

**ORIGINAL RESEARCH**

# Outcome analysis of microlaryngeal surgery for benign vocal fold lesions with special reference to videostroboscopy

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**ABSTRACT**

Benign vocal fold lesions are common causes of change in voice which are often needed surgical correction. They include lesions like vocal polyps, vocal fold nodules, vocal fold cysts and Reinke's edema. An observational cross-sectional study of 100 patients was conducted at Medical college and Hospital, Kolkata between January 2019 to June 2020. The purpose of the study was to evaluate outcome of micro laryngeal surgery for benign lesions of vocal fold using Videostroboscopy. All cases between the age group of 10 -65 years with clinical evidence of benign lesions of vocal fold were included in study. Using Videostroboscopy all the parameters like mucosal wave, amplitude, glottic closure, symmetry and periodicity were assessed both preoperatively and postoperatively at 6 weeks for the outcome of microlaryngeal surgery. At the end of the study data was compiled systematically and analysed using paired 't' test and Chi square test. Overall our study observed statistically significant improvement of all the parameters and also to that conclude microlaryngeal surgery as an effective way for improvement in speech parameters that can be assessed by videostroboscopy.

**Keywords:** Benign lesions, Videostroboscopy, Micro-laryngeal surgery.

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**INTRODUCTION**

The voice is an integral part of the unique human ability to communicate by speech. In the field of laryngology, it is important to discuss the clinical examination and disease findings in a precise and meaningful manner. More than half of the patients presenting with change in voice have benign vocal fold lesions. Voice disorders present in a wide spectrum of patients, across all ages, genders and social status. The causes are often multifactorial and cannot always be fully described in anatomical or functional terms. At present, nondescriptive levels such as vocal fold "nodule" or "masses" can be confusing to doctors and patients alike.[1] This introduces confusion when counseling patients, promotes inconsistent treatment approaches among physicians, and limits research.[2] With regards to vocal folds the lesions includes vocal fold polyps, reinke's edema, vocal fold nodule, vocal fold cysts,

vocal process granulomas, keratosis of vocal folds, post-intubation granulomas etc. Moreover pulmonary, endocrine, neurological, medical, gastrointestinal and psychological factors can affect the voice.

Videostroboscopy is a lighting technique used to examine vocal fold vibration patterns and the relationship between the vocal fold body and cover. The principle of using flashing lights for examination of rapidly moving but quasiperiodic oscillation using the stroboscopy principle has been well known for over a century.

The flashes of light from strobe are synchronized to the vocal fold vibration at a slightly slower speed. The strobe frequency must be less than the fundamental frequency in order to sample successive phases of the cycle. There are few indications of this procedures: It gives predictive value to surgical treatment of vocal fold lesions like polyp, nodule and cyst, preinterventional assessment of the alteration in the

structure and function of the vocal fold lesions, planning of surgical techniques according to the lesions, documentation of the lesions pre and post interventionally by videostroboscopy helps the surgeon to fine tune his skills and the helps the phono surgeon in legal aspects especially while operating on professional voice users. The effectiveness of the examination may be limited by anxiety and discomfort. Bleeding disorders and anticoagulation are relative contraindications because the passage of the scope through the nasal cavity may cause mucosal damage and epistaxis; however, in clinical practice, bleeding is rare and tends to be self-limiting.

Different parameters of videostroboscopy are configuration, symmetry, regularity, glottis closure, amplitude of vibration, mucosal wave propagation, phase of vibration, edge, vertical plane, non-vibrating portion, supraglottic activity

My present study is aimed at examining the subjective and objective parameters using stroboscopic voice analysis of patients presenting with change in voice both pre and post interventional for benign vocal fold mass lesions.

## MATERIALS AND METHODS

This observational based cross-sectional study was conducted in the department of Otorhinolaryngology and Head-Neck surgery in Medical College and Hospital, Kolkata, West Bengal, India, during January 2019 to June 2020. The 100 patients of adult population (10 to 65 years) suffering from change in voice were included in this study.

Pediatric (age < 10 years) and adult (age > 65 years) patients, comorbidities like diabetes, hypertension, immunocompromization, neoplastic lesions, speech defect due to central nervous system pathology, congenital disorders, puberty related voice change were excluded from the study.

Selected patients were prepared for surgery. A further, detailed history on admission was obtained which included their socio-demographic data. With the help of videostroboscopy patients were evaluated before and after the treatment either in the form of conservative or surgical. After the complete pre-operative workup, under general anesthesia selected patients underwent micro laryngeal surgery using a suspension laryngoscope. 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 two weeks. Advice regarding the usage of voice and the do's and don'ts following surgery were given. All the operated patients were asked to come for review after 6 weeks (42 days) following surgery with videostroboscopy report.

### Study techniques

Patients included in this study after fulfilling the inclusion and exclusion criteria defined in this study and after getting valid consent. Each patient with

benign lesion underwent pre and post-operative procedures like Videostroboscopy.

Videostroboscopy demonstrating laryngeal pathology and provides an excellent view of the larynx, particularly suited for patients who are uncooperative for indirect laryngoscopy.

### Procedure

The patient sat on a chair and must facing the examiner. Before starting this procedure each patient was sprayed with 10% lignocaine applied at oropharyngeal mucosa. Then a 10 mm rigid endoscope was passed per orally under direct control and vision.

The visualized areas were the oropharynx and the larynx. The larynx examined in detail regarding the size, shape of vocal fold lesion, presence of hemorrhage and pedunculated or sessile lesion. The contralateral vocal fold was assessed with mobility of the fold.

Stroboscopy is a procedure which allows routine slow motion examination using a laryngeal stroboscope, a 70 degree Hopkins telescope. The procedure was explained to the patient in detail regarding the need to keep the mouth open and avoid swallowing during the test. After few minutes of giving local anesthetic spray, the patient was asked to open the mouth wide and protrude the tongue; tongue being held by the examiner with a gauge piece. The telescope was introduced into the oropharynx to visualize the glottis and the patient was asked to phonate long "eee" to see the folds in motion. While the patient was phonating the stroboscopy pedal was pressed so as to produce pulsed light in accordance to the patient's fundamental frequency. The output picture and sound was captured into a computer monitor using a capture card without compression and analyzed later.

### Statistical analysis plan

Data was analyzed manually and evaluated thereafter at the end of the study by SPSS (Statistical Package for Social Science) software version 20.0 in terms of standard statistical expressions like percentages, proportions and correlation coefficient.

- Continuous data was summarized in terms of MEAN  $\pm$  SD. The difference in means was analyzed using paired 't' test.
- Count data was summarized in terms of proportions. Difference in proportion would be analyzed using Chi square test.
- The level of significance was kept 95% for all statistical analysis.

Each patient underwent fiber optic laryngoscopy followed by videostroboscopy preoperatively.

All patients underwent microlyryngoscopic excision of benign vocal fold lesion with biopsy under general anesthesia in the conventional manner. All the patients advised speech therapy and use of vocal hygiene in post-operative period.

At sixth week of following surgery, these patients were evaluated by videostroboscopy and all the findings were noted.

**Ethics:** The study was conducted after approval of Ethics Committee of Medical College and Hospital, Kolkata.

**Resource:** Infrastructure: The available hospital resources of operating room as well as OPD facilities and the laboratory rooms were used.

### RESULT ANALYSIS

The present study consisted of 44 men and 56 women patients of change in voice who attended the Department of Otorhinolaryngology at Medical College Kolkata, aged between 10 years and 65 years (mean age 35.45 years) (table 1) who fulfilled the inclusion criteria. The study was conducted between January 2019 and June 2020. The chief presenting complaints included change in voice with a mean of 14.29 months (4 to 32 months).

### RESULT

**Table 1: Age wise distribution of the patients:**

Age	Number of patients
11-20	6
21-30	18
31-40	52
41-50	21
51-65	3
<b>Total</b>	<b>100</b>

**Table 2: Distribution among Voice Abusers**

Occupation	Voice abuse (n=68)
Student	21
Teacher	12
Child Care Giver	9
Singer	8
Vendor	8
Preacher	5
House Maidservant	4

**Table 3: Site/Position of Lesion**

Position of Lesion	Percentage
Anterior 1/3 <sup>rd</sup>	7%
Middle 1/3 <sup>rd</sup>	20%
Junction of Anterior and Middle 1/3 <sup>rd</sup>	61%
Whole Length	12%
<b>Total</b>	<b>100%</b>

### PRE-INTERVENTIONAL AND POST-INTERVENTIONAL ANALYSIS OF STROBOSCOPIC PARAMETERS

#### Symmetry

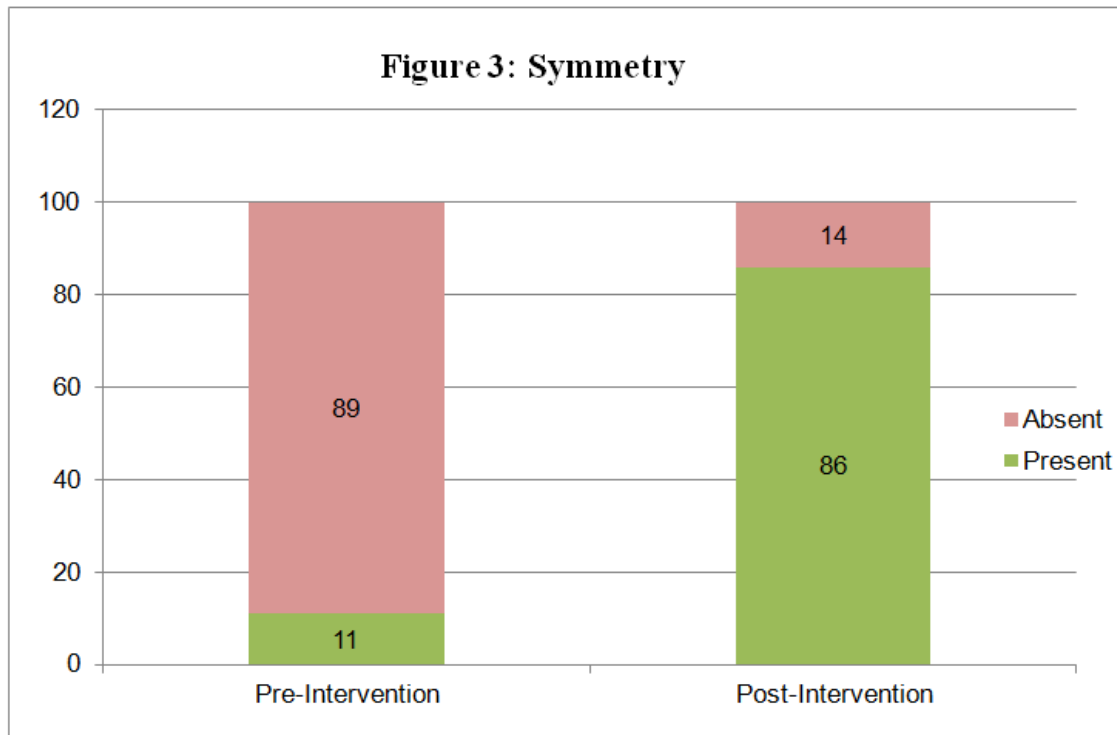
Of the 100 patients studied, 89% (89 patients) had asymmetry of the vocal fold and only 11% (11 patients) had symmetrical vocal fold preinterventionally. Post-interventionally 84% (75 patients) had restored the symmetry of the vocal fold and 16% (14 patients) did not regain their symmetry at the 6<sup>th</sup> week of follow-up.

Out of 100 patients, 37% were smokers (81% men and 19% women) and 63% non-smokers. As vocal abuse is one of the leading known etiological factors for benign vocal fold lesions; in this study, out of 100 patients, 68% had history of voice abuse majority of being students and teachers (table 2).

Out of 100 patients, 43% had bilateral lesions, 34% had left sided lesion and 23% had right sided lesion (figure 1) with the majority of them had lesions at the junction of anterior and middle 3<sup>rd</sup> of the fold (61%) and middle 3<sup>rd</sup> lesions (20%) were more frequent than the anterior 3<sup>rd</sup> lesions (7%) (Table 3).

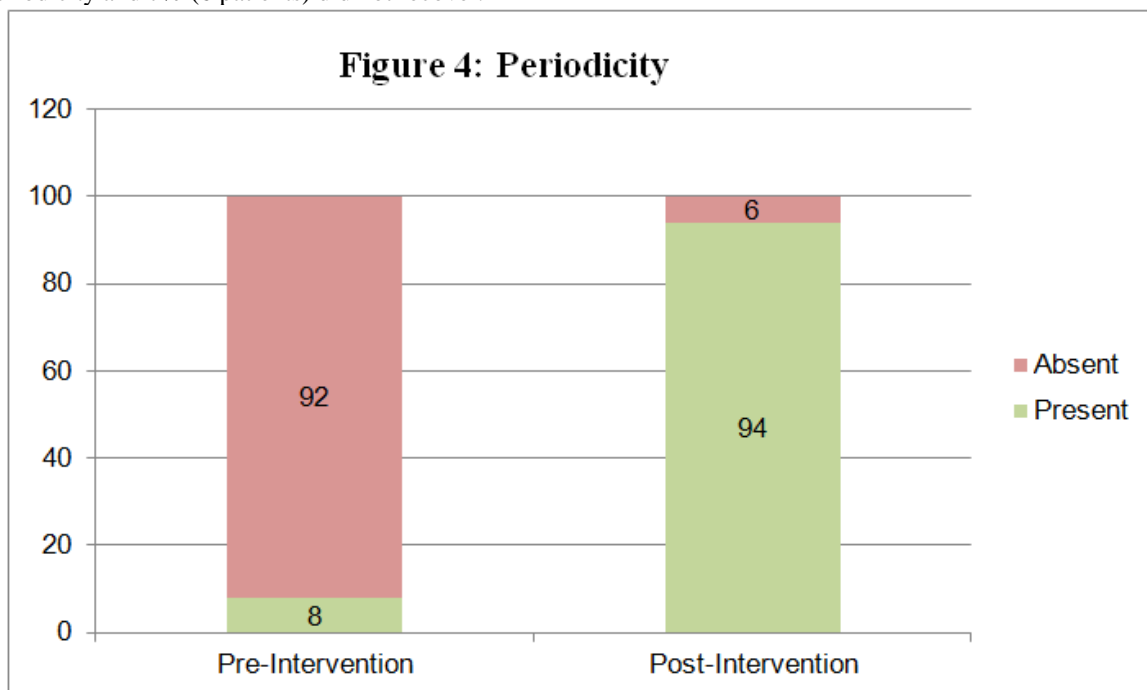
Fiber-optic laryngoscopic and videostroboscopic finding showed that, out of 100 patients, 41% had Vocal polyp, 30% had Vocal nodules, 16% had Vocal cysts and 13% had Reinke's edema (figure 2).

The patients were evaluated both under Fiberoptic laryngoscopy and Videostroboscopy pre-interventionally and post-interventionally at 6 week.



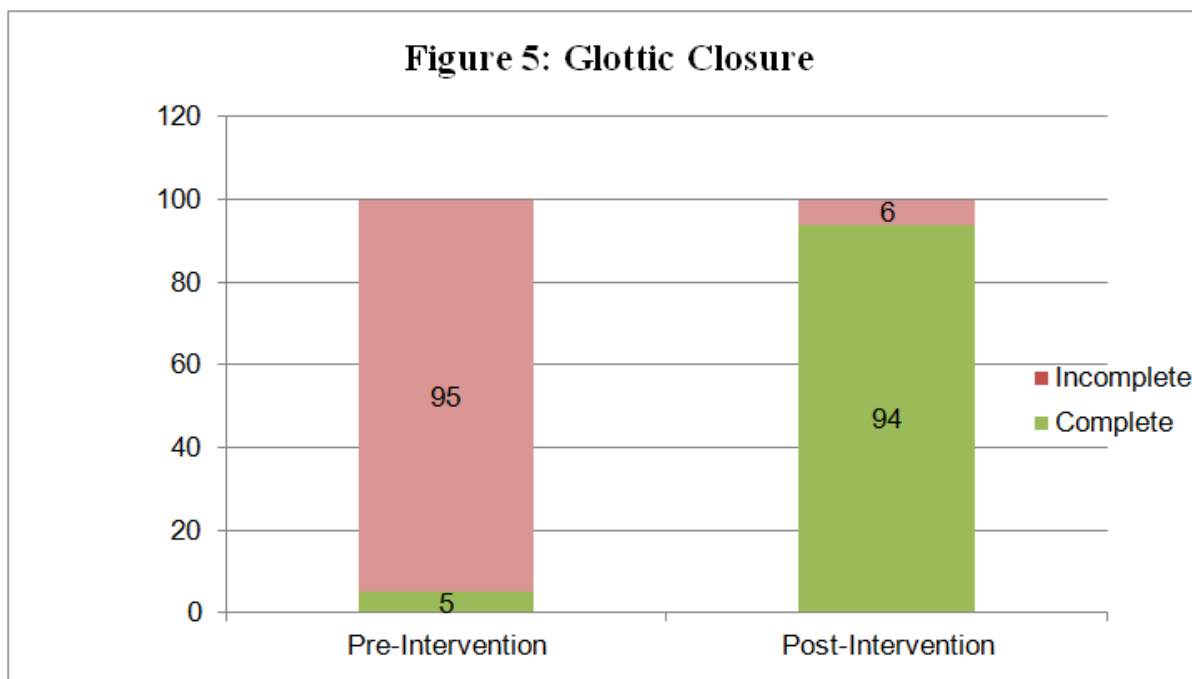
**Periodicity**

Of the 100 patients studied, pre-interventionally 92% (92 patients) had lost their periodicity of the fold and only 8% (8 patients) had periodicity. Postinterventionally at 6<sup>th</sup> week of follow up 93% (86 patients) regained their periodicity and 7% (6 patients) did not recover.



**Glottic Closure**

Among 100 patients studied, pre-interventionally 5% (5 patients) had complete closure and 95% (95 patients) had incomplete closure. Postinterventionally at 6<sup>th</sup> week of follow up 94% (89 patients) had complete glottic closure and 6% (6 patients) had incomplete glottic closure.



**Table 4: Variants of glottic closure (Vocal Nodule)**

	Complete	Hourglass	Posterior chink
<b>Present</b>	0	26(86.7%)	4(13.3%)
<b>Absent</b>	30(100%)	4(13.3%)	26(86.7%)

**Mucosal Wave**

Right and left mucosal wave pattern were analyzed both pre-intervention and post-interventionally at 6<sup>th</sup> week of follow up.

**Mucosal Wave (Right)**

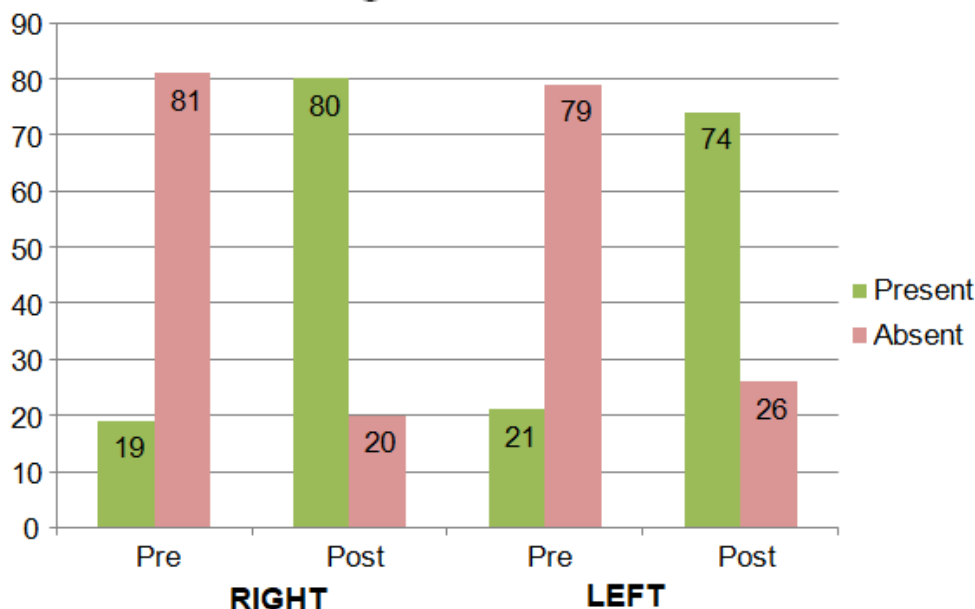
Out of 100 patients, pre-interventionally mucosal wave on right side of vocal fold was absent in 81% (81 patients) and present in about 19% (19 patients) of patients. Post-interventionally at 6<sup>th</sup> week, 75% (61

patients) recovered and 25% (20 patients) did not recover.

**Mucosal Wave (Left)**

Among 100 patients, pre-interventionally mucosal wave on left side of fold was absent in 79% (79 patients) and present in about 21% (21 patients) of patients. Post-interventionally at 6<sup>th</sup> week, 67% (53 patients) recovered and 33% (26 patients) did not recover.

**Figure 6: Mucosal Wave**



**Table 5: Pre-interventional stroboscopic analysis (n=100)**

Category	Present	Absent
Symmetry	11	89
Periodicity	8	92
Mucosal Wave (Right)	19	81
Mucosal Wave (Left)	21	79
Glottic Closure	5	95

**Table 6: Post-interventional stroboscopic analysis (n=100)**

Category	Present	Absent
Symmetry	86	14
Mucosal Wave (Right)	80	20
Periodicity	94	6
Mucosal Wave (Left)	74	26
Glottic Closure	94	6

**Table 7: Statistical Chi-square test and p-value of stroboscopic parameters**

Observation	Category	Preinterventional	Post interventional	X <sup>2</sup>	p-value
Symmetry	Present	11	86	112.6013	<0.00001
	Absent	89	14		
Periodicity	Present	8	94	147.9792	<0.00001
	Absent	92	6		
Mucosal Wave(Right)	Present	19	80	74.4274	<0.00001
	Absent	81	20		
Mucosal Wave(Left)	Present	21	74	56.3208	<0.00001
	Absent	79	26		
Glottic Closure	Present	5	94	158.4358	<0.00001
	Absent	95	6		

**Table 8: Management (n=100)**

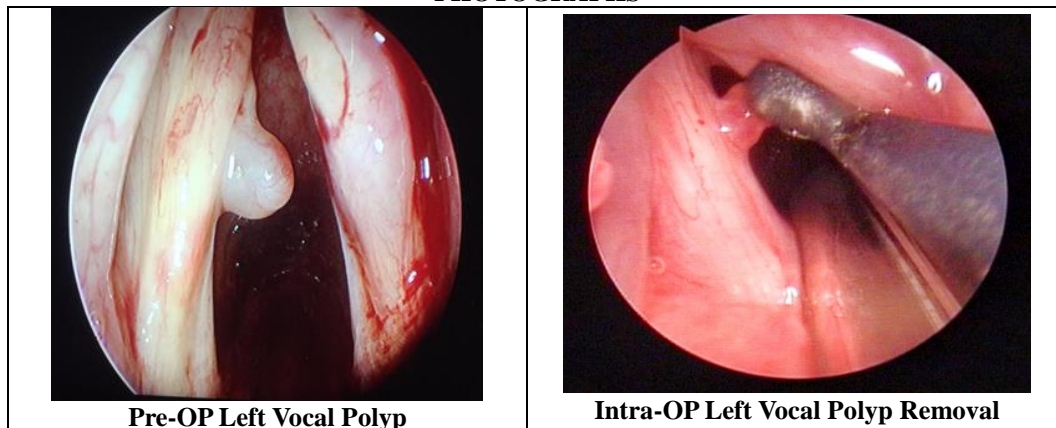
Conservative	Surgery
26	74

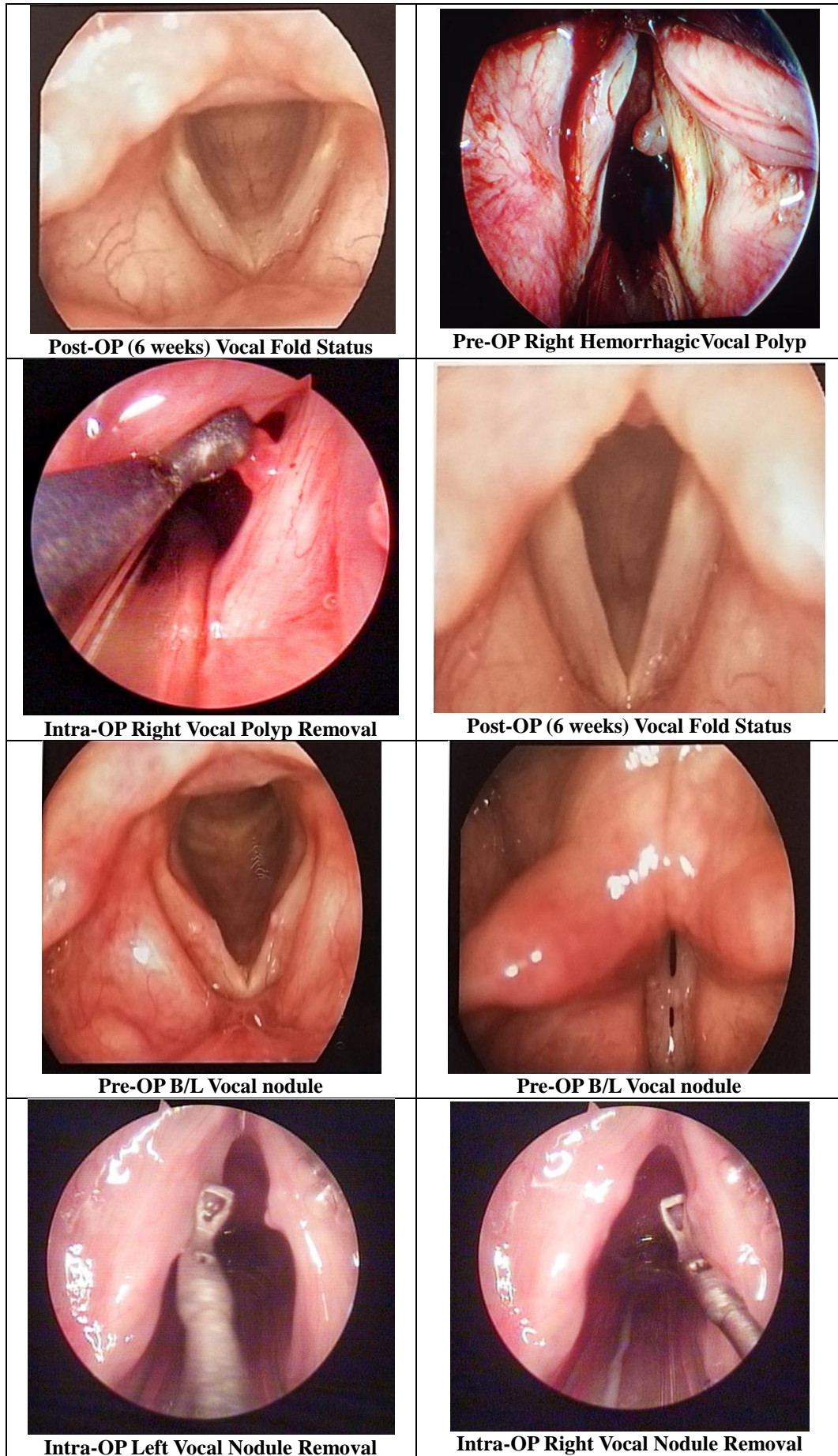
Of the 100 patients, (age range 10-65 years; mean age of 35.45 years) included in the study, 57 patients had a unilateral lesion (34 on the left fold and 23 on the right) and 43 patients had bilateral lesions. The benign lesions observed were vocal polyps, nodules, cysts and Reinke’s edema.

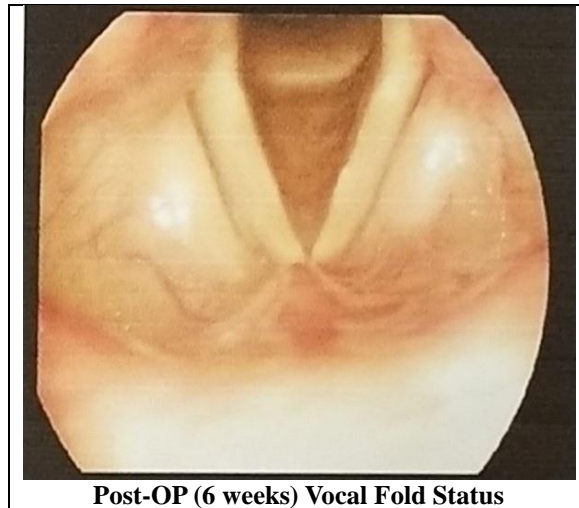
On videostroboscopic analysis the parameters were summarized in the table 5, table 6 and table 7 both

pre-interventional and post-interventional at 6<sup>th</sup> week of follow up. All the parameters (symmetry, periodicity mucosal wave and glottic closure) were found statistically significant (p<0.00001). Among 100 patients, 74 patients underwent Micro-laryngeal surgery (MLS) and rests 26 were responded well to conservative (speech therapy) treatment (table 8).

**PHOTOGRAPHS**







**Post-OP (6 weeks) Vocal Fold Status**

## DISCUSSION

Benign vocal fold lesions like vocal nodules, polyps and cysts cause significant change in voice as they disrupt normal vocal fold vibratory function. In my present study out of 100 patients, who underwent stroboscopic analysis 16 patients were found to be a case of vocal fold cysts that were missed on routine clinical examination. Bouchayer et al [3] in a study of 157 subjects, 16 (10%) were found to be cases of sulcus vocalis, mucosal bridges and vocal cysts which are likely to be missed in routine clinical examination. Hence the role of stroboscopy played a key to differentiate these lesions.

In this study, the videostroboscopic parameters were evaluated in 100 patients with benign vocal fold lesions before intervention and they followed up at 6<sup>th</sup> week post-intervention. There were 56 female patients and 44 male patients indicating female preponderance[4]

Smoking noted in 37 patients, majority were males (81%), which played an important role in producing erythema, edema and inflammation of the vocal fold framework.

Vocal abuse is one of the leading known etiological factors for benign vocal fold lesions. In this study, out of 100 patients, 68% had history of voice abuse majority of being students and teachers. A comparative histopathological study by Miland and Effat [5] and a study by Branski et al [6] showed that benign lesions were associated with smoking and vocal abuse.

The vocal fold vibratory function was assessed by stroboscopic parameters, symmetry (whether present or absent), periodicity (whether present or absent), glottic closure configuration whether complete or incomplete and integrity of mucosal wave (whether present or absent). Any vocal fold lesions prevent a complete glottic closure. Woo et al [7] in their study of benign lesions of vocal fold, observed that the vocal fold edge, glottal configuration, vibratory amplitude and mucosal wave are the key factors observed during stroboscopy that affect quality of the voice. 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 fold vibration.[8]

After proper assessment of all 100 patients, it was observed that 89 patients (89%) with asymmetrical vocal fold showed significant improvement ( $p < 0.00001$ ) at the 6<sup>th</sup> week of follow up post-interventionally. Courey et al [9] in his study on 17 patients of benign vocal fold lesion after treatment showed statistically significant improvement in symmetry.

Of 100 patients, 92 patients (92%) had aperiodicity of vocal fold showed a statistically significant ( $p < 0.00001$ ) improvement with 86 patients (93%) showed a periodic movement of the vocal fold at 6<sup>th</sup> week of follow up.

Among all the 100 patients, the right and left mucosal wave were observed separately. Pre-interventionally, 81 patients (81%) with absent right mucosal wave showed a statistically significant ( $p < 0.00001$ ) improvement with 61 patients (75%) at 6<sup>th</sup> week of follow up and also the left mucosal wave which was absent in 79 patients (79%) showed a statistically significant ( $p < 0.00001$ ) improvement with 53 patients (67%) at 6<sup>th</sup> week of follow up. The absence or dampening of the mucosal waves is due to extensive involvement of the sub epithelium and superficial layer of lamina propria in vocal fold polyps and cysts.[10] After phonosurgery restoration of mucosal vibratory function result in a better voice.

Pre-interventionally out of 100 patients, only 5 patients (5%) showed a complete glottic closure whereas 95 patients (95%) showed incomplete glottic closure. Post-interventionally at 6<sup>th</sup> week of follow up, the glottic closure showed a statistically significant ( $p < 0.00001$ ) improvement with 89 patients (94%) showed complete glottic closure.

Removal of such benign lesions, restoring the vibratory function and optimizing the voice are the goals in the treatment of benign vocal fold lesions.[8] Out of 100 patients, 30 patients of vocal nodules and 13 patients of Reinke's edema were advised speech therapy for a period of 6 weeks and then followed up.



It was observed that 24 out of 30 patients of vocal nodules and 2 out of 13 patients of Reinke's edema were responded well and rests planned for microlaryngeal surgery. In a study of Sataloff [11] it is well documented that voice therapy can lead to resolution of symptoms in 90% of cases; however complete resolution of pathology may not occur in all patients. Lesions not responsive to voice therapy and/or medical therapy have to be excised surgically. Pre-operative and post-operative assessment will help to evaluate the quality of treatment and documentation of the lesions by videostroboscopy.[7]

### CONCLUSION

Our study conclude that microlaryngeal surgery is an effective way to provide speech improvement in patients with benign vocal fold lesions, that can be assessed using videostroboscopy which will allow video perceptual analysis to investigate the success of behavioral, pharmacological and surgical treatment of benign vocal fold lesions.

Conflict of interest: All the authors declare that they have no conflict of interest.

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