IJPHS:
International Journal of Psychology and Health Science
GREENATION PUBLISHER
+62 812 1046 7572 http://greenpub.org greenation.info@gmail.com
DOI: https://doi.org/10.38035/ijphs.v4i3

Correlation of Reflux Symptom Index and Reflux Finding Score with Voice Disability Severity in Patients with Laryngopharyngeal Reflux

I Gusti Ayu Karindra Dewi[1], Putu Dian Ariyanti Putri[2]
[1]Department of Otorhinolaryngology-Head and Neck Surgery, Faculty of Medicine, Universitas Udayana / Prof. Dr. I.G.N.G. Ngoerah General Hospital, Denpasar, Bali, Indonesia, igstayukarindradewi@gmail.com
[2]Department of Otorhinolaryngology Head and Neck Surgery, Faculty of Medicine, Universitas Udayana / Prof. Dr. I.G.N.G. Ngoerah General Hospital, Denpasar, Bali, Indonesia, dianariyantiputri.ap@gmail.com

Corresponding author: igstayukarindradewi@gmail.com[1]

Abstract: Laryngopharyngeal reflux (LPR) is a frequent cause of dysphonia, yet how reflux severity relates to voice disability is not fully characterized. Most prior studies used only the self-reported Voice Handicap Index, leaving perceptual and objective voice measures under-examined. This study assessed the correlation of the Reflux Symptom Index (RSI) and Reflux Finding Score (RFS) with voice disability, evaluated simultaneously by the subjective GRBAS scale and VHI-10 and the objective maximum phonation time (MPT), in patients with LPR. A cross-sectional analytic study enrolled 26 patients with LPR-related dysphonia at a tertiary ORL-HNS clinic between February and April 2026. LPR was defined by RSI >13 and/or RFS >7. Because the score data were non-normally distributed, associations were analyzed with Spearman rank correlation. Median RSI was 17.00 and median RFS 7.50. Most patients had moderate voice disability. RSI and RFS correlated positively with grade, roughness, breathiness, and VHI-10, and negatively with MPT (RSI–MPT $\rho=-0.713$, RSI–VHI-10 $\rho=0.896$, RFS–MPT $\rho=-0.813$, RFS–VHI-10 $\rho=0.781$, all $p<0.001$). Combining RSI and RFS with multidimensional voice assessment identifies LPR patients at risk of voice impairment and reduced phonatory efficiency.

Keywords: Laryngopharyngeal Reflux, Reflux Symptom Index, Reflux Finding Score, Voice Disability, Dysphonia

INTRODUCTION

Laryngopharyngeal reflux (LPR) is the retrograde movement of gastric contents into the pharynx and larynx, producing laryngeal symptoms such as cough, throat clearing, throat mucus, dysphonia, globus, and throat pain (Cui et al., 2024; Krause, 2024). The condition is common in otolaryngology practice: an estimated 10 percent of ear, nose, and throat outpatients have LPR, and up to 64 percent of patients presenting with voice complaints are diagnosed

with LPR (Sirajuddin et al., 2020). Reported prevalence varies widely, reaching about 20 to 27 percent in adult populations, and LPR can substantially reduce quality of life while, when prolonged, increasing the risk of chronic laryngitis and laryngeal malignancy (Lien et al., 2023; Massawe et al., 2021).

Because LPR lacks a single, universally accepted gold-standard test, diagnosis in routine practice relies on characteristic symptoms and laryngeal signs summarized by two scoring systems: the Reflux Symptom Index (RSI) and the Reflux Finding Score (RFS). The RSI is a nine-item, patient-reported instrument scored from 0 to 45, with a total above 13 suggesting LPR. The RFS is an eight-item scale based on flexible laryngoscopy, with a total above 7 suggesting LPR. Both are quick, reproducible, and useful for monitoring treatment response (Abraham & Kahinga, 2022; Muddaiah & Vybhavi, 2023). However, they should be interpreted cautiously, as a high RSI in patients with hoarseness from non-reflux causes can lead to over-diagnosis (Gojayev et al., 2025).

Dysphonia is among the most common LPR symptoms, and more than half of patients with hoarseness have LPR. Voice disability can be evaluated with complementary tools: the Voice Handicap Index (VHI), a patient-reported measure of the impact of voice problems on daily life; the GRBAS scale (grade, roughness, breathiness, asthenia, strain), an auditory-perceptual assessment; and maximum phonation time (MPT), a simple aerodynamic measure of glottal efficiency. Each of these has been used to grade severity and to follow patients with LPR before and after therapy (Barsties et al., 2023; Jain et al., 2022; Lechien et al., 2019).

Most previous studies relating LPR severity to voice disability have used the subjective, self-reported VHI, whereas data directly correlating RSI and RFS with perceptual (GRBAS) and objective (MPT) voice measures remain limited. RSI and RFS also frequently show poor concordance, so relying on a single instrument may misclassify disease severity (Nilakhe et al., 2020; Zhang et al., 2025). This study therefore assessed the correlation of RSI and RFS with the severity of voice disability, measured by GRBAS, MPT, and VHI-10, in patients with LPR.

METHOD

This was an observational analytic study with a cross-sectional design carried out at the Otorhinolaryngology-Head and Neck Surgery (ORL-HNS) outpatient clinic of Prof. Dr. I.G.N.G. Ngoerah General Hospital, Denpasar, from February to April 2026. Primary data were collected from patients with dysphonia diagnosed with LPR who attended the clinic during the study period.

Participants were selected by consecutive sampling. The inclusion criteria were patients with dysphonia diagnosed with LPR, defined by an RSI above 13 and/or an RFS above 7, and aged over 18 years. Patients who had undergone surgery of the neck or vocal folds, or who had laryngeal disease unrelated to LPR, were excluded. Twenty-six patients met the criteria and were enrolled. The sample size was not fixed by a formal power calculation. All eligible patients presenting during the study period were consecutively enrolled, giving a final sample of 26.

Each participant completed the RSI, a nine-item self-report of reflux symptoms over the preceding month (each item 0 to 5). The RFS was determined by flexible nasopharyngolaryngoscopy across eight laryngeal findings. Voice disability was assessed using three instruments: the VHI-10, a 10-item patient-reported questionnaire scored 0 to 40 (0 to 11 mild, 12 to 23 moderate, 24 to 40 severe); the GRBAS scale, in which each of the five perceptual parameters is rated 0 (normal) to 3 (severe); and MPT, the longest sustained phonation after maximal inspiration, recorded in seconds. Demographic data were obtained from medical records.

Data were analyzed using SPSS version 24.0. The Shapiro-Wilk test assessed the normality of numerical variables and showed that RSI, RFS, and the GRBAS parameters were not

normally distributed, whereas MPT and VHI-10 were. Descriptive statistics were presented as mean ± standard deviation for normally distributed data, median and interquartile range (IQR) for non-normally distributed data, and frequency and percentage for categorical data. Because the predictor scores and the GRBAS ratings were ordinal or non-normal, and to keep one consistent method across all pairs, the correlation between the independent variables (RSI and RFS) and the dependent voice-disability measures (GRBAS, MPT, and VHI-10) was evaluated with the Spearman rank correlation coefficient (ρ). Correlation strength was interpreted as weak (ρ 0.00 to 0.30), moderate (ρ 0.31 to 0.60), strong (ρ 0.61 to 0.90), and very strong (ρ 0.91 to 1.00) (Akoglu, 2018). Statistical significance was set at $p < 0.05$.

Ethical consideration. Written informed consent was obtained from every participant before enrolment. Ethical approval for this study was granted by the Research Ethics Committee of the Faculty of Medicine, Universitas Udayana / Prof. Dr. I.G.N.G. Ngoerah General Hospital (No. 0692/UN13.2.2.VII/LT/2026).

Results and Discussion

Demographic characteristics and LPR severity

This study involved 26 patients with LPR. The mean age was 49.69 ± 15.00 years, with half of the patients (50.0 percent) aged 40 to 60 years. The sex distribution was nearly balanced, with a slight male predominance (53.8 percent). LPR severity was graded using the RSI and RFS. The median RSI was 17.00 (IQR 14.00 to 21.00) and the median RFS was 7.50 (IQR 7.00 to 8.25). All patients had an RSI above 13 (100 percent), whereas only 50.0 percent had a high RFS (above 7); ten patients had an RFS of 7 and three had an RFS of 6. Detailed characteristics are shown in Table 1.

Table 1. Demographic characteristics and LPR severity

Characteristic	Total (n = 26)
Age (years), mean ± SD	49.69 ± 15.00
21–40 years	7 (26.9%)
40–60 years	13 (50.0%)
> 60 years	6 (23.1%)
Sex, n (%)	
Male	14 (53.8%)
Female	12 (46.2%)
RSI, median (IQR)	17.00 (14.00–21.00)
High RSI (> 13)	26 (100%)
Low RSI (≤ 13)	0 (0%)
RFS, median (IQR)	7.50 (7.00–8.25)
High RFS (> 7)	13 (50.0%)
Low RFS (≤ 7)	13 (50.0%)

IQR, interquartile range; RFS, Reflux Finding Score; RSI, Reflux Symptom Index; SD, standard deviation.

The age distribution is consistent with earlier Indonesian LPR series. Widiantari and Sucipta (2019) reported that most patients were aged 40 to 49 years, and Adha et al. (2024) found LPR most often in patients over 50 years. A similar pattern is reported internationally: a large Chinese study found LPR most frequent at 40 to 60 years (Liu et al., 2025), and a Saudi cross-sectional study identified a high prevalence in middle-aged adults (Ahbail et al., 2024). Aging reduces esophageal motility, bicarbonate secretion, and sphincter tone, and laryngeal mucus secretion declines from around 40 years, leaving the laryngeal mucosa more vulnerable

to refluxate. The concentration of cases in the 40-to-60 age band, rather than in the oldest group, may also reflect greater psychological stress in this age range, which can disturb autonomic function and esophageal sphincter relaxation (Barillari et al., 2025; Liu et al., 2025).

The near-balanced sex distribution, with slight male predominance, contrasts with several studies reporting a female predominance in LPR (Adha et al., 2024; Liu et al., 2025; Widiantari & Sucipta, 2019). Proposed reasons for higher female risk include shorter, thinner vocal folds with lower superficial-layer hyaluronic acid, estrogen-related nitric oxide production that relaxes the lower esophageal sphincter, and a stronger inflammatory response. However, lifestyle risk factors such as smoking, caffeine, and alcohol are more common in men and reduce sphincter tone and gastrointestinal motility, which can bring male risk closer to that of women, as seen in this sample (Ahbail et al., 2024; Dinc et al., 2020; Nehlig, 2022).

Voice disability in patients with LPR

Voice disability was assessed with the GRBAS scale, MPT, and VHI-10. On the GRBAS scale, half of the patients had moderate overall hoarseness (grade G2, 50.0 percent) and most had moderate roughness (R2, 57.7 percent). By contrast, breathiness was absent in 65.4 percent of patients, asthenia was absent in 96.2 percent, and strain was absent in 73.1 percent. The median MPT was 14.00 seconds (IQR 11.75 to 16.50), and the mean VHI-10 was 17.81 ± 4.93. By VHI-10 category, most patients had moderate voice disability (73.1 percent) and 15.4 percent had severe disability. Details are shown in Table 2.

Table 2. Voice disability characteristics in patients with LPR

Voice disability measure	Total (n = 26)
GRBAS – Grade (G)	
Severe (G3)	4 (15.4%)
Moderate (G2)	13 (50.0%)
Mild (G1)	9 (34.6%)
GRBAS – Roughness (R)	
Severe (R3)	2 (7.7%)
Moderate (R2)	15 (57.7%)
Mild (R1)	9 (34.6%)
GRBAS – Breathiness (B)	
Mild (B1)	9 (34.6%)
None (B0)	17 (65.4%)
GRBAS – Asthenia (A)	
Mild (A1)	1 (3.8%)
None (A0)	25 (96.2%)
GRBAS – Strain (S)	
Mild (S1)	7 (26.9%)
None (S0)	19 (73.1%)
MPT (seconds), median (IQR)	14.00 (11.75–16.50)
VHI-10, mean ± SD	17.81 ± 4.93
Severe disability (24–40)	4 (15.4%)
Moderate disability (12–23)	19 (73.1%)
Mild disability (0–11)	3 (11.5%)

IQR, interquartile range; MPT, maximum phonation time; SD, standard deviation; VHI, Voice Handicap Index.

These findings agree with the pathophysiology of reflux-related voice change. Repeated exposure of the vocal-fold mucosa to acid and pepsin causes intraepithelial inflammation, epithelial thickening, and increased mucus adhesion, which raise vocal-fold mass and stiffness and disturb the amplitude and regularity of mucosal vibration (Alanazi et al., 2018; Lechien et al., 2017). Moderate disability on GRBAS and VHI-10 is consistent with Lechien et al. (2019), who reported a mean VHI of about 18 in LPR patients, and with a Chinese case-control series reporting moderate pre-treatment GRBAS and VHI (Zhang et al., 2025). The reduced MPT (median 14 seconds, against healthy adult values of roughly 25 to 35 seconds in men and 15 to 25 seconds in women) further supports phonatory dysfunction, in line with a pre-treatment median MPT of 11.5 seconds reported by Zhang et al. (2025) and with age-adjusted norms that remain above 20 seconds in healthy older adults (Maslan et al., 2012).

The predominance of grade and roughness, with little breathiness, asthenia, or strain, reflects the typical site of LPR injury at the vibratory margin of the vocal fold, which mainly disturbs mucosal vibration and produces roughness rather than glottic-closure defects. Breathiness and asthenia usually arise from glottic incompetence, as in vocal-fold paralysis or muscle atrophy, which were not features of this cohort, and strain reflects laryngeal hyperfunction that is not the main adaptive mechanism in LPR (Fujiki & Thibeault, 2023; Lechien et al., 2017). The apparent tension between the low prevalence of clinically rated breathiness and its statistically significant correlation with RSI and RFS (below) is explained by the difference between a severity distribution and a correlation: within the observed range, rising reflux severity was accompanied by the emergence of mild breathiness in a subset of patients, even though most patients scored B0.

Correlation of RSI and RFS with voice disability

The RSI correlated significantly and positively with GRBAS grade (ρ = 0.850), roughness (ρ = 0.820), and breathiness (ρ = 0.485), and with VHI-10 (ρ = 0.896), and correlated significantly and negatively with MPT (ρ = -0.713). No significant correlation was found between RSI and asthenia (ρ = -0.121, p = 0.555) or strain (ρ = 0.193, p = 0.345). The correlations of RSI with voice-disability measures are shown in Table 3 and Figure 1.

Table 3. Correlation of RSI with GRBAS, MPT, and VHI-10

Parameter	Grade	Rough-ness	Breathi-ness	Asthenia	Strain	MPT	VHI-10
RSI, ρ	0.850	0.820	0.485	-0.121	0.193	-0.713	0.896
p-value	<0.001*	<0.001*	0.012*	0.555	0.345	<0.001*	<0.001*

*Statistically significant (p < 0.05). MPT, maximum phonation time; RSI, Reflux Symptom Index; VHI, Voice Handicap Index.

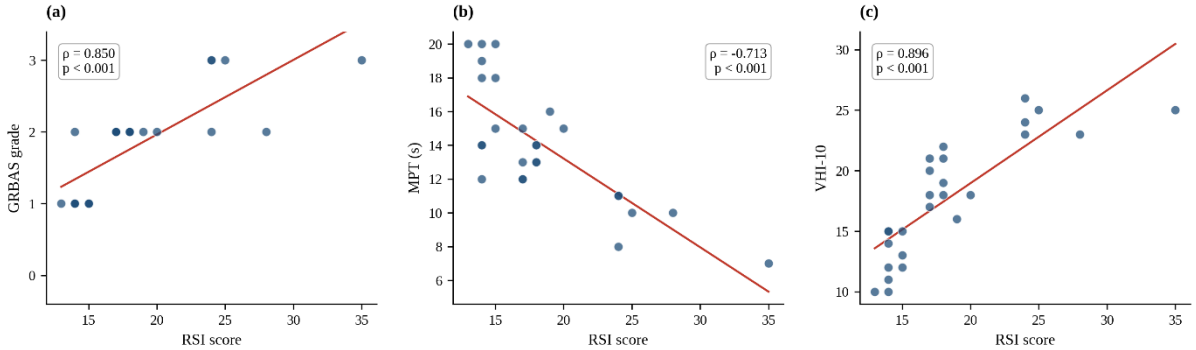

Figure 1. Scatter plots of RSI against GRBAS grade (a), MPT (b), and VHI-10 (c).

The RFS correlated significantly and positively with grade (ρ = 0.758), roughness (ρ = 0.711), and breathiness (ρ = 0.612), and with VHI-10 (ρ = 0.781), and correlated significantly and negatively with MPT (ρ = -0.813). RFS did not correlate significantly with asthenia (ρ = -

0.139, p = 0.499) or strain (ρ = -0.030, p = 0.884). The correlations of RFS with voice-disability measures are shown in Table 4 and Figure 2.

Table 4. Correlation of RFS with GRBAS, MPT, and VHI-10

Parameter	Grade	Rough-ness	Breathi-ness	Asthenia	Strain	MPT	VHI-10
RFS, ρ	0.758	0.711	0.612	-0.139	-0.030	-0.813	0.781
p-value	<0.001*	<0.001*	<0.001*	0.499	0.884	<0.001*	<0.001*

*Statistically significant (p < 0.05). MPT, maximum phonation time; RFS, Reflux Finding Score; VHI, Voice Handicap Index.

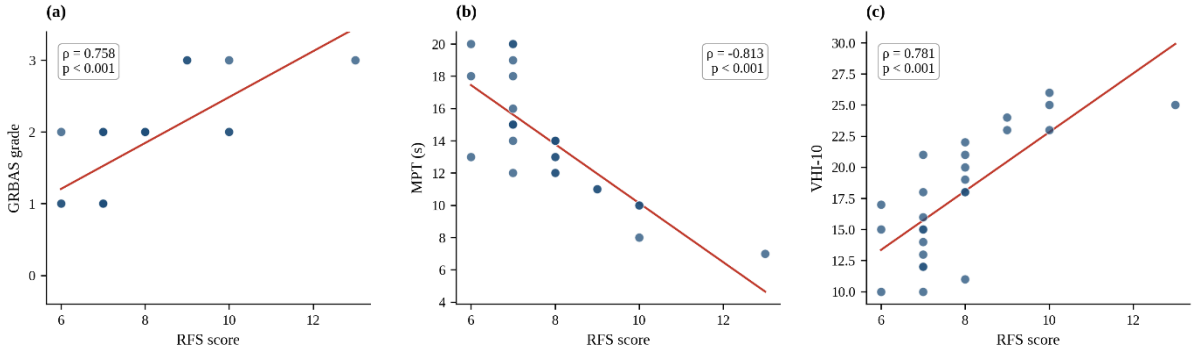

Figure 2. Scatter plots of RFS against GRBAS grade (a), MPT (b), and VHI-10 (c).

Taken together, higher RSI and RFS were associated with greater voice disability across grade, roughness, breathiness, and VHI-10, and with shorter phonation time. These results are consistent with previous work. Gojayev et al. (2025) reported a moderate positive correlation between RSI and VHI-10, and Alanazi et al. (2018) found RSI to be a significant predictor of VHI-10. Kaddah et al. (2011) similarly reported moderate positive correlations of both RSI and RFS with VHI. Evidence directly relating RSI or RFS to MPT and GRBAS is scarce, and by including these perceptual and objective measures this study adds to the mostly VHI-based literature.

Physiologically, a higher RSI reflects a greater symptomatic burden from more frequent and persistent reflux, while a higher RFS reflects greater structural and inflammatory change in the larynx, including vocal-fold edema, erythema, and endolaryngeal mucus. The parallel rise of both scores with voice disability fits a dose-dependent injury model, in which more frequent and severe refluxate exposure produces progressively greater mucosal damage, impaired vocal-fold vibration, and worse voice outcomes (Lechien et al., 2020; Suda et al., 2024). The consistency of the symptom-based (RSI) and finding-based (RFS) correlations supports using both instruments together rather than either alone.

The principal finding of this study is that both symptom-based (RSI) and finding-based (RFS) measures of LPR severity correlate strongly and consistently with voice disability across the self-reported, perceptual, and objective domains. Its novelty lies in evaluating these two reflux indices simultaneously against the GRBAS scale, VHI-10, and MPT in the same cohort, whereas most earlier work relied on the self-reported VHI alone. By showing that the symptom index and the laryngoscopic finding score move together with perceptual roughness, self-perceived handicap, and reduced phonatory efficiency, the study supports using RSI and RFS jointly, rather than either alone, as a practical screen for LPR patients at risk of voice impairment.

CONCLUSION

In patients with LPR, most had moderate voice disability on the GRBAS scale and VHI-10, with grade and roughness the most affected parameters and a reduced MPT. Both the RSI and the RFS correlated significantly and positively with GRBAS grade, roughness, and

breathiness and with VHI-10, and correlated significantly and negatively with MPT. Greater LPR severity, measured by symptoms and by laryngeal findings, is therefore associated with greater voice disability and reduced phonatory efficiency. Combining the RSI and RFS with a multidimensional voice assessment (VHI-10, GRBAS, and MPT) may help identify LPR patients at high risk of voice impairment in clinical practice.

This study had limitations. It was a single-center study with a small convenience sample (n = 26) and no a priori sample-size calculation, so the strong correlations should be regarded as exploratory. MPT norms differ by sex, but MPT was analyzed for the whole group without sex stratification, which may confound the results. The cross-sectional design cannot establish causality. Larger, multi-center, and longitudinal studies using acoustic and aerodynamic analysis are recommended to confirm these associations and to assess voice recovery after therapy. Future work should also stratify MPT by sex and include a formal sample-size calculation.

Author Contributions

Both authors contributed to the study's conception and design. I.G.A.K.D. collected and analyzed the data and drafted the manuscript. P.D.A.P. supervised the clinical assessment and critically revised the manuscript. Both authors approved the final version.

Acknowledgment

The authors thank the staff of the Otorhinolaryngology-Head and Neck Surgery outpatient clinic of Prof. Dr. I.G.N.G. Ngoerah General Hospital for their support during data collection, and the patients who participated in this study.

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