

LITERATURE REVIEW

Particularities of anesthesia in ENT endoscopic surgery

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ABSTRACT

Due to technical developments in the last decades, as well as the improvement of otorhinolaryngologic endoscopic surgery methods, coupled with a growing concern for patients' life quality, indications for external surgery in the treatment of ENT inflammatory and tumoral disorders have become more and more limited. For successful surgeries under endoscopic control in ENT, besides the necessary technical equipment, good anesthesiology training is essential. From this point of view, endoscopic surgery requires some particular anesthesiology conditions, depending on the anatomical level subject to surgery, controlled hypotension or patient's good relaxation. Choosing the type of anesthesia or between the tracheal tube and the laryngeal mask depends on the anesthetist's experience, the duration of the surgical intervention and the patient-related risk factors.

KEYWORDS: endoscopic sinus surgery, anesthesia, endoscope ENT surgery

INTRODUCTION

Due to technical developments in the last decades, as well as the improvement of otorhinolaryngologic endoscopic surgery methods, coupled with a growing concern for patients' life quality, indications for external surgery in the treatment of ENT inflammatory and tumoral disorders have become more and more limited.

This is mainly due to the transition that has been made from FESS – functional endoscopic sinus surgery, developed in the late 70s of the last century, to EESS – extended endoscopic sinus surgery, respectively transnasal endoscopic surgery for the treatment of orbitonasal borderline pathology or that of the skull base (TES – transnasal endoscopic surgery) (Figure 1). This is the reason why there should be no overlap between the concepts of external surgery and radical surgery, since at present endoscopic endonasal techniques may allow extensive resections similar to the external approach¹⁻³.

At the same time, endoscopic laryngeal surgery, performed by suspension laryngoscopy, has greatly extended indications, from phonosurgery (vocal nodules, polyps, cysts or other benign endolaryngeal tumors) to surgery of the malignant laryngeal tumor

pathology (neoplasias stages I-II – through partial laryngectomies, possibly laser-assisted)^{4,6}.

For successful surgeries under endoscopic control in ENT, besides the necessary technical equipment, good anesthesiology training is essential. From this point of view, endoscopic surgery requires some particular anesthesiology conditions, depending on the anatomical level subject to surgery, controlled hypotension or patient's good relaxation⁷⁻¹¹.

INTRAOPERATIVE LARYNGEAL EVALUATION – SUSPENSION LARYNGOSCOPY

Accurate and detailed examination of the larynx and trachea is made intraoperatively, by suspension laryngoscopy under general anesthesia. Examination usually continues with endoscopic evaluation of the larynx, contact endoscopy and last but not least with therapeutic maneuvers (ablation of the tumors, excision biopsy, vocal cord decortication, partial endoscopic resections)¹³⁻¹⁶.

The surgeon and his team must be familiar with the equipment used and the surgical technique.

Suspension laryngoscopy techniques (Figure 2) slightly differ from institution to institution, but it is

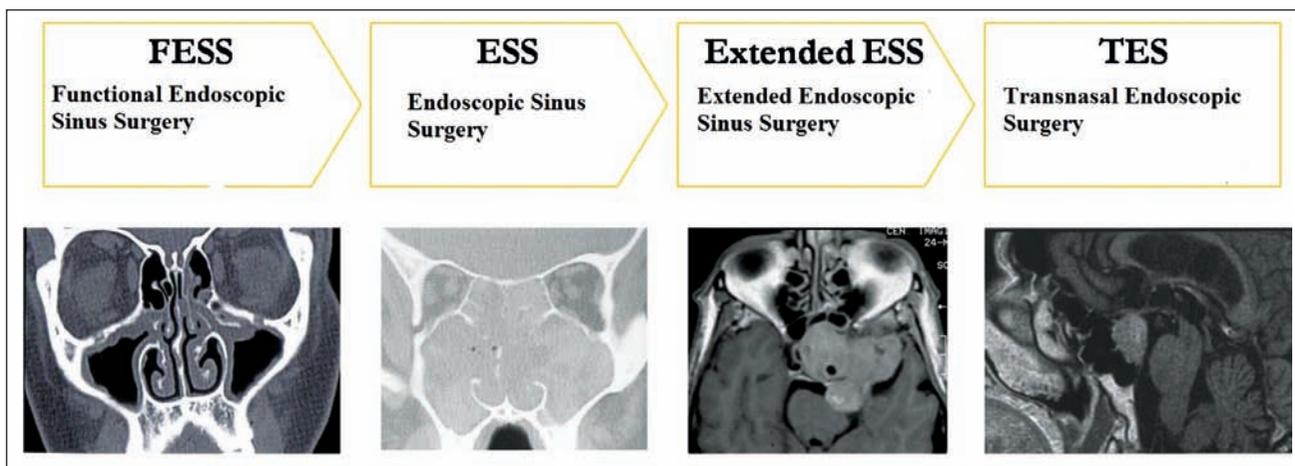


Figure 1 Evolution of endoscopic sinus surgery

important to develop a routine technique that all team members are familiar with.

An excellent method to practise suspension laryngoscopy is under general anesthesia and with microscopic control. Muscle relaxation and a larger image are essential for assessing lesions, but especially for a functional surgical act¹⁷⁻¹⁹.

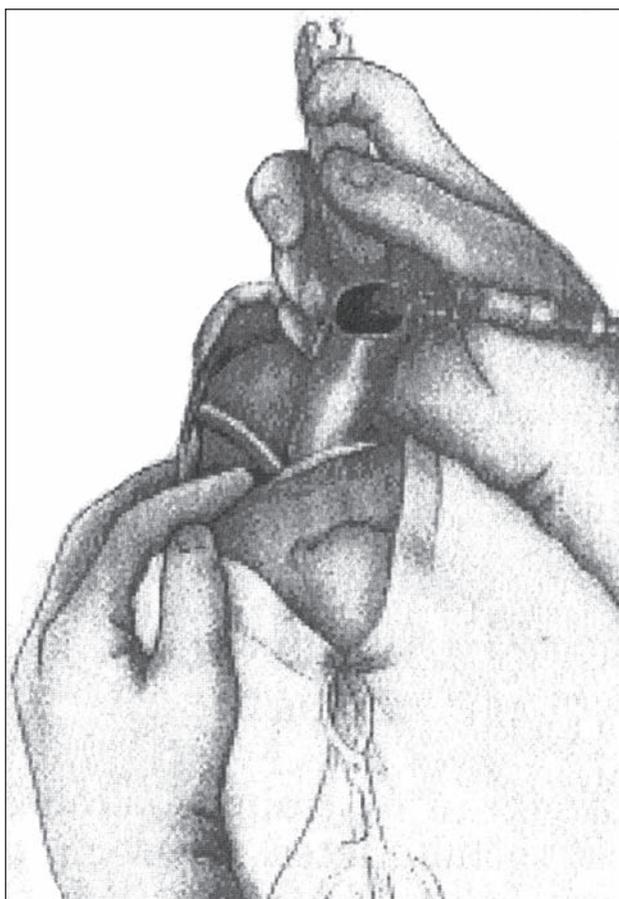


Figure 2 Suspension laryngoscopy – intubation technique

There are advocates of mask inhalation general anesthesia, while the patient breaths spontaneously^{20,21}. In such cases, the larynx must be quickly visualised (possibly also anesthetized with lidocaine 2% to prevent subsequent laryngospasm). After insertion of the laryngoscopy tube, one can also perform additional endoscopic laryngeal, tracheal and bronchial examination²²⁻²⁵.

Generally, after suspension of the larynx, one evaluates in detail the supraglottic level, the vocal cords and then the subglottic level. Examination is easily made with 0° Hopkins endoscopes. Completion of the examination with 30° or 70° optics allows a better visualization of the insertion, the origin and extension of the lesion^{1,2,3}.

The technique is simple and is based on the following stages: the patient's head is positioned in maximum extension, the laryngoscope is inserted between the inferiorly located orotracheal tube and the anteriorly located mandible, trying not to injure the lip or the tongue body. The laryngoscope is pushed forward, the epiglottis is loaded and the supraglottic level is reached. If the laryngoscope is placed more deeply, the ventricular bands and vocal cords are displaced laterally. In some cases of hypertrophy of the ventricular bands, they obstruct the vocal cords image, so the laryngoscope will be placed right at the limit of the vocal cords or between them^{11,26,27}.

If it is necessary to explore the back of the larynx, the endotracheal tube is pushed into the anterior commissure with the tip of the laryngoscope²⁸.

Application of external pressure on the larynx prevents using excessive pressure on the laryngoscope and allows easy examination of the back of the larynx.

A better image of the anterior commissure is obtained by withdrawal of the laryngoscope tip into the ventricular bands and by applying external pressure on the lower part of the larynx, so as to create an ob-

tuse angle between the larynx and the optical axis of the laryngoscope (Figure 3).

ENDOSCOPIC SINUS SURGERY

The concept of endoscopic sinus surgery has evolved a lot over time. Initially, endoscopic approach in the treatment of chronic rhinosinusitis was limited to permeabilization of the ostiomeatal complex (OMC), having as purpose the restoration of ventilation and normal drainage of the paranasal sinuses, that is restoration of normal rhino-sinusal functionality. This is why this type of surgery was originally called FESS – functional endoscopic sinus surgery²⁹⁻³³. Over time, it has been concluded that the term FESS is often misused, since surgery often has no functional result, at least in more extensive disease; that is why the term ESS – endoscopic sinus surgery, has begun to be used increasingly frequently. Moreover, the purpose of surgery (in rhinosinusitis leading to compromised sinus mucosa) is sometimes that of creating a single nasosinusal cavity to allow ventilation and drainage of rhinosinusal secretions, a concept called MESS – marsupialization endoscopic sinus surgery, by Levine³⁴⁻³⁶.

Surgery indications in the treatment of rhinosinusitis are the following (adapted from Levine)³⁶:

- Failure of correct maximal medical treatment in chronic rhinosinusitis;
- Recurrent rhinosinusitis;
- Acute and chronic rhinosinusitis complications;
- Symptomatic nasal polyposis;
- Invasive or localized fungal rhinosinusitis;
- Mucocele;
- Tumor excisions;
- CSF fistulas;
- Orbital decompressions (optic nerve decompression);

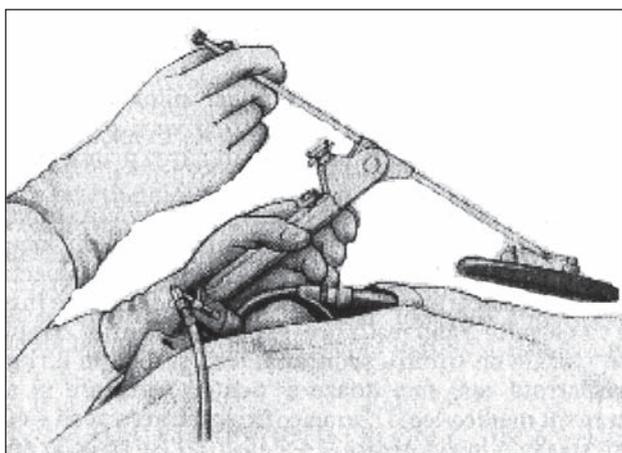


Figure 3 Suspension laryngoscopy – suspension technique

- Dacryocystorhinostomy;
- Removal of foreign bodies.

For successful surgery, from our point of view, it is necessary to meet several preliminary preoperative conditions:

- Good preoperative preparation of the patient (therefore, know the patient!):
 - ✓ Thorough anamnesis, microbiological, endoscopic and radiological evaluation (CT scan ± MRI);
 - ✓ Patient's informed consent;
 - Good theoretical and practical training of the doctor (therefore, know our limits!);
 - ✓ Knowledge of rhinosinusal endoscopic and radiological anatomy;
 - ✓ Mastering endoscopic surgical techniques (pay attention to the “learning curve”!), but also open techniques, so that the surgeon is always able to convert endoscopic surgery to an open technique;
 - Endowment with instruments and proper medical equipment;
 - Preanesthetic consultation performed the evening before surgery³⁷⁻³⁹.

Also, in patients with extended nasal polyposis, it is recommended to administer a systemic cortisone flash therapy 5-7 days preoperatively (for example, Medrol, 32 mg/day, or injectable dexamethasone 8 mg/day) to reduce the size of nasal polyps and decrease intraoperative bleeding.

At the same time, for a good intraoperative comfort (better view, reduced intraoperative bleeding), decongestion of the nasal mucosa performed at least 10-15 minutes preoperatively, by applying nasal pads soaked with decongestant substances, is essential. Intraoperative anesthetic - vasoconstrictor infiltrations (Figure 4) in the unciform apophysis and insertion of the middle nasal turbinate, using a mixture of 1% Xylocaine with epinephrine 1:100.000,

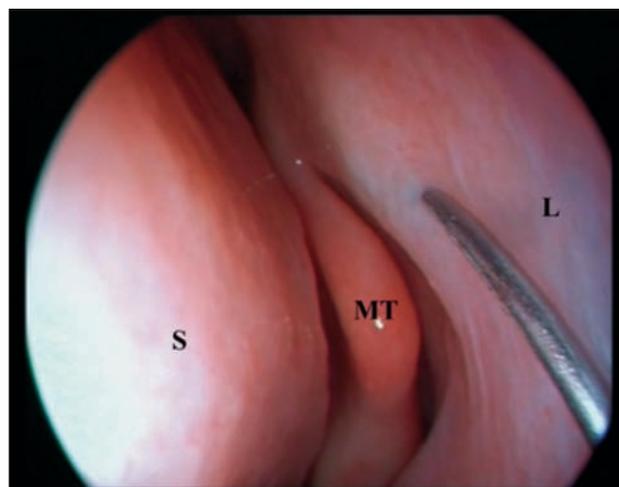


Figure 4 Anesthetic-vasoconstrictor infiltrations in the unciform apophysis (S-nasal septum, MT-middle turbinate, L- lateral wall of nasal fossa)

are used not so much for their anesthetic effect, but for the vasoconstrictor one⁴⁰⁻⁴⁴.

The main surgical techniques used in the treatment of chronic rhinosinusitis, with or without nasal polyps, are:

- Endonasal surgery
- Endoscopic
- Microscopic
- Combined (“COMET surgery” – Combined Microscopic and Endoscopic Technique)
- Classical polypectomy
- External surgery.

General anesthesia is essential for the success of endoscopic surgery, providing comfort to both patient and surgeon, especially if controlled hypotension is achieved.

Anesthetic concerns in ENT endoscopic surgery consist of upper airway control, risk of difficult intubation, head and neck mobility during surgery, reduced intraoperative bleeding⁴⁵⁻⁵⁰.

Anesthesia in ENT endoscopic surgery has several particularities:

- the major anesthetic problem consists in airway sealing;
- access to the airway is limited during the surgical procedure – a safe and unobstructed airway is essential;
- surgical interventions are conducted in the airways, working together with the ENT surgeon;
- all interventions in the nose have the potential to contaminate the upper airways with blood and secretions, requiring the most efficient protection;
- preoperative evaluation of the anesthetic risk (ASA classification) is essential;
- assessing the risk of difficult intubation (Mallampati scale, direct laryngoscopy, predictive intubation difficulty factors); antecedents of difficult oral-tracheal intubation (OTI), maxillofacial interventions and trauma, voice changes (tumors), identification of obstructive sleep apnea syndrome associated with the metabolic syndrome, Widal syndrome with episodes of severe bronchospasm;
- use of controlled hypotension in order to decrease the risk of bleeding during endoscopic surgery under deep and stable general anesthesia;
- airway interventions are frequently followed by acute laryngospasm or obstruction.

Preanesthetic preparation requires a complete clinical examination, routine and special paraclinical investigations, depending on the particularities of the case. Endoscopic surgery can be performed under local anesthesia, but most often under general anesthesia, which involves a good collaboration between the ENT surgeon and the anesthetist⁵¹⁻⁵⁵.

ANESTHESIA IN ENDOSCOPIC SURGERY OF THE LARYNX

The anesthesia in endoscopic surgery of the larynx can be performed:

A. without OTI (in cooperative patients); maintaining spontaneous ventilation presents minimal risk of smoke, blood or gastric fluid inhalation;

B. with OTI with small calibre tubes no. 6-6,5;

C. Jet ventilation that requires deep anesthesia with curarizing substances, equipment and special knowledge⁵⁶⁻⁵⁸.

Anesthetic technique depends on the patient's general condition, the mobility and location of the lesion, the use of laser. It must meet the following objectives:

- complete control of the airway without risk of aspiration;
- control of the ventilation with oxygenation and adequate carbon dioxide elimination;
- to ensure cardiovascular stability;
- not to be associated with the risk of airway fire (FiO₂<0,4);
- to ensure complete muscle relaxation and adequate pharyngolaryngeal mobility;
- to allow rapid awakening with minimal risk of laryngospasm.

Laryngoscopy may be used as a diagnose (about 15 minutes) or therapeutic (vocal cords microsurgery, laser) and can be performed in two possible circumstances:

- in emergency situations – in case of acute respiratory failure, when symptoms can be significant and vital risk is often present;
- in normal situations, in a hemodynamically and respiratorily stable patient, benefiting from premedication and antibiotic prophylaxis, or in a patient with occult airway obstruction detected after induction, creating intubation difficulties⁵⁹⁻⁶⁵.

The purpose of anesthetic conduct is to achieve permanent control of the airway, to ensure adequate oxygenation, to isolate the airway from the digestive tract. Ideal control is gained under general anesthesia by OTI in a completely relaxed patient. It requires a deep muscle relaxation which should minimize the risk of damage to the anatomical formations encountered during laryngoscopy⁶⁶⁻⁶⁸.

ANESTHESIA IN ENDOSCOPIC SINUS SURGERY

Is performed by:

- **Total intravenous anesthesia (TIVA) + FiO₂ 100% + laryngeal mask** – should be the procedure of choice in ENT surgery, with the advantages of rapid awakening, high-quality analgesia necessary for short inter-

ventions under deep anesthesia, with a low incidence of postoperative nausea and vomiting; the propofol-opioids combination (fentanyl, remifentanyl) is ideal and doses are adapted to the surgical stimuli. Compared to fentanyl, remifentanyl is preferable – it provides a good hemodynamic stability and an adequate cerebral perfusion with moderate hypotension⁶⁹⁻⁷¹.

• **General anesthesia with orotracheal intubation (GA-OTI)** – in combination: Propofol-Fentanyl (Remifentanyl) or Sevoflurane-Fentanyl⁷²⁻⁷⁵.

The advantage of using a tracheal tube consists in securing the airway, the airway protection during negative pressure ventilation or spontaneous ventilation. In order to improve blood control during ENT endoscopic surgery, we use controlled hypotension; an intraoperative preparation of the patient with risk factors for bleeding is required⁷⁶⁻⁷⁸:

- intranasal insertion of pads with vasoconstrictor about 10-15 minutes before intubation;
- administration after intubation of 10 ml local anesthetic solution with adrenaline 1:100.000;
- deep and stable anesthesia with effective analgesia;
- 25 degree anti-Trendelenburg position;
- mean arterial pressure (MAP) maintained between 60-70 mmHg during the intervention, by adapting the minimum alveolar concentration (MAC) of halogenated anesthetic; in order to prevent cerebral vasoconstriction, EtCO₂ should be maintained within normal limits;
- maintaining anesthesia with sevoflurane with MAC - 2.5% mixed with O₂/air – 40/60.

This technique will not be applied in those cases where controlled hypotension is contraindicated⁷⁹⁻⁸¹.

For induction and maintenance of anesthesia any anesthetic technique can be used, provided that it is adapted to the duration of surgery and patient's situation. Anesthesia can be induced and maintained both intravenously, with any of the known injectable agents or by inhalation. Among these, propofol provides the fastest awakening if associated with an opioid⁸²⁻⁸⁴. Propofol causes a decrease in MAP by reducing peripheral vascular resistance (PVR) and a slight decrease in cardiac output without significant variations in heart rate. When used alone in a dose of 2.5 mg/kg of body, it can allow intubation, but it does not represent a solution for difficult intubation. The French Society of Anesthesia and Resuscitation recommends selection of non-depolarizing curarizing substances depending on the type of surgery and duration of intervention. Succinylcholine remains the safe depolarizing curarizing substance in case of difficult intubation or full stomach. Inhalation induction with Sevoflurane is an alternative to curarization, often used in pediatrics and increasingly often in adults. The adult requires higher concentrations than children to achieve

optimal intubation conditions: MAC 50 = 2* MAC (3.5-4.5%). Concentrations may be lower in induction if associated with opioids: 1.5-2% with fentanyl 1-4µg/kg and 2% with remifentanyl 1µg/kg + 0,25µg/kg/min. Rocuronium is the only non-depolarizing relaxant whose latency approaches that of succinylcholine, since the dose used for intubation (0,6-1 mg/kg) has a duration of action that can exceed 45 minutes, while in case of difficult intubation it can be fatal. The complete block induced by Rocuronium can be reversed by Sugammadex in about 90 seconds (it is an alternative that must be taken into consideration). Tracheal intubation is preferable – it has the following advantages: airway protection, possibility of controlled ventilation and improved surgical access^{85,86}.

Regardless of the type of anesthesia used, patient monitoring must be ensured. The minimum standard means: clinical follow-up, measuring systolic and diastolic blood pressure, mean arterial pressure, ECG monitoring, EtCO₂, temperature, pulse oximetry. It is mandatory to own equipment and substances required for resuscitation. The most dangerous moment in ENT surgery anesthesia is represented by the awakening due to the increased risk of airway obstruction with foreign bodies, severe bronchospasm, laryngospasm, bleeding. To avoid these complications, it is required a careful control of the oral cavity and the posterior nasal region, proper oral cavity toilet at the end of the surgical intervention, together with the specific treatment for each patient with associated pathology. Postoperative analgesia can be ensured with anti-inflammatory agents; the use of opioid in this type of surgery is not recommended⁸⁷. The patient will be extubated after complete awakening, when there is no major risk of airway obstruction by hemorrhage, edema. The advantage of awake extubation in ENT surgery consists of airway control, restoration of laryngeal reflexes and protection against subsequent contamination of the airway with blood and secretions.

CONCLUSIONS

Choosing the type of anesthesia or between the tracheal tube and the laryngeal mask depends on the anesthetist's experience, the duration of the surgical intervention and the patient-related risk factors.

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