



A COMPARATIVE STUDY OF BENIGN VOCAL CORD MASS LESIONS USING VIDEOSTROSCOPY, VOICE ANALYSIS AND VOICE HANDICAP INDEX BEFORE AND AFTER MICROLARYNGEAL SURGERY

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ABSTRACT Vocal cords are delicate structure that helps a human being to Breath, speak and to sing. It is a micro structure and their functions are very accurate, even a small change in it by a lesion can produce enormous change in its function. Video Laryngo Stroboscopy is the process in which the normal and pathological vibrating pattern of vocal cord is made visible during phonation. Voice is analysed using Voice analyser and Voice Handicap Index (VHI).

AIM : The study is aimed at examining the objective and subjective parameters using Stroboscopy voice analysis and VHI of patients with Benign Vocal Cord Lesions before and after Microlaryngeal surgery.

METHOD : This study was conducted in the Department of Otorhinolaryngology of Government Stanley Medical College during December 2014 to September 2015. 38 patients with voice disorders were selected and sub categorized. Among 38 Patients 16 are presented as Vocal Nodule, 16 Presented as Cyst and 6 Presented as Vocal Polyp which includes both male and females.

RESULTS : Pre and Post operative assessment of patients with benign vocal cord mass lesions using stroboscopy, voice analyses and Voice Handicap index is a useful way to assess the degree of improvement following surgery. Both the patients and surgeon were provided with definitive evaluation with respect to the benefit following surgery and speech therapy.

KEYWORDS : . Video Laryngo Stroboscopy, Microlaryngeal surgery, Vocal Polyp, Voice Handicap Index (VHI)

INTRODUCTION

The voice is an integral part of the unique human ability to communicate by speech. The larynx is the major source of sound used during speaking. Phonation is the generation of sound by vibration of vocal cords. Benign vocal cord mass lesions such as polyps, nodules and cysts affect voice production. The objective measurement of the degree of pathology in the vocal folds is performed by using various parameters of videostroboscopic examination.

A comparison of pre operative and post operative changes in the vocal folds can show the degree of improvement. Videostroboscopic examination may also be combined with analysis of voice parameters to assess the improvement or worsening of voice after Micro Laryngeal surgery.

The present study aimed at examining the subjective and objective parameters using stroboscopic voice analysis and VHI Of patients undergoing Microlaryngeal Surgery for Benign Vocal Cord Mass Lesions.

AIM OF THE STUDY

A Comparative Study Of Benign Vocal Cord Mass Lesions Using Videostroboscopy, Voice Analysis And Voice Handicap Index Before And After Microlaryngeal Surgery.

OBJECTIVE OF THE STUDY

1. Comparing pre and post operative vocal cord vibratory changes in a patient with benign vocal cord lesions using stroboscopy.
2. Comparing pre and post operative voice changes in a patient with benign vocal cord mass lesions using voice analysis.
3. Assessing the subjective improvement of patient's voice using voice handicap index before and after Microlaryngeal Surgery.
4. To assess the predictive value of the tests.

MATERIALS AND METHODS

1. STUDY DESIGN

A prospective cohort study of 38 patients with benign vocal cord lesions, were included in the study presented to the Department of ENT and Head and Neck Surgery, Govt Stanley Medical College and Hospital, Multi Speciality Teaching Institute. Chennai -1

2. INCLUSION CRITERIA:

patients with Benign looking vocal cord lesion

Age above 12 years

On Rigid fiberoptic endoscopy / indirect laryngoscopic examination the vocal cords will be freely mobile.

3. EXCLUSION CRITERIA:

Patients with malignant looking lesions.

Patients suffering from Respiratory distress

Patient with coronary heart diseases.

Inability of patients to turn for follow up at six weeks.

4. METHODOLOGY:

Patients included in this study after fulfilling the inclusion and exclusion criteria defined in this study. After obtaining valid consent , each patient with benign vocal cord mass lesion underwent pre and post operative three procedures like, Video laryngoscopy, stroboscopy and voice analysis.

(A) VIDEOLARYNGOSCOPY:

Fiberoptic laryngoscopy demonstrating laryngeal pathology and provides an excellent view of the larynx, particularly suited for patients who are unco-operative for indirect laryngoscopy.

(B) STROSCOPY

Stroboscopy is a procedure which allows routine slow motion examination using a laryngeal stroboscope, a 70 degree Hopkins telescope. The output picture and sound was captured into a computer monitor using a capture card without compression and analyzed later.

The stroboscopy picture was analyzed to note:

- a. Symmetry (symmetry of movement and approximation of vocal cords)
- b. Mucosal wave (pattern of light traveling on the vocal cord)
- c. Glottis closure (completeness of glottic closure)

(C) VOICE HANDICAP INDEX

Voice handicap questionnaire have been designed for assessment of patients with voice disorders. Here questionnaire developed by "Jacobson et al" was used^[1].

. All patients administered the questionnaire and a measure called the voice handicap index was calculated. The measurer refers to the total sum obtained (minimum of '0' and maximum of '120') when the voice handicap score is administered.

(D) VOICE ANALYSIS

Each patient was taken to a sound proof room to record voice using a low impedance commercial microphone and asked to phonate in low and comfortable voices. Each of these vowel sounds were voiced for at least of 15 to 20 seconds for low and comfortable intensity. Speech is recorded in intensity comfortable for the patient.

Only a good quality continuous signal was selected and used for analysis. Speech sound was recorded by asking the patient to count numbers slowly and clearly. The recorded voices are stored in computer for analysis. Voice analysis was performed on PHONOLAB software version 03.02.08 ECLERIS.

“PHONOLAB” is an open source freeware developed specifically keeping in mind scientific analysis of the sound signals recorded in “wav” format. This software is freely available in internet (freeware). This is an opens source code; which means that the program can be altered to fit to individual necessity.

- The parameters that were observed on voice analysis were
- Fundamental frequency (vocal cord vibrating frequency)
 - Standard deviation of fundamental frequency.
 - Jitter (fundamental frequency variation)
 - Shimmer (one cycle to cycle amplitude variation)
 - Harmonics to noise ratio (amount of noise in voice)

(E) SURGERY

After the complete preoperative workup, under general anesthesia all patients underwent micro laryngeal surgery using a suspension laryngoscope. The surgeon was not the same for all the patients. In surgery, the lesions were completely excised to the satisfaction of the surgeon and an independent observer. Post operatively, patients were advised strict voice rest for a period of fourteen days. Advice regarding the usage of voice following surgery were given. Contact numbers of all patients were noted.

POST OPERATIVE REVIEW

All the operated patients were asked to come for review after 6 Weeks (42 days) following surgery. On review 1. Stroboscopy, 2. Voice analysis, 3. Voice handicap index questionnaire were done. The methodology used for each patient was similar to that used preoperatively.

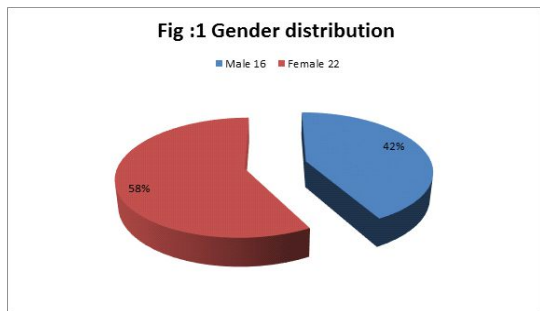
5. RESULTS AND ANALYSIS

5(A). AGE DISTRIBUTION:

In the group of 38 patients the mean age was 36.47. The youngest Patient was 13 years and eldest 62 years old.

5 (B). SEX DISTRIBUTION:

A total of 38 patients were enrolled in this study. Females were 22 compared and males were 16.



5(c). DURATION OF COMPLAINT:

Among the 38 patients; a mean duration was 12.44 months. The range of duration of complaint was 02 to 48 months.

ASSOCIATED HABITS AND HISTORY

6. VOICE DEMAND AND VOICE ABUSE

In the group of 38 patients, there was one professional voice (grade I) (n=1) user as preacher. On categorizing them according to the voice demands, there were professional voice users (grade II) (n=03) non professional voice users (grade III)(n=07) and non professional non voice users (grade IV) (n=27). Voice abuse is one of the leading known etiological factors for benign vocal cord lesions. In this study, we found that almost all patients with history of voice abuse.

7. SMOKING

Among the 38 patients 74 % were non smokers and 26 % were smokers. All the smokers were males.

8. STROBOSCOPIC PARAMETERS

Pre operative analysis

SYMMETRY

Almost All patients with vocal cord lesions had Asymmetry.

TABLE I. Pre-operative stroboscopic analysis (n=38)

	Present	Absent
Symmetry	0	38
Mucosal wave (right)	17	21
Mucosal wave (left)	9	29
Glottic closure	0	38

MUCOSAL WAVE

Right and left patterns were analyzed separately.

MUCOSAL WAVE (RIGHT)

Nearly 21 (55.26 %) of patients were found with absent mucosal wave on right vocal cord.

MUCOSAL WAVE (LEFT)

Among 38 patients 29 (76.31 %) of patients showed absence mucosal wave on the left.

GLOTTAL CLOSURE

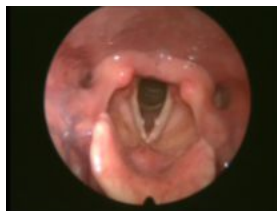
In complete closure of the glottal chink were noted in all the patients.

Table II. Analysis of Glottic closure (vocal nodule)

	Complete	Hourglass	Irregular	Posterior chink
Present	0	14(95%)	0	2(5%)
Absent	16(100%)	2(5%)	0	14(95%)

VOCAL CORD LESIONS FOR SIDE AND SITE

Among 38 patients right cord involved in 28.9 % and 31.6 % lesions on both vocal cords. Left side involvement was in 39.5 %. Glottic closure pattern were different according to the size of polyps. Majority were hour glass type of closure.



Vocal nodule



Rt vocal polyp

POSITION OF LESION

The majority (39.5%) of patients had left cord lesions at the junction of anterior and middle third of cord (42.10 %) and they were more frequent than the anterior third lesions (15.78 %)

TYPES OF LESIONS

16 patients had vocal nodules and cysts they were equal in number (42.1%). 6 patients had Vocal polyp (15.8%).



Pre-op Left vocal cord cyst



post-op picture

9. POST OPERATIVE ANALYSIS:

SYMMETRY:

Post operative glottic symmetry has risen from 0 to 100 in patients.

MUCOSAL WAVE RIGHT:

The Mucosal wave right pattern considerably increased from 55 % to 95 %.

MUCOSAL WAVE LEFT

The Mucosal wave on the left vocal cord increased from 76 % to 96 %.

GLOTTAL CLOSURE

Remarkable improvement in complete glottal closure was noted post operatively which showed an increase to 96%.

ADDITIONAL FINDINGS

Post operatively, the prevalence of additional findings was clearly seen, LPR showed almost decreased.

10. ACOUSTIC ANALYSIS

Fundamental Frequency:-

Among 38 Patients the mean fundamental frequency recorded for comfortable voice is 197.1. While the speech frequency is ranging from 128.3 to 254.2.

STANDARD DEVIATION OF PITCH

Pre-OP mean value is 28.3 and Post-Op Mean Value is 18.7 for this parameter. Post Operative value shows significant improvement.

JITTER

Pre Operative Mean Value of jitter is 1.91 and Post Operative mean is 1.30. Post operative analysis of data's revealed a trend toward improvement.

SHIMMER

The mean of this parameter Pre Operatively is 7.9 and Post Operatively is 4.5. There is an improvement in Shimmer when compared to pre operative parameter.

HARMONIC NOISE RATIO (HNR)

Mean of this parameter pre operatively 0.0104 and Post Operatively 0.119. Post Operative data analysis showed improvement in Harmonic Noise Ratio with Significant p Value.

MAXIMUM PHONATION TIME

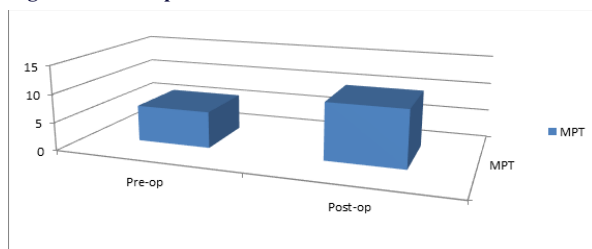
The Mean of this parameter Pre Operatively 6.45 and Post-Operatively 10.05.

Table.III

Maximum phonation time				
		Mean	S.D	P-Value
MPT	Pre-op	6.447	2.617	0.0005
	Post-op	10.053	2.026	

Postoperatively the maximum phonation time showed an increase with statistically significant p value (p=0.0005)

Fig 2.. Maximum phonation time



VOICE HANDICAP INDEX (VHI)

The Mean of this parameter preoperatively is 23.7 and post operatively is 6.9.

Analysis was done by using RATHER PAIRED T test with statistically significant p-value (p=0.0005) which shows overall improvement in VHI Scores when compared pre-operative values.

SUB GROUP ANALYSIS

Male and Female

Females preponderance seen more when compared to male (M=16: F=22). Both showed better improvement in voice after surgical treatment.

SMOKERS Vs NON SMOKERS

In this study there are 10 smokers out of 38 Patients and all smokers are

Males. Smokers show higher VHI value than Non Smokers. Post Operative Analysis Shows improvement in emotional component and Total score of VHI in Smokers. Non Smokers shows satisfactory improvement in all the components of VHI with statistically significant p value.

DISCUSSION

Vocal cord benign lesions like vocal nodules, polyps and cysts alter the vocal fold vibratory function causing voice disorders. Micro laryngeal surgery is indicated for lesions not responsive to voice therapy / medical therapy. Goals of treatment are complete excision of lesions and thereby restoring the better vocal cord function. Pre and post operative assessment will help to evaluate the quality of the treatment and documentation of the lesions by video stroboscopy and by voice analyzer helps the surgeon to fine tune his skills.

In our study three parameters evaluated namely videostroboscopy, voice analysis, VHI scores in 38 patients with benign lesions before micro laryngeal surgery and 6 weeks (42 Days) after surgery. There were 16 males (42%) and 22 female (58%) indicating female predominance^[2,3,4,5,6,7,8].

Smoking noted in 10 male patients (26%) which plays an important role in producing erythema, oedema and inflammation of the vocal cord framework. Rest of 6 Males and all females are non smokers. Vocal Cyst and nodule were the most common benign lesion. The vocal fold vibratory function was assessed by the stroboscopic parameters, glottic closure configuration whether complete or incomplete, integrity of mucosal wave (whether normal or abnormal). The vocal fold lesions prevent a complete glottic closure. The entire patient had an incomplete glottic closure (100%). Excision of the lesion resulted in complete glottic closure in 95% patients. Complete glottic closure results in greater vocal fold contact because of a smooth edge, with generation of a greater subglottic pressure and better amplitude of cord vibration. The resulting equality of vocal fold mass and regular oscillation of each fold produces an improved voice. The mucosal wave was absent on the right in 21 while on the left it was absent in 29. Post operatively on the right cord it increased to 95 % and on the left it was to 96 %. The absence or dampening of the mucosal waves is due to the extensive involvement of the subepithelium and the superficial layer of lamina propria in vocal polyps and cyst^[2].

. After phonosurgery restoration of mucosal vibratory function would result in a good voice^[3].

Looking at individual pathologies nodule and cysts (n=16) were the majority of lesions. The stroboscopic assessment of closure pattern showed 100 % incomplete closure. Types of closure seen were Hourglass (n=14) (95%) and Posterior Chink (n=2)(5%).

The VHI data represent the patient's perception of the problem in daily life in relation to the patient's emotional, functional and physical activities. VHI also can be used to evaluating the effectiveness of specific voice treatment techniques. In this study the mean pre-operative score is 52.5 which is decreased to 21.09 post operatively with statistically significant p value. Behrman et al^[9] retrospective study suggested that the amount of voice demand in relation to patient's life style and working status influence VHI score. Routine voice users had significantly lower VHI scores than those with the high vocal demands. Overall the VHI scores were low in benign mucosal lesion tend to result in milder voice disorder compared to neurological disorder.^[11]

The acoustic analysis was done using PHONOLAB programme created analysis of a sustained tone reveals fundamental frequency (Fo), the average pitch measured in hertz (Hz). The normal fundamental frequency for males is 100-150 Hz and that for female is 190- 250 Hz. Low fundamental frequency noted in voices associated with chronic vocal abuse, misuse or vocal mass lesion.

In this study the pre operative fundamental frequency for male was 153.6 Hz and females was 214.7 Hz. In the post operative status fundamental frequency for males was 163.5 Hz and females was 218.2 Hz, which shows significant improvement postoperatively. The Periodicity of the Vocal Cord Vibration which correlates with the Frequency perturbation or jittering the pre operative status (1.91) was greater than post operatively (1.30). Shimmer Pre operatively (7.9) and post operatively (4.5) which show reduction implies that it was improved.

CONCLUSION

Vocal cords are very delicate and intricate structure that helps a human being to Breath, Speak as well as to sings. It is a micro structure and their functions are very accurate, even a small change in it by a lesion can produce enormous change in its function (Voice and Singing).

Hence a PHONOSURGEON to give a Near-perfect voice for professional and non professional voice users with lesions in vocal cord must use Video Stroboscopy with voice analyser.

ADVANTAGES OF VIDEO STROBOSCOPE VS CONVENTIONAL VIDEO ENDOSCOPE

1. It gives predictive value to surgical treatment of vocal fold lesion like Cysts, Nodule, and Polyp.
2. Pre Operative precise assessment of the alteration in the structure and function of vocal cord lesions.
3. Planning of Surgical techniques according to the lesions.
4. Post operative review and assessment of return back of structure and functions.
5. Documentaion of the lesions pre and post operatively by video stroboscopy helps the surgeon to fine tune his skills.
6. Documentation helps the phonosurgeon in legal aspects especially while operating professional voice users.

With the above mentioned advantage a phonosurgeon can use video stroboscopy with voice analyzer and voice handicap index as a tool to give best anatomical and functional results.

In conclusion pre and post operative assessment of patients with benign vocal cord mass lesions by stroboscopy, acoustic analysis and Voice Handicap Index is a useful way to assess the degree of improvement following surgery.

Both subjective and objective parameters are assessed. Both patients and surgeons provided with a definitive evaluation with respect to the benefit following surgery and speech therapy.

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