Chapter 25

NBI® technology in the diagnosis and follow-up of laryngeal cancer

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Abstract

Several technological improvements have been introduced to obtain an optical biopsy of the laryngeal suspicious lesions. Among these, Narrow Band Imaging (NBI®, Olympus Medical System Corporation, Tokyo, Japan) is a new imaging technique for visualization of tumor-specific neoangiogenesis. The use of NBI® is currently considered of substantial benefit in detecting superficial mucosal laryngeal lesions as it provides better detection of irregular microvascular patterns of pre-malignant and malignant lesions compared to conventional WL.

For these reasons, different classifications of intraepithelial papillary capillary loop (IPCL) features have been proposed to facilitate the prediction of laryngeal cancer and/or precancerous lesions, and the most comprehensive classification to date has been formulated by Ni et al. The main advantage of NBI® is that it can easily detect and distinguish malignant and premalignant tumors from benign lesions that are not detectable with more traditional endoscopic procedures.

Many authors have shown how NBI® plays different roles in the management of laryngeal cancer during preoperative diagnostic work up, in the intraoperative setting, and during post-treatment (surgery, radiotherapy, or chemoradiotherapy) follow-up.

Keywords: SCC, NBI®, WL, biologic endoscopy, neoangiogenesis, accuracy, Dx, intraepithelial papillary capillary loop (IPCL)

Introduction

Several technological improvements have been introduced to enhance conventional white light (WL) endoscopy of the larynx to provide more data through the identification of specific biological properties of neoplastic tissue. “Biologic endoscopy” techniques can provide deeper insight into the behavior of a target lesion and allow detection of lesions that are not otherwise visible.

Among these, Narrow Band Imaging (NBI®, Olympus Medical System Corporation, Tokyo, Japan) is a new imaging technique for visualization of tumor specific neoangiogenesis [1-4]. It provides real-time, on-demand optical image enhancement of the mucosal and submucosal vascular morphology, and mucosal surface texture; it represents a conceptual revolution in the endoscopy because its main focus is not on evaluation of macroscopic appearance of the neoplasm, but on its vascularization [1-4].

Since, squamous cell carcinoma (SCC) of the larynx is one of the most frequent malignant tumor of the head and neck. Early diagnosis of laryngeal cancer is not only the key to increase the disease determinate survival rate, but also to allow a function-preserving therapy. The available evidence indicates that NBI® is a promising approach in the management of laryngeal cancer [3,4] as it may provide earlier diagnosis (Dx).
Proposals of classification of laryngeal lesions

The use of NBI® is currently considered of substantial benefit in detecting superficial mucosal laryngeal lesions: it provides better detection of irregular microvascular patterns of pre-malignant and malignant lesions compared to conventional WL through better visualization of the demarcation line because the narrow band blue light, which has a short wavelength, penetrates the mucosa, and highlights the superficial vasculature [5].

Several studies highlight that “brownish spots” seem to have become a “gold standard” in identifying early mucosal laryngeal cancer. However, there are several physiologic and metaplastic epithelia in the subsites of the larynx, including keratinized thick, non-keratinized thin, very thick stratified squamous epithelium, and pseudostratified ciliated columnar epithelium. Hence, the secondary question is whether or not the different epithelial types can affect the appearance of brownish spots.

For these reasons, different classifications of intraepithelial papillary capillary loop (IPCL) features have been proposed to facilitate the prediction of laryngeal cancer and/or precancerous lesions.

The most comprehensive classification to date has been formulated by Ni et al. [6]; changes in IPCLs, viewed by NBI®, may be classified into five types, as follows:

In type I, the IPCLs are almost invisible, and oblique and arborescent vessels of small diameter can be clearly seen.

In type II, the IPCLs are also almost invisible, but the diameter of the clearly observed oblique and arborescent vessels is enlarged.

In type III, the mucosa is white and the IPCLs cannot be seen; if the white patch is thin, the oblique and arborescent vessels may be seen indistinctly, but if the white patch is thick, the vessels will be obscured.

In type IV, the mucosal IPCLs are visible with a relatively regular arrangement and low density, the capillary terminals are bifurcated or slightly dilated, and the IPCLs appear as scattered, small, dark brown spots; the oblique and arborescent vessels are usually not visible.

Type V changes are subdivided into types Va, Vb, and Vc according to the shape, regularity, and distribution of vessels. In type Va, IPCLs are significantly dilated and of relatively high density, and appear to be solid or to have hollow, brownish, speckled features and various shapes. In type Vb, the IPCLs are destroyed, with their remnants present with snake-, earthworm-, tadpole-, or branch-like shapes, and microvessels are dilated, elon-

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**Figure 1.** White light (a) and NBI® (b) laryngeal valuation in a patient presenting left vocal cord SCC.
gated, and ‘woven’ in appearance. In type Vc, the lesion surface is covered with necrotic tissue, and the IPCLs are present as brownish speckles or tortuous shapes of uneven density that are irregularly scattered on the tumor surface [6].

Lesions viewed under NBI® were recorded as: malignant (i.e., type V), suspected malignant (i.e., protuberant or ulcerative lesions covered with necrotic tissue, or leukoplakia of unknown type), or benign (i.e., types I to IV) [6].

A review of the literature by Kraft et al. classified endoscopic NBI® findings into the five types according to the IPCLs features as recommended by Ni [7]. In the study of Lukes et al., the observations of irregular shapes, calibers, and courses of the IPCLs were assessed for potential carcinomas; diagnosis was correctly determined in 86.6% of patients with observable IPCLs [8]. Bertino et al. also adopted the Ni classification [5, 8]; they found that the 98% of histologically malignant lesions corresponded to a type V endoscopic pattern, whereas 84.8% of non-neoplastic lesions corresponded to a type I to IV pattern. The NBI® positive patterns were histologically confirmed as malignant lesions in 91.6% of cases.

Piazza et al. demonstrated that any well-demarcated brownish area with thick dark spots and/or winding vessels may be considered as “suspicious” lesions at NBI® [9]. Furthermore, the presence of an afferent hypertrophic vessel branching out in small vascular loops in the context of the lesion is regarded as indicative of malignancy [9].

References
