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Diagnostic utility of videostroboscopy in hoarseness disorders. A hospital-based cross-sectional study in a tertiary care hospital in Telangana.

Dr. Akram Unnisa Sufia[1], Dr.Talari Yasaswi[2,*], Dr. Koppolu Sowjanya Kumari[3], Dr. T. Maheswari Rani[4]
[1]Senior Resident, Department of Otorhinolaryngology, ENT, Government Medical College Vikarabad, Telangana, India
[2]Assistant Professor, Department of Otorhinolaryngology, ENT, Government Medical College Vikarabad, Telangana, India
[3]Associate Professor, Department of Otorhinolaryngology, ENT, Government Medical College Vikarabad, Telangana, India
[4]Professor and Head, Department of Otorhinolaryngology,ENT, Government Medical College Vikarabad, Telangana, India

Abstract

Background

Hoarseness (dysphonia) is a common otolaryngology presentation that affects communication, work efficiency and quality of life.

Objectives

To determine the extent to which videostroboscopy refines diagnosis in patients presenting with hoarseness and to document the additional diagnostic information obtained beyond initial indirect/video laryngoscopy.

Methods

A hospital-based observational study was conducted in a tertiary ENT centre among 147 patients presenting with hoarseness. After a structured clinical history and routine laryngeal examination, videostroboscopy was performed to assess glottic closure, mucosal wave characteristics, lesion morphology, vibratory symmetry and vocal fold mobility. Diagnoses recorded before stroboscopy were compared descriptively with diagnoses after stroboscopic evaluation to identify diagnostic shifts and newly detected abnormalities, including among patients initially labelled as having no abnormality detected.

Results

A total of 60 patients with persistent hoarseness were evaluated. Most participants were male (38, 63.3%), while females accounted for 22 (36.7%), yielding a male-to-female ratio of 1.7:1. The most affected age group was 31–50 years (36.7%). Videostroboscopy showed vocal cord nodules in 18 cases (30.0%), vocal cord polyps in 12 (20.0%), chronic laryngitis in 10 (16.7%), vocal cord cysts in 8 (13.3%), early glottic carcinoma in 6 (10.0%), and functional dysphonia in 6 (10.0%). It detected mucosal wave abnormalities in 48 patients (80.0%) and asymmetric vocal fold vibration in 42 (70.0%). Compared with conventional laryngoscopy, videostroboscopy provided additional diagnostic information in 21 cases (35.0%). Its diagnostic yield was significantly higher for subtle mucosal lesions and vibratory abnormalities ($p < 0.05$).

Conclusion

Videostroboscopy enhances diagnostic precision in hoarseness by revealing clinically meaningful vibratory abnormalities and by distinguishing visually similar lesions through mucosal-wave and stiffness assessment.

Recommendations

Videostroboscopy should be integrated into routine evaluation of persistent or unexplained hoarseness, professional voice users, and suspected epithelial lesions to support early detection, appropriate triage and tailored therapy.

Keywords: *hoarseness; dysphonia; videostroboscopy; laryngostroboscopy; vocal cord lesions; mucosal wave.*
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Corresponding Author: *Dr.Talari Yasaswi*
Email id: ***drtyasaswi6@gmail.com***
Assistant Professor, Department of ENT, Government Medical College Vikarabad, Telangana, India

Introduction

Hoarseness (dysphonia) reflects an alteration in voice quality, pitch, loudness or effort that is perceptible to the patient or listener. It constitutes a common presentation in ENT outpatient practice and can impair communication, work performance and psychosocial well-being. Clinical

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practice guidelines emphasise timely laryngeal visualisation in patients with persistent hoarseness and highlight that early identification of serious laryngeal pathology improves outcomes [1,2]. The etiological spectrum is wide and includes phonotraumatic lesions such as nodules and polyps, inflammatory conditions, neurogenic disorders, age-related atrophy, and premalignant or malignant lesions of the glottis [3,4].

Standard evaluation begins with a structured history (onset, duration, vocal demand, irritant exposure and associated symptoms) and inspection of the larynx using indirect mirror examination or rigid/flexible laryngoscopy [5]. Although these methods provide valuable anatomical information, they operate under continuous light and often offer limited insight into the vibratory behaviour of the vocal folds during phonation. Because vocal fold vibration occurs at very high frequencies, subtle abnormalities of the mucosal wave, phase symmetry and closure pattern can be overlooked when vibration cannot be visualized in slow motion. In busy clinics, this gap can translate into delayed therapy, repeated visits, and prolonged morbidity [6,7]. This limitation is clinically relevant in patients who appear normal on routine examination yet continue to have symptoms, and in those with apparently similar lesions (for example, leukoplakia versus early glottic carcinoma) where vibratory stiffness can suggest deeper involvement [8,9].

Videostroboscopy (laryngostroboscopy) uses a flashing light synchronized with the fundamental frequency of phonation to generate an apparent slow-motion display of mucosal vibration across successive vibratory cycles. It is widely considered a practical technique for assessing viscoelastic properties of the vocal fold cover, glottic closure configuration, periodicity, amplitude and mucosal wave characteristics [3,7]. Earlier work demonstrated that strobovideolaryngoscopy frequently modifies initial impressions and provides additional diagnoses or clinically actionable details [3]. More recent studies have reiterated its value in differentiating premalignant and early malignant vocal fold lesions and in improving diagnostic confidence in benign conditions [9,11,12].

Despite these advantages, access to and routine use of videostroboscopy remains variable in many tertiary settings. Locally generated evidence that quantifies diagnostic refinement can support service planning, training, and consistent voice-clinic workflows. In this context, the present study was undertaken in a tertiary care ENT hospital in Telangana. The objectives of the study were: (i) to assess the efficacy of videostroboscopy in diagnosing hoarseness disorders, and (ii) to analyse the additional diagnostic information provided by videostroboscopy after initial laryngeal examination.

Methodology

Study design, setting and period

This was a hospital-based cross-sectional study conducted in the Department of Otorhinolaryngology, Government ENT Hospital, Koti, Hyderabad, Telangana, India, over a 22-month period from August 2022 to May 2024.

Study population and sample size

A consecutive sampling method was used. All eligible patients presenting with hoarseness to the outpatient department during the study period and fulfilling the inclusion criteria were enrolled. A total of 147 participants were included in the final analysis.

Eligibility criteria

Patients of all age groups with a primary complaint of hoarseness were eligible. Patients unable to cooperate for endoscopic examination, those with acute airway compromise requiring emergency intervention, and individuals declining consent were excluded.

Clinical evaluation and provisional diagnosis

A structured history captured onset and duration of hoarseness, vocal demand, prior upper respiratory symptoms, gastro-oesophageal reflux symptoms, prior intubation/surgery, and key exposures such as smoking and vocal abuse. General ENT examination was followed by routine laryngeal assessment using indirect laryngoscopy and/or video laryngoscopy. A provisional diagnosis was recorded at this stage in line with guideline-based evaluation of dysphonia [1,2].

Videostroboscopy procedure

Videostroboscopy was performed as an office-based procedure using a rigid endoscope coupled to a stroboscopic light source and video recording unit. Topical anaesthesia with lignocaine spray was provided when required. Participants were instructed to sustain comfortable phonation (e.g., /i/ or /e/) at habitual pitch and loudness, and additional tasks (pitch glide and soft phonation) were used when needed to clarify periodicity. Stroboscopic recordings were reviewed for six predefined parameters: (1) glottal closure pattern, (2) mucosal wave (present/reduced/absent and symmetry), (3) description of lesion (number, colour, shape and surface), (4) vocal fold mobility, (5) supraglottic activity (antero-posterior or

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false-cord constriction), and (6) symmetry of arytenoid movement. Findings were documented using a structured proforma, and still images/video clips were stored for review and consensus when interpretation was uncertain. Ratings were interpreted with attention to known reliability constraints of stroboscopic parameters [7,10].

Outcome variables

The primary outcome was change in diagnosis after videostroboscopy compared with the provisional diagnosis after routine examination. Secondary outcomes included the spectrum of diagnoses after stroboscopy and the distribution of new diagnoses detected among participants initially labelled as NAD.

Bias Control

Several measures were implemented to minimize potential bias. Selection bias was reduced by enrolling consecutive patients who met the predefined inclusion criteria during the study period. Information bias was minimized through the use of standardized clinical examination protocols and videostroboscopic evaluation performed by experienced otorhinolaryngologists. Additionally, uniform data collection forms were used to ensure consistency in recording demographic and clinical information. Observer variability was addressed by correlating videostroboscopic findings with conventional laryngoscopic examination and maintaining consistent diagnostic criteria throughout the study.

Statistical analysis

Data were entered in a spreadsheet and analysed using descriptive statistics. Categorical variables were summarised as frequencies and percentages. Diagnoses before and after videostroboscopy were compared descriptively by observing shifts in category frequencies.

Ethical considerations

Ethical approval was obtained from the Institutional Ethics Committee of Osmania Medical College, Hyderabad, Telangana, India. Confidentiality was maintained by de-identifying records, and study findings were reported in aggregate without personal identifiers. Informed consent was obtained prior to endoscopy.

Results

Participant Flow

A total of 156 patients were examined for eligibility during the study period. After application of the inclusion and exclusion criteria, 9 patients were excluded, including 4 with incomplete clinical records, 3 with previous laryngeal surgery, and 2 who declined videostroboscopy. Finally, 147 participants were enrolled and included in the final analysis. As this was a cross-sectional study, all enrolled participants completed evaluation, and no participant was excluded after enrolment.

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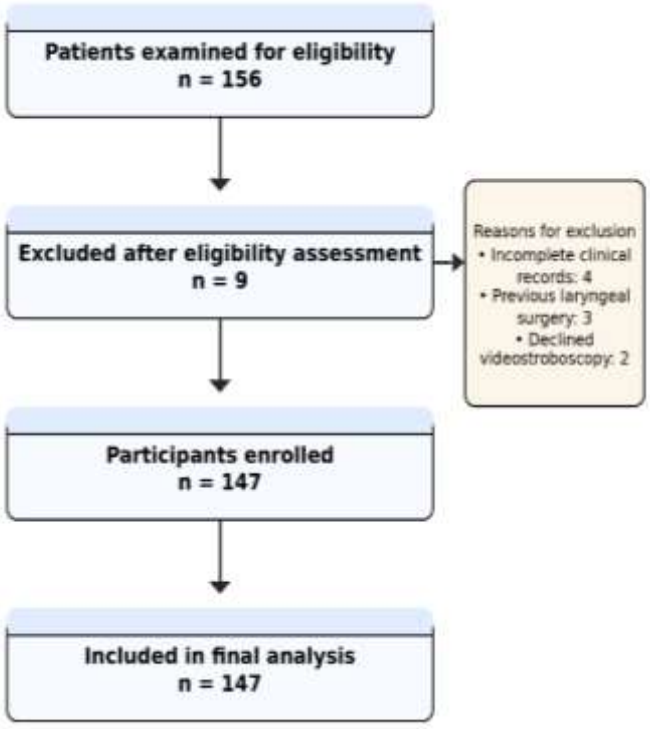

Figure 1: Flow Diagram of Study Participants

Of the 147 participants evaluated, the highest proportion belonged to the 61–70-year age group (33%), followed by 31–40 years (22%). The gender distribution was almost equal, with a slight male predominance (52%) (Table 1).

Table 1. Demographic characteristics of the study population (n = 147).

Variable	Category	Frequency	Percentage (%)
Age group (years)	<10	3	2
Age group (years)	11–20	6	4
Age group (years)	21–30	19	13
Age group (years)	31–40	32	22
Age group (years)	41–50	15	10
Age group (years)	51–60	20	14
Age group (years)	61–70	48	33
Age group (years)	>70	4	3
Gender	Male	76	52
Gender	Female	71	48

Professional voice users constituted a notable subset, with singers (12%) and teachers (10%) together accounting for 22% of the sample. Nearly one-third of participants reported vocal abuse (29%), while 21% had a history of smoking (Table 2).

Table 2. Occupational profile and significant history of study participants (n = 147).

Variable	Category	Frequency	Percentage (%)
Occupation	Singers	17	12
Occupation	Teachers	15	10
Occupation	Others*	115	78

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Significant history	Vocal abuse	42	29
Significant history	Smoking	32	21
Significant history	Others / none	73	50

*Others include housewives, students, farmers, and manual workers.

Comparing diagnoses before and after videostroboscopy showed diagnostic refinement (Table 3). Vocal cord nodules increased from 33 (22%) to 41 (28%) and early glottic carcinoma increased from 9 (6%) to 14 (10%) after stroboscopy. Leukoplakia decreased from 22 (15%) to 17 (12%). Importantly, the NAD category reduced from 14 (10%) on routine examination to 0 after stroboscopy.

Table 3. Comparison of diagnoses before and after videostroboscopy (n = 147).

Diagnosis	Before stroboscopy n (%)	After stroboscopy n (%)
Vocal cord nodules	33 (22)	41 (28)
Vocal cord polyps	15 (10)	15 (10)
Vocal cord palsy	14 (10)	14 (10)
Hemorrhagic polyp	9 (6)	9 (6)
Leukoplakia	22 (15)	17 (12)
Early glottic carcinoma	9 (6)	14 (10)
No abnormality detected (NAD)	14 (10)	0 (0)
Chronic laryngitis	5 (3)	5 (3)
Epidermoid cyst	2 (1)	2 (1)
Functional dysphonia	5 (3)	6 (4)
Intubation granuloma	4 (3)	4 (3)
Vocal cord scarring	4 (3)	4 (3)
Presbyphonia	1 (1)	1 (1)
Puberophonia	1 (1)	1 (1)
Reinke's edema	6 (4)	6 (4)
Synechia	2 (1)	2 (1)
Sulcus vocalis	1 (1)	2 (1)
Atrophic furrow	0 (0)	1 (1)
Vocal cord cyst	0 (0)	3 (2)

Among the 14 participants initially labelled as NAD, videostroboscopy identified specific abnormalities in every case (Table 4). Vocal cord nodules were the commonest newly detected diagnosis (57%), followed by vocal cord cyst (21%). Sulcus vocalis, atrophic furrow and functional dysphonia each accounted for 7%.

Table 4. New diagnoses detected by videostroboscopy in patients initially labeled as NAD (n = 14).

New diagnosis (among initial NAD, n=14)	Frequency	Percentage (%)
Vocal cord nodules	8	57
Vocal cord cyst	3	21
Sulcus vocalis	1	7
Atrophic furrow	1	7
Functional dysphonia	1	7

Discussion

The present observational study demonstrates that videostroboscopy materially improves diagnostic precision in patients presenting with hoarseness in a tertiary care ENT setting. A key practical observation was the elimination of the NAD category after stroboscopic evaluation, indicating that apparently normal laryngoscopic appearances under continuous light can conceal clinically relevant vibratory or subtle structural abnormalities. This aligns with the diagnostic intent of contemporary hoarseness guidelines, which recommend directed laryngeal visualisation and escalation of

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evaluation when symptoms persist or when initial assessment does not fully explain the complaint.

Across diagnoses, videostroboscopy increased identification of vocal cord nodules and early glottic carcinoma. Nodules are classically associated with phonotrauma, and the observed burden of vocal abuse and the representation of professional voice users provide a plausible clinical context for this pattern. Stroboscopy adds value by clarifying mucosal-wave behaviour and closure patterns that support differentiation between small nodules, early polypoid change and functional disorders [10,11]. The additional yield among patients initially labelled as NAD (especially nodules and cysts) reinforces the view that stroboscopy can uncover edge lesions or subepithelial pathology not readily appreciated on routine examination [12,14].

The increase in early glottic carcinoma diagnoses coupled with a reduction in leukoplakia highlights the importance of vibratory assessment in suspected epithelial lesions. Reduced or absent mucosal wave suggests increased stiffness and has been evaluated as a marker for dysplasia or invasive disease in multiple studies. El-Demerdash and colleagues reported high sensitivity and specificity for videostroboscopic assessment when differentiating dysplasia from early invasive glottic carcinoma based on mucosal-wave findings [9]. Rzepakowska et al. similarly reported strong predictive performance of videostroboscopy for premalignant and early malignant glottic lesions, supporting its role as a screening adjunct in appropriate clinical contexts [11,13]. Although stroboscopy cannot replace histopathology when malignancy is suspected, it can strengthen triage decisions, guide biopsy planning and support earlier intervention.

From a service perspective, these findings support integrating videostroboscopy into structured hoarseness pathways in tertiary hospitals, particularly for persistent dysphonia, professional voice users, and patients with epithelial lesions were management hinges on accurate classification. Standardization remains important: inter-rater variability and parameter interpretation have been addressed through frameworks such as the VALI form and other reliability studies, underscoring the need for training and shared terminology [7,10].

Generalizability

The study was conducted in a single, high-volume tertiary government ENT hospital, reflecting patients who typically present to referral-level care. The diagnostic spectrum and risk-factor profile are likely similar across comparable tertiary centers in Telangana and neighboring regions, including mixed urban–rural catchment areas. These observations should hold across district-level government referral networks. However, patterns can differ in primary-care settings where case-mix and referral thresholds vary, and service availability also shapes who reaches tertiary clinics.

Conclusion

Videostroboscopy substantially refines the evaluation of hoarseness by revealing vibratory abnormalities and subtle lesions that are not consistently apparent on routine laryngeal examination. In this cohort, stroboscopy increased detection of vocal cord nodules and early glottic carcinoma, reduced over-classification as leukoplakia, and removed the NAD label by assigning a definitive diagnosis to all previously unremarkable cases. These findings support incorporating videostroboscopy into standard diagnostic workflows for patients with persistent dysphonia, high vocal demands, or suspected epithelial lesions, where accurate classification informs voice therapy, microlaryngeal surgery, follow-up intensity, and timely oncologic referral. Routine availability and trained interpretation can strengthen early care pathways, streamline decision-making, and reduce diagnostic uncertainty in voice clinics.

Limitations

This single-center observational study relied on descriptive comparison of diagnoses before and after videostroboscopy. Histopathological confirmation was not available for all lesion categories in this manuscript, limiting lesion-level verification for epithelial abnormalities. Formal inter-rater reliability assessment was not performed. Risk-factor history was limited to key exposures such as smoking and vocal abuse without detailed quantification. Participant selection reflected tertiary referral patterns rather than community prevalence.

Recommendations

Routine inclusion of videostroboscopy is recommended for hoarseness persisting beyond the expected acute period, for professional voice users, and for patients with epithelial lesions on initial examination. Voice clinics should adopt a structured reporting template for glottic closure and mucosal-wave parameters, supported by periodic assessor calibration sessions. Patients with reduced or absent mucosal wave over leukoplakic lesions should undergo expedited microlaryngoscopy and biopsy as per oncologic pathways. Dedicated referral links with

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speech-language pathology services can improve rehabilitation planning and adherence. Future studies should correlate stroboscopic features with histopathology and treatment outcomes to refine local triage protocols and follow-up schedules.

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Abbreviations.

ENT – Ear, Nose and Throat

NAD – No abnormality detected

VALI – Voice-Vibratory Assessment with Laryngeal Imaging

VC – Vocal cord.

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The study had no funding.

Conflict of interest

The authors declare no conflict of interest.

Author contributions

AUS-Concept and design of the study, results interpretation, review of literature and preparing first draft of manuscript. Statistical analysis and interpretation, revision of manuscript. **TY**- Design of the study, results interpretation, review of literature and preparing first draft of manuscript, revision of manuscript. **KSK**-Review of literature and preparing first draft of manuscript. Statistical analysis and interpretation. **TMR**- Design of the study, results interpretation, review of literature and preparing first draft of manuscript. Statistical analysis and interpretation, revision of manuscript

Data availability

Data is available upon request from the author.

Author Biography

Dr. Akram Unnisa Sufia completed her MBBS from Osmania Medical College. She pursued her postgraduate training (MS in ENT) at Osmania Medical College, gaining strong clinical and surgical expertise in otorhinolaryngology. She subsequently worked as a Senior Resident at Government Medical College, Vikarabad, where she has been involved in comprehensive ENT patient care, clinical decision-making, and procedural management in a tertiary care setting. **ORCID iD: https://orcid.org/0009-0006-4740-5234**

Dr. Talari Yasaswi completed her MBBS at Chalmeda Anand Rao Institute of Medical Sciences. She pursued postgraduate training in Otorhinolaryngology (ENT) at Kamineni Institute of Medical Sciences. She subsequently worked as a Senior Resident at Osmania Medical College, gaining extensive clinical and surgical exposure in comprehensive ENT care.

She served as a Former Assistant Professor at Gandhi Medical College, Secunderabad, contributing to undergraduate and postgraduate teaching, clinical mentoring, and patient management in a tertiary care setting. Currently, Dr. Talari Yasaswi is working as an Assistant Professor in the Department of ENT at Government Medical College, Vikarabad, Telangana, India. Her academic interests include evidence-based ENT practice, surgical outcomes, and advancing clinical training in otorhinolaryngology. **ORCID iD: https://orcid.org/0009-0009-8686-2085**

Dr. K. Sowjanya Kumari is an Associate Professor in the Department of ENT at Government Medical College (GMC), Vikarabad. She is actively involved in tertiary-level patient care, academic teaching, and clinical training of undergraduate and postgraduate students. Her professional focus includes comprehensive otorhinolaryngology services, evidence-based practice, and strengthening academic standards in ENT education. **ORCID iD: https://orcid.org/0009-0007-4597-4545**

Dr. T. Maheswari Rani is Professor and Head of the Department of Otorhinolaryngology (ENT) at Government Medical College, Vikarabad, Telangana, India. She provides leadership in clinical services, academic teaching, and postgraduate training, with a strong focus on evidence-based ENT practice and patient-

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centered care. She is actively involved in mentoring, departmental administration, and strengthening surgical and clinical standards in otorhinolaryngology. **ORCID iD: https://orcid.org/0009-0009-0210-7569**

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