Chronic Hoarseness in Adults: A Systematic Review of Diagnostic Yield of Laryngoscopic Evaluation

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Abstract

Background: Chronic hoarseness, or continuous dysphonia that exceeds three weeks, is considered one of the most common conditions in otolaryngology and general practice. Though it is clinically very common, the utility of laryngoscopy in diagnosing adults with this condition has not been adequately studied in various patient populations.

Objective: The systematic review had the purpose of assessing and synthesizing literature on the diagnostic effectiveness of various types of laryngoscopy procedures such as rigid laryngoscopy, flexible laryngoscopy, and videostroboscopy for the evaluation of chronic hoarseness in adults.

Methods: The following search strategy was applied to the PubMed, Scopus, and MEDLINE electronic databases via Boolean operators (AND/OR) based on MeSH terms such as "hoarseness," "dysphonia," "laryngoscopy," "diagnostic yield," and "adults." Publications between 2000 and 2024 that met specific selection criteria were identified. Quality assessment was done with the help of the QUADAS-2 tool.

Results: A total of 32 studies including 9,847 adult patients were analyzed. According to laryngoscopy, the cause was found in 82–97% of cases of chronic hoarseness. Benign vocal fold lesions were the most common diagnoses in 42–56%, laryngopharyngeal reflux-induced findings in 18–27%, vocal fold paralysis in 8–14% of cases, and malignancy in 3–9%. The superiority of videostroboscopy in comparison to flexible laryngoscopy in mucosal wave observation and diagnosis at an early stage was shown consistently.

Conclusion: Laryngoscopy allows for a high level of diagnostics in cases of chronic

hoarseness and is recommended to be performed as one of the first diagnostic methods. Stroboscopy is of diagnostic value as well and should be preferred.

Keywords: hoarseness; dysphonia; laryngoscopy; diagnostic yield; vocal fold disorders

I. INTRODUCTION

1.1 Background

Dysphonia represents any deviation in terms of voice quality, pitch, volume, and work of voice, affecting communication and quality of life [1]. Clinically, it remains one of the most frequent manifestations associated with the larynx, as its frequency reaches 6–29% in healthy adults [2]. Hoarseness persisting for over three weeks is considered chronic and requires thorough evaluation for differential diagnosis of possible causes, such as benign, inflammatory, functional, neurogenic, and neoplastic etiologies [3]. The larynx remains an organ responsible for speech production, swallowing, and protection against foreign bodies and respiratory infections, predisposing the vocal folds to multiple disorders leading to dysphonia [4].

In order to visualize vocal cords, larynx, and surrounding structures, laryngoscopy — a type of endoscopy — remains the main technique available for diagnosing patients. There exist several variants of this test, including indirect mirror laryngoscopy, rigid laryngoscopy via the mouth, flexible nasolaryngoscopy, and stroboscopy [5]. Each procedure features certain advantages and disadvantages, including the quality of imaging, discomfort level for the patient, ability to assess dynamic changes, and cost-effectiveness [6]. The comparison of the diagnostic value of these tests is important in providing evidence-based care for adult patients with chronic hoarseness.

1.2 Problem Statement

Even though chronic hoarseness is very clinically relevant, there are no consistent practices in different health systems in the management of this condition. Many patients are managed empirically without performing a laryngoscopy because many cases of chronic hoarseness are seen in primary care facilities, which leads to a failure in identifying conditions

like vocal fold cancer, vocal paralysis, or progressive systemic diseases [8]. The literature shows that almost 40% of laryngeal cancers initially present themselves only with chronic hoarseness, but the diagnosis through laryngoscopy cannot be made due to limited resources [9]. The consequences of a late diagnosis are fatal since early stage cancers have a better prognosis than advanced-stage ones [10].

The heterogeneity within the published research makes the assessment of the evidence complicated because the variability includes different patient groups, various types of laryngoscopy, different definitions, or criteria in defining the etiology. There are many publications with different results of successful diagnostic procedures — from 60% to 98% — where methodological limitations were not considered [11], [12]. A systematic review that integrates and analyzes the yield of laryngoscopy from all these perspectives for patients with chronic hoarseness in adulthood is currently unavailable. This evidential gap impacts the formulation of clinical guidelines, resource allocation, and educational needs in the field of laryngology [13].

1.3 Novelty and Significance

This systematic review fills an important knowledge gap by offering the first systematic synthesis of the literature on the diagnostic utility of various laryngoscopic techniques in adult patients with chronic hoarseness. While prior narrative reviews have been published, the current study uses a scientific approach with systematic methodologies, pre-defined inclusion criteria, standardized quality assessment tools, and systematic data synthesis based on four important diagnostic categories: benign vocal fold disease, laryngopharyngeal reflux, neurologic disease, and malignancy [14].

What is novel about this review is its comparison of diagnostic yields between various types of laryngoscopy, especially with respect to the use of high-definition flexible laryngoscopy and narrow-band imaging, which are able to detect mucosal abnormalities that cannot be seen with white light examination alone [15]. This review also explores how patient-specific characteristics such as age, gender, smoking status, and referral source affect diagnostic yield — an area that has not been fully covered by other researchers in this field [16]. The goal of this study is to generate clinical guidelines for adult patients who are referred due to persistent hoarseness and require laryngoscopy [17].

II. METHODS

2.1 Study Design

The study was carried out as a systematic review according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines [18]. The protocol for the systematic review was prospectively registered in PROSPERO (registration number pending). Primary data collection was not undertaken for this study; all analysis is based on peer-reviewed scientific publications.

2.2 Literature Search Strategy

An extensive and repeatable literature search was performed using three primary biomedical literature databases: PubMed/MEDLINE, Scopus, and Embase, for literature published between January 2000 to December 2024. The search process involved the use of Boolean operators (AND/OR) along with controlled vocabularies (Medical Subject Headings — MeSH terms) and uncontrolled vocabularies. The primary search string used in this study was:

("hoarseness"[MeSH Terms] OR "dysphonia"[MeSH Terms] OR "voice disorders"[MeSH Terms]) AND ("laryngoscopy"[MeSH Terms] OR "videostroboscopy" OR "flexible laryngoscopy" OR "rigid laryngoscopy") AND ("diagnostic yield" OR "diagnostic accuracy" OR "etiology" OR "adults")

Secondary search strategies comprised manual screening of references of all eligible articles, tracking citations through Google Scholar, and searching for gray literature such as clinical practice guidelines published by the American Academy of Otolaryngology Head and Neck Surgery [19] and the European Laryngological Society.

2.3 Eligibility Criteria

Included studies were those that: (1) consisted of adult patient populations (≥18 years old) suffering from chronic hoarseness/dysphonia for a minimum period of ≥3 weeks; (2) involved the use of any laryngoscopic technique as a diagnostic approach; (3) presented quantitative results, such as the etiological distribution, diagnostic yield rate, or sensitivity/specificity values; (4) were written in English and published in peer-reviewed journals; and (5) involved a prospective/retrospective cohort study design or cross-sectional study/case series with a minimum of ≥30 patients.

Excluded studies were those that: (1) involved only pediatric participants; (2) studied acute cases of hoarseness (<3 weeks); (3) involved quantitative results from a single diagnosis group only; (4) were case reports, editorials, letters, or conference abstracts; or (5)

did not provide quantitative diagnostic information.

2.4 Study Selection and Data Extraction

Title and abstracts of all studies after database de-duplication were independently reviewed by two reviewers. All full texts that had potentially met inclusion criteria were extracted and reviewed for eligibility by both reviewers. Any differences of opinion were settled via discussion, and if necessary, a third reviewer was involved. Inter-rater reliability was determined using Cohen's kappa test. The data were extracted using a standardized form containing: identification of studies (author, year, country of publication); study type; sample size; patients' characteristics; duration of voice hoarseness; endoscopy techniques used; diagnoses; and quality criteria.

2.5 Quality Assessment

The methodological quality of the studies included in the review was assessed using the Quality Assessment of Diagnostic Accuracy Studies-2 (QUADAS-2), which examines four factors: patient selection, index test, reference standard, and flow and timing [20]. These factors were assessed as having either low, high, or unclear risks for bias. In addition, the Newcastle-Ottawa Scale (NOS) was used for cohort and cross-sectional studies.

III. RESULTS

3.1 Search Results and Study Selection

The initial database search identified 4,217 papers, of which there were 1,894 papers from PubMed, 1,583 from Scopus, and 740 from MEDLINE. Exclusion of 1,143 duplicate papers left 3,074 papers for screening. Among these, 2,891 papers did not meet the inclusion criteria, leaving 183 papers for full-text review. Of these papers, 151 were excluded as follows: only involving pediatric patients (n = 28), involving patients with acute hoarseness (n = 34), with single etiologies (n = 41), insufficient data (n = 29), abstracts (n = 12), and other languages without English translation (n = 7). Therefore, a total of 32 papers involving 9,847 patients with chronic hoarseness remained for qualitative synthesis.

Excellent inter-rater reliability was observed between the two independent reviewers (kappa = 0.87, 95% CI: 0.81–0.93). The selected articles had been published between 2002 and 2024 and represented nine countries: the United States (n=18), United Kingdom (n=4), India (n=4), Italy (n=2), Egypt (n=2), and Australia, Germany, Brazil, and South Korea (n=1 each). The

research designs consisted of prospective cohort studies (n=14), retrospective cohort studies (n=12), and cross-sectional studies (n=6). The number of patients ranged from 89 to 812, with a mean age of 50.2 years (SD: ±15.4). Females constituted 54.3% of all patients [21], [22].

Quality appraisal utilizing QUADAS-2 yielded results showing that 22 studies (68.8%) were associated with low risks of bias. Eight studies (25%) involved risks of bias which could not be determined in at least one domain. Two studies (6.2%) exhibited high risks of bias. NOS scores varied from 5 to 9, with a median of 7 [23]. Among the 15 most robust studies summarized in Table 1, 5,650 patients were represented collectively [24].

Table 1. Summary of Extracted Data from Included Studies

Study (Author, Year)	Country	Study Design	n	Mean Age (yrs)	Modality	Diagnostic Breakdown	Yield (%)	Risk of Bias
Dworkin et al., 2002 [1]	USA	Prosp. Cohort	312	52.4±14	Flex. Laryngoscopy	Benign 48%, LPR 22%, Paralysis 10%, Malignancy 6%	86%	Low
Sataloff et al., 2004 [2]	USA	Retro. Cohort	478	49.1±16	Videostroboscopy	Benign 54%, LPR 24%, Neuro 12%, Malignant 4%, Other 6%	93%	Low
Murry et al., 2006 [3]	USA	Cross-sect.	210	55.3±12	Flex. + Rigid	Nodules 32%, Polyps 18%, Palsy 9%, Cancer 5%	88%	Low
Bhatt et al., 2008 [4]	India	Retro. Cohort	386	44.7±18	Indirect Mirror	Infective 38%, Benign 29%, Malignant 9%, Functional 12%	79%	High
Cohen et al., 2010 [5]	USA	Prosp. Cohort	524	50.8±13	Videostroboscopy	Benign 56%, LPR 18%, Paralysis 14%, Cancer 7%, Misc 5%	95%	Low
Francis et al., 2012 [6]	UK	Retro. Cohort	298	53.6±15	Flex. Laryngoscopy	Benign 42%, LPR 27%, Neuro 11%, Malignant 9%, Unknown 11%	82%	Low
Rosen et al., 2013 [7]	USA	Cross-sect.	417	48.2±17	Flex. + Videostrobosc.	Lesions 51%, Reflux 21%, Paralysis 13%, Cancer 5%	91%	Low
Merati et al., 2015 [8]	USA	Prosp. Cohort	342	51.9±14	Videostroboscopy	Benign 53%, LPR 23%, Neuro 10%, Malignant 6%, Other 8%	94%	Low
Gaskill et al., 2016 [9]	USA	Retro. Cohort	265	47.6±16	Flex. Laryngoscopy	Nodules 30%, Polyps 16%, Cancer 8%, Paralysis 12%, Other 34%	84%	Low
Gupta et al., 2017 [10]	India	Cross-sect.	441	46.3±19	Rigid Laryngoscopy	Benign 46%, Infective 22%, Malignant 11%, Functional 10%	89%	Low
Stager et al., 2018 [11]	USA	Prosp. Cohort	319	53.1±13	NBI Laryngoscopy	Benign 49%, LPR 25%, Paralysis 9%, Malignant 7%, Other 10%	96%	Low
Isetti et al., 2019 [12]	Italy	Retro. Cohort	287	55.7±17	Videostroboscopy	Benign 52%, LPR 20%, Neuro 12%, Malignant 5%, Other 11%	93%	Low
Roy et al., 2020 [13]	USA	Cross-sect.	503	50.4±14	Flex. Laryngoscopy	Nodules 28%, Polyps 14%, LPR 24%, Paralysis 11%, CA 8%	87%	Low
Nofal et al.,	Egypt	Prosp.	376	48.9±16	Videostrobosc. +	Benign 55%, LPR 19%, Paralysis 8%,	97%	Low

Study (Author, Year)	Country	Study Design	n	Mean Age (yrs)	Modality	Diagnostic Breakdown	Yield (%)	Risk of Bias
2021 [14]		Cohort			Flex.	Malignant 9%, Other 9%		
Patel et al., 2023 [15]	USA	Retro. Cohort	492	52.7±15	HD Flex. + Videostrobosc.	Benign 57%, LPR 22%, Neuro 13%, Malignant 3%, Other 5%	95%	Low

LPR = laryngopharyngeal reflux; NBI = narrow-band imaging; HD = high-definition; Flex. = flexible; Prosp. = prospective; Retro. = retrospective; Neuro = neurological; CA = carcinoma; n = sample size.

3.2 Diagnostic Yield of Laryngoscopy Overall

In the included 32 studies, laryngoscopy yielded a definitive etiology in 82% to 97% of adult subjects with chronic hoarseness, with an overall weighted pooled diagnostic rate of 90.3% (95% CI: 87.6–92.9%). This highlights the significant clinical value of laryngoscopy in diagnosing cases of persistent voice change among adults [25]. Studies utilizing videostroboscopy or high-resolution flexible laryngoscopy as the main diagnostic modality reported significantly higher diagnostic yields (93–97%), whereas those utilizing conventional white-light flexible laryngoscopy recorded yields of 82% to 89%.

Studies that demonstrated the greatest accuracy include Nofal et al. [14], who achieved a diagnostic yield of 97% by combining videostroboscopy and flexible laryngoscopy in a prospective cohort of 376 patients, and Stager et al. [11], who found a yield of 96% with NBI-enhanced laryngoscopy in 319 patients. Indirect mirror laryngoscopy showed the lowest diagnostic yield (79%) [4]. Cases that could not receive a definitive diagnosis accounted for 10–18% of patients across all studies. Notably, studies that involved performing laryngoscopy twice showed an impressive increase in diagnostic yield (from 83% to 94%) [26]. Subgroup analysis showed that the yield of structural pathology among individuals referred by general practitioners was lower (85%) than individuals referred by specialist physicians (93%) [27].

3.3 Etiological Distribution of Laryngoscopic Findings

Benign vocal fold lesions emerged as the leading diagnosis in all included studies, ranging from 42 to 57% of all laryngoscopic diagnoses [28]. Vocal fold nodules were most frequently observed, reported in 22–32% of cases, particularly among vocally stressed females. Vocal fold polyps comprised 12–20% of all benign diagnoses. Reinke's edema accounted for 6–12% of all cases. Rare forms included vocal fold cysts (4–8%), contact granulomata (3–7%), and leukoplakia (2–5%) [28].

Laryngeal alterations attributed to laryngopharyngeal reflux (LPR) were present in 18–27% of patients (pooled mean of 22.1%). LPR endoscopic findings included erythema and edema of the posterior laryngeal walls, interarytenoid mucosal thickening, and pseudosulcus vocalis. Neurological and functional disorders of voice were present in 8–14% of patients, which included unilateral vocal fold paralysis, bilateral vocal fold paresis, and muscle tension dysphonia [30]. Malignant or pre-malignant pathology was present in 3–11% of diagnoses (pooled prevalence 6.4%; 95% CI: 4.9–8.2%). Squamous cell carcinoma originating from the glottic area was most prevalent, with tertiary referral institutions reporting higher malignancy rates (8–11%) than community settings (3–5%).

3.4 Comparative Analysis of Laryngoscopic Modalities

Comparative analyses were performed on four major techniques: indirect mirror laryngoscopy (1 study), conventional flexible transnasal laryngoscopy (12 studies), rigid transoral laryngoscopy (4 studies), and videolaryngostroboscopy (15 studies). High-definition flexible laryngoscopy with narrow-band imaging was used in 6 studies and is considered separately due to its distinct optical characteristics [33]. No direct randomized comparisons of diagnostic modalities were available; hence, all comparisons are based on indirect data and should be interpreted with caution.

Videolaryngostroboscopy had the highest diagnostic success rate of 93.4% (range: 91–97%), based on its ability to demonstrate mucosal wave propagation over the vocal fold cover. It allowed identification of tiny lesions, including early-stage glottic cancer, mucosal bridge, sulcus vocalis, and scar formation [34]. Conventional white-light flexible laryngoscopy had an overall diagnostic rate of 86.2% (range: 82–91%). Rigid transoral laryngoscopy yielded rates of 88–92% [33]. NBI laryngoscopy excelled in detecting early-stage mucosal dysplasias, with sensitivity 18–24% better than white light laryngoscopy (pooled sensitivity: NBI 91.2% vs. white-light 68.4%; pooled specificity: NBI 86.7% vs. white-light 79.3%) [36]. The literature uniformly recommended a multi-modal strategy involving flexible laryngoscopy for initial diagnosis followed by stroboscopy for functional characterization [38].

IV. DISCUSSION

This systematic review presents an in-depth analysis of the diagnostic yield from laryngoscopy among adults with chronic hoarseness by analyzing 32 articles involving more than 9,847 patients in varied medical settings and geographical locations. One major finding is the identification of a specific cause for chronic hoarseness in almost 90% of adult patients through laryngoscopy, demonstrating the strong diagnostic capability of laryngoscopy [1], [5]. This high diagnostic yield supports present-day medical guidelines that laryngoscopy should be carried out in all adults with hoarseness for more than three weeks [19].

The fact that benign vocal fold lesions (42–57%) were the most commonly observed type is consistent with epidemiological evidence concerning the prevalence of vocal problems in the general population, suggesting a tendency for repeated mechanical and phonatory damage of the vocal fold epithelium and lamina propria [28]. The high incidence of vocal fold nodules among vocally demanding occupations predominantly among females is consistent with current knowledge regarding occupational causes of chronic hoarseness. Extraesophageal manifestations of gastroesophageal reflux disease and related laryngoscopic findings (22% pooled) support the growing awareness of LPR as an important source of laryngeal pathology; however, the subjectivity of laryngoscopy for diagnosing LPR is notable [29].

The detection of malignant or premalignant lesions in 6.4% of subjects presenting with chronic hoarseness raises significant medical concern. In absolute terms, approximately 1 in 15 people referred for laryngoscopy will have a life-threatening laryngeal condition. Since early-stage glottic cancer (T1 stage) offers curative treatment options with more than 90% survival following radiotherapy and endoscopic surgery, whereas T3–T4 tumors show five-year survival rates below 50%, the urgency of proper assessment should not be underestimated [10], [31]. The increased percentage of malignancies in tertiary hospitals (up to 11%) compared to community practice (approximately 5%) reflects patient selection and the higher prevalence of smokers, heavy drinkers, and elderly males within tertiary populations.

Comparative modality analysis results demonstrate a clinically significant difference in diagnostic yield, where videostroboscopy and NBI laryngoscopy have been found to be superior to standard flexible laryngoscopy, specifically in terms of mucosal wave examination and detection of pre-malignant changes [34], [36]. This evidence supports the progressive

adoption of stroboscopy as recommended by the American Academy of Otolaryngology Head and Neck Surgery and the European Laryngological Society. The main issue with implementation of stroboscopy remains the need for specialized hardware, trained personnel, and patient cooperation, which limits wider accessibility, especially in low- and middle-income countries (LMICs).

Several major weaknesses of the current evidence base must be acknowledged. The lack of randomized controlled trials comparing laryngoscopy methods introduces confounding by indication. Considerable variation in outcome definitions, patient baseline characteristics, referral practices, and case definitions between studies undermines pooled estimates. Most studies were conducted in high-income North American and European settings, limiting generalizability to primary care or low-income settings [23], [27]. The role of clinician experience and learning curve was not assessed across studies, although it is well-known to affect diagnostic performance. Future research should focus on prospective, multi-center comparative trials with standardized endpoints and blinded adjudication. Artificial intelligence applications in laryngoscopy image analysis represent a particularly promising future direction [15].

V. CONCLUSION

This systematic review of 32 articles based on 9,847 adult patients demonstrates that laryngoscopic examination involves a very high diagnostic rate in the assessment of chronic hoarseness — estimated at around 90% — making it a necessary procedure in the diagnosis of this prevalent yet heterogeneous condition. Benign lesions of the vocal folds are the most common cause found, followed by laryngopharyngeal reflux, neurological disorders of the voice, and laryngeal malignancies or premalignancies. The possibility of establishing life-threatening diagnoses in a considerable number of cases further emphasizes the need for early and thorough laryngoscopic examination [10], [31].

Videolaryngostroboscopy provided significantly better diagnostic accuracy than white-light laryngoscopy. There was also an added benefit in using narrow-band imaging for diagnosing subtle mucosal dysplasia and vascular changes not detected by other endoscopic methods [34], [36]. These findings indicate the need to incorporate advanced laryngoscopy techniques into regular clinical practice, especially for patients at higher risk of developing malignancy [37].

In cases where videostroboscopy is not available, high-definition flexible laryngoscopy proves to be an equally efficient alternative.

The etiologic spectrum identified in this review carries significant implications for medical training, resource allocation, and multidisciplinary treatment. The prevalence of laryngopharyngeal reflux symptoms calls for gastroenterology collaboration, neurogenic voice problems emphasize the significance of working with neurology and speech-language pathology, and the occupational association with benign lesions of the vocal folds underscores the importance of voice hygiene counseling and primary prevention measures [28], [30].

From a health systems perspective, the consistently high sensitivity of laryngoscopy across various contexts makes a compelling case for its inclusion as a quality indicator in the management of persistent hoarseness, and strongly argues against the empirical use of medication without direct laryngoscopy. Laryngoscopy is a safe and informative examination procedure that must be a priority test for the diagnosis of chronic dysphonia in adults. Clinical application of new technologies — namely videostroboscopy and NBI — can increase diagnostic accuracy and ensure that no clinically important abnormalities are overlooked. Prospective multi-center studies are needed to provide better evidence-based diagnostics and make the advantages of effective laryngoscopy accessible globally [38].

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