

APPLICATIONS IN RESECTION MARGINS EVALUATION IN ONCOLOGICAL LARYNGEAL SURGERY THROUGH NARROW BAND IMAGING

Diana-Larissa Bogatu¹, Razvan Hainarosie², Viroel Zahinea²

¹Carol Davila' University of Medicine and Pharmacy, Bucharest, ROMANIA

²Prof. Dr. Dorin Hociota' Institute of Phonoaudiology and Functional Ear Nose Throat Surgery, Bucharest, ROMANIA

ABSTRACT

Aims: The objective of the study is to demonstrate the utilization of refined optic technology such as narrow band imaging in the intraoperative visualization and the circumference of the lesion. The resection/ablation line of the tumor is established according to these two parameters. The operative strategy is based on the premise that a better imaging of the tumor will allow more accurate resection margins to be obtained from an oncological point of view.

Methods: This is a prospective study that lasted for 15 months and includes 50 patients with stage T1-T3 laryngeal cancer who, according to the European Laryngology Society criteria, were eligible for endoscopic endolaryngeal resection. The suspended microlaryngoscopy was used under general anaesthesia and the CO₂-LASER for the resection of the cancerous lesion. The resection margins were defined through illumination of the surgical field with the endoscopic narrow band imaging polarized light. Tissue fragments prelevations were obtained from the resection margins defined by the narrow band imaging and extemporaneous control examinations were made.

Results: Narrow band imaging technique has led to more accurate and secure resection margins from an oncological point of view after laryngeal endoscopic resection with CO₂-LASER or with cold instruments, therefore lowering the risk of tumor remaining and relapse.

Additionally, this technique avoids the necessity of a second surgical intervention thus decreasing the patient's risks and hospitalization costs.

Furthermore, a significant benefit is the limitation of the healthy peritumoral tissue excision hence a superior functional prognostic.

Conclusion: Narrow band imaging associated with laryngeal endoscopic surgery plays an essential role in precancerous and cancerous laryngeal pathology helping the surgeon accomplish both goals - curative surgery and functional results.

Keywords: Laryngeal neoplasms, laryngoscopy, CO₂- LASER

INTRODUCTION

Laryngeal cancer accounts for approximately 40% of all cervico-facial cancers and according to worldwide statistics, it is the second most common neoplasia of the respiratory tract after pulmonary cancer. Romania is the third country in Europe concerning laryngeal cancer incidence, prevalence and mortality. The exposure of a very high number of subjects to usual risk factors such as tobacco and alcohol makes it a major public health problem (1).

Institute of Phonoaudiology Functional ENT Surgery "Professor Dr. Dorin Hociota" from Bucharest is one of the largest medical facilities in Eastern Europe with a number of approximately 2500 patients with oncologic procedures each year.

Laryngeal cancer is often discovered in advanced stages due to the fact that patients do not pay attention to early symptoms such as dysphonia, hemming, cervical pain or irradiated to other areas. The other symptoms are dyspnea and dysphagia which appear in advanced stages (2).

Early detection of laryngeal neoplasm is one of the key factors for the success of the treatment. Oncological surgery with curative purpose raises the important problem of resection margins on which the evolution of the cases essentially depends.

The objective of this study is the utilization of refined optic technology such as narrow band imaging (NBI) in the intraoperative visualization of the lesion and its circumference.

The operative strategy is based on the premise that a better visualization of the tumor will allow more accurate resection margins to be obtained from an oncological point of view (3, 4).

NBI has been used for a long time in gastroenterology and has proved to be very efficient. Therefore applying the same technology in ENT and Head and Neck surgery offers promising results.

The vocal cords are very important structures in terms of speech. An extensive damage would have a huge impact on the people whose careers depend on their voices and of course impending any individual to function normally in a society, thus lowering the quality of life.

MATERIAL AND METHODS

The study included 50 patients with stage T1-T3 laryngeal cancer that were eligible for endoscopic laryngeal resection according to the European Laryngology Society Criteria.

After using the NBI polarized light to define the margins, the CO₂-LASER was used for the resection of the cancerous lesions and extemporaneous control examinations were made. After completing the resection, the margins were controlled once more using NBI light.

This technology is based on the idea is that it modifies in real time the luminous spectrum through which the endoscopy image is visualized by applying a color filter in front of the Xenon light bulb.

In comparison to white light, the obtained light through the NBI contains only 2 wavelengths of 415 nm and 540 nm. These luminous frequencies are highly absorbed by the hemoglobin (5).

When exposed to white light, composed by an equal percentage of the colors blue, green and red, the respiratory mucosa is uniformly and superficially penetrated.

On the other hand, with the NBI the 415 nm frequency penetrates the superficial layer of the mucosa and is absorbed by the capillaries at this level and the 540 nm frequency penetrates the tissues more deeply all the way through the submucosa and it is absorbed by the veins which are situated at a deeper level than the capillaries. This way the contrast between the blood vessels and the mucosa is increased (5, 6).

The capillaries from the superficial mucosal layer are visualized in brown and the submucosal veins in cyan (Figure 1).

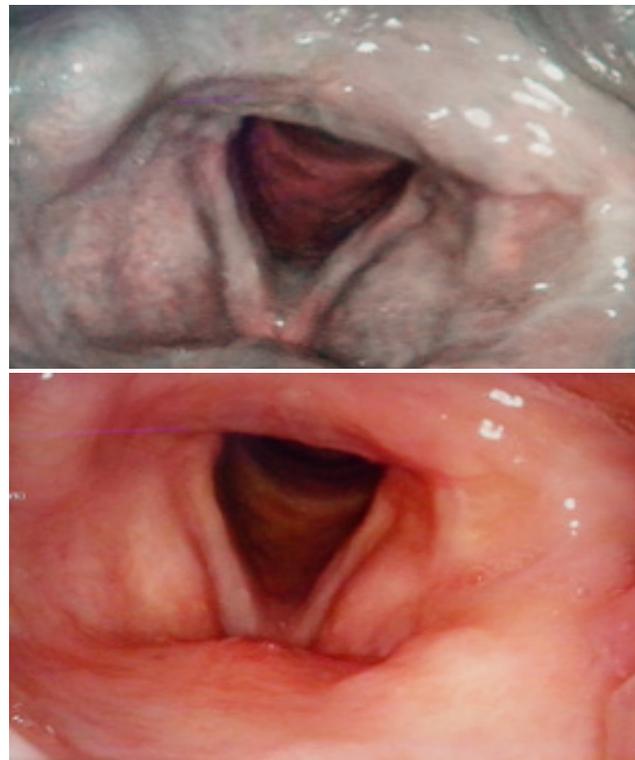


Figure 1: Normal endolaryngeal videofibrosopic aspect with Xenon wide band light (left) in comparison with the NBI videofibrosopic (right) aspect where the vascular network is more detailed.

Observing the abnormal vessel patterns will guide the surgeon to perform targeted biopsies and resections (5, 6).

Small tumors are difficult to notice with conventional white light and due to this fact they can be easily missed thus delaying the treatment and allowing the cancer to spread.

These properties allow the recognition of the pathologically vascularized areas and the real margins of the lesions with a more accurate precision and by using the close focus technique lesions that are invisible to the white light can be identified.

It can be used not only for early detection but for follow-up as well.



Figure 2: Laryngeal papillomatosis suspected of malignancy under white light (left) and under the NBI (right)

In the left image in Figure 2 the videofibrosopic aspect of a laryngeal papillomatosis suspected of malignancy can be seen under the Xenon wide band light.

From the first look the lesion appears to be small and not too invasive of the vocal cords. In the right image, the same lesion can be seen, but visualized under the NBI polarized light. The difference regarding

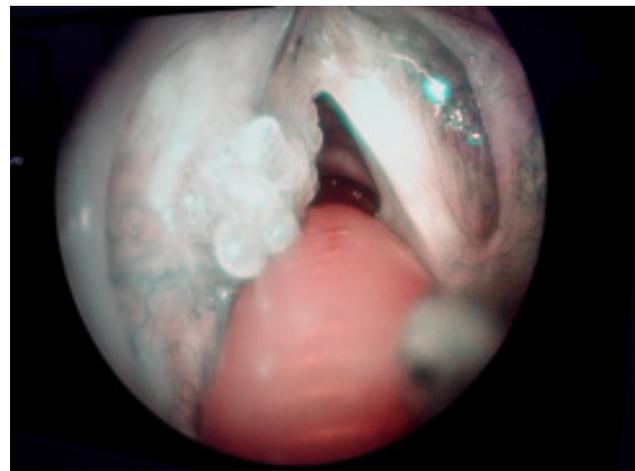


Figure 3: Left vocal cord papillomatosis suspected of malignancy under the intraoperative microscope with white light on the left and NBI on the right

the extension of the tumor is very well observed.

In Figure 3 another lesion can be viewed under the intraoperative microscope with white light. It is a left vocal cord papillomatosis, suspected of malignancy. It is rather difficult to identify the exact borders under the white polarized light. The NBI (right picture) allows a more precise definition of the borders and reveals the accurate resection margins.

This way the surgeon makes sure that the entire tumor is excised and normal functional tissue is preserved thus avoiding unnecessary and irreparable damage.

RESULTS

The NBI technique offers more accurate and secure resection margins from an oncological point of view after laryngeal endoscopic resection with CO₂-LASER or with cold instruments therefore lowering the risk of

tumor remaining and relapse. Recent studies showed that the percentage of disease free resection margins when using NBI intraoperatively improved up to 45%. Additionally it avoids the necessity of a second surgical intervention thus decreasing the patient's risks and hospitalization costs.

Furthermore a significant benefit is the limitation of the healthy peritumoral tissue excision hence a superior functional prognostic.

DISCUSSION

Laryngeal cancer represents a significant health problem due to its frequency among other cervico-facial cancers and the importance of functional tissue preservation raises the controversial issue of resection margins, therefore achieving a higher survival rate along with better functional prognostic is required.

Narrow band imaging (NBI) can be used for early detection as well as for the follow-up of patients with laryngeal cancer by allowing the surgeon to detect lesions before they are visible to the white light.

In addition, the surgical technique is improved by helping the surgeon achieve more accurate resection margins from an oncological point of view and preserve functional healthy tissue. Moreover, this technology provides the surgeon with the ability to perform targeted biopsies intraoperatively.

Recent studies showed that the percentage of disease free resection margins when using NBI intraoperatively improved up to 45%.

However the endoscopic NBI light investigation cannot replace histopathological examinations. Narrow band imaging associated with laryngeal endoscopic surgery plays an essential role in precancerous and cancerous laryngeal pathology helping the surgeon accomplish both goals - curative surgery and functional results.

Ethics Committee Approval: This study was approved by Prof. Dr. Dorin Hociota' Institute of Phonoaudiology and Functional ENT Surgery (Bucharest,Romania)

Informed Consent: Written informed consent was obtained from the participants of this study.

Conflict of Interest: The authors declared no conflict of interest.

Financial disclosure: The authors declared that this

study received no financial support.

REFERENCES

1. Blot WJ, McLaughlin JK, Winn DM, Austin DF, Greenberg RS, Preston-Martin S et al. Smoking and drinking in relation to oral and pharyngeal cancer. *Cancer Res* 1988;48:3282.
2. Hartig G, Truelson J, Weinstein GS. Supraglottic cancer. *Head Neck* 2000;22:426.
3. Behrbohm H, Kaschke O, Nawka T, Swift A. *Ear, Nose and Throat Diseases*, Thieme, 3rd edition, 2009; 298-301
4. Phan N, Farzad B, Robert H, Julie A, Camile SF, Edwina D et al. High specificity of combined narrow band imaging and autofluorescence mucosal assessment of patients with head and neck cancer. *Journal of Sciences and Specialties of Head and Neck* 2013;35(5):619-25.
5. Gono K, Yamazaki K, Doguchi N Nonami T, Obi T, Yamaguchi M et al. Endoscopic observation of tissue by narrowband illumination. *Opt Rev* 2003;10:211-15.
6. Gono K, Obi T, Yamaguchi M, Ohyama N, Mac-hida H, Sano Y et al. Appearance of enhanced tissue feature in narrow-band endoscopic imaging. *J Biomed Opt* 2004;9:568-77.