

Research Article

COMPARATIVE STUDY OF NARROW BAND IMAGING WITH WHITE LIGHT IMAGING IN DIAGNOSING LARYNGOPHARYNGEAL REFLUX DISEASE

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ABSTRACT

Background: Laryngopharyngeal reflux disease (LPRD) is a multifactorial inflammatory condition resulting from the retrograde exposure of the laryngopharyngeal mucosa to gastric contents, including acid, pepsin, and bile salts. Unlike classical gastroesophageal reflux disease, Laryngopharyngeal Reflux Disease (LPRD) frequently presents with extra-esophageal manifestations such as dysphonia, chronic cough, globus sensation, and throat clearing, which are often nonspecific and contribute to diagnostic ambiguity. Conventional diagnostic modalities, including symptom indices, laryngoscopic scoring systems, and pH monitoring, exhibit significant limitations in sensitivity, specificity, and feasibility. Narrow Band Imaging (NBI), an optical image-enhancement technology that utilizes filtered blue and green wavelengths to

accentuate mucosal microvascular architecture, has emerged as a promising adjunct in the evaluation of laryngeal pathology. The present prospective cross-sectional study was conducted on 100 patients presenting with symptoms suggestive of Laryngopharyngeal Reflux Disease (LPRD). Each patient underwent laryngeal examination using both conventional white light (WL) endoscopy and Narrow Band Imaging (NBI). Findings were analyzed using standardized scoring systems, including the Reflux Finding Score (RFS) and the Garcia-Vidal Narrow Band Imaging (NBI) grading system. The results demonstrated that Narrow Band Imaging (NBI) significantly improved the detection of key inflammatory features, including erythema/hyperemia (96% vs 75%), granuloma formation (88% vs 70%), and vascular ectasia/microvascular proliferation (68% vs 24%), when compared with WL

imaging. These findings underscore the superior diagnostic sensitivity of Narrow Band Imaging (NBI) in identifying subtle mucosal and vascular alterations associated with Laryngopharyngeal Reflux Disease (LPRD). The incorporation of Narrow Band Imaging (NBI) into routine laryngoscopic evaluation may enhance early diagnosis, improve clinical decision-making, and reduce reliance on invasive diagnostic modalities.

KEYWORDS: Laryngopharyngeal reflux disease, Narrow Band Imaging, White Light Laryngoscopy, Microvascular proliferation, Reflux Finding Score

INTRODUCTION

Laryngopharyngeal reflux disease (LPRD)) is increasingly recognized as a significant cause of chronic laryngeal inflammation, accounting for approximately 4–10% of patients presenting to otorhinolaryngology clinics [4,5,10]. It is defined as the retrograde flow of gastric contents, including acid, pepsin, and bile salts, into the larynx and pharynx, resulting in mucosal irritation and inflammation [3,11]. Unlike gastroesophageal reflux disease (GERD), Laryngopharyngeal Reflux Disease (LPRD) is predominantly characterized by extra-esophageal symptoms such as dysphonia, chronic cough, throat clearing, globus sensation, and excessive throat mucus, often in the absence of classical reflux symptoms such as heartburn [3,5].

The pathogenesis of Laryngopharyngeal Reflux Disease (LPRD) is complex and involves both direct and indirect mechanisms. Direct mucosal injury occurs due to exposure of the laryngeal epithelium to acidic and enzymatic refluxate, leading to epithelial disruption, edema, and inflammatory infiltration [3,13]. Additionally, pepsin has been shown to remain active in non-acidic environments, contributing to persistent mucosal injury even in the

absence of acid reflux. Indirect mechanisms involve vagally mediated reflexes that result in chronic cough and throat irritation. The laryngeal mucosa, lacking the protective buffering mechanisms present in the esophagus, is highly susceptible to even minimal reflux exposure, resulting in exaggerated inflammatory responses [3,11,12]. Despite its clinical importance, the diagnosis of Laryngopharyngeal Reflux Disease (LPRD) remains controversial due to the absence of a universally accepted gold standard. Multichannel intraluminal impedance-pH monitoring is considered the most objective diagnostic modality; however, it is invasive, expensive, and has limited reproducibility due to variability in probe positioning and lack of standardized thresholds [5,10]. Consequently, clinical practice relies heavily on symptom-based and endoscopic assessments such as RSI and RFS. However, RSI is inherently subjective and influenced by patient perception, while RFS, although more objective, lacks specificity and is unable to grade disease severity effectively [1,2].

Conventional white light laryngoscopy, which forms the cornerstone of routine clinical evaluation, is limited in its ability to detect subtle mucosal and vascular changes. Findings such as erythema, edema, and posterior commissure hypertrophy are nonspecific and may be observed in various non-reflux conditions, including allergic laryngitis, infections, and vocal strain [5, 15, 16].

Narrow Band Imaging (NBI)) represents a significant advancement in endoscopic imaging technology. By utilizing narrow bandwidths of blue (415 nm) and green (540 nm) light, Narrow Band Imaging (NBI) enhances the visualization of superficial and subepithelial vascular structures by exploiting the absorption properties of haemoglobin [9,14]. This results in improved contrast and allows for detailed assessment

of microvascular patterns, which are indicative of inflammatory and pathological changes [6].

Recent studies, including the work by Pace *et al.*, have demonstrated that Narrow Band Imaging (NBI) significantly increases the detection of Laryngopharyngeal Reflux Disease (LPRD) compared to white light laryngoscopy, identifying up to 88% of cases compared to 65% detected by conventional methods. Furthermore, the identification of characteristic features such as increased vascularity and “green spots” in the posterior commissure provides an objective basis for grading disease severity. In light of these advancements, the present study aims to evaluate and compare the diagnostic efficacy of Narrow Band Imaging with conventional white light laryngoscopy in patients with suspected Laryngopharyngeal Reflux Disease (LPRD), with particular emphasis on mucosal and microvascular changes [7,8].

AIM AND OBJECTIVES

Aim

To Compare Narrow Band Imaging with White Light Imaging in diagnosing Laryngopharyngeal Reflux Disease.

Objectives

- To describe Narrow Band Imaging (NBI) endoscopic features associated with Laryngopharyngeal Reflux Disease (LPRD).
- To describe White light laryngoscopy features associated with Laryngopharyngeal Reflux Disease (LPRD) light.
- To compare Narrow Band Imaging (NBI) & White light laryngoscopy in diagnosing laryngopharyngeal reflux disease (LPRD).

Table 1: Garcia-Vidal NARROW BAND IMAGING (NBI) Scoring System

Parameter	Score	Description
Erythema / Hyperemia	0	Absent
	1	Arytenoids only
	2	Diffuse erythema
Vocal Fold Edema	0	Absent

MATERIALS AND METHODS

The present study was designed as a retrospective cross-sectional observational study conducted in the Department of Otorhinolaryngology at MGM Medical College and Hospital, Chhatrapati Sambhajinagar. A total of 100 patients presenting to the outpatient department with symptoms suggestive of Laryngopharyngeal Reflux Disease (LPRD) were included over the study period of 3 months from August 2025 to October 2025.

Eligible participants were adults aged between 18 and 80 years presenting with clinical features such as hoarseness, chronic throat clearing, globus sensation, chronic cough, and throat discomfort. Patients with confounding factors such as smoking, alcohol consumption, vocal abuse, malignancy, or recent upper respiratory tract infection were excluded to minimize bias.

All patients underwent a comprehensive clinical evaluation followed by laryngeal examination using rigid endoscopy under both conventional white light and Narrow Band Imaging modes. The examinations were performed under standardized conditions to ensure consistency. Findings were systematically recorded using structured proformas.

The Reflux Finding Score (RFS) was used to quantify laryngoscopic findings under white light, while the Garcia-Vidal Narrow Band Imaging (NBI) scoring system was employed to assess vascular and mucosal changes under Narrow Band Imaging. Data were compiled and analyzed using descriptive statistical methods to compare the diagnostic yield of both modalities.

	1	Mild
	2	Moderate
	3	Severe
	4	Contact ulcer
	5	Polypoid
Posterior Commissure Hypertrophy (Green Spots)	0	Absent
	1	< 25% involvement
	2	25–50% involvement
	3	50–75% involvement
	4	> 75% involvement
Granuloma	0	Absent
	1	Initial
	2	Present

Table 2: Reflux Finding Score (RFS)

Parameter	Score	Description
Subglottic Edema	0	Absent
	2	Present
Ventricular Obliteration	0	None
	2	Partial
	4	Complete
Erythema / Hyperemia	0	None
	2	Arytenoids only
	4	Diffuse
Vocal Fold Edema	0	None
	1	Mild
	2	Moderate
	3	Severe
	4	Polypoid
Diffuse Laryngeal Edema	0	None
	1	Mild
	2	Moderate
	3	Severe
	4	Obstructing
Posterior Commissure Hypertrophy	0	None
	1	Mild
	2	Moderate
	3	Severe
	4	Obstructing
Granuloma / Granulation Tissue	0	Absent
	2	Present
Thick Endolaryngeal	0	Absent

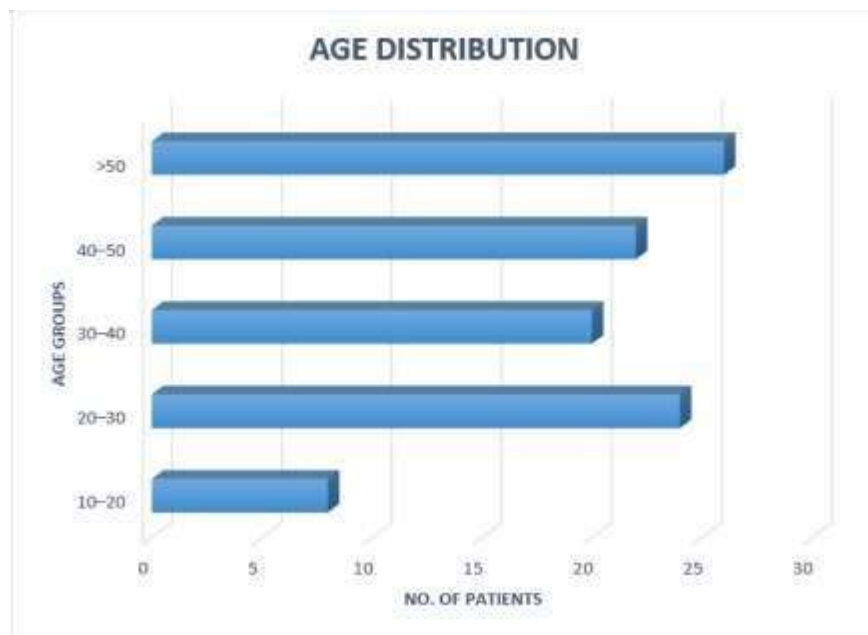
Mucus		
	2	Present

RESULTS

A total of 100 patients clinically suspected of laryngopharyngeal reflux disease (Laryngopharyngeal Reflux Disease (LPRD)) were included in the present study. Demographic analysis revealed that the highest proportion of patients belonged to the age group above 50 years (26%), followed by the 20–30 years age group (24%), 40–50 years group (22%), and 30–40 years group (20%). The least number of patients were observed in the 10–20 years age group (8%). These findings suggest that Laryngopharyngeal Reflux Disease (LPRD) was more frequently encountered among middle-aged and elderly individuals.

Table 3: Age distribution

Age Group (Years)	Number of Patients (n)	Percentage (%)
10–20	8	8%
20–30	24	24%
30–40	20	20%
40–50	22	22%
>50	26	26%
Total	100	100%



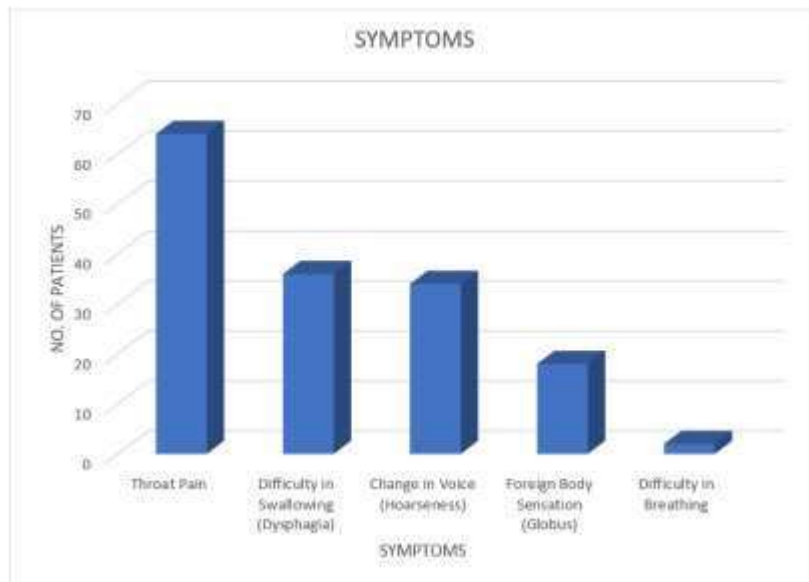
Graph 1: Age distribution

Symptom analysis demonstrated that throat pain was the most common presenting complaint, observed in 64% of patients. Difficulty in swallowing (dysphagia) was present in 36% of cases, while change in voice or hoarseness was noted in 34% of patients. Foreign body sensation (globus pharyngeus) was reported by 18% of individuals, whereas difficulty in breathing was the

least common symptom, observed in only 2% of cases. The symptom profile observed in the present study reflects the predominantly nonspecific upper aerodigestive manifestations associated with Laryngopharyngeal Reflux Disease (LPRD).

Table 4: Symptom distribution

Symptom	Number of Patients (n)	Percentage (%)
Throat Pain	64	64%
Difficulty in Swallowing (Dysphagia)	36	36%
Change in Voice (Hoarseness)	34	34%
Foreign Body Sensation (Globus)	18	18%
Difficulty in Breathing	2	2%



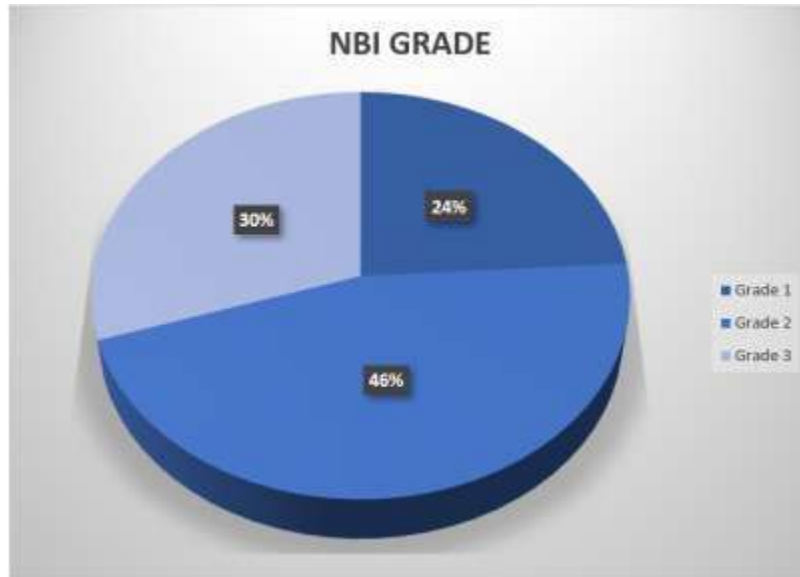
Graph 2: Symptom distribution

Evaluation of Narrow Band Imaging (NBI)) grading demonstrated that Grade 2 lesions constituted the largest proportion, accounting for 46% of cases. Grade 3 lesions were identified in 30% of patients, while Grade 1 lesions were observed in 24% of patients. These findings indicate that the majority of patients exhibited moderate mucosal and vascular alterations on Narrow Band Imaging (NBI) assessment.

Table 5: Narrow Band Imaging (NBI) Grade

Sr. No.	Narrow Band Imaging (NBI) Grade	Number of Patients (%)
1	Grade 1	24%
2	Grade 2	46%
3	Grade 3	30%

Total	100%
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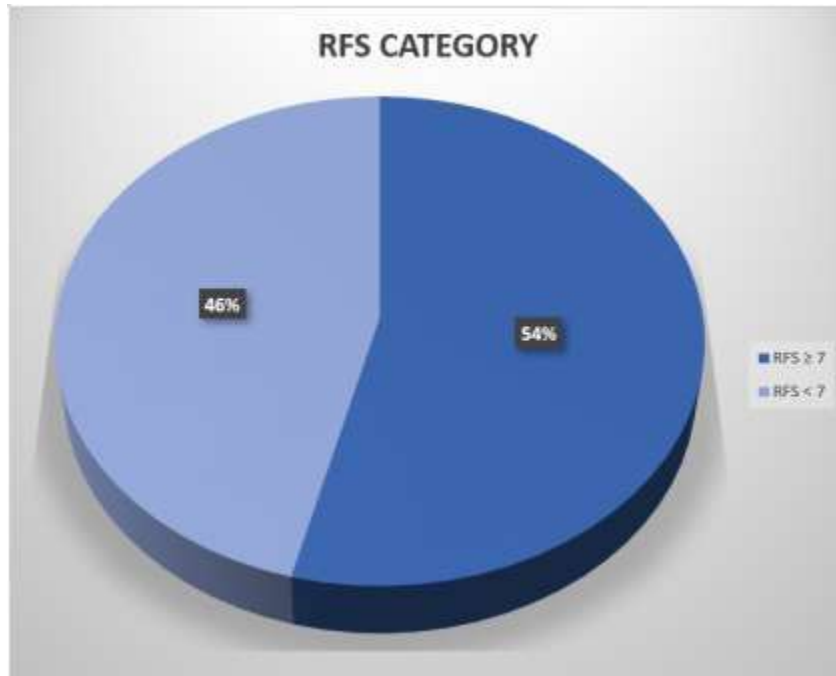


Graph 3: Narrow Band Imaging (NBI) Grade

Assessment of Reflux Finding Score (RFS) distribution revealed that 54% of patients had an RFS score ≥ 7 , suggestive of significant laryngopharyngeal reflux-related changes, whereas 46% of patients demonstrated an RFS score < 7 . This indicates that more than half of the study population showed clinically significant laryngeal findings associated with reflux disease.

Table 6: Distribution of Reflux Finding Score (RFS) Among Study Participants

Sr. No.	Reflux Finding Score (RFS) Category	Percentage (%)
1	RFS ≥ 7	54%
2	RFS < 7	46%
	Total	100%

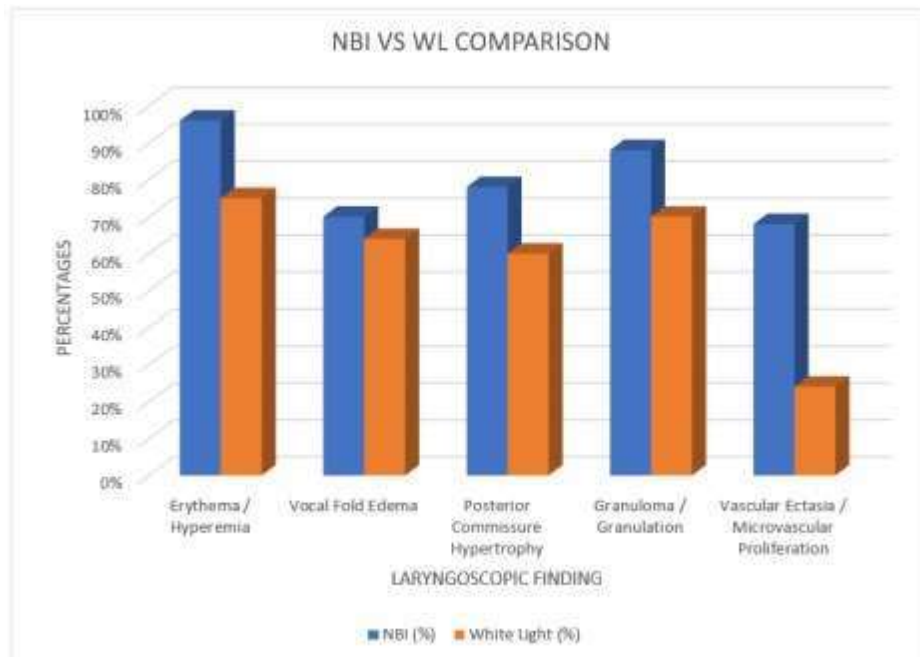


Graph 4: Distribution of Reflux Finding Score (RFS) Among Study Participants

Comparative evaluation between Narrow Band Imaging (NBI) and White Light (WL) imaging demonstrated superior detection rates with Narrow Band Imaging (NBI) for various laryngoscopic findings. Erythema and hyperemia were detected in 96% of patients using Narrow Band Imaging (NBI) compared to 75% using WL imaging. Vocal fold edema was identified in 70% of cases with Narrow Band Imaging (NBI) and 64% with WL. Posterior commissure hypertrophy was observed in 78% of patients on Narrow Band Imaging (NBI), compared to 60% on WL imaging. Granuloma or granulation tissue was detected in 88% of patients with Narrow Band Imaging (NBI) versus 70% with WL. Most notably, vascular ectasia and microvascular proliferation were identified in 68% of patients using Narrow Band Imaging (NBI), whereas only 24% were detected using white light imaging.

Table 5: Narrow Band Imaging (NBI) vs WL comparison

Laryngoscopic Finding	Narrow Band Imaging (%)	White Light (%)
Erythema / Hyperemia	96	75
Vocal Fold Edema	70	64
Posterior Commissure Hypertrophy	78	60
Granuloma / Granulation	88	70
Vascular Ectasia / Microvascular Proliferation	68	24



Graph 5: Narrow Band Imaging (NBI) vs WL comparison

Overall, the findings of the present study demonstrate that Narrow Band Imaging provides enhanced visualization of mucosal inflammation and microvascular alterations when compared with conventional white light imaging. The improved detection capability of Narrow Band Imaging (NBI) suggests its potential utility as a valuable adjunctive diagnostic modality in the evaluation of laryngopharyngeal reflux disease.

DISCUSSION

The findings of the present study strongly support the superior diagnostic performance of Narrow Band Imaging in the evaluation of Laryngopharyngeal Reflux Disease (LPRD). The enhanced detection of erythema, granuloma, and microvascular changes observed with Narrow Band Imaging (NBI) can be attributed to its ability to highlight hemoglobin-rich vascular structures, thereby improving visualization of inflammatory changes.

The results are consistent with the findings of Pace *et al.*, who reported a significantly higher detection rate of Laryngopharyngeal Reflux Disease (LPRD) using Narrow Band Imaging (NBI) compared to white light laryngoscopy. The identification of

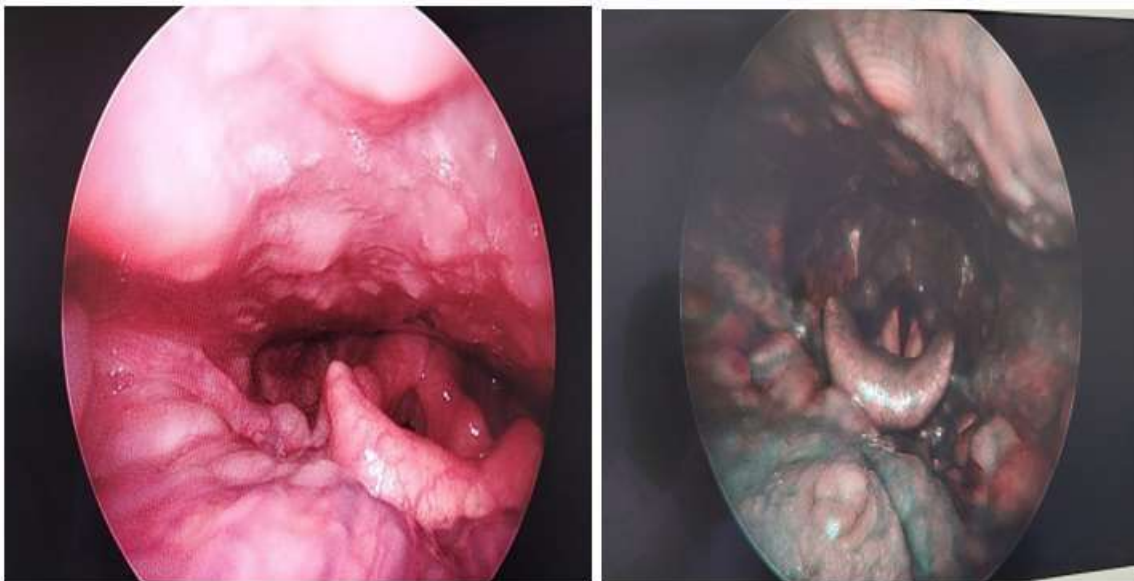
characteristic features such as “green spots” in the posterior commissure provides an objective marker of disease severity and reflects chronic mucosal injury.

Moreover, the ability of Narrow Band Imaging (NBI) to detect early-stage disease that may not be apparent under white light imaging has important clinical implications. Early diagnosis allows for timely intervention, which may prevent progression to more severe complications.

However, it is important to note that Narrow Band Imaging (NBI) may have limitations in detecting certain structural abnormalities such as subglottic edema, suggesting that it should be used as an adjunct rather than a replacement for conventional laryngoscopy.

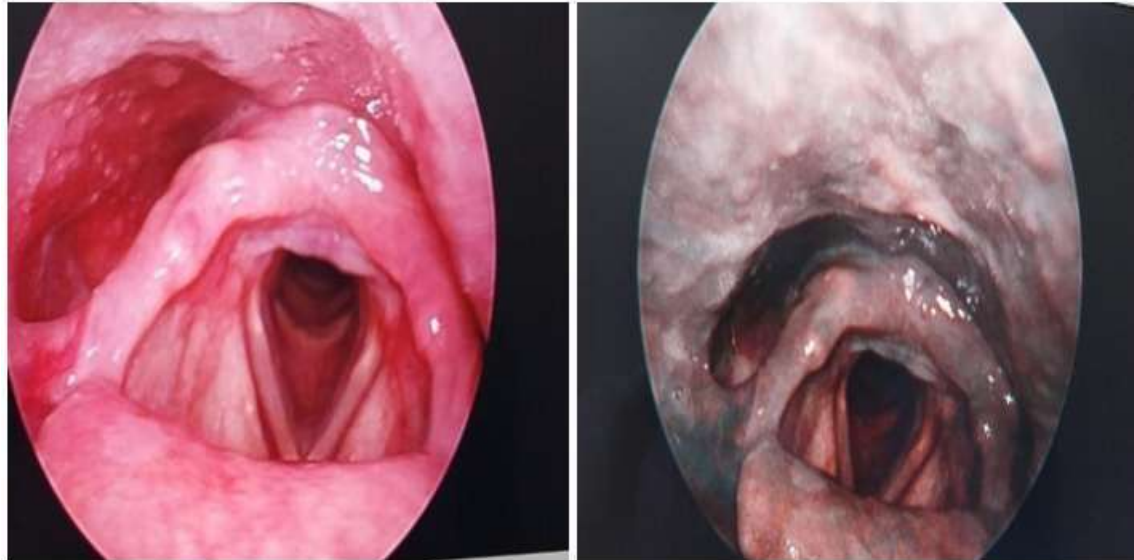


On comparing White light image with Narrow Band Imaging (NBI) image granulation's appears more significant in NBI as it stand out in contrast with green background



white light image: - diffuse edema & granulation are seen over white light

narrow band imaging (NBI) image : - Visualization of superficial and subepithelial vessels making vascular changes more evident in Narrow Band Imaging (NBI).



White light image: - Erythema, granulation & Posterior commissure hypertrophy is evident

Narrow Band Imaging (NBI) image : - Erythema seen as green spots over Posterior commissure (covering >50% area)

CONCLUSION

Narrow Band Imaging represents a significant advancement in the endoscopic evaluation of Laryngopharyngeal Reflux Disease. By enhancing visualization of mucosal and microvascular changes, Narrow Band Imaging (NBI) provides superior diagnostic sensitivity compared to conventional white light laryngoscopy. Its incorporation into routine clinical practice has the potential to improve diagnostic accuracy, facilitate early detection, and optimize patient management.

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