

The usefulness of the NBI – narrow band imaging for the larynx assessment

Authors' Contribution:

A – Study Design
B – Data Collection
C – Statistical Analysis
D – Data Interpretation
E – Manuscript Preparation
F – Literature Search
G – Funds Collection

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Article history: Received: 28.07.2017 Accepted: 27.11.2017 Published: 30.06.2018

ABSTRACT:

Narrow band imaging (NBI) by enhancing the contrast between the mucosal epithelium and submucosal vessels facilitates diagnosis of precancerous and cancerous lesions, as well as hypertrophic lesions such as laryngeal papillomatosis. Narrow band imaging (NBI) is an optical technique based on the modification of white light by the use of special optical filters. Every change in the microvascular architecture of the mucosa is classified according to Ni's classification (2011). The use of NBI improves sensitivity and specificity of assessment of laryngeal lesions and allows more precise assessment of the status of surgical margins of early-stage and locally-advanced laryngeal cancers managed in endoscopic laser cordectomy.

KEYWORDS:

NBI, phonosurgery, vocal fold benign lesions, laryngeal papillomatosis

ABSTRACT:

Narrow band imaging (NBI) by enhancing the contrast between the mucosal epithelium and submucosal vessels facilitates diagnosis of precancerous and cancerous lesions, as well as hypertrophic lesions such as laryngeal papillomatosis. Narrow band imaging (NBI) is an optical technique based on the modification of white light by the use of special optical filters. Every change in the microvascular architecture of the mucosa is classified according to Ni's classification (2011). The use of NBI improves sensitivity and specificity of assessment of laryngeal lesions and allows more precise assessment of the status of surgical margins of early-stage and locally-advanced laryngeal cancers managed in endoscopic laser cordectomy.

INTRODUCTION

Narrow-band imaging (NBI), by visualizing submucosal vessels, facilitates diagnosis of hypertrophic, precancerous and cancerous lesions. The NBI is based on modification of standard white light spectrum using special optical filters and an endoscope (Fig. 1)(Fig. 2) (CVC260SL and CLV processor, 260SL light source, Olympus Optical Co Ltd., Tokyo, Japan). The filters absorb all light except for two wavelength ranges: 400 to 430

nm (415 nm – blue light), which allows to identify mucosal architecture and superficial capillaries appearing brownish. The wavelength range within 525 to 555 nm (540 nm – green light) penetrates deeper and, hence, allows to visualize submucosal capillaries, which appear turquoise. Blue light corresponds to maximum absorbance of hemoglobin, thus producing contrast between blood and surrounding tissues [6,8].

CHARACTERISTICS OF PRECANCEROUS AND CANCEROUS LESIONS OF THE LARYNX ON NBI:

In 2011, Japanese researchers proved that NBI combined with white light endoscopy significantly improves sensitivity and detection rate of precancerous and cancerous lesions of the larynx. Each pathology has its own corresponding capillary pattern. For the assessment of such lesions on the NBI, Ni's classification was developed in the same year [5] (Table I).

BENIGN LESIONS OF VOCAL FOLDS ON NBI

Benign lesions of vocal folds usually show capillaries of abnormal architecture or lack any capillaries within them [1].

A vocal fold cyst is an encapsulated lesion filled with se-

Tab. 1. Ni's classification.

Type 1: (benign lesions)	<ul style="list-style-type: none"> · Narrow, branching and well-defined capillaries · Intraepithelial papillary capillary loops are not visible 	
Type 2: (benign lesions, chronic laryngitis)	<ul style="list-style-type: none"> · Increased diameter of capillaries · Intraepithelial papillary capillary loops are not visible 	
Type 3: (benign lesions, leukoplakia, low-grade dysplasia)	<ul style="list-style-type: none"> · Capillaries are partially obscured by hyperkeratotic layer (so-called 'umbrella effect') · Intraepithelial papillary capillary loops are not visible 	
Type 4: (middle- and high-grade dysplasia)	<ul style="list-style-type: none"> · Intraepithelial papillary capillary loops, recognised as small dots 	
Type 5a: (high-grade dysplasia, carcinoma in situ)	<ul style="list-style-type: none"> · Intraepithelial papillary capillary loops appear as solid or hollow, with a brownish, speckled pattern and various shapes 	
Type 5b: (carcinoma in situ, invasive cancer)	<ul style="list-style-type: none"> · Intraepithelial papillary capillary loops appear as irregular, tortuous, line-like shapes 	
Type 5c: (carcinoma in situ, invasive cancer)	<ul style="list-style-type: none"> · Intraepithelial papillary capillary loops appear as brownish speckles or tortuous, line-like shapes with irregular distribution, scattered on the tumor surface. 	

mi-solid masses, underlying the vocal fold epithelium. Applying NBI, the lack of capillaries can be visualized at the site of the cyst with typical architecture of capillaries surrounding the cyst.

Vocal fold polyps contain nutrient vessels which can be visualized using the NBI. It facilitates phonosurgical intervention by elimination of capillary network in the first stage. Thus, it significantly reduces the risk of recurrence.

Reinke's edema has a very characteristic capillary pattern on NBI, however, clear capillary network can be seen on classic endoscopy as well.

Laryngeal papillomatosis has light-green appearance on NBI. In 2014, researchers established that the most important feature of papillomas on NBI is the lack of blood vessel along the central axis of each single papilloma [4]. Capillaries usually display normal regular pattern and structure, which helps differentiate them from cancerous lesions.

**Fig. 1.** Larynx in white light.**Fig. 2.** Larynx on NBI.

DISCUSSION:

NBI is a modern form of endoscopy, which increases sensitivity and accuracy of detecting precancerous, cancerous and hypertrophic lesions when combined with classic endoscopy [7,8]. Moreover, NBI is a useful tool for the assessment of superficial resection margins during laser cordectomy in early and intermediate laryngeal cancer [2].

Combining classic endoscopy and narrow-band imaging may allow better and more precise detection of benign vocal fold lesions compared to white light endoscopy. It applies primarily to vocal fold cysts [1].

The NBI also increases diagnostic efficacy of laryngeal leukoplakia and by assessing epithelial capillaries of the surrounding tissues, it allows to escape the 'umbrella effect', i.e. non-translucency of the epithelium. When the mucous membrane surrounding leukoplakia plate does not look suspicious on NBI, the risk of high-grade dysplasia or carcinoma in situ is low [3].

In summary, the NBI is a valuable tool in assessing mucous membrane, in addition to classic white light endoscopy. Diagnostic and therapeutic benefits can be obtained when applying NBI for the

evaluation of precancerous, cancerous as well as hypertrophic lesions. It should be emphasized that NBI does not substitute pathological assessment and can only act as an additional diagnostic tool.

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Word count: 660 Tables: 1 Figures: 2 References: 8

Access the article online: DOI: 10.5604/01.3001.0011.7253 Table of content: <https://otolaryngologypl.com/issue/11199>

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Competing interests: The authors declare that they have no competing interests.

Cite this article as: Klimza H., Jackowska, Wierzbicka M.; The usefulness of the NBI – narrow band imaging for the larynx assessment; *Otolaryngol Pol* 2018; 72 (3): 1-3