibration of the vocal folds. FO is reported in Hz, an indication of the number of cycles per second of the vibratory pattern.

FO STATISTICAL REPORT

Standard deviation of FO is a measurement of the variability in statistical sampling of the FO.

Max.FO is a measurement of maximum FO.

Mm. FO is a measurement of minimum FO.

Model FO is a measurement of most frequent FO (or called habitual FO)

JITTER OF PITCH PERIOD PERTUBRATION

Jitter is the cycle-to-cycle variability of the pitch period or fundamental frequency. jitter is a measurement of how much a given pitch period differs from the one or several pitch periods that immediately precede or follow it.

Jitter is sometimes described as the cycle-to-cycle perturbation of the pitch period of as fundamental frequency perturbation. Changes in pitch period and amplitude of audio waveform can be made from such a waveform. In this sample, pitch periods are measured from the zero-cross of each cycle. Amplitudes are measured from maximum peak amplitude or peak-amplitude of each cycle.

SHIMMER OR AMPLITUDE PERTURBATION

Shimmer or amplitude is a perturbation measure of cycle-to-cycle fluctuation in waveform amplitude. This measure is sometimes made using peak-to-peak amplitude or sometimes with peak - amplitude. In Vocal Assessment, we use peak amplitude.

GLOTTAL NOISE ENERGY (NNE)

Normalised Noise Energy (Kasuya et al., in 1986, 1993) is a measure of the turbulent noise energy produced during vocalisation and is obtained using a comb filter. This measure is obtained by subtracting the harmonic signal energy from the total vocal energy. The remainder is the NNE.

It has been concluded that NNE may be more sensitive than HNR in detecting the presence of glottal noise and, therefore, more useful in discriminating pathological voice from normal voices.

HARMONIC - TO - NOISE RATIO (HNR)

Harmonic - to - noise Ratio (HNR) (Yumoto, Gould, & Bear, 1982; Yamoto Sasaki, & Okamura, 1984) is the ratio of harmonic energy and noise energy Yumoto's mean - addition method to measure the HNR involves a special case of the comb filtering method.

FO TREMOR AND AMP TREMOR

This refers to a 1-15 Hz modulation of a cycle parameter (e.g. frequency or amplitude) from the voice signal, either of a neurologic origin or an

interaction between neurological and biomechanical properties of the vocal fold.

VOWEL SPECTRUM

Spectral displays are derived by Fast Fourier Transform (FFT) and LPC algorithms to identify resonant frequencies of the vocal tract. Speech spectrum is useful in voice analyses because they provide information about the distribution of voice energy as a function of frequency.

CLINICAL IMPLICATIONS OF ACOUSTIC MEASURES OF VOICE

Acoustic analysis provide information about voice quality. Based on an investigation between perceptual judgment and acoustic parameters (HUang 1995b), some conclusions are :

1. The perception of hoarse voice quality should be considered as some combination of breathiness and harshness.
2. Vocal Jitter appears to be related primarily to harsh voice quality.
3. The magnitude of glottal noise closely corresponds to the breathy voice quality.
4. Shimmer appears to be the primary influence on hoarse voice quality.
5. The spectral tilt of the glottal source is significantly related to the perceived breathiness.

MATERIALS AND METHODS

The materials for this study were collected randomly from the out patients and inpatients attending with chief complaint of change of voice with organic cause, of sample size about 50 patients at the UPGRADED INSTITUTE OF OTO-RHINI-LARYNGOLOGY, MADRAS MEDICAL COLLEGE, CHENNAI, during the period of study from October 2004 to September 2005.

A detailed case history has been obtained from all patients and were undergone a detailed ENT examination and the findings were carefully noted.

All the patients attended were asked detailed history and past history were taken and examined. Both general and ENT examination were done to make out the causes of voice disorder clinically, using a standard proforma. Special attention was given to the examination of neck, cardiovascular system, respiratory system and central nervous system wherever necessary.

In some patients, in whom previous history of admission was given, old case sheet were referred and important points regarding case history, investigations were collected.

Investigation profile includes the following indirect Laryngoscopic examination, chest-x-ray (PA), blood sugar, serology, x-ray neck, Lateral and PA view, Barium swallow, sputum for AFB, urine analysis, direct laryngoscopy and Biopsy for HPE, Bronchoscopy and oesophagoscopy. All the patients were subjected to undergo Dr.Speech voice assessment and Electroglottography study.

This study conducted only after informing the patients and after obtaining their written consent for surgical interventions.

OBSERVATION AND RESULTS

The following data is obtained from the present series of 50 cases, taken randomly from those who attended as out patients and inpatients which chief complaints of change of voice with organic cause at upgraded institute of Oto-Rhino - laryngoscope, Govt. General Hospitals attached to MMC, Chennai, during the period of study Oct. 2004 to Sep. 2005 A.D.

DISCUSSION

Fifty cases of change of voice were examined and investigated to determine the etiological conditions.

The cause of change of voice were enumerated in Table - 1. Commonest cause being vocal nodule's (26%) followed vocal cord paralysis (22%) vocal polyp (14%), laryngitis (10%), malignancy of larynx (8%) and other in causes 20%.

AGE & SEX (3 & 2 TABLE)

In the present study of 50 cases male (56%) were commonly affected than females (44%).

Parikh N.P.⁶¹ (1991) observed that 67% males and 33% of females were affected.

A very high prevalence of change of voice is observed in 21-50- years of age group in males. This high prevalence in males could be attributed to habits like smoking, alcohol intake and due to occupational hazards.

CHANGE OF VOICE DUE TO VOCAL NODULE (TABLE - 4,5,6)

In the present study vocal nodule is the commonest cause of change of voice (26%). In this female (84%) were more commonly affected and more patients in the age group of 21 - 50 years were observed. This higher prevalence in females and in 21-50 years of age group might be due to excessive voice use emotional disturbances due to familial factors.

This in accordance with study conducted by Holinger⁶³ et al., and Chopra¹⁰ et al., in which females more than male in cause of vocal nodule's.

CHANGE OF VOICE DUE TO VOCAL CORD PARALYSIS (TABLE - 13,14,15,16)

In 22% of the cases studied had vocal cord paralysis resulting in voice changes. In this 36% of them the cause of paralysis are not known. This has been in accordance with the studies done by Tucker⁴⁹ Orgura and S.K. De⁵¹.

Cardiac enlargement is the next commonest causing vocal cord paralysis.

Left recurrent Laryngeal nerve paralysis (81%) occurred more frequently than right (18%), similar to Stall and Maran studies.

Vocal cord paralysis commonly observed in 21-50 year age group. Males (72%) were commonly affected than females (27%), similar male predominance is seen in S.K.De⁵¹ et al., studies.

CHANGE OF VOICE DUE TO VOCAL POLYP (TABLE - 18,19,20)

About 14% of the cases with voice change had vocal polyps. Among them 71% are males and 29% are females.

The most affected age group is 21-50 years. The high male predominance may be due to excessive smoking habit and alcohol consumption.

CHANGE OF VOICE DUE TO LARYNGITIS

In cases (10%) the voice change is due to laryngitis and most of them fall in the age group of 21 - 50 years. The respiratory tract infection, smoking and GERD were the predisposing factors. Adult cases appear to have been on increase as noted by Howlons et al.,

CHANGE OF VOICE DUE TO MALIGNANCY OF LARYNX (TABLE - 25,26,27)

Malignancy of Larynx is the cause of voice change in 8% of the cases and among them 75% are males.

In Moreau studies⁵⁶ and Deka R.C. series⁵¹, where malignancy of larynx dominant cause for change of voice.

Majority of the cases with laryngeal malignancy reported medical advice only in the advanced stages.

This reflects on lack of public awareness of hoarse voice and disease causing it, ignorance of people, inadequate impact of health education and health care facilities available, and inadequate knowledge about disease causing the hoarseness of voice among the general practitioners as our most patients were from rural background in lower socioeconomic groups.

Barua⁴⁶ et al., and Paymaster in their series showed about 28% of cases were presented with hoarseness of voice. Postcricoid malignancy present is one case.

All the males with voice change due to malignancy of larynx had smoking habit and alcohol intake.

Keygu M.F.⁵⁵ et al., and Das and Bose⁵⁷ series showed laryngeal malignancy occurs more commonly in age group of 50 - 60 (50%).

Vega M.F.⁵⁵ et al., Rohin⁵³ et al., (1991) and Das Bag⁷ series showed similar observation.

Baruna⁴⁶ et al., and Carpenter showed similar observation as in our study.

The change of voice due to other cause and Tuberculosis of larynx, puber phonia, Renike's edema, contact pachydermia, lipoid proteinosis, dysphonia plica ventricularis, hyperkinetic voice, subglottic haemangioma and epiglottis cyst etc.

VOCAL ASSESSMENT RECORDING IN PRESENT SERIES (TABLE 7,8,9,10,11)

In present study, all the 50 cases were recorded with Dr.Speech and Electro Glotto Graphy vocal assessment.

Dr.Speech on voice assessment showed in at 76% had extreme breathy voice, 54% had harsh voice, and 44% had hoarse voice. In Electro Glotto Graphy study 26% of the cases had extreme vocal fold irregularity.

Electro Glotto Graphy recordings on 50 cases showed that 30% of them had moderate vocal fold irregularity and only 8% had moderately decreased glottal closure time.

In above 34% of the cases, mild degree of hoarseness were present. In 8% and in 4% of the cases mild harsh and mild breathy voice was present respectively. In only 10% of the cases there was mild vocal fold irregularity.

In about 30% of the cases there was no Harsh voice and in 12% did not show any breathiness and 4% did not have hoarseness of voice. Electro Glotto Graphy recording showed normal Glottal closure time in 85% of the cases and in about 34% the vocal fold regularity was normal.

PRE AND POST TREATMENT VOICE ASSESSMENT IN VOCAL NODULE (TABLE 12 & 31)

Pre-treatment assessment of voice showed in all patients with vocal nodules (13 cases) there was varying degree of hoarseness, and in 12% cases. There was varying degree of breathy voice and in 9 cases varying degree of harsh voice was noticed. In all cases glottal closure time appears to be normal.

After 2 weeks of post - treatment inclusive of micro Laryngeal Excision of nodule followed by speech therapy in 2 cases - and by speech therapy in 11 cases alone. The voice assessment with Dr.Speech showed only in one case there was mild hoarse and breathy voice. Remaining 12 cases restored to have normal voice. However in post - treatment Electro Glotto Graphy recording, there was vocal fold irregularity in 6 cases.

PRE AND POST TREATMENT VOICE ASSESSMENT IN VOCAL POYLP (TABLE 21 & 33)

Pre- treatment assessment of voice and vocal fold showed 5 out of 7 cases with vocal polyp extreme harsh voice, 3 had extreme breathy voce, and 2 had extreme hoarse voice. The remaining patients had varied to Moderate degree of hoarse and breathy voice.

Pre - treatment Electro Glotto Graphy recording showed that 2 extreme vocal fold irregularity and 3 had moderate vocal fold irregularity only in 1 cases there was mildly reduced glottal closure time.

Post - Micro Laryngeal Excision of vocal polyp followed by speech therapy, the recording showed that only in 2 cases there was mild to moderate degree of hoarse, harsh and breathy voice. Remaining cases have restored their normal voice only in 2 cases there was vocal fold irregularity after treatment. Remaining cases have normal vocal fold and in all 7 cases the glottal closure time is found to be normal.

PRE AND POST TREATMENT IN LARYNGITIS (TABLE 24 & 32)

In cases with laryngitis, there was varying degree of hoarse, hoarse and breathy voice in all 5 cases before treatment. The post treatment assessment was done after 10 days. The assessment showed normal findings in voice except in 3 cases in whom there was breathy voice. This was possible by adapting improved voice hygiene (Drink lots of fluids, voice rest, Avoid smoking, balanced diet, avoid dry artificial interior climates, do not eat late at night and use a humidifier to assist with hydration along with speech therapy.

VOICE ASSESSMENT OF VOCAL PARALYSIS (TABLE 17)

In majority of the cases, there was extreme breathy (10 cases), harsh (8 cases) and hoarse (7 cases) voice. Remaining had mild to moderate degree of hoarse, harsh and breathy voice. The glottal closure time was normal in 7 cases. The vocal fold regularity was abnormal in 8 cases out of 11 cases.

VOICE ASSESSMENT IN MALIGNANCY OF LARYNX (TABLE 28)

All the patients with malignancy of larynx had varying degree of hoarse, harsh and breathy voice. The glottal closure time was normal in all patients. The vocal fold regularity was abnormal in all patients.

VOICE ASSESSMENT IN MISCELLANEOUS CAUSE (TABLE 30)

In majority of cases there was hoarse, breathy and harsh voice. The glottal closure time was normal in all the patients. The vocal fold regularity was abnormal in 4 cases out of 10 patients.

SUMMARY AND CONCLUSION

1. Voice disorder is one of the important and major indicator of diseases of throat and nose. The present study titled "Analysis of voice disorders by Dr.Speech and Electroglottography", is mainly aimed at voice assessment inclusive of Hoarse voice, Harsh voice, Breathy voice, vocal fold regularity and Glottal closure time and etiopathology of voice disorder. Fifty cases randomly collected presented with change of voice of various etiology were at the UPGRADED INSTITUTE OF OTO - RHINO LARYNGOLOGY, GOVT. GENERAL HOSPITAL, Chennai, attached to Madras Medical College, during the period of study from October 2004 to September 2005 A.D.

2. The etiopathological study of 50 cases of change of voice revealed that :

1.	Vocal Nodules	-	26%
2.	Vocal cord paralysis	-	22%
3.	Vocal polyp	-	14%
4.	Malignancy of larynx	-	8%
5.	Laryngitis	-	10%
6.	Miscellaneous	-	20%

3. Vocal nodule's commonly seen in female patients and 21 - 50 years age groups.

4. Vocal cord paralysis commonly seen in male patients in the 21 - 50 years age groups.
5. Vocal polyp commonly seen in male patients in 21 - 50 years age groups.
6. Voice abuse is being the most predisposing factor in vocal nodule's and vocal polyp, resulting in voice disorder.
7. Malignancy of larynx commonly seen in male patients in the 21 - 50- years age group smoking and alcohol intake are being the commonest predisposing habits.
8. Laryngitis more common in female patients in the 21 - 50 years age groups mainly due to gastroesophageal reflex disorder.
9. Miscellaneous causes of voice disorder also recorded in this study for their presentation in vocal assessment.
10. Dr.Speech is very useful to identify voice characteristics of different vocal cord pathologies and with in depth study of Dr.Speech and Electroglottography, it may be possible to approximate diagnosis just by analysing the voice assessment and EGG recordings. It is also useful in voice therapy to restore the voice in cases with non - malignant voice disorders, before and after medical and surgical management.

BIBLIOGRAPHY

1. Robin P.E., Olofsson J., "Tumours of larynx". In Hibbert John et al Scott Brown's laryngology and HNS Vol - 5,6th edition, London: Butterworth - Heinemann - 1997 pp 6/11/1-5/11/47, 5/6/1-5/6/25,5/9/1 - 5/9/20 - 5/5/18.
2. Weir Neil, "Anatomy of the larynx tracheobronchial tree". In Gleeson Michael et al - Scott - Brown's Basic Science Vol-1,6th edition, London; Butterworth - Heinemann - 1997, pp 1/12/1-1/12/28,1/4/1-1/14/27.
3. Freeland A.P., "Acute laryngeal infections". In adams D.A., Cinnamond M.J. et al - Scott - Brown's paediatric oto laryngology, Vol-6, 6th edition London, Butterworth-Heinmann - 1997, pp.6/24/1-6/24/16/6/22/1-6/22/7.
4. Thawley E. - Cysts and tumours of larynx. In paparell M., Shumrick et al - otolaryngology - Head and neck surgery, Vol - 3, 3rd edition - London; W.B. saunders company 1991, pp-2215 - 2384.
5. Kirchner J.A. "Physiology of the larynx". In paparell M., Shumrick et al - otolaryngology Basic science and relative principles, Vol-1, 3rd edition, London; W.B. Saunder's Company, 1991, pp 333 - 340, 132 - 135.
6. Castellellano's F., Spector G.-Tumours of larynx and laryngopharynx. In "Ballenger J., snow et al octolaryngoloty - Head and neck surgery, Vol3, 15th edition, London; Williams & Wilkins - 1996 pp.417-438, 464-593.
7. Dass (1969) - "Laryngeal paralysis in thyroidectomy and disease of the thyroid gland" - Indian Journal of Otol, Vol - 21, No.3, 1969, 121 - 125.
8. Kameshwaran (1981) - "Surgical treatment of bilateral abductor paralysis", Ind J.Otol. Vol.23, No.1, March - 1971, 24-26.

9. Daham D., Sessions G., Paniello C, et al - (1998) - "Primary subglottic cancer", *Laryngoscope* 108, May 1998, 741 - 745.
10. Chopra H., Kapoor M., (1997); Study of benign glottic lesions undergoing microlaryngeal surgery:, *Ind.J.otol-HNS*, Vol.49, July - Sep, 1997, 276 - 279.
11. Haysfeld J.N. (1998); "Hoarseness current concept on etiologies and treatment alternatives', *Md.Med.J.*1998; Feb - Mar 47 (2); 59 - 63.
12. Weing B.M., Heffner D.K. (1995); "Liposarcomas of the larynx and Hypopharynx; A clinicopathologic study of eight new cases and a review of the literature". *Laryngoscope* 105 July 1995, 745 - 755.
13. Benjamin B., Croxson G. (1985)" Vocal cord granulomas *Ann otol rhinol laryngol* 94, may 1995, 538 - 541.
14. Silver Carl E., - "Historical aspects". In Silver's "Surgery for cancer of the larynx and related structures", Newyork, Churchill living stone 1981, pp-10, 13-23.
15. Roger G., Denoyelle F., Triglia J.M. et al (1995) - "Severe laryngomalacia : Surgical indications and results in 115 patients", *Laryngoscope* 105 oct. 1995, 1111 - 111.
16. Ferlito A., Rinaldo A et al - "Impact of phenotype on treatment and prognosis laryngeal malignancies", *Journal of laryngology and otology*, Vol 112, Aug 1998, 710 - 714.
17. Wanamaker J.R., Netterville j.L. et al (1993) - "Silastic medialization for unilateral vocal cord paralysis". *Otolary - HNS* vol 4 No.3, Sep.1993, pp.207 - 217.
18. Shaida A.M., Bottrill I.D. et al (1998) - "Recent advance in the use of lasers in otolaryngology" - *IJO & HNS* vol 50m No.,3, July - Sep. 1998. 222 - 228.

19. Amin M.r. Isaacon G.et al(1997) "State dependent laryngo malacia " - Ann otol rhinol laryngol 106, May 1996, 887 - 890.
20. Robson N.L.K. Oswal V.H. et al (1990) - "Radiation therapy of laryngeal cancer - A twenty year experience" - Journal of larynx and otology. Vol 104 sep 1990, pp. 699 - 703.
21. Ahmed F.S., Hanson D.R. et al (1990) - "Hoarseness as the sole presenting symptom of foramen magnum meningioma" - Journal of laryngology and otology Vol. 104, Sep. 1990, pp 715 - 717.
22. Sellars I., Keen E.N. (1990) - " Laryngeal growth in infancy" - Journal of laryngology and otology, Vol.104, Aug 1990 00, 622 - 625.
23. Fairley J.w., Hughes M (1992) - "Acute stridor due to bilateral vocal fold paralysis as a presenting sign of myasthenia graivs - Journal of laryngology and otology, Vol. 106, Aug 1992 pp. 737 - 738.
24. Rudert H.H., Werner J.A. et al (1998) - " Transoral carbon - dioxide laser resection of supraglottic carcinoma" - Ann otol rhinol laryngol 108, 1999 pp 819 - 826.
25. Dikkers f.G., Sutter A.M. (1994) " Suspicion microlaryngoscopic surgery and indirect microlaryngostroboscopic surgery for benign lesion of the vocal folds" - Journal of laryngology and otology Vol. 108, Dec 1994, pp. 1064 - 1067.
26. garabedian, Ducrox V.et al (1999) - "Results of partial laryngectomy for benign neural tumors of the larynx in children" - Ann otol rhinal laryngol 108, 1999, pp. 66 - 671.
27. Carrat X., Hoverhuist J. et al (2000) - " Postintubation interarytenoid adhesion" - Ann otol Rhinol laryngol Vol. 109, 2000, pp. 736 - 74.
28. Laccourreye O. et al (2000) - "Vertical partial laryngectomy versus supracricoid partial laryngectomy for selected carcinomas of teh true vocal cord classified as T2 NO" - ann otol Rhinol laryngol Vol.109, 2000, pp 969 - 97.

29. Mclean - Muse A. et al (2000) - " Montgomery, thyroplasty implant" - Ann otol Rhinol laryngol Vol. 109, 2000, pp 393 - 40.
30. Krishnamurthy S.N., Paulose K.O. et al (1989) - "Vocal cord paralysis with Ebstein's amomaly" - Journal of laryngology and otology, vol. 103, June 1989, pp. 626 - 62.
31. Soni N.K. (1994) - "Scleroma of the lower respiratory tract; a bronchoscopic study" - Journal of laryngology and otology, Vol 108, June 1994, pp. 484 - 485.
32. Hartley C., Hamilton J et al (1994) - "Recurrent respiratory papillomatosis - the manchester experience "- Journal of laryngology and otologym, Vol. 108, March 1994, pp. 226 - 229.
33. Gupta A.K., Mann S.B.S. et al (1997) - "Surgical management of bilateral immobil vocal folds and long term follow up" - Journal of laryngology and otology, Vol.111, may 1997, pp - 474 - 477.
34. Perry A. (1997) - " The role of the sopeech and language therapist in voice restoration after laryngectomy" - Journal of laryngology and otology, Vol. III, Jan 1997, pp. 4-7.
35. Bulman C.H. (1998) " Management of cancers of the larynx and pharynx-a ten year audt". Journal of laryngology and otologym, Vol.112, Oct. 1998, pp 948 - 953.
36. Shine J.E.NMam S.y. et al (2000) - " Changing trends in clinical manufestations of laryngeal tuberculosis" - Laryngoscope Vol. 110. Nov. 2000, PP. 1950 - 1956.
37. Mochloulis G., Irving R.M. et al (1996) - "Laryngeal kaposis sarcoma in patients with AIDS" - Journal of laryngology and otology, Vol.110, Nov. 1996; PP 1034 - 1037.
38. Smith E. et al (2000) - " Human Papilloma virus and risk of laryngeal cancer - Ann otol rhinol laryngol Vol.1 109, 2000, PP. 1069 - 1076.

39. Banerjee S. (1997), " Hundred years of laryngology" IJO & HNS Vol.49, No.3, Jul-Sep. 1997 PP. 195 - 200.
40. Maran A.G.D. et al (1988) - Vocal cord paralysis " In Logan Turner's disease of Nose, Throat and Ear" 10th edition, 1988, Butterworthy, Heinmann, New Delhi, PP. 142 - 185.
41. Graney O.D. Bastian R.W., (Benigh vocal fold mucosal disorders) Cummings C.W. et al. In otolaryngology HNS vol3,3rde edition, 1998, Mosby, London, PP 1823 - 2298.
42. Choi S.S., Cummings C.w. et al (1998 - " Voice disorders", In otolaryngology : HNS Vol-5,3rd edition 1998, Mosby London, PP. 335 - 345, 388 - 400.
43. Powell J. and Ronin P.E. (1983) " Cancer of the head and neck" the4 present state. In : Head and Neck cancer, edited by P.Rhys evancs P.E., Robin and J.W.L. fielding. Tubridge Wells: Castle House Publications, 1983 PP. 3-16.
44. Shaw H. (1979) " tumours of the larynx" In : Scott Brown's diseases of Ear, Nose and Throat, 4th edition, ecited by J. Ballantyne and J. Groves, London ; Butterworths, 1979, PP. 421 - 508.
45. Milutinovic Z. (1997) " Symptoms and sings of voice disorders and the pathophysiology of hoarseness - Srpski Archiya Za Celokupno Lekarstvo Vol. 106-9, Mar-Apr 1997 pp. 125 - 129.

PROFORMA OF THE CASE SHEET

Case No.			
Name	:	IP/OP No.	:
Age	:	D.O.A.	:
Sex	:	D.O.D.	:
Occupation	:	Diagnosis	:
Income	:	Results	:
Address	:		
Phone No.	:		

I. PRESENTING COMPLAINTS

1. Hoarseness of voice / change of voice :
2. Aphonia or Dysphonia :
3. Difficulty in breathing :
4. Cough :
5. Difficulty in swallowing :
6. Pain :
7. Fever :
8. Swelling in the neck :
9. Loss of weight :
10. Any other complaints :

II. HISTORY OF PRESENTING ILLNESS

1. Hoarseness of Voice:

- (a) Duration :
- (b) Onset :
- (c) Intermittent or continuous :
- (d) Stationary or progressive :
- (e) Pain related to use of voice :

2. Aphonia / Dysphonia

- (a) Onset :
- (b) Duration :
- (c) Mental status of the patient :

3. Difficulty in breathing:

- (a) Duration :
- (b) Onset :
- (c) Quite or noisy :
- (d) Stridor : Inspiratory :
- : Expiratory :
- : Both :

4. Cough:

- (a) Duration :
- (b) Onset :
- (c) Dry or with expectoration :
- (d) Haemoptysis :
- (e) Hiccup :

5. Difficulty in Swallowing :

- (a) Duration :
- (b) Onset :
- (c) Relation to food : Solids:
 - : Liquids :
 - : Both :
- (d) Level of obstruction :
- (e) Regurgitation :
- (f) Vomitus :
- (g) Haemetemesis :

6. Pain:

- (a) Site : Throat :
 - : Neck :
 - : Retrosternal :
 - : Referred to ear or any where:
- (b) Character : Dull aching:
 - : Burning :
 - : Picking :
 - : F.B.Sensation

- (c) Continuous or intermittent :
- (d) Aggravating or relieving factors :

7. **Fever**

- (a) Duration :
- (b) Onset :
- (c) Continuous or intermittent :
- (d) Associated with sweating or Chills with rigors:

8. **Swelling in the Neck**

- (a) Site / Size / Single / Multiple :
- (b) Onset :
- (c) Pain on swallowing :
- (d) Stationary Or progressive :
- (e) Unilateral or bilateral :
- (f) Mobile or fixed :

9. **Loss of weight**

- (a) Duration :
- (b) Extent of loss :

10. **Associated Complaints**

- (a) Attach of common cold, sore throat
- (b) History of trauma :
- (c) Vocal abuse :
- (d) Corrosive poisoning or inhalation of fumes :

III. **PAST HISTORY**

- History of Tuberculosis / Syphilis / Leprosy
- History of infectious fever - Measles / Chicken pox / Typhoid
- History of trauma or allergy
- Surgery for any other disease in neck and throat
- History of irradiation
- History of diabetes or myxoedema
- Diseases of CNS

IV FAMILY HISTORY

- Similar complaints in any other member in the family
- History of T.B / Diabetes / Hypertension
 - (a) Duration :
 - (b) Onset :

V PERSONAL HISTORY

- (a) Built - Good / Moderate / Poor
- (b) Nutrition - Good / Moderate / Poor
- (c) Mental Status - Conscious / Co-operative
- (d) Pallor / Icterus / Cyanosis / Clubbing / Pedal Edema
- (e) Lymph-node status
Size/Shape/No/Consistency/ Mobility/Overlying Skin :

- Vital Data
- Temperature
 - Pulse
 - Respiratory rate
 - Blood Pressure

VII SYSTEMIC EXAMINATION

- (a) Cardiovascular system
- (b) Respiratory system
- (c) Per Abdomen
- (d) Central Nervous systems

VIII. ENT EXAMINATION / LOCAL EXAMINATION

1. Throat : Lips, Teeth, Gum Margin

- (a) Mucosa....Duct orifices (Parotid/sumbandibular/Sublingular)
Teeth...Gums.... Palate....Floor or mouth
Pillars.... Tonsils....Uvula.... Posterior Pharyngeal wall.....
- (b) Masopharynx : appearance...Secretiong.... Lateral Pharyngeal
bands.... Mirror view of Nasopharynx... Adenoids..., Fossa of
Rosenmuller.
- (c) IDL : (Order of examination)

- (1) Posterior 1/3 of tongue :
- (2) Vallecular :
- (3) Epiglottis :
- (4) Aryepiglottic Fold :
- (5) Arytenoids :
- (6) Right & Left ventricular band :
- (7) right & Left vocal cord :
- (8) Anterior & Posterior commissure :
- (9) Anterior wall of trachea :

All the foregoing observation are made without asking the patient to do anything in order to note the conditions during quite breathing.

The patient now asked to take deep breath and following things are observed.

- (7) Movement of right cord and right arytenoid :
- (8) Movement of left cord and left arytenoid :

Patient is asked to phonate "aah" and preceding two observations repeated. Repeat observation during long phonation of E-ee.

- (9) Pyriform fossae and postcricoid region.

- (d) External palpation of laryngeal cartilages for :
 - 1. Detection of abnormalities in texture and form:
 - 2. Mobility
 - 3. Elicitation and accurate localization of tenderness :
- (e) DIRECT LARYNGOSCOPY :
 - Condition of the mucosa :
 - Type of growth :
 - Site and Extent of growth :
 - Condition of vocal cords regarding movements:
 - Postcricoid region :
 - Pyriform fossae :

2. Nose:

- (a) External appearance :
- (b) Movement of ala with respiration :
- (c) Objective Nasal obstruction :
- (d) Anterior Rhinoscopy :
- (e) Posterior Rhinoscopy :
- (d) Para Nasal Sinus Tenderness :

3. Ear :
- (a) Pinna
 - (b) Pre & Post auricular region :
 - (c) External Auditory Meatus :
 - (d) Tympanic Membrane :
 - (e) TFT - Rinne's
 - Webr's
 - ABC

IX. PROVISIONAL DIAGNOSIS

X. INVESTIGATIONS

- (a) Blood - Hb % / BT / CT / TC / DC / ESR
Blood Urea / Serum creatinine / Blood Cholesterol
Blood VDRL
- (b) Urine - Albumin / Sargar / Microscopy
- (c) Stool Examination for - ova / cyst
- (d) Sputum for AFB/X-ray Chest / Barium Swallow / X-ray Neck
- (e) Dr.Speech (Electroglottography)
- (f) Oesophagoscopy / Bronmchoscopy
- (g) Biopsy - during DL Scopy & HPE

XI. FINAL DIAGNOSIS

XII. MANAGEMENT

XIII. FOLLOW UP

Table 1

Showing causes of change of voice in 50 cases

Sl.No.	Causes	Percentage Present series)
1.	Vocal nodules	13 (26%)
2.	Vocal cord paralysis	11 (22%)
3.	Vocal polyp	07 (14%)
4.	Malignancy of larynx	04 (8%)
5.	Laryngitis	05 (10%)
6.	Other's	10 (20%)
		100%

Present study, shows, commonest etiology factor causing change of voice was vocal Nodule's (26%), followed by vocal cord paralysis 22%, other's 20% vocal polyp 14%, laryngitis 10% and malignancy of larynx 8%.

Showing causes of change of voice in 50 cases

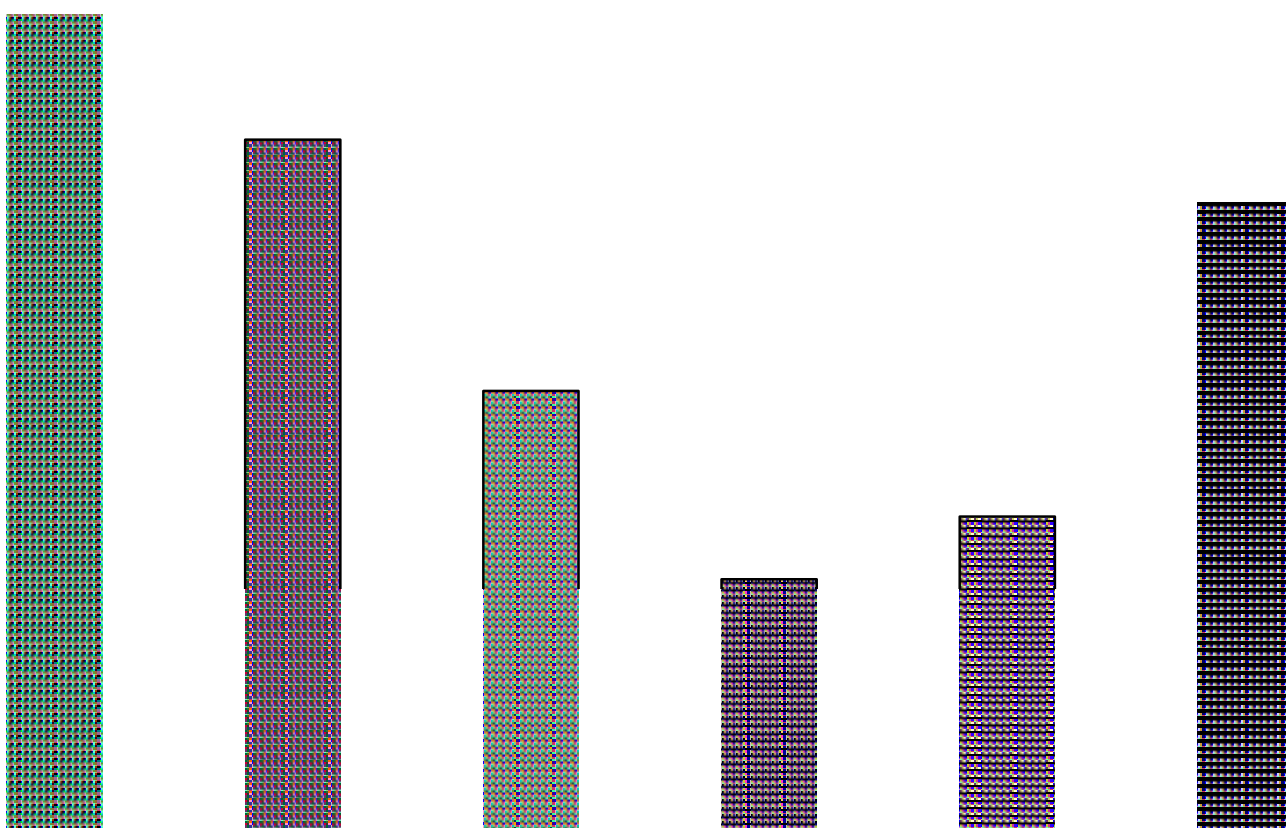


Table 2

Sex distribution in 50 cases of change of voice

Sl.No.	Sex	Percentage (Present series)
1.	Male	28 (56%)
2.	Female	22 (44%)

The present study shows the male predominance with 56% and 44% are females.

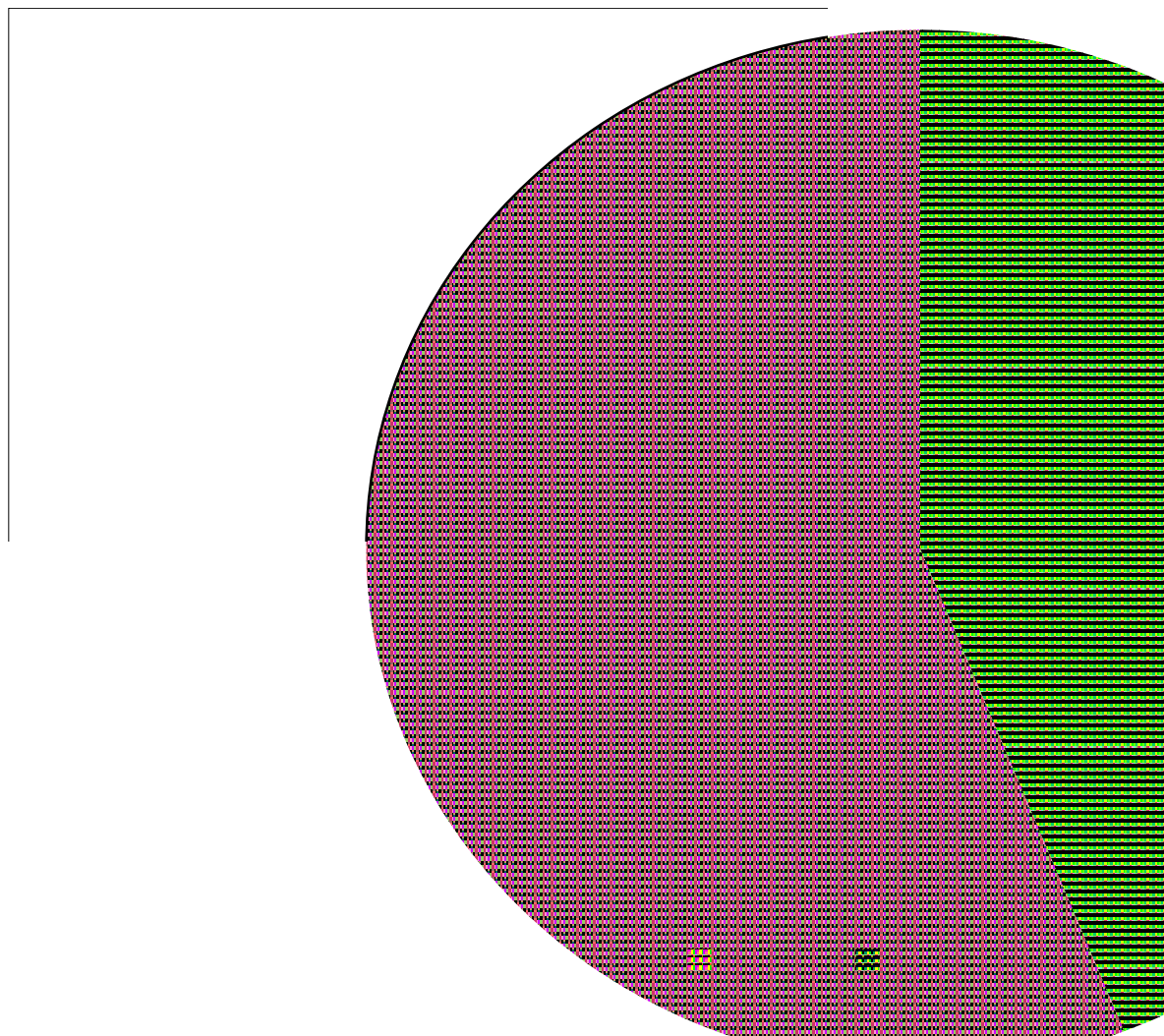
Sex distribution in 50 cases of change of vocal

Table 3**Age distribution in 50 cases of voice change**

Sl.No.	Age	Percentage (Present series)
1.	0-20	05 (10%)
2.	21-50	38 (76%)
3.	> 51	07 (14%)

The above chart shows that a majority (76%) are in the age group of 21 - 50 years.

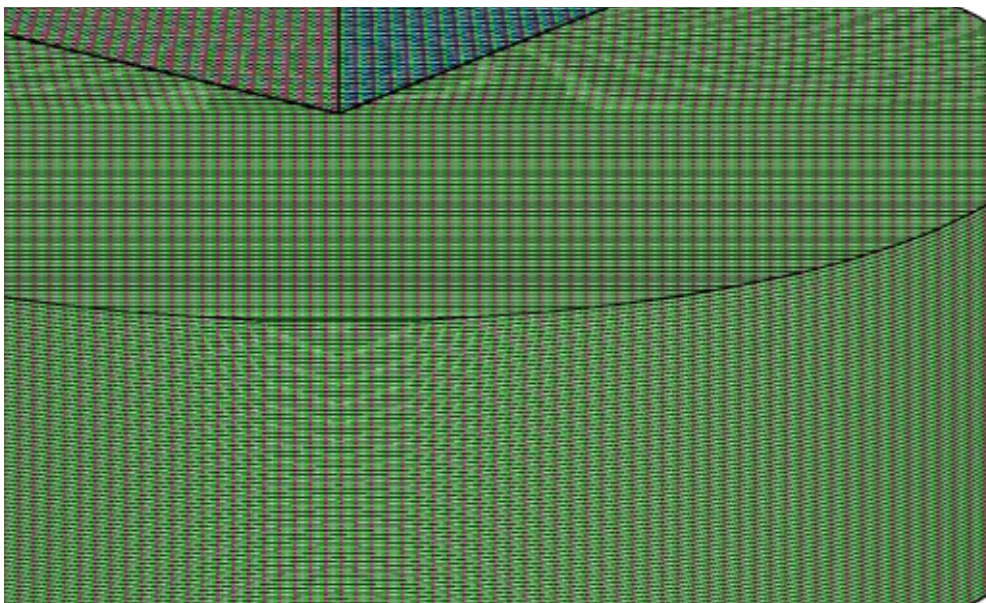
Age distribution in 50 cases of voice change

Table 4**Age incidence in patient with vocal nodule in 13 cases**

Sl.No.	Age	Percentage (Present series)
1.	0-20 Yrs.	0
2.	21-50 Yrs.	12 (93%)
3.	>50 Yrs.	1 (7%)

In the study out of 13 cases with vocal nodules 21 - 50 years age group had very high incidence with 92% and interestingly there was no one in the age group of 0 - 20 years.

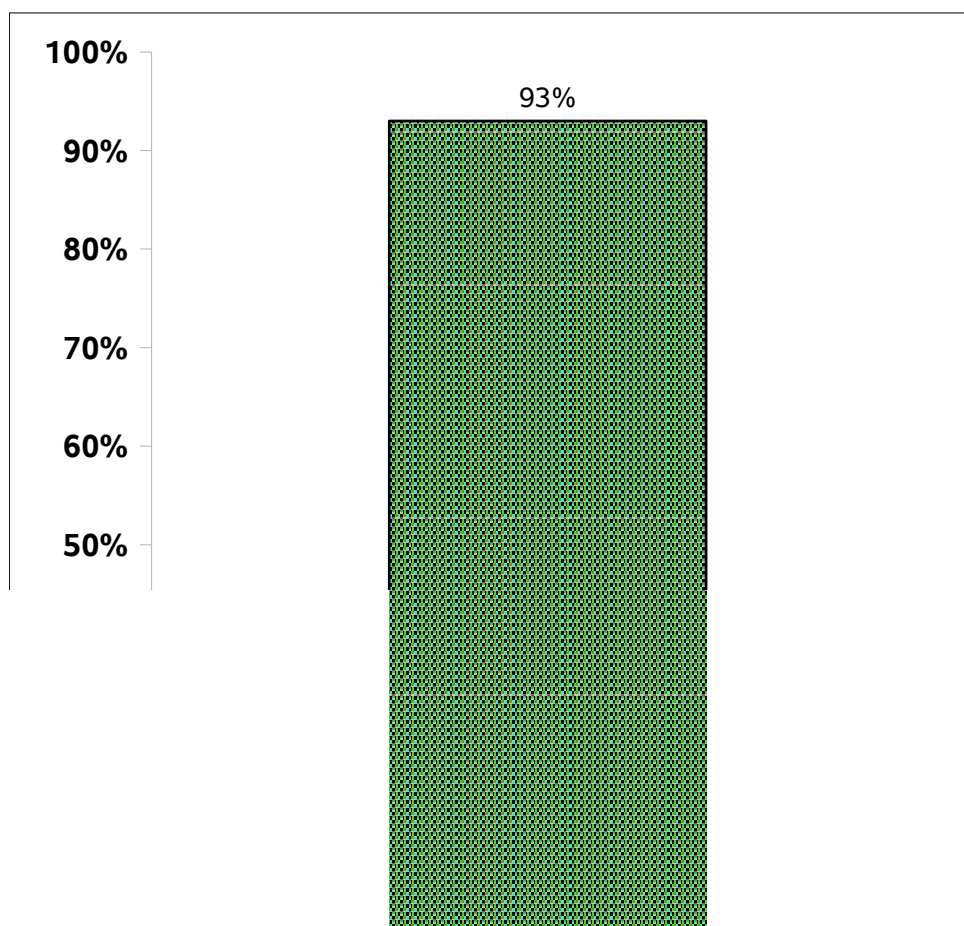
Age incidence in patients with vocal nodule

Table 5**Sex incidence in vocal nodule's case**

Sl.No.	Age	Percentage (Present series)
1.	Male	2 (15%)
2.	Female	11 (85%)

Out of 13 cases with vocal nodule, 11 (84%) of them are females. Only 3 are singers, remaining 8 of them either had abused their voice or misused their voice.

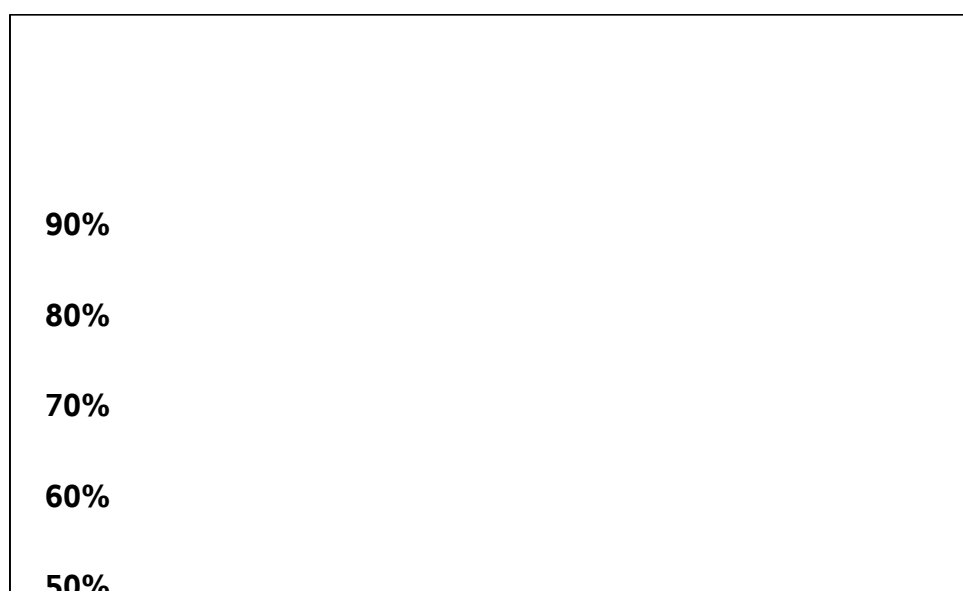
Sex incidence in vocal nodule case

Table 6

Habits in vocal nodule's cases

Sl.No.	Habit	Percentage (Present series)
1.	Voice abuse	8 (62%)
2.	Misuses voice	2 (15%)
3.	Singer's	3 (23%)

Habits in vocal nodule's cases

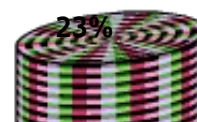


Table 7

Incidence of Hoarse voice by vocal assessment in 50 cases

Sl.No.	Vocal assessment	Percentage (Present series)
1.	Extreme	22 (44%)
2.	Moderate	09 (18%)
3.	Mild	17 (34%)
4.	Normal	02 (4%)
		50 (100%)

Most of the patients presented with Extreme Hoarse voice (44%) followed by Mild Hoarse voice, Moderate Hoarse voice. Only 4% of the patients presented with in normal recording.

Incidence of Hoarse voice by vocal assessment in 50 cases

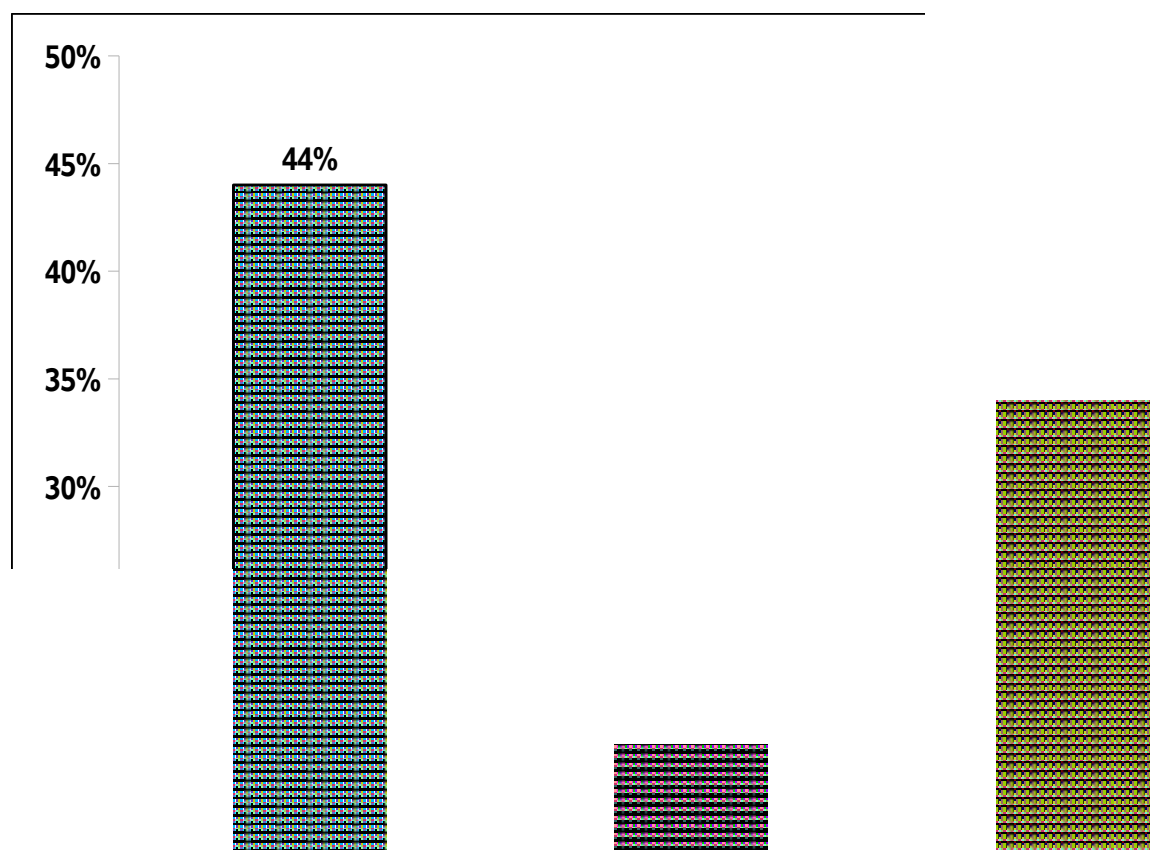


Table 8

Incidence of Harsh voice by vocal assessment in 50 cases

Sl.No.	Vocal assessment	Percentage (Present series)
1.	Extreme	27 (54%)
2.	Moderate	04 (8%)
3.	Mild	04 (8%)
4.	Normal	15 (30%)
		50 (100%)

Most of the patients presented with Extreme Harsh voice (54%) and 30% of the patients presented with normal recording followed by Moderate and mild Harsh voice.

Incidence of Harsh voice by vocal assessment in 50 cases

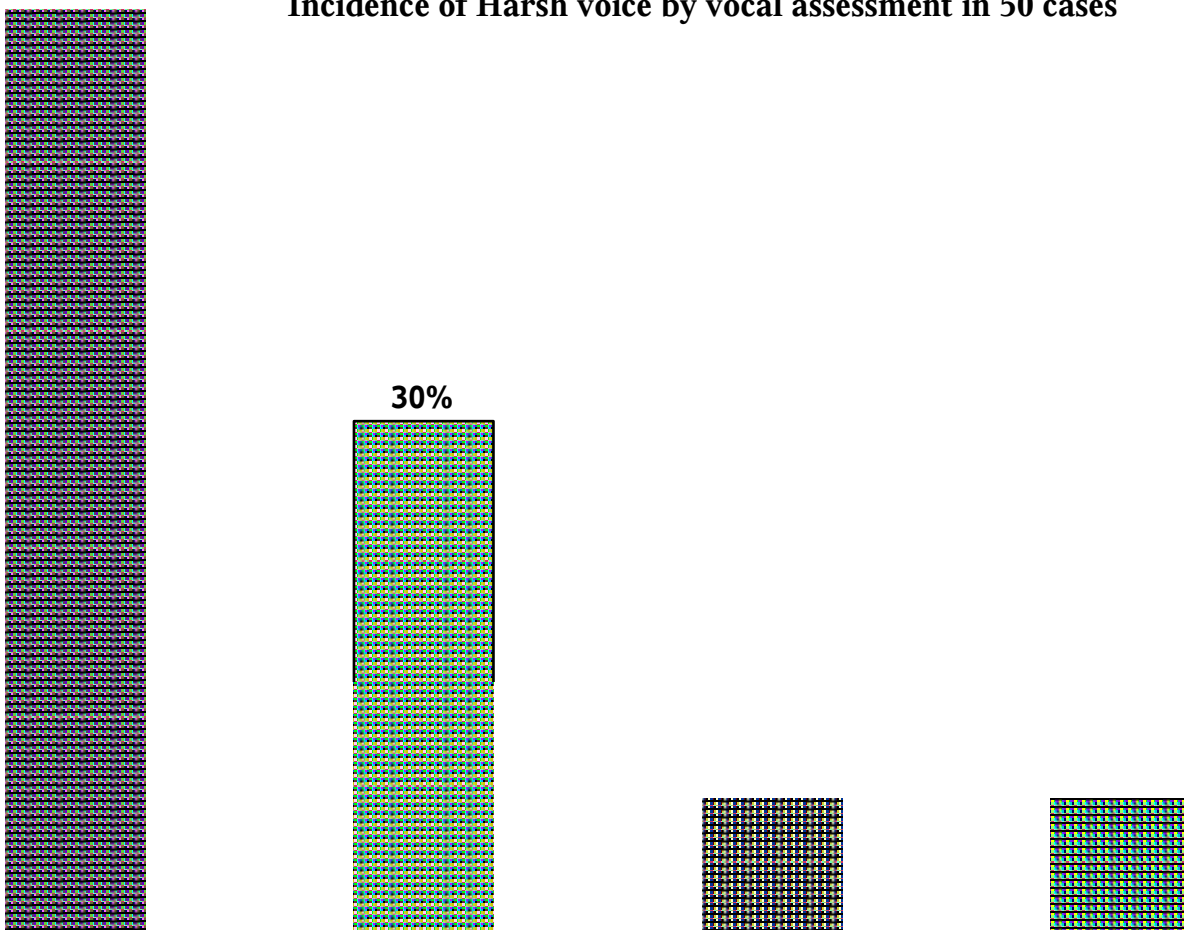


Table 9**Incidence of Breathy voice by vocal assessment in 50 cases**

Sl.No.	Vocal assessment	Percentage (Present series)
1.	Extreme	38 (76%)
2.	Moderate	04 (8%)
3.	Mild	02 (4%)
4.	Normal	06 (12%)
		50 (100%)

Most of the patients presented with Extreme Breathy voice (76%) followed by moderate Breathy voice (8%) and mild breathy voice (4%). By 12% of the patients presented with normal recording.

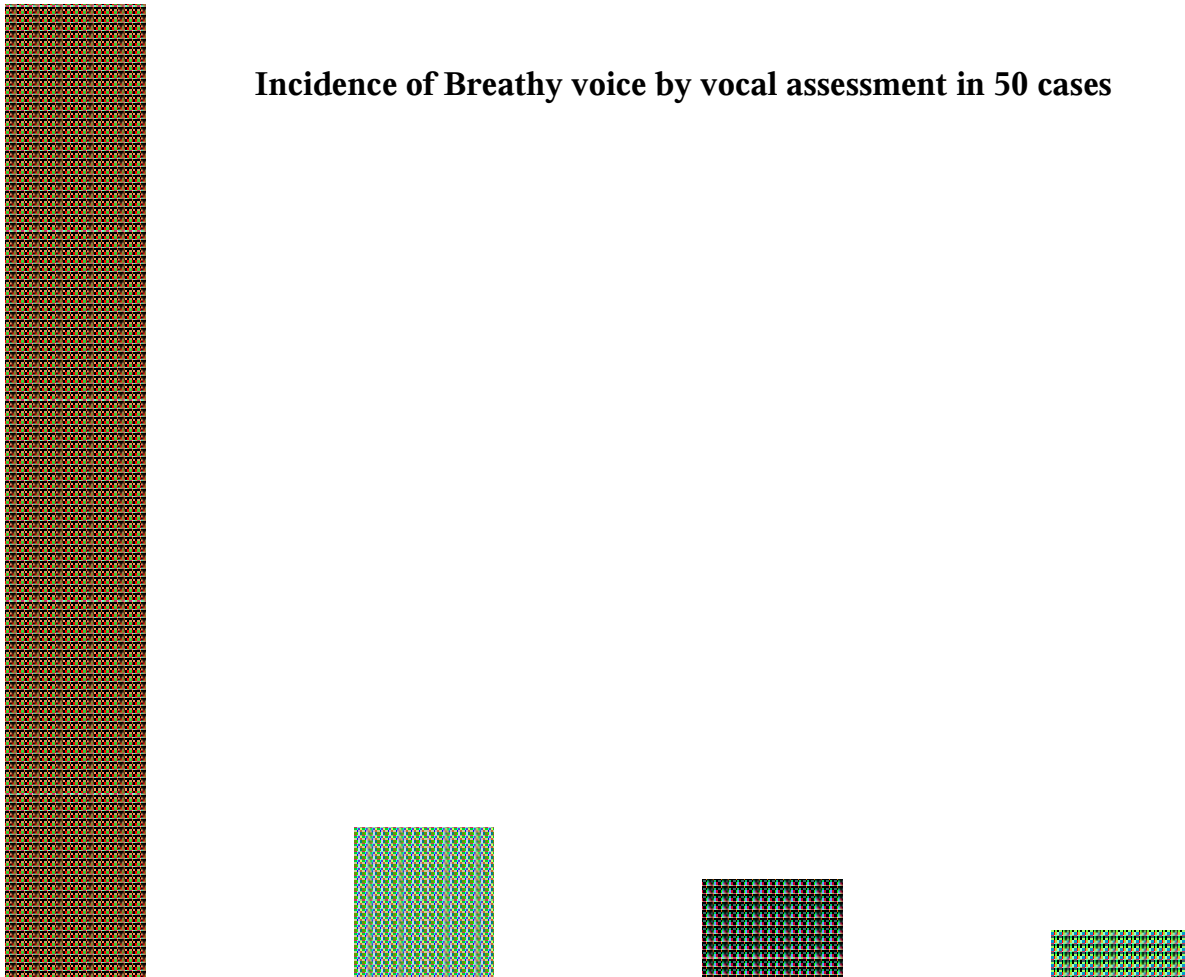
Incidence of Breathy voice by vocal assessment in 50 cases

Table 10

Incidence of vocal fold irregularity by voice assessment in 50 cases

Sl.No.	Vocal assessment	Percentage (Present series)
1.	Extreme	13 (26%)
2.	Moderate	15 (30%)
3.	Mild	05 (10%)
4.	Normal	17 (34%)
		50 (100%)

Most of the patients presented with Normal recording (34%) followed by Moderate vocal fold irregularity (30%), Extreme vocal fold irregularity (26%) and mild vocal fold irregularity 10%.

Incidence of vocal fold irregularity by voice assessment in 50 cases

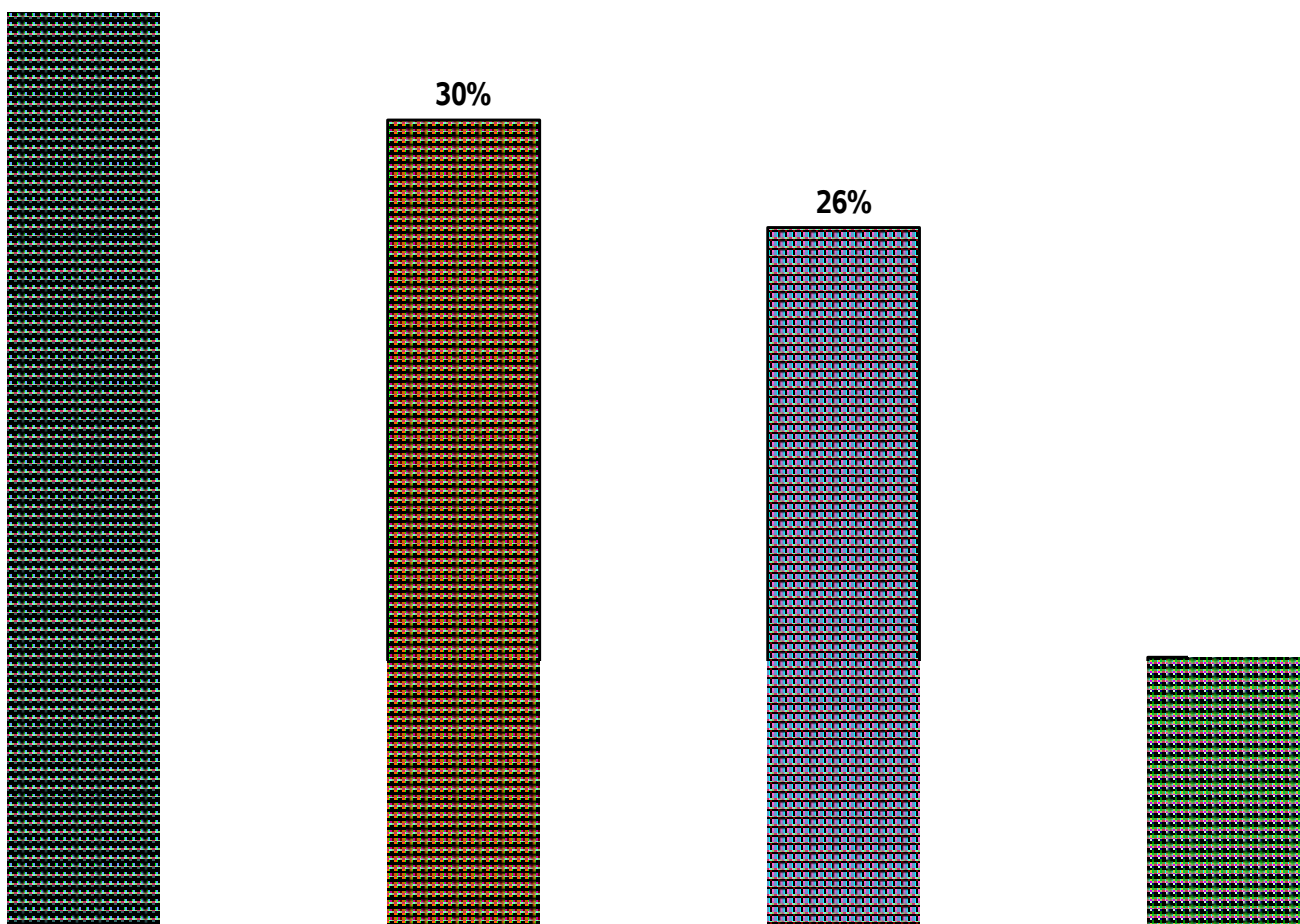


Table 11

Incidence of glottal closure time by vocal assessment in 50 cases

Sl.No.	Vocal assessment	Percentage (Present series)
1.	Extreme	00 (0%)
2.	Moderate	02 (4%)
3.	Mild	04 (8%)
4.	Normal	44 (88%)
		50 (100%)

A large majority of the patients (88%) had normal glottal closure time, followed by moderately decreased glottal closure time (8%) and mildly decreased glottal closure time (4%).

Incidence of glottal closure time by vocal assessment in 50 cases

Table 12**Showing vocal nodule's presentation in vocal assessment in 13 cases****(Pre-treatment)**

Vocal assessment	Extreme	Moderate	Mild	Normal	No. of Patient
Hoarse voice	7 cases	1 case	5 cases	0 case	13 cases
Harsh voice	7 cases	0 case	2 cases	4 cases	9
Breathy voice	12	0	0	1	12
Vocal fold regularity	3	5	2	3	10
Glottal closure time	-	1	0	12	1

Table 13

Age incidence in patients with cord Paralysis in 11 cases

Sl.No.	Age	Percentage (Present series)
1.	0-20 years	2 (18%)
2.	21-50 years	6 (55%)
3.	>51 years	3 (27%)

Out of 11 cases with vocal cord paralysis. 6 (56%) fall in the age group of 21 - 50 years, 3 (27%) fall in the age group of >51 years.

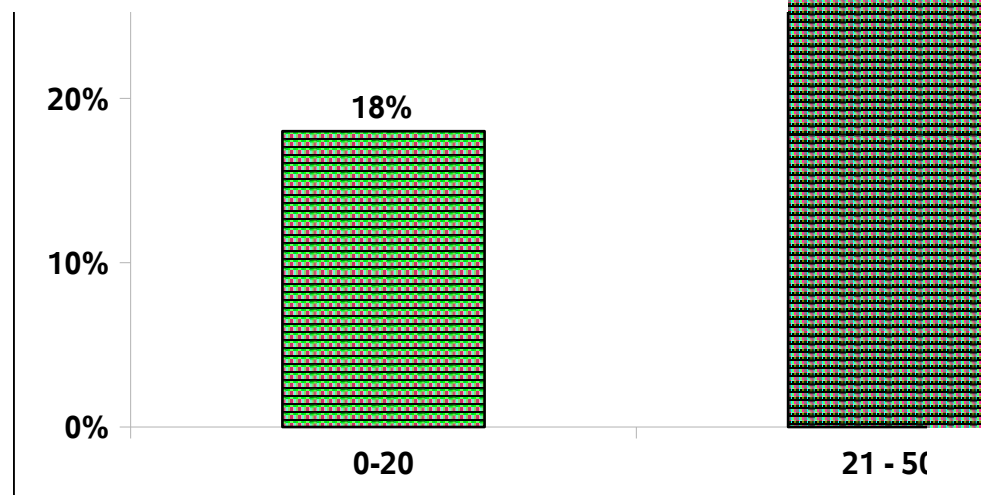
Age incidence in patients with vocal cord paralysis in 11 cases

Table - 14

Sex Incidence in Vocal Cord Paralysis

Sex	% (Percentage)
Male	8 (73%)
Female	3 (27%)

In present series, Males are Commonly affected (72%) than the Females (27%).

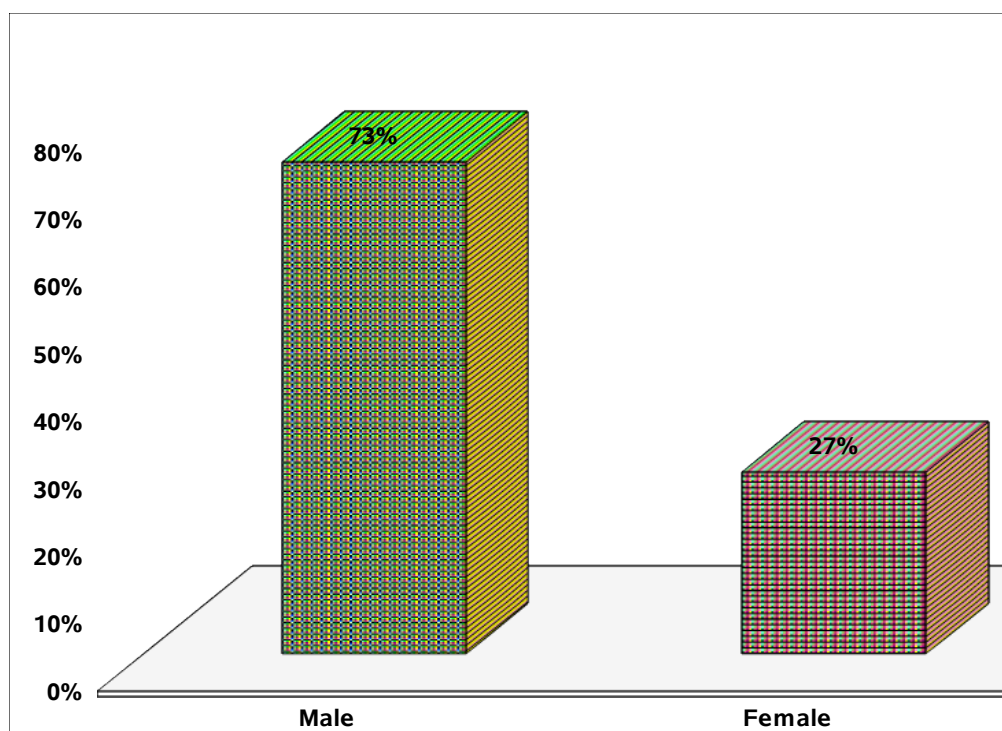
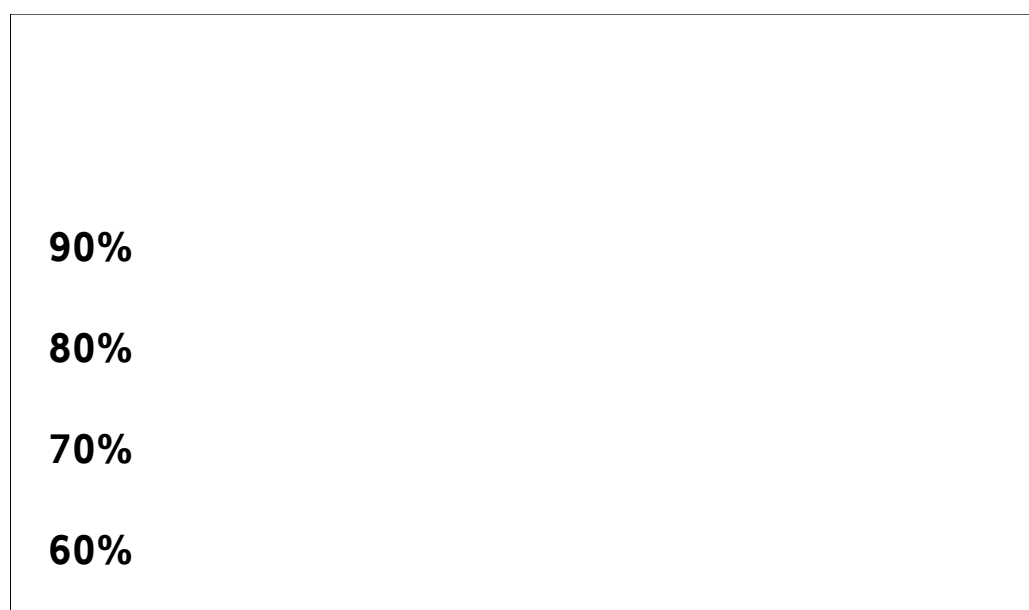
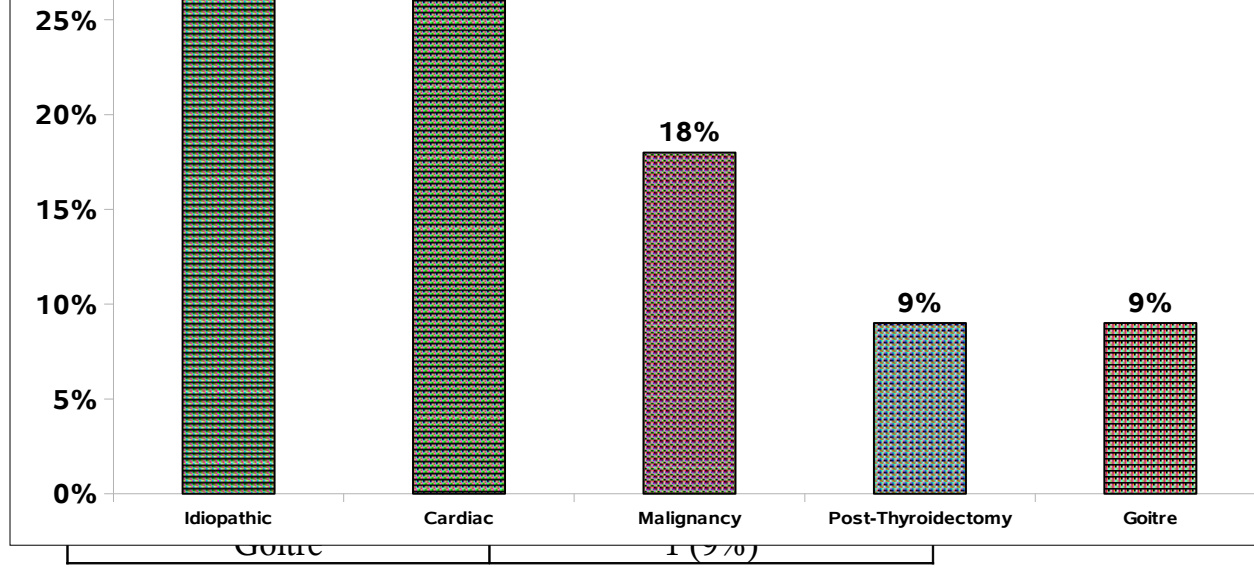
Sex Incidence in Vocal Cord Paralysis

Table - 15**Analysis of site of lesion of laryngeal nerve paralysis**

Side of lesion	% (Present Series)
Right Recurrent Laryngeal Nerve	2 (19%)
Left Recurrent Laryngeal Nerve	9 (81%)

Out of 11 cases with vocal cord palsy, 9 had left recurrent laryngeal nerve palsy and only 2 had right recurrent laryngeal nerve palsy (19%).

Analysis of site of lesion of laryngeal nerve paralysis**Table - 16****Causes of Vocal Cord Paralysis Causing Change of Voice**



In present series, in (36%) 4 patients the cause for vocal and paralysis not known, but 3 (27%) of them had cardiac enlargement in 2 of them, malignancy was the cause for vocal cord paralysis and remaining 1 each had post thyroidectomy palsy and goitre.

Causes of Vocal Cord Paralysis Causing Change of Voice

Table - 17

Showing vocal cord Paralysis Presentation in Vocal Assessment in 11 cases

Vocal assessment	Extreme	Moderate	Mild	Normal	No. of Patients
Hoarse voice	7 cases	2	2	0	11
Harsh voice	8	0	1	2	9
Breathy voice	10	1	0	0	11
Vocal fold regularity	6	2	0	3	8
Glottal closure time	0	1	3	7	4

Table - 18

Age Incidence in Patients with vocal polyp in 7 cases

Age	% (Present Study)
0 - 20 years	0 (0%)
21 - 50 years	6 (86%)
>51 years.	1 (14%)

We observed that, 21 - 50 years age group was the most affected by the vocal polyp (86%), followed by >51 years age group decade (14%).

Age Incidence in Patients with vocal polyp in 7 cases

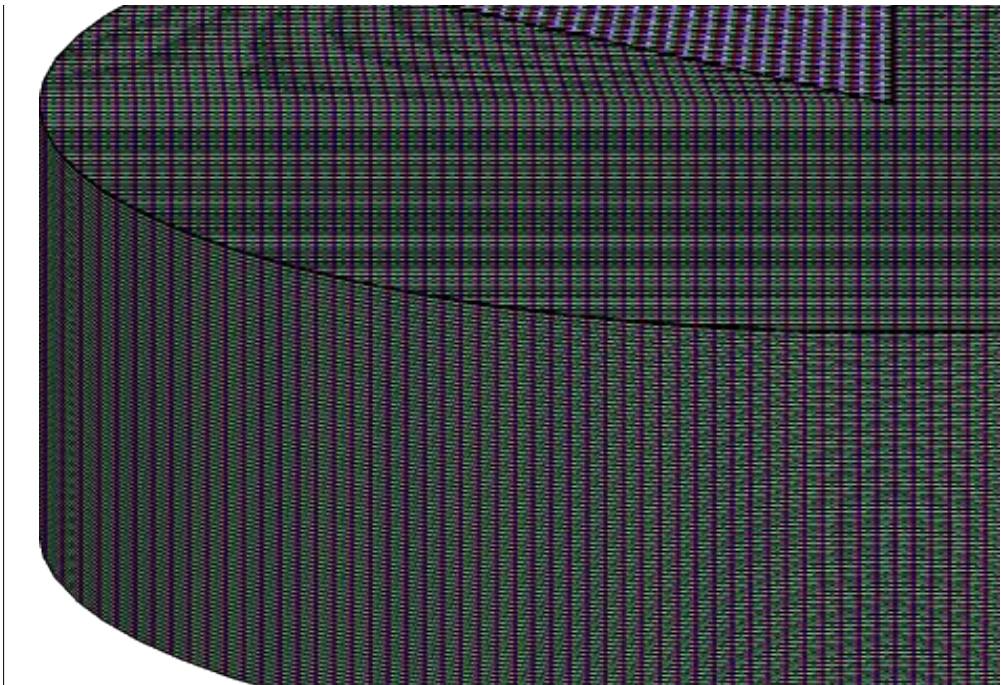


Table - 19
Sex Incidence in Vocal Polyp

Sex	%
Male	5 (72%)
Female	2 (28%)

Among those who were affected by vocal polyp 71% are male and 29% are female which shows high incidence in males.

Sex Incidence in Vocal Polyp



Table - 20
Habits in Vocal Polyp Patients

Habits	% (Present Study)
Voice abuse	5 (71%)
Smoking	2 (29%)

In the cases with polyp 71% were abusing the voice and only 29% had the habit of smoking.

Habits in Vocal Polyp Patients

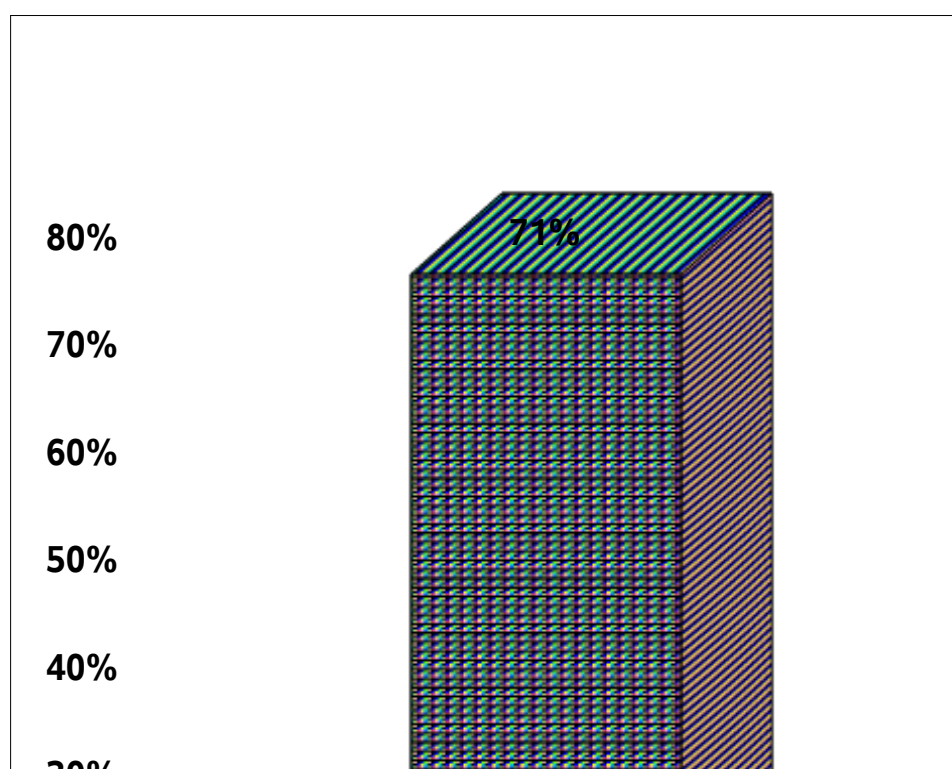


Table - 21

Showing vocal polyp presentation in vocal assessment in 7 cases

(Pre-treatment)

Vocal assessment	Extreme	Moderate	Mild	Normal	No. of Patients
Hoarse voice	2	0	5	0	7
Harsh voice	5	0	0	2	5
Breathy voice	3	1	0	3	4
Vocal fold regularity	2	3	0	2	5
Glottal closure time	0	0	1	6	1

Table - 22

Age Incidence in Laryngitis in 5 cases

Age	% (Present Study)
0 - 20 years	1 (20%)
21 - 50 years	4 (80%)
> 51 years.	0 (0%)

We also observed 80% of the cases with change of voice due to

la

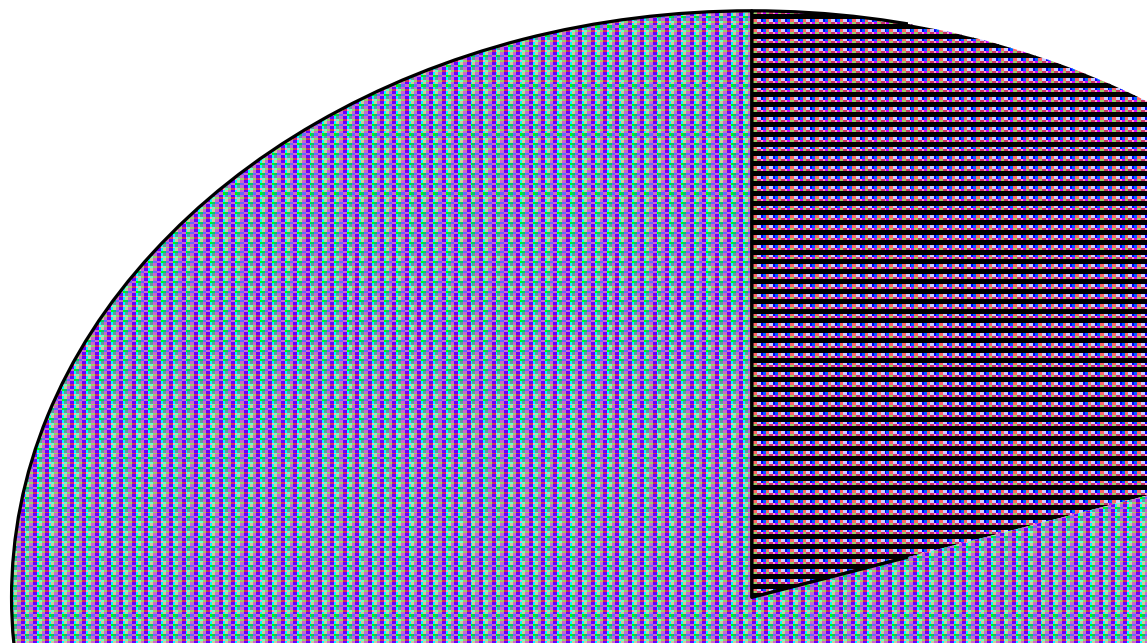


Table - 23
Sex Incidence in Laryngitis

Sex	%
Male	2 (40%)
Female	3 (60%)

If we look into the male female sex ratio in the cases with laryngitis is 2:3 showing more females.

Sex Incidence in Laryngitis

Table - 24**Showing laryngitis presentation in vocal assessment in 5 cases****(Pre-treatment)**

Vocal assessment	Extreme	Moderate	Mild	Normal	No. of Patients
Hoarse voice	1	2	2	0	5
Harsh voice	2	0	0	3	2
Breathy voice	4	0	1	0	4
Vocal fold regularity	0	1	1	3	2
Glottal closure time	0	0	0	5	0

Table - 25**Age incidence in patients with Malignancy of larynx in 4 cases**

Age	% (Present Study)
< 20 years	0
21 - 50	2 (50%)
>51	2 (50%)

Two out of four patients had voice change due to malignancy in the age group of 21 - 50 years and remaining 2 were in the age groups >51 years.

Age incidence in patients with Malignancy of larynx in 4 cases**Table - 26****Sex incidence in malignancy of larynx**

Sex	%
Male	3 (75%)
Female	1 (25%)

It is also observed that 75% of them are males with a male female sex ratio of 3:1.

Sex incidence in malignancy of larynx.

Table - 28
Habits in Malignancy of Larynx

Habit	%
Smoking	4 (50%)
Alochol intake	3 (50%)

All the males with malignancy of larynx had the habit of consumption of alcohol and smoking (20 - 30 beedies).

Habits in Malignancy of Larynx

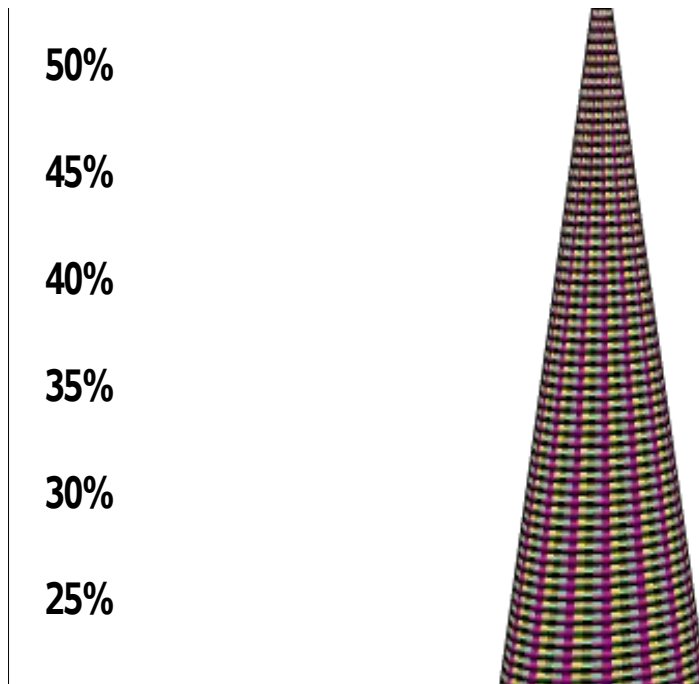


Table - 28

Showing malignancy of larynx presentation in vocal assessment in 4 cases

Vocal assessment	Extreme	Moderate	Mild	Normal	No. of Patients
Hoarse voice	3	1	0	0	4
Harsh voice	3	1	0	0	4
Breathy voice	4	0	0	0	4
Vocal fold regularity	1	3	0	0	4
Glottal closure time	0	0	0	4	0

Table - 29

**List of other's causes causing change of voice in 10 cases whom
voice assessment done**

Sl.No.	Causes	Percentage
1.	Tuberculosis of Larynx	2 (20%)
2.	Puberphonia	1 (10%)
3.	Reinke's Edema	1 (10%)
4.	Contact pachydermia	1 (10%)
5.	Lipiod proteinosis	1 (10%)
6.	Dysphonia plica ventricularis	1 (10%)
7.	Hyperkinetic voice	1 (10%)
8.	Subglottic hemangioma	1 (10%)
9.	Epiglottic cyst	1 (10%)

Table - 30

Showing other's cause presented in vocal assessment in 10 cases

Vocal assessment	Extreme	Moderate	Mild	Normal	No. of Patients
Hoarse voice	2	3	3	2	8
Harsh voice	2	3	1	4	6
Breathy voice	5	2	1	2	8
Vocal fold regularity	1	1	2	6	4
Glottal closure time	0	0	0	10	0

Table - 31

Showing post treatment of vocal nodule presentation in vocal assessment in

13 cases

Vocal assessment	Extreme	Moderate	Mild	Normal	No. of Patients
Hoarse	0	0	1	12	1
Harsh	0	0	1	12	1
Breathy	0	0	1	12	1
Vocal fold regularity	0	3	3	7	6
Glottal closure time	0	0	0	13	0

Table - 32

Showing post treatment of laryngitis presentation in vocal assessment in 5 cases

Vocal assessment	Extreme	Moderate	Mild	Normal	No. of Patients
Hoarse	0	0	0	5	0
Harsh	0	0	0	5	0
Breathy	0	2	1	2	3
Vocal fold regularity	0	0	0	5	0
Glottal closure time	0	0	0	4	0

Table - 33

Showing post treatment of vocal polyp presentation in vocal assessment in

7 cases

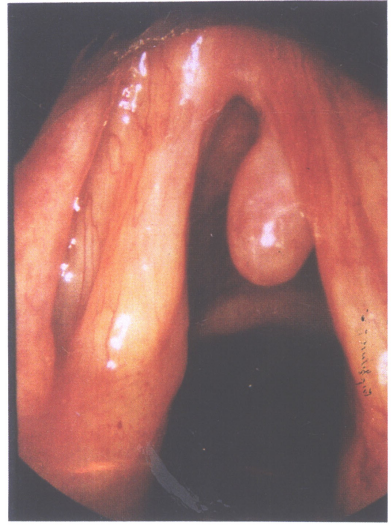
Vocal assessment	Extreme	Moderate	Mild	Normal	No. of Patients
Hoarse	0	1	1	5	2
Harsh	0	2	0	5	2
Breathy	1	0	1	5	2
Vocal fold regularity	1	0	1	5	2
Glottal closure time	0	0	0	7	0

Table - 34

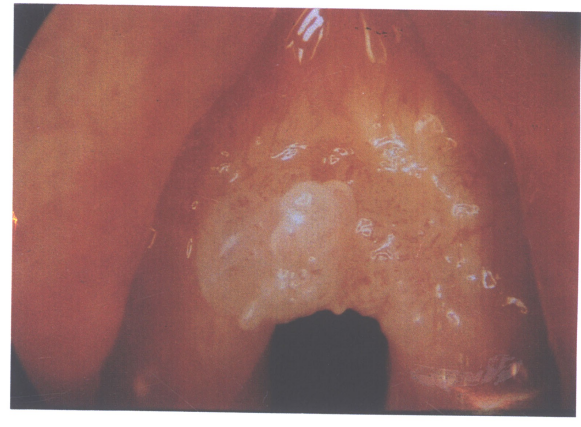
Showing investigation carried out in the present study

Sl.No.	Investigations
1.	Direct Laryngoscopy
2.	Biopsy
3.	Chest x-ray (PA)
4.	X-ray neck - lateral view
5.	Sputum AFB
6.	Barium swallow
7.	Oesophagoscopy
8.	Bronchoscopy
9.	Dr.Speech with Electroglottography

VOCAL CORD POLYP



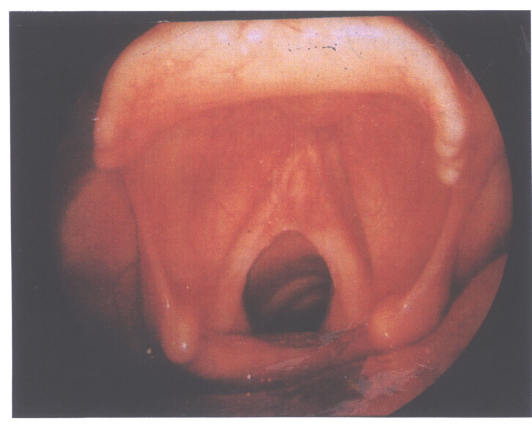
LARYNGEAL PAPILLOMATOSIS



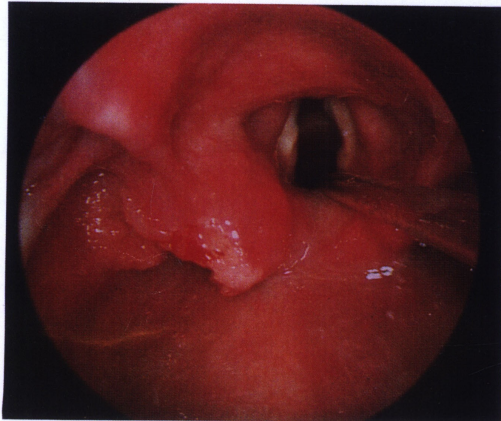
GROWTH VOCAL CORD



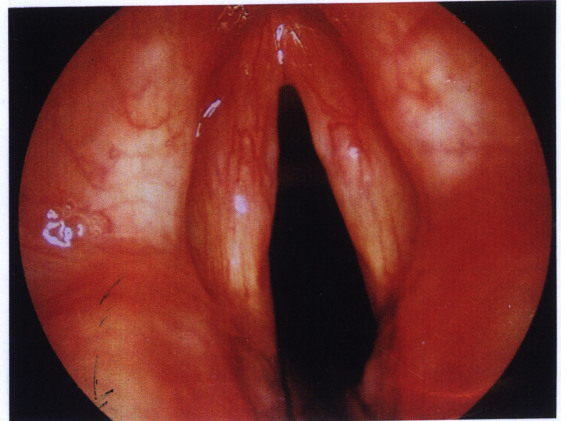
LARYNGEAL WEB



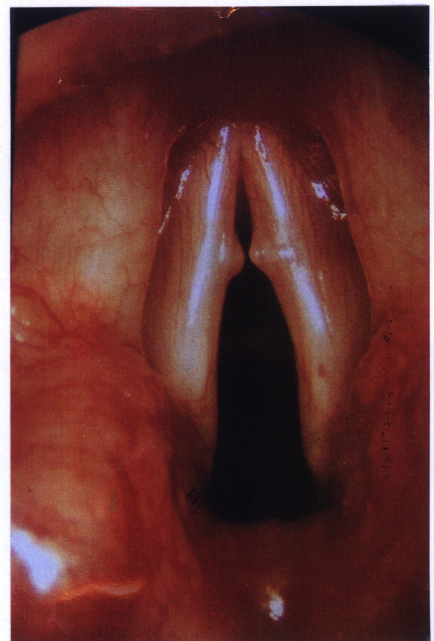
PYRIFORM FOSSA GROWTH



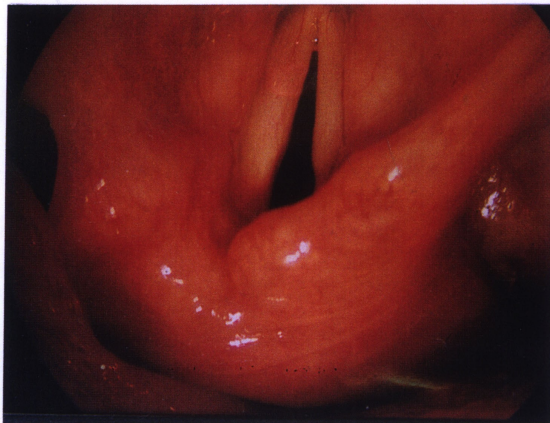
CHRONIC LARYNGITIS



VOCAL NODULE



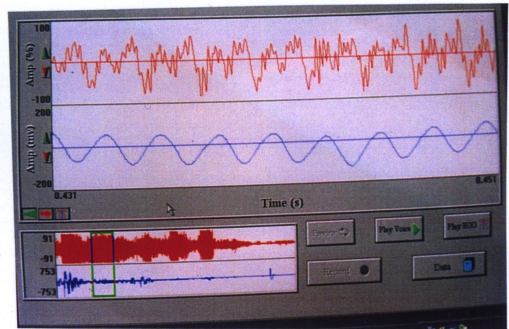
VOCAL CORD PARALYSIS



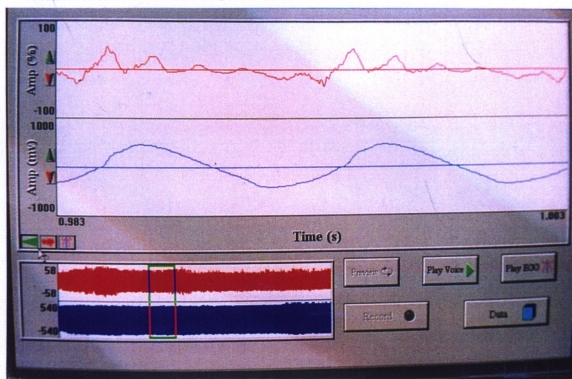
**DR. SPEECH AND ELECTROGLOTTOGRAPHY
ASSESSMENT SYSTEM**



VOCAL CORD - PAPILOMA



VOCAL CORD POLYP



VOCAL NODULE

