Demographic and Videostroboscopic Assessment of Vocal Pathologies

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Abstract Successful treatment of bilateral vocal fold lesions depends on the accuracy of the diagnosis. The application of stroboscopy to the study of vocal fold vibration has led to dramatic advances in the understanding of vocal fold physiology. Laryngeal stroboscopy is the state of the art diagnostic tool and this technique provides valuable information about the nature of the vibration and a visual image that can be used both for immediate analysis and as a permanent record for comparison of repeated examination at a later date. In this study we are presenting demographic analysis and videostroboscopic assessment in 112 cases of different vocal pathologies. Stroboscopic parameters like glottic closure, amplitude, vocal fold edge, symmetry, periodicity and mucosal wave pattern were studied and statistically significant relationship with different vocal pathologies were obtained.

Keywords Larynx · Vocal pathology · Stroboscopy · Parameters

Introduction

In the modern laryngological practice, videostroboscopy is an essential diagnostic procedure for the detection of vocal pathology. Historically, stroboscopy is not new. Vocal tract

imaging using a continuous light source was first reported by Manuel Garcia (1855) [1, 2]. In 1895, internist Oertel used a stroboscopic light source with a laryngeal mirror to investigate voice production [3]. However, his technique has few problems, such as the limitations of illumination, precise control of the flashing frequency, poor image quality, and patient discomfort. Recent technologic developments have changed the status of the stroboscope and have significantly increased our knowledge of the physiology of the vocal cords. Videostroboscopy is most useful in identifying laryngeal pathologies of the vocal fold cover. Hirano et al. [4] has defined some characteristics of stroboscopy that can be evaluated for quantification of the stroboscopic examination, but definitions of visual parameters remain subjective [4].

Aim and Objectives

The present study has following aims and objectives:

1. Use of videostroboscopy in the voice evaluation process and to find out the underlying cause of the voice disorder.
2. To study the basic stroboscopic parameters of the vocal fold in various pathologies.
3. To study the distribution of vocal pathologies in different age and sex group.

Materials and Methods

The study was carried out in 112 cases with complaints of change in voice and hoarseness in the Department of ENT, Pt J N M Medical College and Dr B R A M Hospital, Raipur (CG) from August 2007 to October 2009.

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Stroboscopic examination was carried out after history, routine ENT examination and indirect laryngoscopic examination. Stroboscopic examination was performed by using a 70 degree rigid endoscope connected to Karl Storz strobe unit. The patient is asked to voice the sound/i/. The vocal images seen on the screen was recorded. Further evaluation was done on the basis of the recordings.

Evaluation of Recordings

Three otolaryngologists served as raters. Each rater independently evaluated recordings with no audio playback using standard rating forms to record his or her responses. All cases were rated by three judges and subjective analysis of stroboscopic parameters like glottic closure, vocal fold edge, mucosal wave pattern, symmetry, amplitude and periodicity was done. The raters were instructed to rate separately each parameter by different rating score as given in rating form. The raters were allowed to slow down and replay each video sample as many times as they wanted to before finalizing their ratings. They were asked for ability to make the diagnosis, if rater were able, they made the provisional diagnosis of each recording. If they were unable to make the diagnosis, the reasons for inability were noted.

A criterion level of at least two raters agreement was set for accepting the videostroboscopic rating for each parameter. The parameter that failed to reach this level of agreement were not used for final evaluation and mentioned as “cancelled”. Similarly examination quality and provisional diagnosis of at least two raters were taken as final decision for that recording. The rating forms from each stroboscopic evaluation were then analyzed to evaluate various factors.

Statistical Analysis

All statistical analysis was conducted using the SPSS v. 10.0 statistical software package (SPSS Corporation, Chicago, IL, USA) [5]. The findings of each parameter in all 18 entities of vocal fold lesions were analysed.

Chi-Square Test For Equal Occurrence Hypothesis

This test is meant for testing the significance of the discrepancy. The findings of each parameter in all 18 entities were analysed by the formula and Chi-Square was calculated to know the significance value. Level of significance in each calculation was 0.05.

Correlation Coefficient

In order to measure the magnitude of linear relation between two variables, a coefficient known as product moment

correlation coefficient is defined. It is denoted by (r). The limit of r is -1 to $+1$. $+1$ indicates perfect positive linear relation whereas -1 indicates perfect negative linear relation.

Observations and Results

Total 112 patients with complaint of change in voice were included in this study. Age ranged between 11 and 80 years. 69 (61.6%) cases were male and 43 (38.4%) cases were female with male: female ratio 1.5:1. A slight male predominance was observed.

Vocal Pathologies Observed

In our study 18 entities observed during stroboscopy in 112 cases. Male and female distributions of different vocal pathologies are shown in Fig. 1.

Age and Sex Distribution

Age and sex distribution are shown in Fig. 2. The age of patient varied from 11 year to 80 year. Male: female ratio was 1.5:1. Vocal pathologies were more common in third decade (24.1%) of life followed by fourth (22.3%) and sixth decade (18.8%) of life. Male patient showed higher percentage in sixth decade (20.29%) while female patient showed higher percentage in third (37.21%) and fourth decade (30.23%) of life.

Presenting Complaints

Presenting complaints with duration are shown in Fig. 3. Change in voice was most common presenting complaint in 93 (83.04%) cases and hoarseness of voice in 23 (20.54%) cases. Some patients have more than 2 complaints at the time of examination. Vocal fatigue was observed in 9 cases. 2 cases were presented with dyspnoea and dysphagia. Most of the presenting complaints (49) were of <3 months duration, followed by 37 and 23 presenting complaints of 3–6 months and >12 months duration respectively.

Videostroboscopic Parameters

Following results showed a statistically significant relationship between vocal pathologies and stroboscopic parameters. Statistical analysis was done by Chi-Square test for equal occurrence hypothesis.

1. *Glottic closure:* Table 1 shows glottic closure finding in 107 cases. Chronic laryngitis ($\chi^2 = 21.57$), congestion ($\chi^2 = 14$), papilloma ($\chi^2 = 14$), scarring ($\chi^2 = 14$) showed statistically significant relationship with

Fig. 1 Total 18 entities observed in 112 cases by videostroboscopy

Fig. 2 Age and sex distribution in 112 cases

Fig. 3 Complaint with duration in 112 cases

complete glottic closure. Spindle shaped glottic closure has significant relationship ($\chi^2 = 42$) with bowing of cords. Hourglass shaped glottic closure shows a highly

significant relationship with vocal nodule ($\chi^2 = 47.6$). Incomplete closure of vocal cord shows a significant relationship with vocal cord palsy ($\chi^2 = 32$).

Observation of symmetry in 111 cases, regularity (periodicity) in 105 cases and amplitude in 112 cases of vocal pathologies are shown in Table 2.

2. *Symmetry*: In abductor palsy ($\chi^2 = 8$), acute laryngitis ($\chi^2 = 6$), chronic laryngitis ($\chi^2 = 8.85$), vocal nodule ($\chi^2 = 29.84$) and sulcus vocalis ($\chi^2 = 8$) the corresponding χ^2 value suggest that there is statistically significant relationship with symmetry of vocal cord. Whereas in cancer ($\chi^2 = 10.85$), polyp ($\chi^2 = 12$), palsy ($\chi^2 = 16$) and cyst ($\chi^2 = 20$) corresponding χ^2 values suggest statistically significant relationship with asymmetry of vocal cord.
3. *Periodicity*: In abductor palsy ($\chi^2 = 12$), acute laryngitis ($\chi^2 = 9$), bowing ($\chi^2 = 18$), cancer ($\chi^2 = 14.66$), chronic laryngitis ($\chi^2 = 14.13$), cyst ($\chi^2 = 19.88$), nodule ($\chi^2 = 53.24$), sulcus vocalis ($\chi^2 = 12$) the corresponding χ^2 values shows statistically significant relationship with periodicity of vocal cord. Vocal palsy ($\chi^2 = 8.6$) has significant relationship with aperiodicity of vocal cord.
4. *Amplitude*: Abductor palsy ($\chi^2 = 12$) and vocal palsy ($\chi^2 = 24$) shows statistically significant relation with the decreased amplitude. Bowing ($\chi^2 = 18$), acute laryngitis ($\chi^2 = 9$), chronic laryngitis ($\chi^2 = 21$), cyst ($\chi^2 = 30$), nodule ($\chi^2 = 75$), polyp ($\chi^2 = 18$), sulcus vocalis ($\chi^2 = 12$) have statistically significant relationship with normal amplitude of vocal cord.

Table 1 Glottic closure finding in 107 cases of vocal pathologies

Diagnosis	Glottic closure								Total	χ^2 (df7)
	C	A	P	S	H	IR	IN	CNR		
Abductor palsy	2	0	0	1	0	0	0	0	3	10.33
Acute laryngitis	2	0	0	0	0	0	0	1	3	10.33
Bowing	0	0	0	6	0	0	0	0	6	42*
Cancer	1	0	0	0	0	1	0	9	11	49.36*
Chronic laryngitis	4	0	0	0	0	0	0	3	7	21.57*
Congestion	2	0	0	0	0	0	0	0	2	14*
Cyst	2	0	2	0	4	0	0	2	10	12.40
Leukoplakia	1	0	0	0	0	0	1	0	2	6
No diagnosis	1	0	0	0	0	0	0	2	3	10.33
Nodule	7	0	2	0	13	2	0	1	25	47.64*
Normal finding	11	0	0	0	0	0	0	1	12	69.33*
Palsy	0	0	0	0	0	0	6	2	8	32*
Papilloma	2	0	0	0	0	0	0	0	2	14
Polyp	2	0	0	0	0	0	1	2	5	9.40
Reflux laryngitis	1	0	0	0	0	0	0	0	1	7
Rhinosporodiosis	1	0	0	0	0	0	0	0	1	7
Scarring	2	0	0	0	0	0	0	0	2	14*
Sulcus vocalis	2	0	0	0	0	0	0	2	4	12
Total	43	0	4	7	17	3	8	25	107	–
%	40.2	0	3.7	6.5	15.9	2.8	7.5	23.4	100	–

* Significant at 0.05 level

C Complete, A Anterior,
P Posterior, S Spindle,
H Hourglass, IR Irregular, IN
Incomplete, CNR Cannot rate**Table 2** Observation of symmetry in 111 cases, regularity (periodicity) in 105 cases and amplitude in 112 cases of vocal pathologies

Diagnosis	Symmetry			Total	χ^2 (df2)	Regularity (periodicity)				Total	χ^2 (df3)	Amplitude				Total	χ^2 (df3)
	S	A	CNR			R	IR	IN	CNR			n	↑	↓	CNR		
Abductor palsy	4	0	0	4	8*	4	0	0	0	4	12*	0	0	4	0	4	12*
Acute laryngitis	3	0	0	3	6*	3	0	0	0	3	9*	3	0	0	0	3	9*
Bowing	4	2	0	6	4	6	0	0	0	6	18*	6	0	0	0	6	18*
Cancer	0	10	4	14	10.85*	4	0	0	8	12	14.66*	4	0	6	4	14	5.42
Chronic laryngitis	6	1	0	7	8.85*	6	0	0	1	7	14.13*	7	0	0	0	7	21*
Congestion	2	0	0	2	4	2	0	0	0	2	6	2	0	0	0	2	6
Cyst	0	10	0	10	20*	8	1	0	0	9	19.88*	10	0	0	0	10	30*
Leukoplakia	1	1	0	2	1	2	0	0	0	2	6	2	0	0	0	2	6
No diagnosis	2	0	0	2	4	2	0	0	1	3	3.66	3	0	0	0	3	9*
Nodule	21	4	0	25	29.84*	22	0	1	2	25	53.24*	25	0	0	0	25	75*
Normal finding	12	0	0	12	24*	12	0	0	0	12	36	12	0	0	0	12	36*
Palsy	0	8	0	8	16*	0	4	0	1	5	8.6*	0	0	8	0	8	24*
Papilloma	1	1	0	2	1	1	1	0	0	2	2	1	0	1	0	2	2
Polyp	0	6	0	6	12*	4	1	0	0	5	8.6*	6	0	0	0	6	18*
Reflux laryngitis	1	0	0	1	2	1	0	0	0	1	3	1	0	0	0	1	3
Rhinosporodiosis	1	0	0	1	2	1	0	0	0	1	3	1	0	0	0	1	3
Scarring	1	1	0	2	1	1	1	0	0	2	2	2	0	0	0	2	6
Sulcus vocalis	4	0	0	4	8*	4	0	0	0	4	12*	4	0	0	0	4	12*
Total	63	44	4	111	–	83	8	1	13	105	–	89	0	19	4	112	–
%	56.8	39.6	3.6	100	–	79	7.6	0.9	12.4	100	–	79.5	0	17	3.6	100	–

* Significant at 0.05 level

S Symmetry, A Asymmetry, R Regular, IR Irregular, IN Inconsistent, N Normal, ↑ Decreased, ↓ Increased, CNR Cannot rate

Table 3 Findings of vocal fold edges in 109 vocal pathologies

Diagnosis	Right vocal edge			χ^2 (df/2)	Left vocal edge			χ^2 (df/2)	Total cases
	S	R	CNR		S	R	CNR		
Abductor palsy	3	0	0	6*	3	0	0	6*	3
Acute laryngitis	2	1	0	2	2	1	0	2	3
Bowing	5	1	0	7	5	1	0	7*	6
Cancer	2	7	5	2.71	3	6	5	1	14
Chronic laryngitis	5	2	0	5.42	5	2	0	5.42	7
Congestion	1	1	0	1	0	2	0	4	2
Cyst	2	8	0	10.4*	4	6	0	5.6	10
Leukoplakia	0	2	0	4	0	2	0	4	2
No diagnosis	1	0	1	1	1	0	1	1	2
Nodule	0	25	0	50*	1	24	0	44.24*	25
Normal finding	12	0	0	24*	12	0	0	24*	12
Palsy	8	0	0	16*	8	0	0	16*	8
Papilloma	0	2	0	4	0	2	0	4	2
Polyp	1	4	0	5.2	2	3	0	2.8	5
Reflux laryngitis	0	1	0	2	0	1	0	2	1
Rhinosporodiosis	1	0	0	2	1	0	0	2	1
Scarring	0	2	0	4	0	2	0	4	2
Sulcus vocalis	4	0	0	8*	4	0	0	8*	4
Total	47	56	6	–	51	52	6	–	109

* Significant at 0.05 level

S Smooth, R Rough, CNR Cannot rate

- Vocal edges:** Finding of vocal edges in 109 cases shown in Table 3. Abductor palsy ($\chi^2 = 6$), bowing ($\chi^2 = 7$), palsy ($\chi^2 = 16$), sulcus vocalis ($\chi^2 = 8$), the corresponding χ^2 value suggest that there is statistically significant relationship with smooth vocal fold edge on right and left side. Vocal nodule has significant relationship with rough vocal edge on bilateral side (right side $\chi^2 = 50$; left side $\chi^2 = 44.24$). Cyst ($\chi^2 = 8.85$) has significant relationship with rough vocal edge on right side.
- Mucosal wave:** Findings of mucosal wave in 105 cases shown in Table 4. Bowing ($\chi^2 = 11.33$), nodule ($\chi^2 = 31.48$), palsy (right side $\chi^2 = 17$; left side $\chi^2 = 11$), sulcus vocalis ($\chi^2 = 9$) shows statistically significant relationship with normal mucosal wave pattern on both sides. Chronic laryngitis ($\chi^2 = 8.6$) shows significant relationship with reduced mucosal wave pattern on both sides.

Correlation Matrix

When the correlation between many variables is computed, they are often organized in matrix form. Table shows the correlation between the stroboscopic parameters. The matrix provides a way of easily comparing correlations. It indicates the perfect positive linear relation ($r = +1$) between all parameters. The quantity r , called the linear correlation coefficient, measures the strength and the

direction of a linear relationship between variables. The linear correlation coefficient is sometimes referred to as the *Pearson product moment correlation coefficient*. In our study correlation matrix showed perfect positive linear relationship. Table 5 shows the correlation matrix.

Discussion

Use of stroboscopic light for the evaluation of vocal cord was first reported in 1895 by Oertel [3]. Since that time many articles have recommended the technique for the observation of vocal pathologies. The technique has proven helpful in evaluating many patients with voice complaints. The present study was carried out in the patients with chief complaint of change in voice. Only subjective assessments of stroboscopic parameters in different vocal pathologies were carried out by three judges and statistically significant findings were found out. The rating form used by the judges was adapted from videostroboscopic rating forms described by DM Bless, M Hirano and RJ Feder in 1987 with few modifications [6].

The findings obtained in our present study are as follows:

Underlying Cause of the Voice Disorder

Out of 112 vocal pathologies, 86.61% cases were of organic voice disorder and 10.71% cases were of

Table 4 Mucosal wave findings in 105 cases of vocal pathologies

Diagnosis	Mucosal wave (Rt)				χ^2 (df3)	Mucosal wave (Lt)				χ^2 (df3)	Total cases
	N	↓	↑	CNR		N	↓	↑	CNR		
Abductor palsy	1	2	0	0	3.66	1	2	0	0	3.66	3
Acute laryngitis	2	1	0	0	3.66	2	1	0	0	3.66	3
Bowing	5	1	0	0	11.33*	5	1	0	0	11.33*	6
Cancer	3	2	0	8	10.23*	2	3	0	8	10.69*	13
Chronic laryngitis	1	4	0	0	8.6*	1	4	0	0	8.6*	5
Congestion	1	1	0	0	2	0	2	0	0	6	2
Cyst	3	6	0	0	11	4	5	0	0	9.22*	9
Leukoplakia	0	2	0	0	6	0	2	0	0	6	2
No diagnosis	0	1	0	2	3.66	0	1	0	2	3.66	3
Nodule	18	5	0	2	31.48*	18	5	0	2	31.48*	25
Normal finding	10	0	0	1	25.72*	10	0	0	1	25.72*	11
Palsy	7	0	0	1	17*	6	1	0	1	11*	8
Papilloma	0	0	0	2	6	0	0	0	2	6	2
Polyp	1	4	0	1	6	2	3	0	1	3.33	6
Reflux laryngitis	0	1	0	0	3	0	1	0	0	3	1
Rhinosporodiosis	1	0	0	0	3	1	0	0	0	3	1
Scarring	0	2	0	0	6	1	1	0	0	2	2
Sulcus vocalis	3	0	0	0	9*	3	0	0	0	9*	3
Total	56	32	0	17	–	56	32	0	17	–	105

* Significant at 0.05 level

Rt Right, Lt Left, N Normal, ↓ Reduced, ↑ Increased, CNR Cannot rate

Table 5 The correlation matrix

Variables	Glottic closure	Symmetry	Vocal edge (right)	Vocal edge (left)	Mucosal wave (right)	Mucosal wave (left)	Regularity	Amplitude
Glottic closure	1	0.32**	0.23*	0.20*	0.23*	0.25*	0.37**	0.21*
Symmetry	0.32**	1	0.40**	0.30**	0.16	0.16	0.22*	0.47**
Vocal edge (right)	0.23*	0.40**	1	0.82**	0.38**	0.24*	0.16	−0.03
Vocal edge (left)	0.20*	0.30**	0.82**	1	0.23*	0.37**	0.13	0
Mucosal wave (right)	0.23*	0.16	0.38**	0.23*	1	0.84**	0.48**	−0.1
Mucosal wave (left)	0.25*	0.16	0.24*	0.37**	0.84**	1	0.45**	−0.06
Regularity	0.37**	0.22*	0.16	0.13	0.48**	0.45**	1	0.12
Amplitude	0.21*	0.47*	−0.03	0	−0.1	−0.06	0.12	1

** Significance level 0.01, * Significance level 0.05

psychogenic or functional voice disorder (in which no structural or vibratory anomaly detected via videostroboscopy). Diagnosis could not be made in rest of 2.68% cases. Benign vocal pathologies (nodule, cyst and polyp) together constitute 35.71% of total lesion.

Organic voice disorder in decreasing order were vocal nodule (22.3%), cancer (12.5%), cyst (8.9%), palsy (7.1%), chronic laryngitis (6.3%), polyp (5.4%), bowing (5.4%), sulcus vocalis (3.6%), abductor palsy (3.6%), acute laryngitis (2.7%), leukoplakia (1.8%), congestion (1.8%),

scarring (1.8%), papilloma (1.8%), reflux laryngitis (0.9%) and rhinosporodiosis (0.9%).

Psychogenic or functional voice disorder which showed normal stroboscopic finding were functional dysphonia (66.67%), puberphonia (16.67%), spasmodic dysphonia (16.67%). In functional voice disorders, the patient's voice sounds grossly out-of-proportion to the observed appearance of the larynx. In most cases, the vocal folds and their movement are normal despite varying degrees of dysphonia. Functional disorders may be psychogenic or technical in origin.

Stroboscopic Finding in Different Age and Sex Group

In our study male: female ratio was 1.5:1. In male patient vocal pathologies were common in 6th decade and in female patient in 3rd decade. In male patients, malignancy of vocal cords were observed in their later decades of life while vocal nodules were observed commonly in middle aged female patient due to vocal abuse.

In 97 cases of organic voice disorder vocal nodule (22.3%) was the most common finding. Mean age was 32.5 year. Vocal nodule was found more commonly in females (60%) than males (40%). All cases showed history of vocal abuse. Vocal abuse is the most common cause of nodules. Hourglass closure was the chief factor causing derangement in voice quality. In various other population studies nodules have been shown to be the cause of persistent hoarseness in 25% in children (Silverman et al. [7]) and in 6% of adults with voice problems. Higher percentages are found in teachers and singers with voice problems (Lacina [8]; Urrutikoetxea et al. [9]). In children, they are more common in boys than in girls, while in adults they are very much more commonly found in women particularly under the age of 30 (Nagata et al. [10]; Wendler et al. [11]).

Cancer (12.5%) was the second most common finding. 78.57% were male and 21.43% were female patient. Mean age was 60.79 years. The malignancy of cords is common in the male patient in old age due to smoking. Three cases of malignancy unexpectedly observed in female patient with the history of tobacco chewing and smoking presenting with complaint of change in voice.

Cyst (8.9%) was next most common finding. 60% were male and 40% were female. Mean age was 41 years. Palsy was found in 7.1% of cases of which 75% were male and 25% were female patient. They presented with hoarseness of voice. Right vocal palsy was observed in 5 cases while left vocal palsy in 3 cases. In 3 cases cause was idiopathic. One case has history of head injury. In another 3 cases cause was carcinoma thyroid, bronchogenic carcinoma and hypertensive stroke. The most important parameter on stroboscopy affecting voice quality was the incomplete glottic closure.

Vocal polyp was seen in 5.4% cases with equal male and female distribution. All cases of vocal polyp have history of vocal abuse, in contrast to study by Nagata et al. [10] and Kleinsasser et al. [12] which showed male preponderance between the ages of 30 and 50 years [10, 12].

All 4 cases (3.6%) of sulcus vocalis were female with mean age 29 years. In 2 cases of papilloma (1.8%), male female ratio was 1:1. Both cases were juvenile papilloma presented with history of hoarseness since childhood.

Abductor palsy (3.6%) and bowing (5.4%) showed male predominance. In abductor palsy out of 4 patient 2 were in

age group 11–20 year. Congestion (1.8%) showed female predominance with history of vocal abuse.

Male patients showed 100% predominance in cases of chronic laryngitis (6.3%), acute laryngitis (2.7%), leukoplakia (1.8%), scarring (1.8%), reflux laryngitis (0.9%) and rhinosporodiosis (0.9%).

Our finding is also comparable to the study done by Dobres et al. (1990) according them vocal nodules and edema were most common in early adulthood (22–44 years); polyps and dysphonia, despite a normal laryngeal examination were most common during middle adulthood (45–64 years); and vocal fold paralysis in late adulthood (over age 64 years). Cancer was evenly distributed between the ages of 45–64 and over age 64 years. In males vocal nodules were most common between 0 and 14 years, edema between 25 and 44 years, polyps between 45 and 64 years, and vocal fold paralysis primarily after age 64 years [13].

12 cases have been observed as normal looking vocal cord and rated normal finding by all three raters. Age ranges between 16 and 57 years. 7 male and 5 female cases are included in this group. On the basis of presentation and history, clinical diagnosis was made. Clinical diagnosis of functional dysphonia was made in 8 (66.67%) cases, puberphonia in 2 (16.67%) cases and spasmodic dysphonia in 1 (8.33%) case. One case was post operated case of vocal cyst showing normal stroboscopic finding.

Stroboscopic Parameters in Various Vocal Pathologies

Only the significant stroboscopic findings are discussed here.

Hourglass shaped glottic closure was found in vocal nodule which is statistically highly significant as value showed by Chi square, as these lesions are generally bilateral and symmetric. Incomplete closure of vocal cord shows a significant relationship with vocal cord palsy due to absence of motion of unilateral vocal cord. Depending on the position of the vocal fold, incomplete glottic closure may result in air loss. Patients with unilateral vocal fold paralysis most commonly complain of breathy, hoarse vocal quality with decreased volume and fatigue with prolonged speaking. Spindle shaped glottic closure significantly related to bowing of vocal cords. Chronic laryngitis, congestion, papilloma, scarring showed statistically significant relationship with complete glottic closure.

Glottic closure could not be rated (CNR) in 9 cases of cancer, 3 cases of chronic laryngitis, 2 cases of vocal palsy, 2 cases of polyp, 2 cases of cyst, 2 cases of sulcus vocalis, 1 case of acute laryngitis, and in 1 case of normal finding. It also includes 2 cases in which diagnosis was not made. Reason for not rating the glottic closure in these cases was obstruction of view by supraglottic structure during the phonation.

Bilateral abductor palsy, acute laryngitis, chronic laryngitis, vocal nodule and sulcus vocalis has statistically significant relationship with symmetry of vocal cord, as these lesions usually involves both vocal folds. In cancer, polyp, palsy and cyst has statistically significant relationship with asymmetry of vocal cord, as these lesions usually involve unilateral vocal cord.

Abductor palsy, bowing, vocal cord palsy, sulcus vocalis has statistically significant relationship with smooth bilateral vocal fold edge. Chi square value showed significant relationship between cyst and rough vocal edge on ipsilateral side. Chi square value showed significant relationship between nodule and rough vocal edge on bilateral side. This can be due to phonotrauma at vocal fold edges because of the lesion.

Chronic laryngitis shows significant relationship with reduced mucosal wave pattern on both sides. Disruption of normal viscoelastic properties of the superficial lamina propria in chronic laryngitis results in aberrant vocal fold vibration and mucosal wave propagation. Bowing, nodule, palsy and sulcus vocalis shows statistically significant relationship with normal mucosal wave pattern. Although focal interruption in the mucosal wave at the site of the sulcus can be noted but it can go unnoticed as the sulcus usually involves the vocal fold edges. Nagata et al. [10] and Sataloff et al. [14] observed slightly decreased amplitude of the mucosal wave in cases of vocal nodule, but the wave is generally symmetric. Similarly, decreased or absent mucosal wave can be observed on the side of the cyst because of displacement of lamina propria. Vocal folds with small polyps generally have intact mucosal wave while larger polyps can show prominent decreased mucosal wave amplitude [10, 14]. Shohet et al. [15] compared stroboscopic findings between cysts and polyps. They determined that the mucosal wave was the most important parameter in differentiating cysts from polyps. They also found the mucosal wave to be diminished or absent in 100% of vocal fold cysts, and wave to be present in 80% of polyps. But in our study no significant difference in mucosal wave pattern observed between cysts and polyps.

Vocal palsy shows significant relationship with aperiodicity of vocal cord because of decreased or absent phase closure. In abductor palsy, acute laryngitis, bowing, cancer, chronic laryngitis, cyst, nodule and sulcus vocalis the corresponding Chi square values shows statistically significant relationship with periodicity of vocal cord.

Abductor palsy and vocal palsy shows statistically significant relation with the decreased amplitude. Bowing, acute laryngitis, chronic laryngitis, cyst, nodule, polyp, and sulcus vocalis have statistically significant relationship with normal amplitude of vocal cord.

Conclusion

Videostroboscopy is most useful in identifying laryngeal pathologies of the vocal fold cover. Characteristics of stroboscopy can be evaluated for quantification of the stroboscopic examination, but there have also been recognized subjective difficulties in interpretation of stroboscopic images. A composite assessment of acoustic, aerodynamic, electroglottographic and videostroboscopic phonatory features should be added for diagnostic accuracy of different vocal pathologies.

Conflict of interest None.

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