Narrow Band Imaging (NBI): A Bibliographic Review of Its Utility in Laryngology

Claudia Esper Zamar, Federico Sala y Manuel M. Magaró
Servicio de Otorrinolaringología, Hospital Italiano. Buenos Aires, Argentina

ABSTRACT

Introduction: Imagine the possibility of achieving an accurate etiological diagnosis, almost comparable to the histopathological result, but with our own eyes. This is how the term *optical biopsy* was introduced, referring to the diagnostic precision of the narrow band imaging (NBI) light filter when assessing lesions of the upper aerodigestive mucosa. The morbidity and mortality of laryngeal cancer decrease when the tumor is detected and treated early. Our objective is to analyze the results obtained regarding the sensitivity and specificity of the NBI filter for detecting early laryngeal lesions in studies published between 2011 and 2021. As secondary objectives, we will assess the role of NBI in the intraoperative setting and the validated classifications for applying this technology.

State of the art: The mean sensitivity of the NBI found for premalignant lesions in this analysis was 88% compared to white light (WL), which was 78.4%. The mean specificity was 81.4% compared to WL, which was 68.7%. The variation in sensitivity of NBI vs. WL was 13.8% and specificity was 13.6%. Regarding the evaluation after chemoradiation treatment, Piazza et al. establish that NBI allows 20% more detection of persistence or recurrence than classic endoscopies.

Discussion: Narrow Band Imaging (NBI) significantly enhances the early detection of malignant and recurrent laryngeal lesions, surpassing the sensitivity of conventional white light. Its systematic use optimizes diagnostic interpretation, reduces unnecessary biopsies, and improves surgical margin delineation, even in in-office procedures. Although it does not replace histopathological evaluation, NBI is a key tool that increases diagnostic accuracy and oncologic safety. Two validated classifications exist: the Ni classification and that of the European Laryngological Society (ELS).

Conclusion: NBI is established as an essential tool for the early detection and accurate assessment of laryngeal lesions, improving both diagnostic and surgical safety. Although it does not replace histopathological analysis, it significantly enhances clinical decision-making and reduces invasive procedures.

Keywords: narrow band imaging, early laryngeal cancer, laryngeal endoscopy.

Imagen en banda estrecha (NBI): revisión bibliográfica de su utilidad en laringología

RESUMEN

Introducción: imaginemos la posibilidad de realizar un diagnóstico etiológico certero, casi semejante al resultado anatomopatológico, pero con nuestros propios ojos. Así se introdujo el término biopsia óptica, en referencia a la precisión diagnóstica del filtro de luz de banda estrecha o *narrow band imaging* (NBI) al

Corresponding author: claudia.esper@hospitalitaliano.org.ar, Esper Zamar C.
Received: 02/12/ 2025. Accepted: 10/15/ 2025.

DOI: http://doi.org/10.51987/rev.hosp.ital.b.aires.v45i4.427

How to cite: Esper Zamar C, Sala F, Magaró MM. Narrow Band Imaging (NBI): A Bibliographic Review of Its Utility in Laryngology. Rev Hosp Ital B Aires. 2025;45(4):e0000427.

ISSN (en línea) 2314-3312

evaluar lesiones de la mucosa aerodigestiva superior. La morbimortalidad del cáncer de laringe disminuye al detectar y tratar el tumor de forma temprana. Nuestro objetivo es analizar los resultados obtenidos sobre sensibilidad y especificidad del filtro NBI para la detección de lesiones laríngeas tempranas en los trabajos publicados entre 2011 y 2021. Como objetivos secundarios evaluaremos el papel del NBI en el intraoperatorio y las clasificaciones validadas para la aplicación de esta tecnología.

Estado del arte: la media de sensibilidad del NBI hallada para lesiones premalignas en este análisis fue de 88% en comparación con luz blanca o *white light* (WL) solo que fue de 78,4%. La media de especificidad fue de 81,4% en comparación con WL pero resultó de 68,7%. La variación de sensibilidad de NBI vs. WL fue de 13,8% y de especificidad fue de 13,6%. Con respecto a la evaluación luego de tratamiento quimiorradiante, Piazza y cols. establecen que el NBI permite un 20% más de detección de persistencias o recurrencias por sobre las endoscopias clásicas.

Discusión: el *Narrow Band Imaging* (NBI) mejora significativamente la detección temprana de lesiones malignas y recidivas en la laringe, superando la sensibilidad de la luz blanca convencional. Su uso sistemático optimiza la interpretación diagnóstica, reduce biopsias innecesarias y mejora la delimitación de márgenes quirúrgicos, incluso en procedimientos en consultorio. Aunque no reemplaza al estudio histopatológico, el NBI constituye una herramienta clave que incrementa la precisión diagnóstica y la seguridad oncológica. Existen dos clasificaciones validadas, la de Ni y la de la European Laryngological Society (ELS).

Conclusión: el NBI se consolida como una herramienta esencial para la detección temprana y la evaluación precisa de lesiones laríngeas, mejorando la seguridad diagnóstica y quirúrgica. Aunque no sustituye al estudio histopatológico, potencia significativamente la toma de decisiones clínicas y reduce procedimientos invasivos.

Palabras clave: luz de banda estrecha, cáncer laríngeo temprano, endoscopia laríngea.

INTRODUCTION

Laryngeal cancer has an incidence of approximately 2% and a mortality rate of 1% in the general worldwide population, without distinction by age or sex, according to reports from the World Health Organization in 2020. The cardinal symptom that raises suspicion of this disease is dysphonia, particularly in glottic cancers (GLOBOCAN 2020 – International Agency for Research on Cancer 2024).

The main risk factors are tobacco smoking and alcohol consumption. The synergistic relationship between alcohol and tobacco has been recognized since 1990 and has contributed to increased understanding of the etiology of laryngeal cancer. In recent years, a decline in the incidence of this type of cancer has been observed, possibly due to greater awareness of the dangers of tobacco use and the implementation of anti-smoking campaigns[1,2].

Squamous cell carcinomas, which account for the majority of laryngeal cancer cases, may arise in any area of the head and neck. These tumors are characterized by their potential to present synchronously or metachronously at other sites[3].

Early detection of laryngeal tumors significantly improves patient survival and quality of life. According to data from the American Cancer Society, the five-year survival rate for localized glottic carcinomas is 84%, whereas survival rates for supraglottic and subglottic tumors are 61% and 59%, respectively. In contrast, for advanced tumors, five-year survival decreases markedly, to 45% for glottic tumors, 30% for supraglottic tumors, and 44% for subglottic tumors[4].

Early detection also allows treatment with less invasive techniques, such as transoral laryngeal microsurgery. Although these procedures are performed in the operating room under general anesthesia, they are less invasive than conventional surgery, can be performed on an outpatient basis, and are associated with low morbidity. Conversely, when tumors are more advanced or have spread to other areas, surgical treatment involves partial or total removal of the organ and its regional lymph node stations. These procedures are associated with greater morbidity, such as dysphagia or the need for tracheostomy, and often require prolonged hospitalization.

The diagnosis of laryngeal cancer is based on endoscopic and imaging studies. Computed tomography (CT) and magnetic resonance imaging (MRI) are the most commonly used imaging techniques. Some studies suggest that MRI is more sensitive for unilateral lesions, whereas CT is more useful in bilateral cases, particularly for detecting extralaryngeal involvement[5].

To assess laryngeal anatomy and function, multiple endoscopic diagnostic methods are available, including indirect laryngoscopy, videoendoscopy with flexible fiberoptic scopes, or rigid optics with continuous light or stroboscopic light.

Since 1995, fiberoptic rhinolaryngoscopy has been part of the routine otolaryngologic physical examination worldwide for the detection of cancers of the upper aerodigestive tract mucosa. The light used in this examination is conventional white light (WL).

Narrow band imaging (NBI) is a modern technology that exploits specific characteristics of the light spectrum to more precisely identify mucosal vascularization and vascular patterns on the mucosal surface (Fig. 1). In this way, it provides better guidance in lesions suspected of malignancy due to tumor neoangiogenesis. Initially, NBI was used to identify gastrointestinal tumors; subsequently, its application was extended to the hypopharynx and oropharynx. It is currently also used for the evaluation of early laryngeal tumors[6].

In addition, it is important to reduce interobserver variability through classification systems that standardize the analysis of the images obtained; this approach is particularly useful for otolaryngologists or head and neck surgeons with limited experience.

Regardless of the tumor subsite within the head and neck, NBI is useful for the detection of early cancers, screening and follow-up after chemotherapy or radiotherapy, and even intraoperatively to delineate the safety of surgical margins.

Piazza et al.[7] introduced the concept of *optical biopsy* for biological endoscopy techniques that provide deeper insight into the behavior of the lesion under evaluation and allow visualization of lesions that might otherwise go undetected without the use of this method. Although histopathological examination remains the reference standard (gold standard) for the diagnosis of these lesions, biological endoscopy aims to reduce the number of unnecessary biopsies and false-negative results, while assisting in the selection of the optimal biopsy site[7,8].

The literature describes an approximately 18% higher detection rate of laryngeal carcinomas with the use of NBI compared with conventional white light, even in patients who have received radiotherapy or chemoradiotherapy[9].

OBJECTIVE

The objective of this study is to assess the benefits and the sensitivity and specificity outcomes of the systematic use of NBI in the evaluation of laryngeal lesions and to compare its results with those obtained using white light (WL). As secondary objectives, we aim to describe the benefits of its systematic use in the intraoperative setting –particularly in determining oncologic resection margins– and to review the validated classification systems for lesions evaluated using NBI.

STATE OF THE ART

Search Strategy

A bibliographic search of published studies was conducted using the following search string: *(Laryngeal Neoplasms/diagnosis [Majr]) AND Narrow Band Imaging [Majr]* in the PubMed database. A total of 42 studies published between 2009 and 2021 were identified.

In the BVSalud database, the following search string was used: *(mh:(Laryngeal Neoplasms/DI) AND narrow band imaging)*. A total of 31 studies published between 2010 and 2021 were identified.

Inclusion and Exclusion Criteria

Studies published in English or Spanish addressing early neoplastic laryngeal lesions evaluated using the NBI light filter for diagnostic purposes or intraoperative treatment were included. Studies published in other languages, studies aimed at evaluating benign lesions

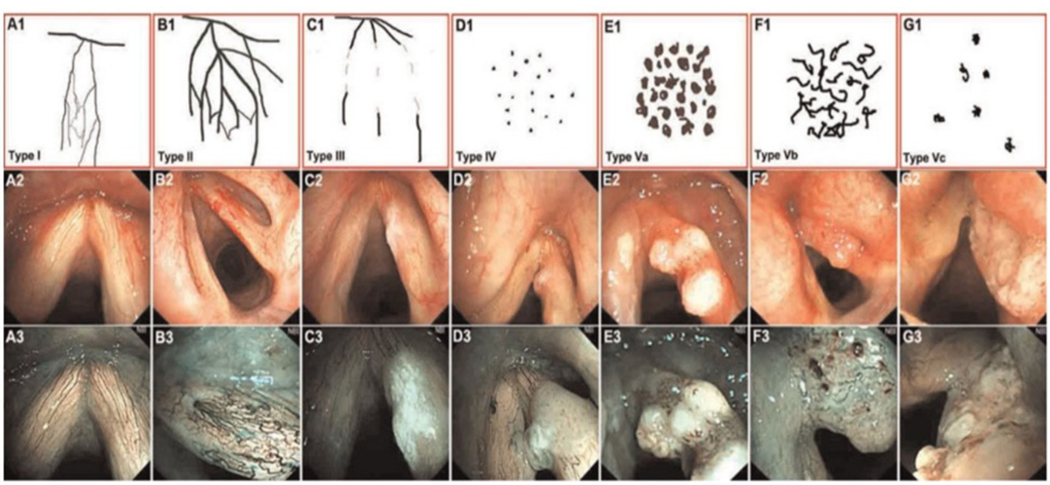


Figure 1. This image illustrates the penetration depth of different light wavelengths. At 415 nm (blue light), penetration reaches the superficial mucosal capillaries, which appear brown. At 540 nm (green light), penetration reaches the submucosal veins, which appear cyan blue. (Figure adapted from Lukes P et al.[5])

(e.g., laryngeal papillomatosis), and studies focused on technologies or artificial intelligence approaches other than NBI were excluded.

Data Extraction

The authors extracted the following information: first author, year of publication, country of origin, number of patients included in the analysis, study duration, and sensitivity and specificity of the techniques used (white light [WL] and narrow band imaging [NBI]).

Following the review process, a total of 73 studies were identified. Seven studies were excluded due to duplication. Of the remaining 66 studies, 45 were excluded (14 because they were published in languages other than English or Spanish, and 31 because they focused on other pathologies, alternative technologies, or provided incomplete information).

In total, 21 studies published between 2009 and 2021 were analyzed (15 from the PubMed® database and 6 from the BVSalud® database). A summary of all included studies is presented in Table 1.

Regarding the method of NBI application, two groups were identified: one focused on performing the examination in outpatient settings, and another in which endoscopy was performed intraoperatively. In the first group, all studies reported that the examination should be conducted in the seated position under local anesthesia via the nasal route using lidocaine.

In the second group, NBI was used in the operating room immediately after intubation to delineate lesions.

1. Sensitivity and Specificity of NBI in the Detection of Premalignant and Malignant Laryngeal Lesions

In 2009, Watanabe et al.[9] conducted a study involving 35 patients and reported a sensitivity of 91.3% and a specificity of 91.6% when using NBI in suspected laryngeal lesions. In 2010, Piazza et al.[10] evaluated 279 patients and reported an overall sensitivity of 98% and a specificity of 90%, although sensitivity was only 60% for premalignant lesions in their follow-up cohort.

Irjala et al.[3], in 2011, reported a sensitivity of 55% and a specificity of 98% for malignant lesions in their cohort, highlighting the usefulness of NBI in patients with a history of laryngeal cancer. In the same year, Ni et al.[11] studied 85 patients and found a sensitivity of 88.9% for the detection of malignant lesions using NBI, compared with 68.9% using WL.

Other studies, such as that by De Vito et al.[12], reported high sensitivity (97%) and specificity (92.5%) with NBI, although no statistically significant differences were observed with respect to the Ni classification. Rzepakowska et al.[13], in 2018, studied 62 patients and reported a specificity of 97.4% and a sensitivity of 100% for malignant lesions.

More recently, Lin et al.[14], in 2021, observed high sensitivity for benign (90.91%) and malignant (93.51%) lesions using NBI, but low sensitivity for premalignant lesions (41.67%).

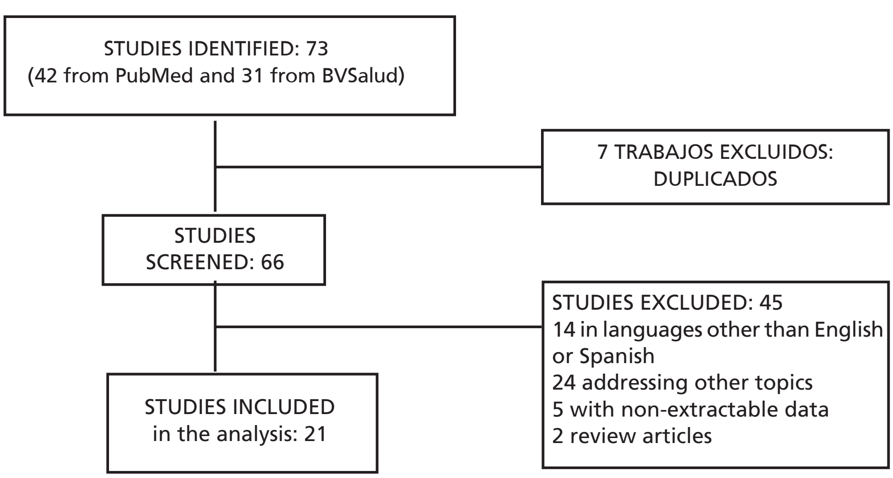
2. Comparison Between WL and NBI

In 2010, Piazza et al.[15] demonstrated that NBI increased sensitivity compared with WL (100% vs. 66%), without affecting specificity (98% vs. 100%, respectively). In 2019, Ni et al.[16] found that training improved NBI specificity, increasing it from 64% to 75% after a dedicated training course.

Shoffel-Havakuk et al.[17], in 2016, also observed increased sensitivity with NBI, although specificity was lower compared with WL. In the same year, Ni et al.[18] compared NBI, WL, and autofluorescence (AF), finding that NBI was superior to WL in terms of specificity (85% vs. 48%).

Bäck et al.[19] reported, in 2017, a sensitivity of 100% with NBI compared with 62% with WL. Sakthivel et al.[20], in 2018, observed increased sensitivity when NBI was combined with WL, reaching 100%. Popek et al.[21], in 2019,

Table 1. Characteristics of the analysis



also reported higher sensitivity (98.5%) and specificity (98.5%) with NBI compared with WL.

Finally, Zwakenberg et al.[22], in 2021, demonstrated that flexible-fiber NBI had sensitivity comparable to that of rigid laryngoscopy, highlighting its usefulness for office-based evaluation of laryngeal lesions.

3. Intraoperative Use of NBI

Garofolo et al.[23] (2015) highlighted that intraoperative NBI significantly reduced the rate of positive surgical margins (23.7% with WL vs. 3.6% with NBI). Klimza et al.[24] (2018), in a cohort of 44 patients, reported a sensitivity of 100% with NBI compared with 79.5% using WL. Rzepakowska et al.[25] (2018) found that NBI increased sensitivity for both premalignant (98.8%) and malignant lesions (97.6%) compared with WL (90.2% and 92.9%, respectively).

4. Use of NBI After Radiotherapy or Chemoradiotherapy

In 2010, Piazza et al.[15] concluded that NBI is highly sensitive (100%) and specific (98%) for detecting recurrences in patients after radiotherapy or chemoradiotherapy, demonstrating a 20% higher detection rate compared with WL. NBI allows differentiation between inflammatory changes and active neoplastic lesions, making it a valuable tool for post-treatment follow-up.

5. Validation of Endoscopic Classification of Lesions Evaluated With NBI

Bertino et al.[26] (2015), applying the Ni classification (Fig. 2), found that the use of NBI significantly increased specificity (84.6%) and positive predictive value (91.6%) compared with WL, while maintaining a high sensitivity (98.1%), consistent with other published studies.

6. Contribution of Stroboscopic Light to WL Plus NBI

In 2017, Yang et al.[27] demonstrated that the combination of stroboscopic light with WL and NBI improved specificity and positive predictive value in the evaluation of laryngeal lesions, with a statistically significant improvement compared with the use of WL and NBI alone.

7. Interobserver and Intraobserver Validation of NBI Versus WL

Davaris et al.[28] (2019) reported higher interobserver reliability with NBI (κ = 0.849) compared with WL (κ = 0.661), while intraobserver reliability was similar for both methods.

8. Limitations identified in the use of NBI

Rzepakowska et al.[16] pointed out that epithelial thickening in certain leukoplakias hampers evaluation with NBI; similarly, difficulty in distinguishing papillary lesions from well-differentiated carcinoma represents another limitation. In addition, NBI does not allow assessment of the depth of tumor infiltration, making tissue biopsy always necessary to obtain this information. Zwakenberg et al.[22] noted that bleeding lesions may interfere with the reliability of NBI due to light absorption by hemoglobin, resulting in poorly defined enhancement patterns. The learning curve was also identified as a limitation, as proper interpretation of NBI requires training and experience, which may initially increase the rate of false-positive findings.

DISCUSSION

Narrow Band Imaging has proven useful for the detection of synchronous or metachronous lesions, particularly in patients with a history of head and neck cancer. This technique can identify tumors that would otherwise go unnoticed under conventional white light. Katada et al.[29] (2008) demonstrated that NBI is effective in detecting superficial tumors in patients treated with chemoradiotherapy, which is essential for postoperative surveillance and early detection of recurrences. The classification systems used to interpret NBI findings are fundamental for accurate image interpretation.

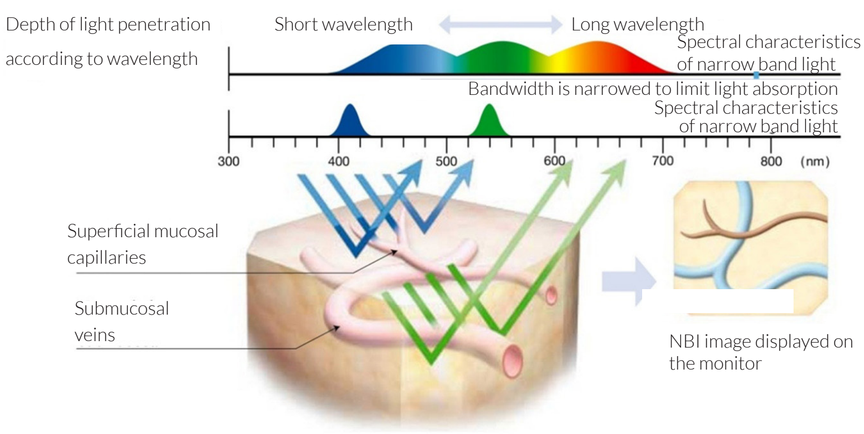


Figure 2. Ni classification. Vascular patterns from type 1 to type 5c are shown, comparing the schematic representation of the vascular pattern, its visualization under conventional white light (WL), and the subsequent visualization using narrow band imaging (NBI). (Figure adapted from Ni XG et al.[11])

The Ni classification (2011)[11] and that of the **European Laryngological Society (ELS, 2016)**[30] are the most widely used. The Ni classification divides vascular patterns into five types, ranging from benign lesions (Types I and II) to those suggestive of malignancy (Type V). Both specificity and sensitivity for detecting malignancy increase considerably in Type V lesions, whereas Types I and II are considered completely benign[11].

The ELS classification simplifies interpretation by grouping lesions into two categories based on vascular orientation: vessels arranged parallel or perpendicular to the free edge of the vocal fold. Lesions exhibiting perpendicular vascular patterns are suspicious for malignancy and warrant closer evaluation[30].

Numerous studies have validated the usefulness of NBI in predicting malignancy. In 2015, Bertino et al.[26] demonstrated that the systematic use of NBI in the evaluation of laryngeal lesions increases specificity and negative predictive value, thereby reducing the need for unnecessary biopsies[26].

In addition, NBI has proven particularly useful for defining surgical margins during tumor excision. Both Garofalo et al.[32] (2015) and Zwakenberg et al.[31] (2023) found that intraoperative NBI significantly reduces the rate of positive margins, consequently decreasing the need for reintervention (Fig. 3). In the latter study, a higher rate of disease recurrence was also observed in patients operated on using conventional white light alone. Similarly, in 2021, Lauwerends et al.[32] reported that intraoperative use of NBI influences surgical decision-making by improving visualization of tumor margins (oncologic safety) and facilitating the detection of additional lesions. These findings position NBI laryngeal endoscopy as one of the most promising modalities for intraoperative margin detection, while remaining a safe and noninvasive technique[5],[22],[30]. The ability of NBI to differentiate between malignant and benign lesions is also valuable in the outpatient setting[35], where biopsies and other procedures can be performed without general anesthesia. The use of NBI-guided outpatient procedures has enabled patients to avoid hospitalization and invasive anesthesia, improving quality of life and reducing healthcare costs. Transnasal NBI-guided biopsy procedures in patients with a history of head and neck cancer have been shown to be effective and well tolerated, yielding accurate histopathological results without complications[28].

Despite its many advantages, NBI has certain limitations. The accumulation of saliva or mucus on the mucosal surface may hinder visualization of the underlying vascular patterns, and lesions such as hyperkeratosis can cause epithelial thickening that complicates interpretation. Laryngeal papillomatosis represents another significant challenge, as these lesions may exhibit vascular patterns similar to those of malignant tumors, increasing the risk of false-positive findings[30].

It is important to emphasize that, although NBI is a powerful diagnostic tool, the reference procedure (gold standard) for the diagnosis of laryngeal cancer remains histopathological examination. No imaging or endoscopic modality has replaced histological analysis as the primary diagnostic method. Nevertheless, NBI represents a significant advance in endoscopic evaluation, as it improves diagnostic accuracy, optimizes surgical margins, and reduces the need for invasive procedures.

CONCLUSIONS

In conclusion, narrow band imaging (NBI) demonstrates high sensitivity and specificity for the detection of premalignant laryngeal lesions, outperforming conventional white light endoscopy.

In addition, NBI has been shown to provide a significant benefit in the intraoperative setting by improving the identification of negative oncologic margins, thereby reducing the risk of tumor recurrence and the need for surgical reintervention.

Finally, both the Ni classification and the European Laryngological Society (ELS) classification are validated tools for the analysis of laryngeal lesions using NBI, offering a reliable diagnostic approximation.

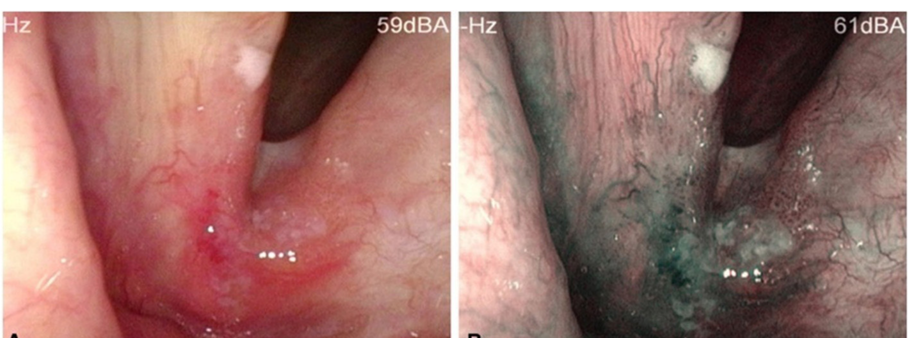


Figure 3. Left image: erythroplakic lesion of the anterior commissure visualized under white light (WL). Right image: the same lesion visualized under narrow band imaging (NBI), showing a greater extension than that observed with WL, indicating the need to enlarge the resection to obtain free surgical margins. (*Figure adapted from Davaris N et al.*[28])

Table 2. **Data extracted from the analyzed studies**

N	DOI	Title	Country	Year	First author	Follow-up	Sample size	Sensi-. tibity	Speci-ficity
1	10.1007/s00405-008-0758-5	The value of narrow band imaging for early detection of laryngeal cancer	Japan	2009	Watanabe et al.	14 months	35 pa-tients	91.3%	91.6%
2	10.1007/s00405-010-1236-0	Role of narrow-band imaging and high-definition television in the surveillance of head and neck squamous cell carcinoma after chemo- and/or radiotherapy	Italy	2010	Piazza et al.	24 months	59 pa-tients	100%	98%
3	10.1007/s00405-010-1121-6	Narrow band imaging and high-definition television in the assessment of laryngeal cancer: a prospective study	Italy	2010	Piazza et al.	18 months	279 patients	60% (95% CI)	87%
4	10.1007/s00405-011-1576-7	Pharyngo-laryngeal examination with narrow band imaging techno-logy: early experience	Belgium	2011	Liraj et al.	18 months	73 pa-tients	55%	98%
5	10.1017/S0022215 111000223	Endoscopic diagnosis of laryngeal cancer and precancerous lesions using narrow band imaging	China	2011	Ni et al.	6 months	85 pa-tients	88.9%	93.2%
6	10.1002/lary.23882	Effectiveness of narrow band imaging in detecting premalignant and malignant laryngeal lesions: validation of a new diagnostic classification	Italy	2015	Bertino et al.	24 months	248 le-sions (97 patients)	97.4%	84.6%
7	10.1177/00034894 55560082	Intraoperative narrow band ima-ging better delineates superficial resection margins during transoral laser microsurgery for early glottic cancer	Italy	2015	Garofolo et al.	21 months	82 pa-tients	–	–
8	10.1111/coa.12728	Narrow band imaging as a screening test for early detection of laryngeal cancer: a prospective study	Italy	2016	De Vito et al.	48 months	73 pa-tients	97%	92.5%
9	10.1002/lary.26163	Does narrow band imaging improve preoperative detection of glottic malignancy? A matched comparison study	Israel	2016	Shoffel-Havakuk et al.	24 months	45 le-sions (36 patients)	58.6% (48.7–71.6%)	61.2%
10	10.1007/s00405-016-3902-9	Narrow band imaging versus auto-fluorescence imaging for detection of head and neck squamous cell carcinoma: a prospective study	China	2016	Ni et al.	6 months	65 le-sions (50 patients)	95%	85%
11	10.1007/s00405-017-4526-6	Feasibility of narrow band imaging in patients with suspected upper airway lesions: a multicenter study	Finland	2017	Back et al.	8 weeks	125 patients	100%	84%

(Continued in Table 2)

(continuation table 2)

12	10.1007/s00405-017-1388-2	Value of narrow band imaging combined with stroboscopy for detection of early-stage vocal cord cancer	China	2017	Yang et al.	45 months	160 lesions (110 patients)	67%	72%
13	10.1016/j.bjorl.2018.01.004	Role of intraoperative narrow band imaging in transoral laser microsurgery for early and moderately advanced glottic cancer	Italy	2018	Klimza et al.	19 months	90 lesions (45 patients)	90%	95%
14	10.1002/lary.25047	Narrow band imaging versus laryngovideostroboscopy in precancerous and malignant vocal fold lesions	Poland	2018	Rzepakowska et al.	12 months	105 lesions	Premalignant: 98.8% (NBI) / 80.2% (WL) Malignant: 92.9% (NBI) / 87.7% (WL)	Premalignant: 73.9% (NBI) / 62.6% (WL) Malignant: 88.9% (NBI) / 85.4% (WL)
15	10.1002/lary.25201	Narrow band imaging for risk stratification of glottic cancer	Poland	2018	Rzepakowska et al.	—	91 lesions (52 patients)	91.3%	97.4%
16	10.4103/ijss.ijss_79_17	Role of narrow band imaging in diagnosis of laryngeal lesions: a pilot study	India	2018	Sathivel et al.	3 months	30 patients	100% (NBI) / 71.4% (WL)	91% (NBI & WL)
17	10.1111/coa.13361	Clinical utility of a training program for application of a new NBI classification in vocal fold leukoplakia	China	2019	Ni et al.	24 months	26 patients	75%	93%
18	10.1007/s00405-018-5254-1	Flexible transnasal endoscopy with white light or narrow band imaging for diagnosis of laryngeal malignancy	Germany	2019	Davaris et al.	36 months	170 lesions (163 patients)	85% (NBI) / 59% (WL)	79% (NBI) / 97% (WL)

(Continued in Table 2)

(continuation table 2)

19	10.1055/s-0040-1703401	Clinical experience with narrow band imaging during diagnosis of laryngeal lesions	Poland	2019	Popek et al.	—	333 patients	95.4% (NBI) / 84.2% (WL)	98.5% (NBI) / 84.2% (WL)
20	10.1177/01455 61320952327	Diagnostic value and pathological correlation of NBI classification in laryngeal lesions	China	2021	Lin et al.	12 months	123 lesions (112 patients)	84%	92%
21	10.1002/lary.29361	Evaluation of laryngopharyngeal tumor extension using narrow band imaging versus conventional white light imaging	The Netherlands	2021	Zwakenberg et al.	36 months	233 lesions (CIS: 32; CA: 201)	91% (NBI) / 85% (WL)	86% (NBI) / 82% (WL)

I: Sensitivity and specificity data of NBI in irradiated tissues and/or tissues treated with chemotherapy.

II: Statistically significant p value ($p < 0.02$).

III: Data comparing NBI with and without application of the Ni classification (shown in parentheses).

IV: No data available. Included due to analysis of intraoperative margin assessment.

V: Specificity could not be determined in this study because inclusion criteria required histological confirmation of squamous cell carcinoma prior to surgery; therefore, no false-positive cases were present.

VI: Analyses differentiated premalignant lesions (moderate and severe dysplasia) from malignant lesions (carcinoma in situ and invasive carcinoma).

VII: Analyses distinguished between white light (WL) alone, NBI alone, and the combined use of both modalities.

VIII: Data represent an average of results for malignant and premalignant lesions.

IX: Studies additionally compared intraoperative NBI using rigid optics, demonstrating that the sensitivity of flexible/ambulatory NBI is comparable to that of intraoperative WL.

REFERENCES

1. Yang Y, Fang J, Zhong Q, et al. The value of narrow band imaging combined with stroboscopy for the detection of applanate indiscernible early-stage vocal cord cancer. Acta Otolaryngol. 2018;138(4):400-406. https://doi.org/10.1080/00016489.2017.1388542.
2. Mannelli G, Cecconi L, Gallo O. Laryngeal preneoplastic lesions and cancer: challenging diagnosis. Qualitative literature review and meta-analysis. Crit Rev Oncol Hematol. 2016;106:64-90. https://doi.org/10.1016/j.critrevonc.2016.07.004.
3. Irjala H, Matar N, Remacle M, et al. Pharyngo-laryngeal examination with then arrow band imaging technology: early experience. Eur Arch Otorhinolaryngol. 2011; 268(6):801–806.
4. Piazza C, Dessouky O, Peretti G, et al. Narrow-band imaging: a new tool for evaluation of head and neck squamous cell carcinomas. Review of the literature. Acta Otorhinolaryngol Ital. 2008;28(2):49-54.
5. Lukes P, Zabrodsky M, Plzak J, et al. Narrow band imaging (NBI) — endoscopic method for detection of head and neck cáncer [Internet]. En: Amornyotin S, ed. Endoscopy. [s.l.]: InTech; 2013 [citado 2025 feb 10]. Disponible en: https://www.intechopen.com/chapters/43487. https://doi.org/10.5772/52738.
6. Azam MA, Sampieri C, Ioppi A, et al. Deep learning applied to white light and narrow band imaging videolaryngoscopy: toward real-time laryngeal cancer detection. Laryngoscope. 2022;132(9):1798-1806. https://doi.org/10.1002/lary.29960.
7. Piazza C, Del Bon F, Peretti G, et al. Narrow band imaging in endoscopic evaluation of the larynx. Curr Opin Otolaryngol Head Neck Surg. 2012;20(6):472-476. https://doi.org/10.1097/MOO.0b013e32835908ac.
8. Simo R, Bradley P, Chevalier D, et al. European Laryngological Society: ELS recommendations for the follow-up of patients treated for laryngeal cancer. Eur Arch Otorhinolaryngol. 2014;271(9):2469-2479. https://doi.org/10.1007/s00405-014-2966-x.
9. Watanabe A, Taniguchi M, Tsujie H, et al. The value of narrow band imaging for early detection of laryngeal cancer. Eur Arch Otorhinolaryngol. 2009;266(7):1017-1023. https://doi.org/10.1007/s00405-008-0835-1.
10. Piazza C, Cocco D, De Benedetto L, et al. Narrow band imaging and high definition television in the assessment of laryngeal cancer: a prospective study on 279 patients. Eur Arch Otorhinolaryngol. 2010;267(3):409-414. https://doi.org/10.1007/s00405-009-1121-6.
11. Ni XG, He S, Xu ZG, et al.Endoscopic diagnosis of laryngeal cancer and precancerous lesions by narrow band imaging. J Laryngol Otol. 2011;125(3):288-296. https://doi.org/10.1017/S0022215110002033.
12. De Vito A, Meccariello G, Vicini C. Narrow band imaging as screening test for early detection of laryngeal cancer: a prospective study. Clin Otolaryngol. 2017;42(2):347-353. https://doi.org/10.1111/coa.12728.
13. Rzepakowska A, Sielska-Badurek E, Żurek M, et al. Narrow band imaging for risk stratification of glottic cancer within leukoplakia. Head Neck. 2018;40(10):2149-2154. https://doi.org/10.1002/hed.25201.
14. Lin C, Zhang S, Lu L, et al. Diagnostic value and pathological correlation of narrow band imaging classification in laryngeal lesions. Ear Nose Throat J. 2021;100(10):737-741. https://doi.org/10.1177/0145561320925327.
15. Piazza C, Cocco D, De Benedetto L, et al. Role of narrow-band imaging and high-definition television in the surveillance of head and neck squamous cell cancer after chemo- and/or radiotherapy. Eur Arch Otorhinolaryngol. 2010;267(9):1423-1428. https://doi.org/10.1007/s00405-010-1236-9.
16. Ni XG, Wang GQ, Hu FY, et al. Clinical utility and effectiveness of a training programme in the application of a new classification of narrow-band imaging for vocal cord leukoplakia: a multicentre study. Clin Otolaryngol. 2019;44(5):729-735. https://doi.org/10.1111/coa.13361.
17. Shoffel-Havakuk H, Lahav Y, Meidan B, et al. Does narrow band imaging improve preoperative detection of glottic malignancy? A matched comparison study. Laryngoscope. 2017;127(4):894-899. https://doi.org/10.1002/lary.26263.
18. Ni XG, Zhang QQ, Wang GQ. Narrow band imaging versus autofluorescence imaging for head and neck squamous cell carcinoma detection: a prospective study. J Laryngol Otol. 2016;130(11):1001-1006. https://doi.org/10.1017/S0022215116009002.
19. Bäck LJJ, Rekola J, Raittinen L, et al. The feasibility of NBI in patients with suspected upper airway lesions: a multicenter study. Laryngoscope. 2017;127(8):1821-1825. https://doi.org/10.1002/lary.26526.
20. Sakthivel P, Sikka K, Thakar A, et al. Role of narrow band imaging in the diagnosis of laryngeal lesions: Pilot study from India. Indian J Cancer. 2018;55(3):242-247. https://doi.org/10.4103/ijc.IJC_590_17.
21. Popek B, Bojanowska-Poźniak K, Tomasik B, et al. Clinical experience of narrow band imaging (NBI) usage in diagnosis of laryngeal lesions. Otolaryngol Pol. 2019;73(6):18-23. https://doi.org/10.5604/01.3001.0013.3401.
22. Zwakenberg MA, Halmos GB, Wedman J, et al. Evaluating laryngopharyngeal tumor extension using narrow band imaging versus conventional white light imaging. Laryngoscope. 2021;131(7):E2222-E2231. https://doi.org/10.1002/lary.29361.
23. Garofolo S, Piazza C, Del Bon F, et al. Intraoperative narrow band imaging better delineates superficial resection margins during transoral laser microsurgery for early glottic cancer. Ann Otol Rhinol Laryngol. 2015;124(4):294-298. https://doi.org/10.1177/0003489414556082.
24. Klimza H, Jackowska J, Piazza C, et al. The role of intraoperative narrow-band imaging in transoral laser microsurgery for early and moderately advanced glottic cancer. Braz J Otorhinolaryngol. 2019;85(2):228-236. https://doi.org/10.1016/j.bjorl.2018.01.004.
25. Rzepakowska A, Sielska-Badurek E, Cruz R, et al. Narrow band imaging versus laryngovideostroboscopy in precancerous and malignant vocal fold lesions. Head Neck. 2018;40(5):927-936. https://doi.org/10.1002/hed.25047.
26. Bertino G, Cacciola S, Fernandes WB Jr, et al. Effectiveness of narrow band imaging in the detection of premalignant and malignant lesions of the larynx: validation of a new endoscopic clinical classification. Head Neck. 2015;37(2):215-222. https://doi.org/10.1002/hed.23582.
27. Missale F, Taboni S, Carobbio ALC, et al. Validation of the European Laryngological Society classification of glottic vascular changes as seen by narrow band imaging in the optical biopsy setting. Eur Arch Otorhinolaryngol. 2021;278(7):2397-2409. https://doi.org/10.1007/s00405-021-06723-7.
28. Davaris N, Voigt-Zimmermann S, Kropf S, et al. Flexible transnasal endoscopy with white light or narrow band imaging for the diagnosis of laryngeal malignancy: diagnostic value, observer variability and influence of previous laryngeal surgery. Eur Arch Otorhinolaryngol. 2019;276(2):459-466. https://doi.org/10.1007/s00405-018-5256-1.
29. Katada C, Nakayama M, Tanabe S, et al. Narrow band imaging for detecting metachronous superficial oropharyngeal and hypopharyngeal squamous cell carcinomas after chemoradiotherapy for head and neck cancers. Laryngoscope. 2008;118(10):1787-1790. https://doi.org/10.1097/MLG.0b013e31817f4d22.
30. Arens C, Piazza C, Andrea M, et al. Proposal for a descriptive guideline of vascular changes in lesions of the vocal folds by the committee on endoscopic laryngeal imaging of the European Laryngological Society. Eur Arch Otorhinolaryngol. 2016;273(5):1207-1214. https://doi.org/10.1007/s00405-015-3851-y.
31. Zwakenberg MA, Westra JM, Halmos GB, et al. Narrow-band imaging in transoral laser surgery for early glottic cancer: a randomized controlled trial. Otolaryngol Head Neck Surg. 2023;169(3):606-614. https://doi.org/10.1002/ohn.307.
32. Lauwerends LJ, Galema HA, Hardillo JAU, et al. Current intraoperative imaging techniques to improve surgical resection of laryngeal cancer: a systematic review. Cancers (Basel). 2021;13(8):1895. https://doi.org/10.3390/cancers13081895.