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Research Article

Evaluating the Utility of Stroboscopic Research Instrument in the Diagnosis of Laryngopharyngeal Reflex

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Abstract

Objectives: To evaluate the role of Stroboscopic research instrument in the diagnosis of laryngopharyngeal reflex patients.

Methods: Patients coming to otorhinolaryngology OPD after informed consent were grouped into cases and controls according to the RSI Score (≥13 and < 13, respectively). Matching was performed between cases and controls according to age, sex, and body mass index. All the subjects underwent laryngeal endoscopy and videostroboscopy, and findings were evaluated using the Reflux Finding Score (RFS) and the Stroboscopic Research Instrument (SRI) score, respectively.

Results: For the 86 patients (43 cases and 43 controls) in this study, the mean RFS was 8.60 ± 2.59 among the cases and 4.98 ± 2.45 among the controls. Among the cases, only 76.7% showed a high RFS (≥7). The means SRI score in cases were 79.60 ± 73.85 and in controls were 23.86 ± 41.76. In the SRI, the amplitude, symmetry, duration of closure, and mucosal wave parameters were significantly different between cases and controls. We also found a weak positive correlation between the SRI score and RFS in cases of LPR.

Conclusion: Our study tried to establish the role of SRI in the objective evaluation of LPR patients and found weak correlation between laryngoscopic and stroboscopic findings using standardized instruments.

Keywords: Laryngopharyngeal Reflux (LPR); Videostroboscopy; Laryngeal Endoscopy; Stroboscopic Research Instrument (SRI); Reflux Symptom Index (RSI); Reflux Finding Score (RFS)

Introduction

Laryngopharyngeal reflux (LPR) is a common disease encountered by otorhinolaryngologists in routine clinical practice, amounting to an incidence of approximately 4-10% of all patients. The term LPR was coined by James A. Koffmann (1980) and was described in 1996 as retrograde reflux of the gastroduodenal contents into the larynx and pharynx, leading to tissue damage of the upper aerodigestive tract [1,2].

LPR has a wide range of manifestations. It can present simply, with persistent cough, voice changes, or foreign body sensation in the throat, or severely, with subglottic stenosis, muscle tension dysphonia, and laryngospasm. In chronic cases, it can also present with asthma, vocal process granuloma, and laryngeal carcinoma. There is a tendency among primary care physicians to empirically treat this condition before referral to a specialist, which results in

incorrect diagnoses and further complications [3]. As LPR does not show pathognomonic symptoms or findings, it could be missed under direct, constant-light visualization even by an experienced otorhinolaryngologist, thus calling for advanced equipment. Videostroboscopy was developed in 1895 to overcome the limitations of direct, constant-light visualization. It is used in the analysis of vocal fold movements and in the diagnosis of various voice disorders [4]. With advances in technology, videostroboscopy has become more accurate in identifying subtle signs and symptoms of laryngeal edema much earlier than constant light endoscopy [5].

A wide variety of laryngopharyngeal lesions and voice disorders have already been studied with the help of videostroboscopy, but very few studies have been conducted to date on the role of videostroboscopic examination in assessing LPR. In our study, we aimed to establish the role of videostroboscopy in assessing LPR using validated standardized instruments.

Materials and Methods

All the subjects in this study were recruited from among patients attending the outpatient otorhinolaryngology department of a tertiary care centre between July 2018 and January 2020 after considering the inclusion and exclusion criteria as per the study protocol. Institutional ethical committee clearance was obtained for the study was registered in the Clinical Trials Registry – India.

Subjects between the ages of 18 and 50 years were included in the study. Patients with a Reflux Symptom Index (RSI) ≥13 were assigned to the case group, and those with an RSI <13 were assigned to the control group. Patients with laryngeal tumours or masses, asthma, chronic obstructive pulmonary disease, a previous history of treatment with proton pump inhibitors, antacids or H2 inhibitors, or a previous history of radiotherapy or head and neck surgeries were excluded from the study. Tobacco users, patients undergoing psychiatric treatment, and patients with known hypertension and diabetes mellitus were also excluded from the study to avoid the influence from all possible confounding factors.

Matching between cases and controls was performed based on age (± 3), sex, and body mass index (± 1). All subjects in the case and control groups underwent laryngeal endoscopy (with a Karl Storz 70° rigid endoscope) and videostroboscopy (with a 40160120 Karl Storz Pulsar II), whose findings were evaluated using the Reflux Finding Score (RFS) and Stroboscopic Research Instrument (SRI) score, respectively. As both the RFSs and SRI scores are visual-perceptual ratings and observer dependent, all the recorded videos were evaluated by a team of three otorhinolaryngologists, and a consensus score was provided to reduce bias.

Statistical analysis of nonparametric data between cases and controls was performed using the Wilcoxon signed-rank test and Fisher's exact test. The correlation between the RFSs and SRI scores was analysed using Spearman's rho test.

Results

A total of 86 patients (43 cases and 43 controls) were included in the study. The mean ages of the patients in the case and control groups were 38.42 ± 8.02 and 37.91 ± 8.77 years, respectively. Most patients were between 46 and 50 years of age (27.9%). The study population showed a female predominance, with a male to female ratio of 1.0:1.89. The mean BMI of the patients in the case and control groups was 23.73 ± 3.64 and 23.86 ± 3.77, respectively (Table 1).

Parameter	Group		p value
	Case (n = 43)	Control (n = 43)	
Age (Years)	38.42 ± 8.02	37.91 ± 8.77	-
Sex			-
Male	16 (37.2%)	16 (37.2%)	
Female	27 (62.8%)	27 (62.8%)	
BMI	23.73 ± 3.64	23.86 ± 3.77	
RFS: Total Score***	8.60 ± 2.59	4.98 ± 2.45	<0.001[1]

Table 1: Patient Characteristics in two groups (BMI: Body mass index; RFS: reflux Finding Score).

In our study, the mean RFS of the case group was 8.60 ± 2.59 and that of the control group was 4.98 ± 2.45. Only 76.7% of the cases and 23.3% of the controls had an RFS ≥7. The videostroboscopy parameters and SRI scores between cases and controls are shown in table 2. The parameters amplitude, symmetry, duration of closure, and mucosal wave were significantly different between cases and controls. A significantly greater number of cases demonstrated

decreased amplitude, mild to moderate asymmetry, predominantly closed and half closed/half open phase and restricted mucosal wave patterns than controls ($p < 0.05$). We found a weak positive correlation between the RFS and SRI score (rho = 0.22, p = 0.148) and between the RSI and SRI score (rho = 0.2, p = 0.206) (Table 3).

Parameter	Group		p value
	Case (n = 43)	Control (n = 43)	
SRI: Symmetry***			0.026[1]
Normal	37 (86.0%)	43 (100.0%)	
Mild Asymmetry	4 (9.3%)	0 (0.0%)	
Moderate Asymmetry	2 (4.7%)	0 (0.0%)	
SRI: Amplitude***			0.011[1]
Normal	25 (58.1%)	35 (81.4%)	
Mild Decrease	10 (23.3%)	8 (18.6%)	
Moderate Decrease	6 (14.0%)	0 (0.0%)	
Severe Decrease	2 (4.7%)	0 (0.0%)	
SRI: Periodicity			0.116[1]
Normal	39 (90.7%)	43 (100.0%)	
Mild Aperiodic Vibrations	4 (9.3%)	0 (0.0%)	
SRI: Closure Shape			0.309[2]
Complete Closure	26 (60.5%)	33 (76.7%)	
Anterior Glottic Chink	3 (7.0%)	0 (0.0%)	
Posterior Glottic Chink	4 (9.3%)	5 (11.6%)	
Hourglass	1 (2.3%)	0 (0.0%)	
Spindle	5 (11.6%)	3 (7.0%)	
Complete Nonclosure	4 (9.3%)	2 (4.7%)	
SRI: Duration of Closure***			0.002[1]
Predominantly Closed Phase	6 (14.0%)	1 (2.3%)	
Half Closed/Half Open Phase	6 (14.0%)	0 (0.0%)	
Predominantly Open Phase	31 (72.1%)	42 (97.7%)	
SRI: Nonvibratory Segment			0.110[2]
None	37 (86.0%)	42 (97.7%)	
Anterior 1/3rd	5 (11.6%)	1 (2.3%)	
Posterior 1/3rd	1 (2.3%)	0 (0.0%)	
SRI: Mucosal Wave***			<0.001[2]
Normal	26 (60.5%)	40 (93.0%)	
Restricted	16 (37.2%)	3 (7.0%)	
Absent	1 (2.3%)	0 (0.0%)	
SRI: Total Score***	79.60 ± 73.85	23.86 ± 41.76	<0.001[1]

Table 2: Comparison of SRI (Stroboscopic Research Instrument) parameters between cases and controls.

	Correlation coefficient (rho)	p value
RSI vs RFS	-0.03	0.871[1]
RSI vs SRI score	0.2	0.206[1]
RFS vs SRI score	0.22	0.148[1]
***Significant at p < 0.05, 1: Spearman's correlation		

Table 3: Spearman's Correlation between RSI, RFS and SRI score in LPR patients.

Discussion

LPR is one of the most predominant diseases that can be found in any otorhinolaryngologist's practice at any time. Diagnosing this condition with the currently available gold standard investigation, i.e., 24 hr pH monitoring, is a painstaking procedure for physicians. RSI and RFS are simple techniques for identifying LPR. RSI is a subjective score assessed by the patients themselves that tends to change according to the patients' tolerance, while the RFS is obtained with a constant light source endoscope, which cannot identify subtle changes in the larynx in LPR patients [6]. For a better interpretation of the laryngeal changes, we used videostroboscopy in evaluating and diagnosing LPR.

Oertel (1895) developed a stroboscope for the evaluation of vocal fold vibrations [7]. Later, stroboscopic light was introduced by Edgerton in the 1970s, which helped in freezing the motion of subjects for film recordings [8]. The basic principle on which stroboscopy operates was described by William Henry Fox Talbot

(1834) and later modified by Plateau (Talbot-Plateau law) [9]. The stroboscopic parameters were initially explained by Hirano, Bless and Feder (1987) in an attempt to improve the qualitative assessment of the videostroboscopic findings [10]. Many scoring systems have been proposed for the quantitative assessment of these parameters, but none are easily reproducible [11]. Rosen., *et al*. (2005) introduced the Stroboscopy Research Instrument (SRI) to address the need for a videostroboscopic protocol that could yield reliable results [7]. In the present study, we used this scoring system to assess laryngeal changes in LPR. To the best of our knowledge, our study is the first to use the SRI in the evaluation of LPR patients and to determine the correlation between laryngoscopic findings and stroboscopic findings using standardized instruments.

In LPR, recurrent and chronic inflammation occurs due to the reflux of gastric contents, i.e., pepsin, gastric acid and pancreatic enzymes, which results in edema of the vocal folds and, later, fibrosis. This leads to increased stiffness of the vocal folds, decreased amplitude and restricted mucosal waves, which have been described as hallmark signs of LPR in stroboscopy. Other signs, such as aperiodicity, incomplete closure and asymmetry, are also seen frequently in patients with LPR because of mass loading due to vocal fold edema [8].

In our study, among the parameters in the SRI, decreased amplitude (41.9%), asymmetry (14%), restricted mucosal waves (37.2%) and a predominantly open-phase glottal cycle were found to be significantly different between cases and controls. Most previous studies used either a flexible fiberoptic laryngoscope or rigid a videolaryngoscope to assess laryngeal changes in LPR. Very few studies have used stroboscopy in LPR patients. Prebuiscine., *et al*. observed that incomplete glottal closure, irregular vocal fold vibrations, asymmetry and reduced mucosal waves were statistically significant in LPR patients [12]. Hansa., *et al*. studied 112 patients with voice change and hoarseness using stroboscopy and found reduced mucosal waves and rough vocal fold edges, as found in LPR patients [13].

In the present study, the mean RFS scores of cases and controls were 8.60 ± 2.59 and 4.98 ± 2.45, respectively. Belafsky., *et al*. proposed that patients with an RFS >7 have a 94% probability of having LPR [14]. In our study, 76.7% of cases had RFS ≥7, and 23.3% of controls had RFS>7.15. The difference in results was due to differences in case and control selection. In our study, we selected patients based on the RSI, whereas Belafsky., *et al*. selected patients following dual probe pH monitoring. A total of 23.3% of controls in our study had an RFS >7, which may have been due to asymptomatic LPR [15]. We also compared the videostroboscopy and laryngeal endoscopy findings with the RSI and found a weak and insignificant correlation. This suggests that the RSI, RFS and SRI score are not accurate in independently diagnosing LPR, whereas incorporating all three scores will increase the accuracy.

The limitations of our study include the small sample size, the ethnicity and dietary patterns of the subjects and patient cooperation during the usage of the rigid endoscope. Other limitations include the high cost of the equipment and the lack of trained physicians, which make it difficult to implement videostroboscopy on a larger scale.

Conclusion

Decreased amplitude, asymmetry, restricted mucosal waves and a predominantly open-phase glottal cycle are seen more commonly in patients with LPR. In our study we have used validated instruments to objectively evaluate the stroboscopic findings in patients of laryngopharyngeal reflex patients and tried to establish the relationship between the stroboscopic scores and laryngeal endoscopic scores.

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Conflict of Interest

None.

Disclaimers

Nil.

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Declaration on Competing Interest

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

Bibliography

1. Koufman JA. "The otolaryngologic manifestations of gastroesophageal reflux disease (Gerd): A clinical investigation of 225 patients using ambulatory 24-hour ph monitoring and an experimental investigation of the role of acid and pepsin in the development of laryngeal injury". *Laryngoscope* 101.4 (1991): 1-78.

2. Bhargava A., *et al*. "Role of Reflux Symptom Index and Reflux Finding Score in Evaluation of Treatment Outcome in Patients with Laryngopharyngeal Reflux". *International Journal of Phonosurgery and Laryngology* 7.2 (2017): 39-43.

3. Fritz MA., *et al*. "The Accuracy of the Laryngopharyngeal Reflux Diagnosis: Utility of the Stroboscopic Exam". *Otolaryngology–Head and Neck Surgery (United States)* 155.4 (2016): 629-634.

4. Verikas A., *et al*. "Advances in laryngeal imaging". *European Archives of Oto-Rhino-Laryngology* 266.10 (2009): 1509-1520.

5. Dhillon VK and Akst L. "Videostroboscopy, Laryngopharyngeal Reflux, and Dysphonia: A Complex Relationship". *Current Otorhinolaryngology Reports* 4.1 (2016): 49-54.

6. He C., *et al*. "The utility of narrow band imaging in endoscopic diagnosis of laryngopharyngeal reflux". *American Journal of Otolaryngology* 40.5 (2019): 715-719.

7. Rosen CA. "Stroboscopy as a research instrument: Development of a perceptual evaluation tool". *Laryngoscope* 115.3 (2005): 423-428.

8. Peak Woo. "Stroboscopy". Plural Pub. Hong Kong (2010).

9. Talbot HF. XLIV. Experiments on light. London, Edinburgh, Dublin Philos Mag J Sci. 5.29 (1834): 321-334.

10. Bless DM., *et al*. "Videostroboscopic evaluation of the larynx". *Ear, Nose Throat Journal* 66.7 (1987): 289-296.

11. Bonilha HS., *et al*. "Parameters and Scales Used to Assess and Report Findings From Stroboscopy: A Systematic Review". *Journal of Voice* 32.6 (2018): 734-755.

12. Pribuisiene R., *et al*. "Perceptual and acoustic characteristics of voice changes in reflux laryngitis patients". *Journal of Voice* 20.1 (2006): 128-136.

13. Banjara H., *et al*. "Demographic and Videostroboscopic Assessment of Vocal Pathologies". *Indian Journal of Otolaryngology and Head and Neck Surgery* 64.2 (2012): 150-157.

14. Belafsky PC., *et al*. "The validity and reliability of the reflux finding score (RFS)". *Laryngoscope* 111.8 (2001): 1313-1317.

15. Chen M., *et al*. "Reflux symptom index and reflux finding score in 91 asymptomatic volunteers". *Acta Otolaryngology* 138.7 (2018): 659-663.