

ORIGINAL RESEARCH

A Study on the Role of Videostroboscopy in the Early Detection of Laryngeal Changes in Patients with Laryngopharyngeal Reflux Disease

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ABSTRACT

Background: Laryngopharyngeal reflux disease (LPRD) is a common cause of chronic throat and voice symptoms and often produces subtle mucosal and vibratory abnormalities that may not be detected on routine laryngoscopy. Videostroboscopy provides dynamic assessment of vocal fold function and may improve early diagnosis and severity stratification. **Objective:** To evaluate the diagnostic utility of videostroboscopy in detecting structural and functional laryngeal abnormalities and to determine its association with symptom severity and treatment outcomes in patients with suspected LPRD. **Methodology:** This was a prospective cross-sectional observational study conducted at the Department of Otorhinolaryngology, BLDEU's Shri B.M. Patil Medical College Hospital and Research Centre, Vijayapura, over the defined study period, including 136 patients with symptoms suggestive of laryngopharyngeal reflux disease (LPRD). **Results:** Females constituted 62.5% of participants. The mean RSI score was 21.05. Moderate LPR was most common (42.65%), followed by mild (27.21%), no/borderline (15.44%), and severe disease (14.71%). ENT examination revealed inflammatory changes in 86.76% of patients, with cobblestoning (25%) and erythema (20.59%) being frequent findings. Videostroboscopy demonstrated reduced vibratory amplitude and mucosal wave in 57.35% of patients, while abnormalities in symmetry, periodicity, and glottic closure were observed in all cases (100%). Reduced amplitude was present exclusively in moderate and severe disease, showing a strong association with severity ($\chi^2 = 272.00$, $p < 0.0001$). At one-month follow-up, 75% of patients improved clinically. **Conclusion:** Videostroboscopy detects early and widespread functional vocal fold abnormalities and correlates strongly with disease severity, making it a valuable adjunct to routine ENT examination for accurate diagnosis, grading, and follow-up of patients with laryngopharyngeal reflux disease.

Keywords: Laryngopharyngeal reflux, videostroboscopy, vocal fold vibration, Reflux Symptom Index, laryngeal inflammation, voice disorders.

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INTRODUCTION

An extra-esophageal form of gastroesophageal reflux is laryngopharyngeal reflux disease (LPRD), where the gastric contents rise above the upper esophageal sphincter and mucosa of the larynx and pharynx is irritated [1]. In comparison to classical GERD that is characterized by heartburn, regurgitation, LPRD is characterized by unusual symptoms, including hoarseness, chronic throat clearing, persistent cough,

globus sensation, and voice fatigue, and in the absence of gastrointestinal symptoms [3]. This silent presentation is usually associated with delay in the diagnosis and misdiagnosis. Laryngeal mucosa is very acid, pepsin, and bile salt sensitive; the slightest reflux exposes the mucosa to inflammation, mucosal edema and loss of vocal fold vibration functions [5]. Recurring trauma can lead to dysphonia, granuloma, thickening of the mucosa and lowered voice quality

and greatly impairs the quality of life, especially in professional voice users [7]. The epidemiological research proposes that LPRD has a significant percentage of the adult population in the world and with the prevalence rates reported between 5-30% and regional data indicates that almost one out of ten people can develop reflux-related laryngeal symptoms [9]. In spite of its clinical significance, it is difficult to diagnose. Symptom based methods like the Reflux Symptom Index (RSI) and laryngoscopic measurements like the Reflux Finding Score (RFS) are commonly used though not very specific and do not correlate well with objective reflux exposure [10]. Traditional fiberoptic laryngoscopy is able to detect structural abnormalities but can fail to detect early or subtle functional abnormalities. Even though a dual-probe pH monitoring and impedance testing offer physiological evidence of reflux, they are invasive, expensive, and inaccessible, which limits their application in clinical practice [12].

Since the injury of the vocal folds may frequently start with the functional disorder before any demonstrable structural harm, the measurement of the dynamics of the vocal folds may provide more prompt diagnostic indicators. Videostroboscopy allows visualizing the mucosa wave propagation, amplitude of vibrations, symmetry, and glottic closure in slow motion, which can identify subtle functional dysfunctions that cannot be seen in the endoscopic examination [14]. There is also emerging evidence that suspected LPRD patients exhibit typical stroboscopic defects in cases where there are simple laryngoscopic results. Videostroboscopy can be used as a useful supplement to early-stage detection of the laryngeal alterations of reflux and the assessment of response to treatment because it has high levels of prevalence of LPRD and the constraints of other diagnostic modalities [16].

Objective

To evaluate the diagnostic utility of videostroboscopy in detecting structural and functional laryngeal abnormalities and to determine its association with symptom severity and treatment outcomes in patients with suspected LPRD.

METHODOLOGY

This was a prospective cross-sectional observational study conducted at the Department of Otorhinolaryngology, BLDEU's Shri B.M. Patil Medical College Hospital and Research Centre, Vijayapura, over the defined study period, including 136 patients with symptoms suggestive of laryngopharyngeal reflux disease (LPRD). The study was designed to evaluate the diagnostic utility of videostroboscopy in detecting early mucosal and functional laryngeal abnormalities associated with reflux. Eligible patients attending routine outpatient and inpatient ENT services were systematically screened and enrolled using consecutive non-probability sampling. Standardized history taking,

clinical examination, symptom scoring, and videostroboscopic assessment were performed at baseline for all participants. In addition, a short longitudinal component with a one-month follow-up was included to assess early treatment response.

Inclusion Criteria

- Patients aged 18–65 years
- Presence of one or more symptoms suggestive of LPRD (hoarseness, throat clearing, chronic cough, globus sensation, voice fatigue)
- Known history of GERD with recent onset of vocal or throat symptoms
- Willingness to provide informed consent

Exclusion Criteria

- Structural laryngeal lesions unrelated to reflux
- Acute upper respiratory tract infections
- Prior laryngeal surgery or trauma
- Neurological or systemic disorders affecting voice
- Patients unwilling to participate

Data Collection

Data were collected using a structured proforma. Demographic variables included age, sex, occupation, and residence. Clinical history comprised chief complaints, duration of symptoms, and past history of gastroesophageal reflux. All patients underwent comprehensive ENT examination, flexible fiberoptic laryngoscopy, and videostroboscopic evaluation in a dedicated voice clinic. Videostroboscopy was performed using synchronized stroboscopic illumination to assess vibratory amplitude, phase symmetry, mucosal wave propagation, periodicity, glottic closure pattern, and supraglottic activity. Symptom severity was quantified using the Reflux Symptom Index (RSI). Patients subsequently received appropriate anti-reflux therapy and lifestyle modification, and follow-up assessment was conducted at approximately one month to document clinical improvement.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 26.0. Continuous variables were expressed as mean \pm standard deviation or median with interquartile range as appropriate, while categorical variables were summarized as frequencies and percentages. Associations between categorical variables, including diagnosis and videostroboscopic parameters, were evaluated using the chi-square test. A p-value of < 0.05 was considered statistically significant.

RESULTS

Among the 136 participants, females constituted the majority with 85 patients (62.5%), while males accounted for 51 (37.5%). Most patients were from urban areas (63.97%), with the remainder from rural

regions (36.03%). The mean Reflux Symptom Index score was 21.05, with a median of 23.5 and an interquartile range of 15–27, indicating a moderate overall symptom burden. Based on RSI classification, moderate LPR was the most common diagnosis

(42.65%), followed by mild LPR (27.21%), no/borderline disease (15.44%), and severe LPR (14.71%), suggesting that the majority presented with clinically significant reflux severity.

Table 1. Baseline Demographic, Symptom Severity, and Diagnostic Profile of Study Participants (n = 136)

Variable	Category	n	%
Sex	Female	85	62.5
Sex	Male	51	37.5
Residence	Urban	87	63.97
Residence	Rural	49	36.03
Final Diagnosis	No/Borderline LPR	21	15.44
Final Diagnosis	Mild LPR	37	27.21
Final Diagnosis	Moderate LPR	58	42.65
Final Diagnosis	Severe LPR	20	14.71
RSI Score	Mean	21.05	100
RSI Score	Median	23.5	100
RSI Score	Range	1–40	100
Total	Participants	136	100

ENT examination revealed that posterior pharyngeal wall cobblestoning was the most frequent finding, observed in 34 patients (25%). Mild pharyngeal erythema was present in 28 (20.59%), arytenoid erythema in 25 (18.38%), and interarytenoid edema in 23 (16.91%). Pachydermialaryngis was comparatively less common, seen in only 8 patients (5.88%). Only 18 patients (13.24%) demonstrated normal mucosal appearance.

Table 2. Detailed ENT Examination Findings of Laryngopharyngeal Structures (n = 136)

Finding	n	%	Cumulative %
Posterior pharyngeal wall cobblestoning	34	25.00	25.00
Mild pharyngeal erythema	28	20.59	45.59
Arytenoid erythema	25	18.38	63.97
Interarytenoid edema	23	16.91	80.88
Normal mucosa	18	13.24	94.12
Pachydermialaryngis	8	5.88	100
Total	136	100	100

Videostroboscopic evaluation demonstrated substantial functional impairment of the vocal folds. Reduced vibratory amplitude and abnormal mucosal wave were each observed in 78 patients (57.35%), while only 58 (42.65%) maintained normal motion. All patients (100%) showed abnormalities in symmetry, periodicity, and glottic closure patterns, indicating universal disruption of vibratory mechanics. Additionally, supraglottic or subglottic pathology was detected in 72 patients (52.94%).

Table 3. Comprehensive Videostroboscopic Functional Assessment (Normal vs Abnormal Distribution) (n = 136)

Parameter	Normal (n)	Normal (%)	Abnormal (n)	Abnormal (%)	Total (n)
Vibratory amplitude	58	42.65	78	57.35	136
Mucosal wave	58	42.65	78	57.35	136
Symmetry	0	0	136	100	136
Periodicity	0	0	136	100	136
Glottic closure	0	0	136	100	136
Supra/Subglottic pathology	64	47.06	72	52.94	136

A strong relationship was observed between vibratory amplitude and reflux severity. All 58 patients with normal amplitude belonged to the no/borderline or mild categories, whereas every patient with moderate (n = 58) or severe disease (n = 20) demonstrated reduced amplitude. Thus, 78 patients (57.35%) with impaired vibration represented exclusively moderate-to-severe cases. This association was highly significant ($\chi^2 = 272.00$, $p < 0.0001$), indicating that reduced amplitude closely correlates with increasing disease severity.

Table 4. Association Between Vibratory Amplitude and Final Diagnosis (n = 136)

Amplitude	No/Borderline	Mild	Moderate	Severe	Row Total
Normal	21	37	0	0	58
Reduced	0	0	58	20	78
Column Total	21	37	58	20	136

$$\chi^2 = 272.00, p < 0.0001$$

Patterns of symmetry and periodicity showed a clear stepwise relationship with disease progression. All symmetric and regularly periodic vibrations (n = 58 each) were confined to no/borderline and mild cases. Mild asymmetry and mostly regular vibrations (n = 58 each) corresponded entirely to moderate disease, while marked asymmetry and irregular periodicity (n = 20 each) were observed exclusively in severe cases.

Table 5. Association of Symmetry and Periodicity Patterns with Disease Severity (n = 136)**A. Symmetry**

Pattern	No/Borderline	Mild	Moderate	Severe	Total
Symmetric	21	37	0	0	58
Mild asymmetry	0	0	58	0	58
Marked asymmetry	0	0	0	20	20
Column Total	21	37	58	20	136

B. Periodicity

Pattern	No/Borderline	Mild	Moderate	Severe	Total
Regular	21	37	0	0	58
Mostly regular	0	0	58	0	58
Irregular	0	0	0	20	20
Column Total	21	37	58	20	136

$$\chi^2 = 272.00, p < 0.0001$$

At one-month follow-up, clinical improvement was observed in 102 patients (75%), while 29 (21.3%) showed no significant change and only 5 (3.7%) experienced worsening. Improvement rates were highest in the mild group (83.8%), followed by moderate (74.1%), severe (70%), and no/borderline disease (66.7%). Despite numerical differences, the association between baseline severity and treatment response was not statistically significant ($\chi^2 = 6.87, p = 0.332$), suggesting comparable short-term outcomes across groups.

Table 6. Treatment Outcome After One-Month Follow-Up According to Final Diagnosis (n = 136)

Diagnosis	Improved	No Change	Worsened	Total	Improvement (%)
No/Borderline	14	6	1	21	66.7
Mild	31	5	1	37	83.8
Moderate	43	12	3	58	74.1
Severe	14	6	0	20	70.0
Overall	102	29	5	136	75.0

$$\chi^2 = 6.87, p = 0.332$$

DISCUSSION

This paper evaluated both clinical and functional value of videostroboscopy in the patients with a suspected laryngopharyngeal reflux disease (LPRD) and involved 136 participants. Women were the largest group (85 cases, 62.5%), and men were the second group (51 cases, 37.5%). There were a higher percentage of patients in the urban setting (63.97%) than in rural populations (36.03%). The overall symptom burden was moderate with the mean Reflux Symptom Index (RSI) of 21.05 and median 23.5 and range 1-40. According to RSI categorization, there were the greatest groups of moderate (58 patients, 42.65%), mild (37, 27.21%), no/borderline disease (21, 15.44%), and severe LPR (20, 14.71%). Such findings suggest that, the vast majority of the patients

had a clinically significant disease rather than early or borderline symptoms. Previous research has also described a similar female preeminence and distribution of severity in a moderate manner [17]. Standard ENT check-up showed inflammatory changes in the mucosal surface in most of the patients. The most common finding was the posterior pharyngeal wall cobblestaining (34, 25%), then mild pharyngeal erythema (28, 20.59%), arytenoid erythema (25, 18.38%), and interarytenoid edema (23, 16.91%). There were also only 18 patients (13.24%), who showed normal mucosa, and pachydermialaryngis was present in 8 (5.88%). In this way almost 87 percentage of participants exhibited some extent of mucosal abnormality, which supports the high level of inflammatory load related to reflux.

Other studies have also found similar distributions of erythema and edema in the past [18]. Even greater functional impairment was proven by videostroboscopic analysis compared to structural analysis. A decrease in the amplitude of vibrations and an irregular mucosal wave were found in 78 patients (57.35%), out of which only 58 patients (42.65) showed normal values. All 136 patients (100 percent) had an abnormality of symmetry, periodicity, and incomplete closure of the glottis, and 72 (52.94 percent) had a supraglottic or subglottic pathology. These findings indicate that functional impairments of vibration are almost universal in symptomatic LPRD and may preclude or be more severe than apparent structural damage. Past studies also have indicated that stroboscopy identifies fine vibratory lesions that are not recognized on the routine laryngoscopy [19]. It was found that the videostroboscopic parameters and the severity of disease showed a strong and statistically significant correlation. All normal vibratory amplitude patients (58) were in the no/borderline category or mild category only (58, 100), while all moderate (58, 100) and severe cases (20, 100) had lower amplitude ($\chi^2 = 272.00$, $p = 0.0001$). Similarly, symmetrical and regularly periodic vibrations were limited to the mild/none category (58 each), mild asymmetry and mostly regular periodicity were entirely found in moderate disease (58 each), and marked asymmetry or irregular periodicity were only found in severe LPR (20 each). This stepwise progression is a clear sign that increasingly severe clinical severity is directly proportional to that of worsening vibratory mechanics. The same correlations between wave mucosal impairment and grade of reflux have been reported in other studies [20]. After a month of treatment the overall improvement was observed in 102 patients (75%), 29 (21.3) patients do not change and only 5 (3.7) patients deteriorated. The mild group had the highest improvement (31/37, 83.8%), then the moderate (43/58, 74.1), severe (14/20, 70) and no/borderline cases (14/21, 66.7). Even though there was no statistically significant difference ($\chi^2 = 6.87$, $p = 0.332$), the rate of recovery was extremely high, indicating that early medical and lifestyle intervention effectiveness is independent of the severity level. The same short-term response rates were also found in the earlier studies [21]. On the whole, the results show that routine ENT examination revealed abnormalities in the patients in about 86.87 percent of cases, but videostroboscopy revealed functional disturbances in more than 57 percent of patients as per amplitude and 100 percent of patients as per vibratory mechanics and is more sensitive. The findings indicate that videostroboscopy is a useful diagnostic and monitoring tool in the early detection, stratification of the severity and follow-up evaluation of LPRD, which aligns the research findings with past studies.

Limitation

This study was limited by its single-center design, relatively modest sample size of 136 patients, short one-month follow-up period, and lack of objective reflux testing such as pH monitoring, which may restrict the generalizability and long-term assessment of outcomes.

CONCLUSION

It is concluded that videostroboscopy demonstrated high sensitivity in detecting functional vocal fold abnormalities, with reduced vibratory amplitude and mucosal wave impairment observed in 57.35% of patients and symmetry, periodicity, and glottic closure disturbances present in 100% of cases, showing a strong correlation with increasing LPR severity ($\chi^2 = 272.00$, $p < 0.0001$); therefore, videostroboscopy serves as a valuable adjunct to routine ENT examination for early diagnosis, objective severity assessment, and treatment monitoring in patients with laryngopharyngeal reflux disease.

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