

ONCOLOGY

Contact endoscopy of the larynx as an auxiliary method to the surgical margins in frontolateral laryngectomy

Endoscopia da contatto: una metodica per la definizione dei margini nella laringectomia frontolaterale

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SUMMARY

Contact laryngomicroscopy is *in vivo* laryngeal mucosa microscopic examination and rigid telescopy is a non-invasive technique that enables the systematic observation of many details in the large area of vocal fold mucosa. These are performed during laryngomicroscopy. This study was performed in order to evaluate the use of rigid and contact endoscopy effectiveness in establishing the margins in patients undergoing frontolateral laryngectomy. Ten patients with glottic squamous cell carcinoma underwent frontolateral laryngectomy from 2000 to 2003. Eight were staged as T1bN0M0, whereas two were staged as T2N0M0. During the frontolateral approach, the lesion and its limits were carefully defined, the surgical margins were established under the rigid telescope and the patients' margins were studied under contact endoscopy after methylene blue staining. Frozen section examination of the margins was performed and the histopathological analysis was compared to the surgical and endoscopic findings. The infraglottic region and the surgical margins were free of disease in all cases and there was a 100% correlation with the histopathological examination. All patients are alive with no evidence of disease after a minimum of 5 years' follow-up. In conclusion, rigid and contact laryngoscopy is effective in establishing the disease-free surgical margins in patients submitted to frontolateral laryngectomy.

KEY WORDS: Larynx • Laryngeal neoplasms • Laryngoscopy • Contact endoscopy • Frontolateral laryngectomy

RIASSUNTO

La microlaringoscopia da contatto è un esame microscopico in vivo della mucosa laringea, associata alla laringoscopia con strumento rigido è una tecnica non invasiva che consente la valutazione sistematica di molti dettagli in una vasta area delle corde vocali. Scopo di questo lavoro è valutare l'utilità dell'endoscopia rigida e da contatto nella definizione dei margini di resezione nei pazienti da sottoporre a laringoscopia frontolaterale. Sono stati considerati 10 pazienti sottoposti a laringectomia frontolaterale tra il 2000 ed il 2003. Otto pazienti erano stati stadiati T1bN0M0, mentre gli altri T2N0M0. Durante l'approccio frontolaterale, la lesione e i suoi limiti sono stati accuratamente studiati, i margini di resezione chirurgica sono stati stabiliti sotto controllo endoscopico e mediante l'utilizzazione di endoscopia da contatto dopo colorazione con Blu di Metilene. È stato eseguito sia l'esame estemporaneo che l'esame istologico dei margini di resezione, e i risultati sono stati confrontati con i riscontri chirurgici ed endoscopici. La regione sottoglottica ed i margini di resezione sono risultati liberi da malattia in tutti i casi, ed è stata riscontrata una correlazione del 100% con l'esame istopatologico. In conclusione, la laringoscopia rigida e da contatto risulta essere una metodica efficace nella determinazione dei margini chirurgici liberi da malattia nei pazienti sottoposti a laringectomia frontolaterale.

PAROLE CHIAVE: Laringe • Tumori della laringe • Laringoscopia • Endoscopia da contatto • Laringectomia frontolaterale

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Introduction

Early glottic tumours involving the anterior commissure can be treated with a variety of therapeutic modalities, such as conservation surgery, radiotherapy and laser endoscopic surgery. In 1956, Leroux-Robert reported that

surgery and radiotherapy were equally successful, usually resulting in complete cure when the cancer, though limited to the vocal fold, involved the entire fold from end to end, yet the fold was still perfectly mobile¹ and proposed the use of frontolateral vertical laryngectomy.

The principles of laryngeal reconstruction were originally described by Pressman². A bipedicle muscle and perichondral flap can be prepared in order to provide an optimal surfacing tissue and a certain amount of bulk to provide a buttress for the opposite true and false vocal folds³.

Contact laryngomicroscopy is an *in vivo* microscopic examination of the laryngeal mucosa without biopsy. It provides detailed magnified images of the live epithelium, using a modified glass rod lens endoscope placed on the surface of the tissue. The technique has been extensively described in gynaecological⁴, and more recently, laryngeal⁵⁻⁷ and cervical visceral tissues⁸. The technique was also employed on the oral mucosa. As it clearly shows the cell morphology of the mucous membrane and the surface vascular network, it was considered reliable for its analysis⁹. Used for observations of the surface of the tongue papillae, in a normal taste group, round shaped papillae and clear blood vessels were observed both with microscopy and contact endoscopy, whereas in the taste disorder group, flat and irregular papillae were observed with microscopy¹⁰. The procedure is performed during laryngomicroscopy by introducing the contact endoscope into the larynx. This technique allowed *in vivo* and *in situ* visualization of the superficial layer of the laryngeal epithelium after staining with methylene blue. The normal squamous epithelium of the vocal cord has a homogeneous cell arrangement, with a spheroid and isochromic nucleus, and a uniform nucleus-cytoplasm ratio. Specific cellular epithelial patterns in malignant tumours were observed. Rigid laryngoscopy is a non-invasive technique that allows systematic observation of many details in the large area both of the vocal fold mucosa, particularly when access to the larynx is difficult, and the dynamic monitoring and immediate pathology consultations inside the operating room¹¹.

Since local recurrence is significantly correlated with the presence of positive surgical margins in patients with early glottic tumours who have undergone surgical resection, the aim of this study was to investigate the use of both rigid and contact endoscopy effectiveness in establishing the margins and oncological outcome in patients undergoing frontolateral laryngectomy.

Methods

Ten patients with squamous cell carcinoma (SCC) of the glottic edge, histologically confirmed, underwent frontolateral laryngectomy in the Service of Head and Neck of Ana Costa Hospital, Santos, Brazil, from June, 2000 to April, 2003. This series comprised 9 males and one female, age range 54-66 years. Nine of these patients were chronic tobacco users. Eight were staged as T1bN0M0, whereas two were staged as T2N0M0 glottic tumours. All were prospectively studied.

Following general anaesthesia with orotracheal intubation, tracheotomy and laryngofissure were performed. The rigid 3 mm 0° endoscope, Karl Storz® (Tuttlingen, Germany) was introduced through the tracheal stoma for the evaluation of the anterior commissure and the subglottic region from below. Thus, the patient underwent suspension laryngoscopy with complete visualization of the glottic edge. The rigid 5.5 mm 0° endoscope, Karl Storz 8715A® and the rigid 3 mm 70° endoscope, Karl Storz® were introduced into the suspension laryngoscope for anterior commissure visualization. The endoscope was connected to a microcamera and video system. The endolarynx was observed at various angles during the surgical approach.

After the analysis of the macroscopic margins (Fig. 1), the 1% methylene blue stain was applied and saline solution was used to remove any excess. Thus, contact endoscopy was performed for the *in vivo* study of the microscopic margins with definition of the mucosal pattern (Fig. 2). Just before the blue staining, the method also allowed observation of the blood vessel patterns (Fig. 3). As the criteria for malignancy have been previously described^{5,6}, regarding the mucosal and blood vessel patterns, these were applied in order to establish the resection line. The surgeon himself applied these criteria without the pathologist's involvement. Thus, after staining the mucosa with the methylene blue solution, the lesion and its limits were carefully analyzed and the excision line was carried along a 2 mm gross margin based on those findings. The endoscopic and intra-operative findings were recorded by means of the DVD system. However, the definition of the margins was performed, in real time, during the operation.

The central segment of the thyroid cartilage and the anterior portion of the contralateral fold were included in the resected specimen. Examination of the margins, on frozen sections, was obtained on tissues of the patient after tumour removal under the rigid laryngoscopic in-

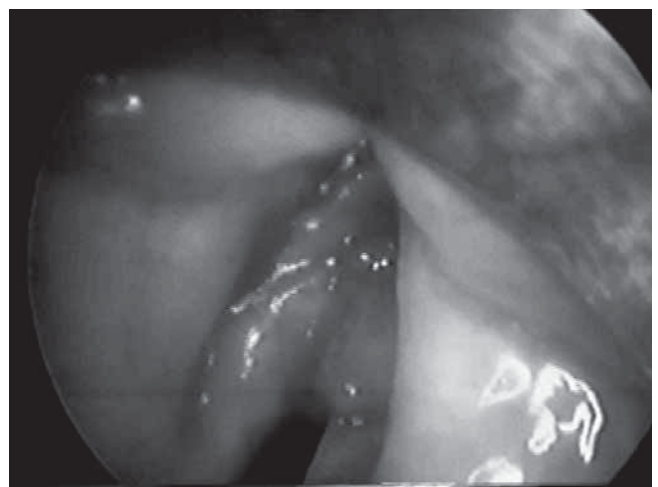


Fig. 1. Rigid telescopic view during tumour excision.

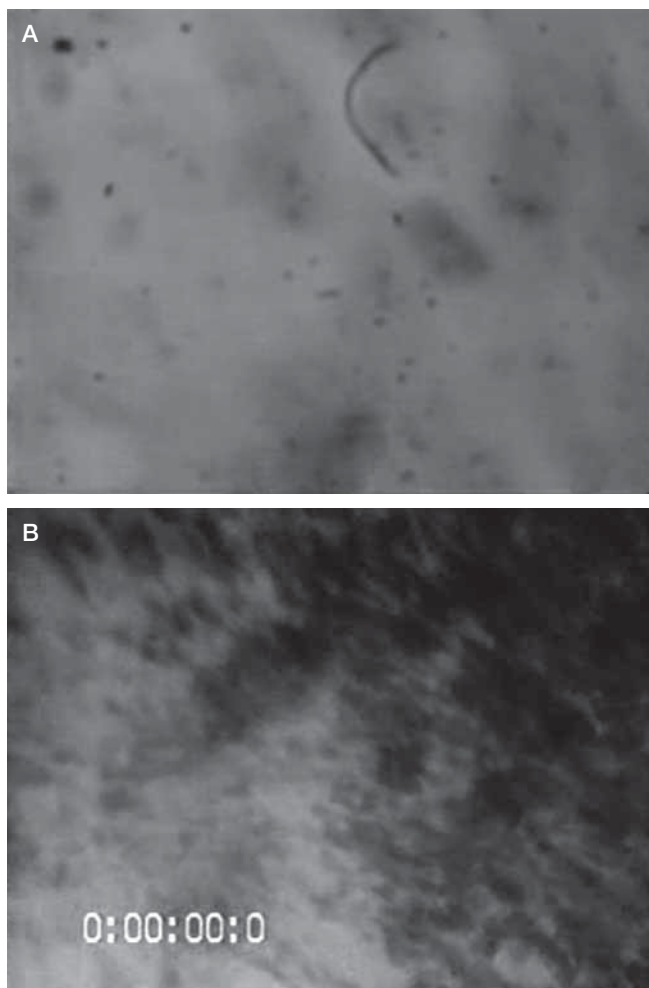


Fig. 2. Normal squamous epithelium of vocal fold is homogeneous, with spheroid and isochromic nucleus, and uniform nucleus-cytoplasm ratio (A), compared to heterogeneous pattern with nuclei presenting different sizes, shapes and distribution (B).

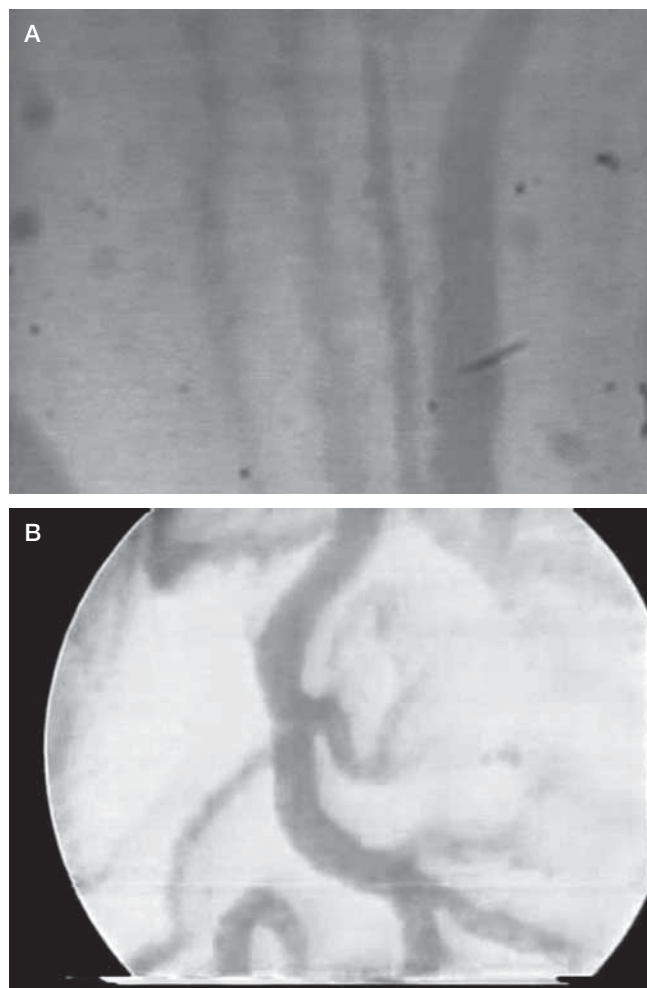


Fig. 3. Blood vessels were parallel to longitudinal axis in normal vocal fold (A) compared to tortuous aspect full of bifurcations in mucosa surrounding tumours (B).

spection (Fig. 4). Histological confirmation of the surrounding tissue confirmed complete excision, and its analysis was compared to the surgical and endoscopic findings.

Results

The infraglottic region and the surgical margins were free of tumour in all cases. Rigid and contact laryngoscopy and the histopathological analysis showed no difference in the analysis.

There was a 100% correlation between rigid and contact endoscopy (based on both mucosal and blood vessels patterns) and the histopathological examination of the margins. The macroscopic examination of the specimens was performed by the surgeon and the pathologist together. All patients were pathologically staged as pT-1bNOM0, thus agreeing with the pre-operative clinical evaluation.

All patients are alive with no evidence of disease after a minimum follow-up of 5 years. No patients were lost at

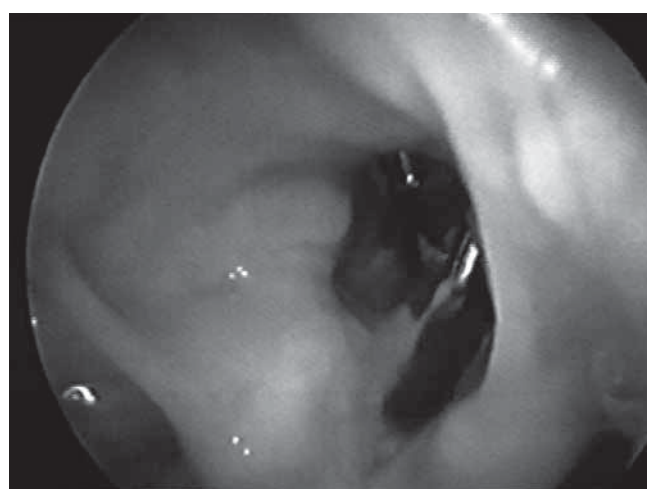


Fig. 4. Rigid telescopic view of additional margin obtained from patient.

follow-up. All patients were evaluated with videolaryngostroboscopy every 2 months until 3 years after treatment and thereafter every 3 months until 5 years after treatment.

Discussion

Despite being considered, by some Authors, as an obsolete procedure, partial vertical laryngectomy is a treatment option for certain T1 glottic cancers that cannot be removed endoscopically, as in the cases with anterior commissure invasion¹². Thus, we consider frontolateral laryngectomy to be efficient treatment for selected cases of early glottic carcinoma¹³.

Contact endoscopy is a new technique used in laryngology, allowing cytological and histological characterization of the mucous tissue of the larynx and particularly the vocal folds and their blood vessels. It still allows observation of many pathological situations amongst which SCC, mapping the lesions and establishing the margins.

The epithelial cells of the basal membrane go toward the mucosal surface, where they suffer continuous wearing and are replaced by the younger cells that are in the deeper layers. The superficial layer is pavementous, and its longer axis is perpendicular to the surface.

Contact laryngoscopy allows viewing of the vessels in the focal folds⁴. These are observed by transparency, before the application of the dye. Vessels of different sizes, in different planes, run parallel and longitudinally along the vocal fold. Furthermore, they make various anastomoses between each other, in various directions. In tumours, the blood vessels surrounding the lesions are present in a higher quantity, are more tortuous, with ecstasies and a larger number of anastomoses. Under higher magnification, a decrease in the flow of erythrocytes can be seen. They move up more slowly through the spiral vessels.

In a preliminary study, by means of laryngeal contact endoscopy during microlaryngoscopy, it was found that the normal squamous epithelium of the vocal cord showed a homogeneous cellular population with regular nuclear and cytoplasmic morphological characteristics and a uniform nucleus-to-cytoplasm ratio. On the other hand, specific cellular epithelial patterns and several alterations of the vascular distribution were found in different pathological

conditions – laryngeal polyps, Reinke's oedema, leukoplakia, papilloma and malignant tumour. Furthermore, the cytological pictures obtained were consistent with histological findings in all patients¹⁴.

In SCC, the distribution of the cells is heterogeneous, with great variation, between the nuclei, in size, shape, distribution and the presence of mitotic figures. With the contact technique, it is possible to establish security margins through the transition limits between mucous tissue with carcinoma and normal mucosa. That limit is not regular. Squamous metaplasia islands can be identified inside the ciliary epithelium¹⁵. In a comparative study between contact endoscopy and histopathology, the contact technique allowed recognition of carcinoma tissues and suggested performing biopsy in dysplasia cases¹⁶.

The excision line was determined both by rigid and contact endoscopy. After the resection of the specimen, analysis of the margins was performed with fragments from the patient, not from the specimen. Cutting was guided by rigid and contact endoscopy and the margins were confirmed by frozen section and post-operative histopathology. As the margins were established previously by rigid and contact endoscopy, all suspicious dysplastic mucosa was included in the surgical specimens. As the method is applied just before cutting, it can also be employed when other surgical techniques are performed, such as endoscopic laser surgery.

As this is a recently developed method, the clinical application of contact endoscopy is not yet widespread and many studies still need to be performed. As a result, its implementation, in clinical practice in laryngology, represents a stimulus and a challenge, hopefully with new data being forthcoming. The frozen section examination is currently the gold standard method for making the diagnosis. Furthermore, a technique such as contact laryngoscopy is able to provide histological information without tissue damage. Mapping of malignant tumours, establishing the transition limit between normal and pathological mucosa, is one of the goals of the technique.

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