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Trans-tracheostomic endoscopy of the larynx in the evaluation of dysphagia

L'endoscopia laringea trans-tracheostomica nella valutazione della disfagia

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SUMMARY

Laryngeal endoscopy plays a determinant role in clinical evaluation of dysphagia. The examination is performed by means of a trans-nasal approach with a flexible fiberoptic endoscope, able to visualize the pre- and post-deglutitory steps of the pharyngeal phase of swallowing. In patients with tracheostomy, it is possible to visualize the glottic or neoglottic function during the intra-deglutitory phase, performing the examination through a trans-tracheostomic route. The procedure and indications of this endoscopic technique are described.

KEY WORDS: Dysphagia • Diagnosis • Flexible fiberoptic endoscopy • Endoscopy of the larynx • Rehabilitation of dysphagia

RIASSUNTO

L'endoscopia laringea ha un ruolo determinante nella valutazione clinica della disfagia. L'esame viene eseguito per via trans-nasale mediante un endoscopio flessibile ed è in grado di visualizzare solo i momenti pre- e post-deglutitori della fase faringea della deglutizione. Nei pazienti portatori di tracheostomia è possibile osservare la funzionalità glottica o neoglottica anche durante la fase intra-deglutitoria, eseguendo l'esame per via trans-tracheostomica. Gli Autori presentano la procedura e le indicazioni di tale tecnica endoscopica.

PAROLE CHIAVE: Disfagia • Diagnosi • Fibroendoscopia • Endoscopia della laringe • Riabilitazione della disfagia

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Introduction

Laryngeal endoscopy plays a determinant role in the clinical evaluation of dysphagia¹. The examination is performed using a flexible endoscope, with a working channel that allows aspiration of the secretions that obstruct the vision and the food that stagnates in the hypo-pharynx or that is inhaled into the lower airways. The working channel is also used to inject cold water or air in order to test or stimulate the sensitivity of the pharyngo-laryngeal mucosa². The endoscope can be either the classic flexible fiberoptic endoscope or the new flexible digital endoscope with a high definition distal chip camera, which offers a superior quality of images. The instrument must be sufficient in length to allow exploration of the lower airways, with aspiration of secretions and inhaled food. The fiberoptic endoscope is connected to a videocamera and the images are displayed on a monitor; the examination is recorded and then analysed in slow-motion. Videoendoscopy of swallowing, usually performed through a trans-nasal route^{3,4}, allows evaluation of morphology, sensitivity and functionality of the soft palate, the pharynx, larynx and cervical oesophagus.

Laryngeal and pharyngeal sensitivity is evaluated by touching the mucosa with the tip of the endoscope or instilling

cold water or insufflating air^{2,5,6}. By touching the tongue base with the tip of the endoscope, gag reflex can be evaluated. The efficacy of cough reflex and voluntary cough is an important evaluation parameter.

Functionality of the soft palate is evaluated during phonation and swallowing, evaluating the eventual presence of velopharyngeal insufficiency, which causes rhinophonia, open rhinolalia and nasal reflux of food (particularly liquids).

Pharyngo-laryngeal functionality can be evaluated:

- during phonation, showing the eventual presence of paralysis of the vocal folds;
- during swallowing of solid, semi-solid, semi-liquid and liquid food, which must be sterile in order to avoid problems in the event of inhalation and coloured in a natural way (blueberry juice) or adding some drops of methylene blue (blue dye test)⁷, in order to distinguish it from the pharyngo-laryngeal mucosa and from secretions. Food should be warm or cold in order to increase the sensitivity⁸. Stagnation of secretions and/or food in the pyriform sinuses can be caused by lack of pharyngeal sensitivity and/or motility or by a spasm of the crico-pharyngeal muscle. The presence of gastro-oesophageal-pharyngeal-laryngeal reflux can be revealed by the presence of oedema of the

posterior glottic commissure or an arytenoidal granuloma and/or by direct display of the reflux after swallowing. The post-cricoid region can be displayed by means of the Valsalva manoeuvre or by means of the “trumpet” manoeuvre. Finally, proceeding with the endoscope beyond the superior oesophageal sphincter (while the patient is swallowing), it is possible to evaluate the morphology and the peristalsis of the cervical oesophagus: the patient is asked to drink several small sips of water (Herman’s procedure), which allows the tip of the endoscope to be cleaned and expands the virtual oesophageal lumen, avoiding the insufflation of compressed air, which results in a non-physiologic situation, which is very irritating for the patient.

Fibre-endoscopic evaluation of swallowing (Fiberoptic Endoscopic Evaluation of Swallow, FEES)⁹ allows evaluation of the pharyngeal phase of swallowing, showing only the pre- and post-deglutitory phases; the glottic closure during the intra-deglutitory phase is not adequately displayed as it is covered by the elevation of the larynx with posterior turn-over of the epiglottis (Fig. 1c), by the posterior shifting of the tongue base and by the contraction of the pharyngeal walls (Fig. 6c) (swallowing blackout)³. Events like the pre-deglutitory fall of the bolus into the pharynx/larynx or post-deglutitory stagnation in the pyriform sinuses, or aspiration of the bolus into the trachea during pre and/or post-deglutitory phase can be displayed, while intra-deglutitory inhalation cannot be directly displayed, but it can be suspected in the presence of cough after swallowing or by the presence of food in the laryngeal vestibule, in the hypoglottic region and/or in the trachea. If tracheostomy is present, the inhaled food can be expelled with the cough or it can be aspirated with a flexible catheter.

The limit of swallowing blackout can be exceeded, when tracheostomy is present, through *trans-tracheostomic laryngeal endoscopy*. This technique, which we always perform in the evaluation of swallowing combined with trans-nasal endoscopy, is carried out with the use of a flexible endoscope with a working channel for aspirating secretions and foods which can remain on the tip of the instrument. The trache-

ostomy tube is temporarily removed; in the event it cannot be removed, the endoscope can be introduced through the window of the tube. The tip of the endoscope must be turned upwards towards the hypoglottic region, displaying the inferior face of the vocal folds. The glottis appears in an upside down position (Fig. 2) compared to the image obtained with trans-nasal (Fig. 1) or trans-oral laryngeal endoscopy.

The cough reflex usually disappears after a few seconds. In those cases in which the endoscope is not tolerated, lidocain 10% is vaporized in the tracheostomy. In order to evaluate swallowing, the patient is given the same sterile coloured food as that used for trans-nasal FEES. The examination is repeated in different positions of the head and with several types of food, in order to detect the better swallow and to offer precious indications to the swallow therapist who assists the phoniatrician during the examination¹⁰⁻¹². The endoscopic control of the body positions and of the facilitating manoeuvres is also a useful feed-back for the patient^{3 11 14}. The *indications for trans-tracheostomic laryngeal endoscopy* are:

- display of the movements of the vocal folds in cases in which it is not possible to perform laryngeal endoscopy through a trans-oral or a trans-nasal approach; laryngostroboscopy from “below” can also be performed, with the display of an inverse mucosal wave;
- evaluation of food inhalation into the trachea during the pre-, post- and also intra-deglutitory phase, with a detailed display of the amount of inhaled bolus and of the zone of the glottic insufficiency where liquid, semi-liquid, semi-solid or solid foods pass;
- selection of the right points where to apply the injection laryngoplasty for surgical rehabilitation of dysphagia after partial laryngectomy (Fig. 5)¹⁵.

As in trans-nasal FEES, the examination is recorded and analysed in slow-motion in order to study, in detail, the glottic or neo-glottic function during phonation and swallowing. Laryngeal endoscopy pictures, during phonation and swallowing, in a 26-year-old patient with dysphagia following traumatic brain injury trauma are shown in Figures 1-3.

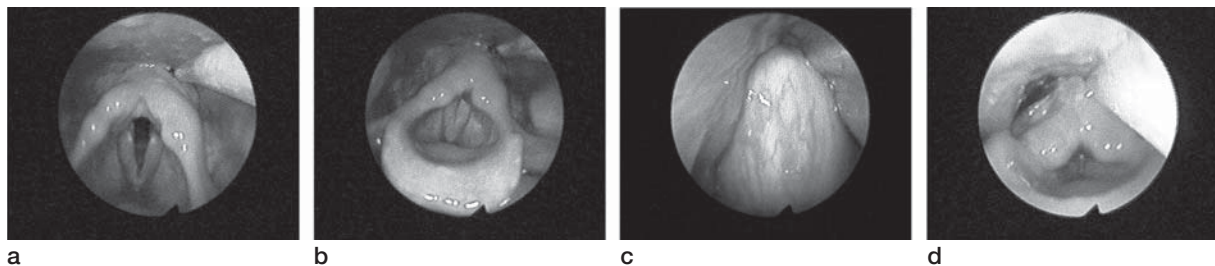


Fig. 1. Trans-nasal laryngeal endoscopy: a) open glottis during breathing; b) phonating glottis; c) intra-deglutitory phase, with posterior turnover of epiglottis which prevents vision of glottic region (suspected bolus aspiration due to appearance of cough); d) post-deglutitory phase, with stagnation of liquid bolus (blueberry juice) in right pyriform sinus.

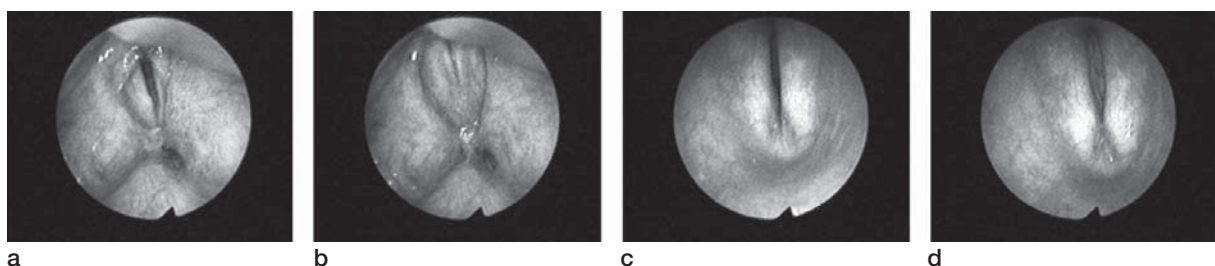


Fig. 2. Trans-nasal laryngostroboscopy (a, b) and trans-tracheostomic examination (c, d): a, c glottic opening phase; b, d glottic closure phase.

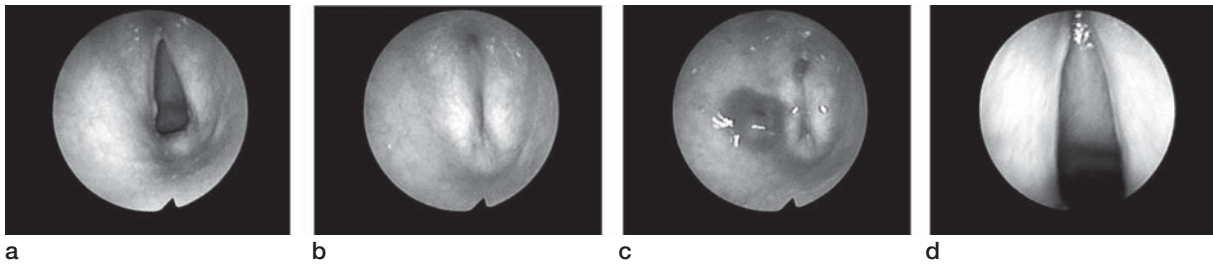


Fig. 3. Trans-tracheostomic laryngeal endoscopy: a) open glottis during breathing; b) phonating glottis; c) intra-deglutitory phase, with penetration of liquid bolus (blueberry juice) into right side of hypoglottic region; d) post-deglutitory phase, with open glottis during breathing and no stagnation of secretions and/or food in sub-glottic region.

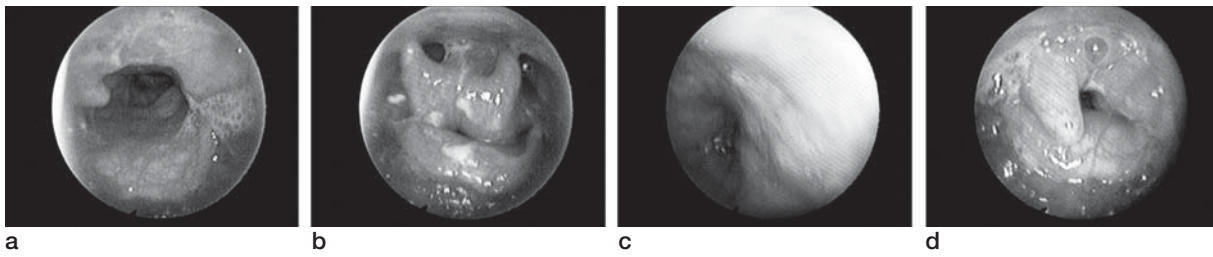


Fig. 4. Pre-operative laryngeal trans-nasal endoscopy: a) neo-glottis during breathing; b) phonating neoglottis; c) intra-deglutitory phase, with bolus (blueberry juice) in trachea with cough; d) post-deglutitory phase, with stagnation of bolus in pharynx and larynx.

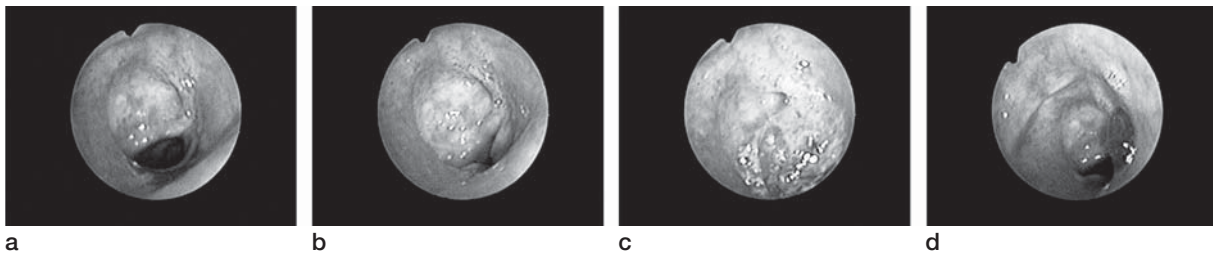


Fig. 5. Pre-operative laryngeal trans-tracheostomy endoscopy: a) neo-glottis during breathing; b) phonating neoglottis; c) intra-deglutitory phase, with bolus (blueberry juice) on left side of hypoglottic region due to incomplete glottic closure; d) post-deglutitory phase, with neo-glottis during respiration and presence of secretion in hypoglottic region.

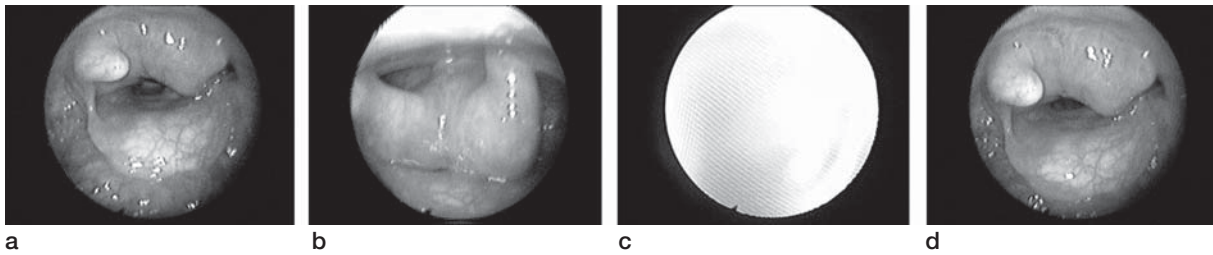


Fig. 6. Post-operative laryngeal trans-nasal endoscopy: a) neo-glottis during breathing; b) phonating neoglottis; c) intra-deglutitory phase, without bolus in trachea; d) post-deglutitory phase, with poor stagnation liquid bolus in pharynx.

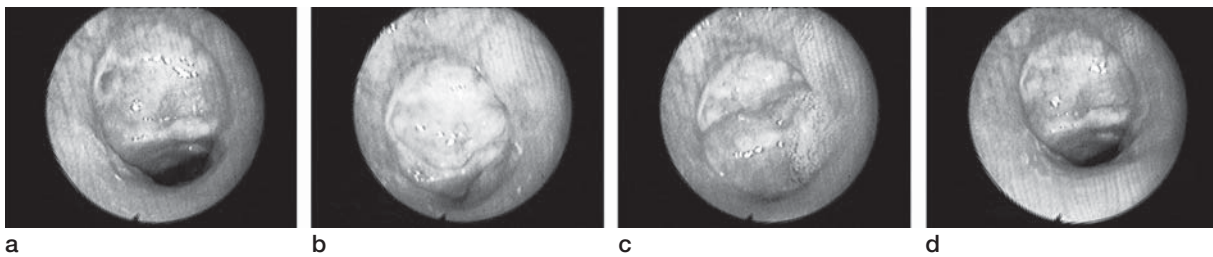


Fig. 7. Post-operative laryngeal trans-tracheostomic endoscopy: a) neo-glottis during breathing; b) phonating neoglottis; c) intra-deglutitory phase, without bolus in hypoglottic region; d) post-deglutitory phase, with neo-glottis during the respiration with poor secretions in hypoglottic region.

Laryngeal endoscopy image, during phonation and swallowing (Figs. 4-7) in a 67-year-old patient, with dysphagia after partial laryngectomy with crico-hyoidopexy with

preservation of two arytenoids, before^{4,5} and after^{6,7} injective laryngoplasty with Vox Implants® (Uroplasty Inc, Minnetonka, MN, USA).

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