CLINICAL TECHNIQUES AND TECHNOLOGY

Exolaryngoscopy: a new technique for laryngeal surgery

La chirurgia laringea in eso-laringoscopia: una nuova tecnica chirurgica

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SUMMURY

The aim of this study is to assess the use of a telescope with a high definition endoscopic video system as an alternative to the operating microscope in endoscopic laryngeal surgery. The system is economic, and allows optimal vision and improved surgeon comfort and ease. In exolaryngoscopy, the optic vitom is positioned in place of the microscope. An extracorporeal optical system (exoscope) is positioned 25 cm from the surgical field. Under exoscopic control, it is possible to use the same series of instruments using a long handle through the laryngoscope. The CO2 laser may also be used by fixing it coaxially to the optical system, and it is possible to use a classic set of microinstruments for phonosurgery. Endoscopic study with auto-fluorescence (NBI; narrow band imaging) can be easily used to visualize both precancerous and cancerous lesions. We treated 12 patients with benign and malign pathologies of the vocal cords; in all cases, the predicted result was reached, and the optic vitom showed its potential advantages in ease and comfort of the surgeon.

KEY WORDS: Laryngoscopy • Phonosurgery • Exoscopy • Laryngeal surgery

RIASSUNTO

Nel presente lavoro si propone l'impiego di un telescopio (VITOM®, Karl Storz) da abbinare alla colonna endoscopica ad alta definizione come alternativa al microscopio operatorio nella chirurgia endoscopica della laringe; questa ottica, definita esoscopio, viene posizionata a circa 25 cm dal campo operatorio. Con tale tecnica è possibile usare la stessa serie di strumenti con manico lungo per la micro e fono chirurgia; inoltre è possibile l'utilizzo del laser CO_2, montato coassiale all'ottica, infine è facilmente applicabile anche lo studio endoscopico con autofluorescenza (NBI narrow band imaging), per la diagnosi delle lesioni neoplastiche e pre-neoplastiche.

Sono stati trattati 12 pazienti, affetti da patologie benigne e maligne delle corde vocali; in tutti i casi si è raggiunto il risultato preventivato e l'ottica vitom si è rivelata comoda da usare, non ingombrante, con un'ottima visione sul monitor della colonna endoscopica HD; inoltre è stata utile per la didattica e per la documentazione.

PAROLE CHIAVE: *Laringoscopia • Fonochirurgia • Esoscopio • Chirurgia laringea*

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Introduction

Currently, there are two principal surgical techniques used in endoscopic surgery of the larynx, namely microlaryngoscopy (MLS), which uses a surgical microscope, and fibrolaryngoscopy (FLS), which uses a fibroendoscope with an operating channel. We present our initial experience using a new technique for laryngeal surgery: a telescope with a high definition (HD) endoscopic video system as an alternative to the operating microscope, which we called exolaryngoscopy (ELS).

Microlaryngoscopy (MLS), developed by Oskar Kleinsasser in 1968, is a technique that can be performed with either 'cold' instruments or with a CO2 laser, in phonomicrosurgery and in the treatment of benign and malign diseases of the larynx. General anaesthesia is carried out through oro-tracheal intubation, and the operating laryngoscope is used to expose the glottal floor, allowing direct view of the vocal cords.

The patient is laid in a supine position with the head slightly hyperextended and attached to a laryngosuspension apparatus consisting in adjustable rod anchored to operating bed; after telescopic examination, the surgical microscope is positioned behind the patient's head [2 3].

The pathological conditions of the larynx that can be treated with this technique include: papillomatosis, leukoplakia, dysplasia, carcinoma, nodules, cysts, polyps, Reinke's oedema, granuloma, scar, sulcus and vergeture, vascular lesion, glottic web and vocal fold paralysis (augmentation).

Fibrolaryngoscopy (FLS) is performed under local anaesthesia with the patient seated and cooperative. A flexible laryngoscope with a working channel is introduced in the nasal

fossa; inside the working channel, it is possible to use different instruments. Usually, a four hands technique allows control of intraoperative results with stroboscopy. The instruments utilized are a strobe light source, flexible laryngoscope with a working channel, forceps, scissors and needle.
The indications of the technique are small polyps, carcinoma (with diode laser), biopsy (especially when general anaesthesia is contraindicated), vocal fold paralysis (injective laringoplastic), botulinum toxin and antiviral injection.
In exolaryngoscopy (ELS), the telescope vitom is positioned in the place of the operating microscope, and is equipped with a HD endoscopic video system (the camera may be analogic, digital or 3D), and is the same used in endoscopic sinus surgery. The pathological conditions of the larynx that can be treat with this technique are the same as MLS.

Clinical techniques and technology

General anaesthesia is carried out through oro-tracheal intubation, and the operating laryngoscope is placed into the oral cavity. It is slided along the ventral surface of the tongue and advanced down towards the base of the tongue and posterior pharyngeal wall. The laryngoscope is then placed under the epiglottis, allowing direct view of the vocal folds, as in MLS. The patient is in supine position on the operating table, with a hyperextended head attached to a laryngo-suspension apparatus consisting in an adjustable rod anchored to the operating table.
The telescope vitom is placed behind the patient's head (VITOM®, Karl Storz, Tuttlingen, Germany), about 25 cm from operating field (provided with spacer), then attached to the supporting arm and finally fixed to the bed. Vitom is a 0° telescope with a diameter of 10 mm and a length of 10 cm; we called it an exoscope because it is positioned outside the body.
The camera head is mounted on the proximal end of the telescope, illumination is provided by a cold light fountain xenon 300, and images are displayed on a HD monitor [4 8] (Fig. 1). The limited dimension of the system does not encumber the operating field, while all long laryngeal surgery instruments may be used; moreover, it is possible to obtain an enlarged view of the vocal cords on the monitor (Fig. 2). When the exoscope vitom is positioned, details of lesions are anatomically relevant on the monitor as fine vascularisation, nodules and irregularities of mucosa are perfectly visible. This optical system also provides a sense of depth, and light transmission is excellent. The same series of instruments with a long handle can be used through the laryngoscope under exoscopic control.
Initially, the long Hopkins rod telescopes with various visualization angles (0°, 30°, 70°) are used to visualize vocal fold pathologies, as well as for photographic documentation and surgical planning.
Endoscopic study with autofluorescence (NBI; narrow band imaging) is easily applicable with this system, and can integrate the information obtained by laryngeal endoscopic study with white light. It is possible to place the autofluorescence optics to the supporting arm [7].

Fig. 1. Optical position.

Fig. 2. HD video system.

A CO2 laser can be positioned coaxially to the telescope, always using opaque instruments to prevent reflection of laser rays. The smoke-aspirator channel is always used despite the fact that a standard coaxial support does not yet exist [5].
Moreover, it is possible to use a classical set of phonosurgical micro-instruments such as curved alligators, triangular Bouchayer forceps, microscissors, microaspirators and endoscopic needles for intracordal injections of fluids or autologous fat [1 6].
The exoscope with a HD endoscopic video system is also extremely useful for training and educational purposes. It provides a clear view and the system is associated with a computer that is capable of capturing images and video sequences, and storing data.
Twelve patients underwent this procedure for benign and cancerous lesions, and in all cases preoperative and postoperative evaluation was performed with stroboscopy, voice assessment and MDVP.

Four patients with Reinke's oedema were treated with ELS performing cordotomy, and myxedema was removed by a microaspirator ("sucking technique" described by Hirano in 1988), with good results. In two cysts of Reinke's space, we performed cordotomy and removed the cyst, preserving the epithelium of vocal fold surface with good results. The sulcus was treated with double cordotomy: lateral and medial, and its removal in a single block with acceptable margins, but with sufficient results.
Three patients with vocal fold polyps were treated with ELS; removal was made with scissors, always respecting the principles of the laryngeal microsurgery without damaging the vocal ligament and without removing the epithelium of the commissure glottic front (to avoid synechia) with good results.
In two cases, autofluorescence endoscopy was performed to delineate the limits of the tumour, proving a useful guide in the choice of sites for biopsy.
In all cases, the predicted result was obtained; the system allowedaccurate laryngeal surgery to be performed. Both stroboscopy and postoperative study of voice showed a good result in resolution of phonatory problems, except for the sulcus in which the result was barely sufficient.
Laryngeal biopsies were easy to obtain, as was the use of NBI.

Discussion

The vitom optic combined with the endoscopic system can be considered an excellent alternative to the operating microscope in endoscopic surgery of the larynx, mainly in ENT Departments where nasosinusal endoscopic surgery is performed, and therefore with a habit of a 'bidimensional view' on the monitor; this optical system has excellent depth of field, magnification, contrast and colour, especially if combined with a HD camera (the optic vitom can be used with analogic camera, digital camera, HD camera and 3D camera).
Many surgeons use the microscope to obtain a stereoscopic view, and this method has the advantage of allowing initial endoscopic exploration of the larynx with long optics (0°, 45° and 70° and autofluorescence if necessary).
It also allows obtaining a static view that is as good as a surgical microscope when the optic vitom is positioned on the support device.
The cost of the system is modest, which is 10 times less than a common operating microscope, even considering the purchase of an endoscopic video system.
The system is not bulky and the operator can use all instruments for endoscopic laryngeal surgery, with the advantage of not having to go under microscope after preliminary study of the larynx with straight and angled optics, which today is always carried out.
The system combined with HD video endoscopy allows excellent view on the monitor, and where available the 3D camera can also be used; it is comfortable for the operator to use who can choose to stay in a sitting or standing position.

Conclusions

The exoscope vitom (VITOM®, Karl Storz) is a new way of displaying the larynx, and the aim of this work was to propose the use this of this optic coupled with a HD endoscopic video system as an alternative to the surgical microscope in endoscopic laryngeal surgery. With this system details are more anatomically relevant, and fine vascularization, nodules and irregularities of the mucosa become perfectly visible with an exceptional depth of field and brightness. The telescope is positioned to 25 cm above the larynx (exoscope), giving the surgeon ample working space, and is extremely useful for training and educational purposes, providing a close and unobstructed view on a monitor. The system enables the surgeon to acquire both static images and video sequences, and can store data. In summary, the vitom is economic and permits optimal vision, allowing accurate laryngeal surgery and improved surgeon comfort and ease.

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