Peri-operative complications of endoscopic upper airway laser surgery in Kasr Al –Ainy hospital

A prospective study

Thesis

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By

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Abstract

Laser surgery of the upper airway is performed endoscopically under the microscope. One of the advantages of this type of surgery over an open partial technique is that it only removes the lesion, preserving larger adjacent free areas and maintaining the laryngeal skeleton closed. The functional results may also improve, and most patients do not require a tracheotomy.

However, because of the increase in the use of this technique for laryngeal and hypopharyngeal lesions, a greater number of complications may be expected.

The aim of this study was to evaluate the incidence, type, and clinical significance of intraoperative and postoperative complications of upper airway lesions treated with laser surgery.

Key words: laser surgery, upper airway, complications, anesthesia

Aim of the work

To analyze the peri-operative complications of endoscopic upper airway laser surgery in Kasr Al-Ainy hospital over one year, and to highlight its possible risks.

Abbreviations

- **ETT:** Endotracheal tube.
- **FiO2:** Fraction of inspired oxygen.
- **J/cm^2:** Joules per square centimeter.
- **MLS:** Micro-Laryngeal Surgery.
- **TIVA:** Total intravenous anesthesia.
- **W:** watts.
- **W/cm^2:** watts per square centimeter.

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Introduction

Shared airway procedures are unique in that both anesthetist and surgeon are working in the same anatomical field. Close cooperation between anesthetist and surgeon, an understanding of each other's problems and knowledge of specialist equipment are often required. Endoscopic techniques take the upper hand nowadays in almost all surgical fields including laryngeal surgeries. Awareness of the anesthetic management of these cases and possible complications is a must.

There is no ideal anesthetic technique for all endoscopic procedures and the technique chosen depends on the patient's general condition, the size, the mobility and location of the lesion, the use of a laser, and surgical requirements. Smooth emergence and recovery from anesthesia are essential.

Anesthetic safety for endoscopic laryngeal laser surgery has been a major limiting factor for laser applications in the larynx and the hypopharynx. Several anesthetic techniques have been proposed and each technique appears to have its own limitations.[1]

An ideal technique would:

(1) Be simple to use.

(2) Provide complete control of the airway with no risk of aspiration.

(3) Control ventilation with adequate oxygenation and carbon dioxide removal.

(4) Provide smooth induction and maintenance of anesthesia.

(5) Provide a clear motionless surgical field, free of secretions.

(6) Do not impose time restrictions on the surgeon.

(7) Not be associated with the risk of airway fire or cardiovascular instability.

(8) Allow safe emergence with no coughing, bucking, breath holding, or laryngospasm.

(9) Produce a pain-free, comfortable, alert patient at the end of the operation.

Some of these techniques conflict. The presence of a cuffed conventional tracheal tube provides control of the airway and prevents aspiration, but may obscure a glottic lesion and is not laser safe. A cuffed laser tube provides some protection against laser-induced airway fires, but has a greater external-to-internal diameter ratio and may obscure laryngeal lesions. Jet ventilation techniques require specialist equipment and knowledge and an understanding of their limitations. Anesthetic techniques can be broadly classified into two groups: first, "closed" systems, in which a cuffed tracheal tube is employed with protection of the lower airway, and second, "open" systems, in which a cuffed tracheal tube is absent using either spontaneous ventilation and insufflation techniques or muscle paralysis and jet ventilation.[2]

A prospective study of patients who undergone this modality of surgery at our institution was done. Our conclusion from this study showed clearly the perioperative complications however anesthetic or surgical and the management of them.

The main hazards during this procedure are:[3]

1) Fire: The most frequent complication of endoscopic laser surgery is ignition of the gas mixture within the airway with involvement of the endotracheal tube. This accident is caused by the high temperature of the laser, which acts on tissue or on tissue particles. The danger increases when combustible material is present in the airway (including the endotracheal tubes), when a gas mixture with a large content of oxygen is used, or if there is continuous or protracted use of a high-energy laser.
2) Major hemorrhage.
3) Aspiration of debris into the lungs.
4) Barotrauma: as pneumothorax, pneumomediastinum or surgical emphysema. [4]
5) Pulmonary venous gas emboli, and bronchial irritation due to laser smoke inhalation.[5]
6) Corneal injury.[6]

Anatomy of the upper airway

Introduction:

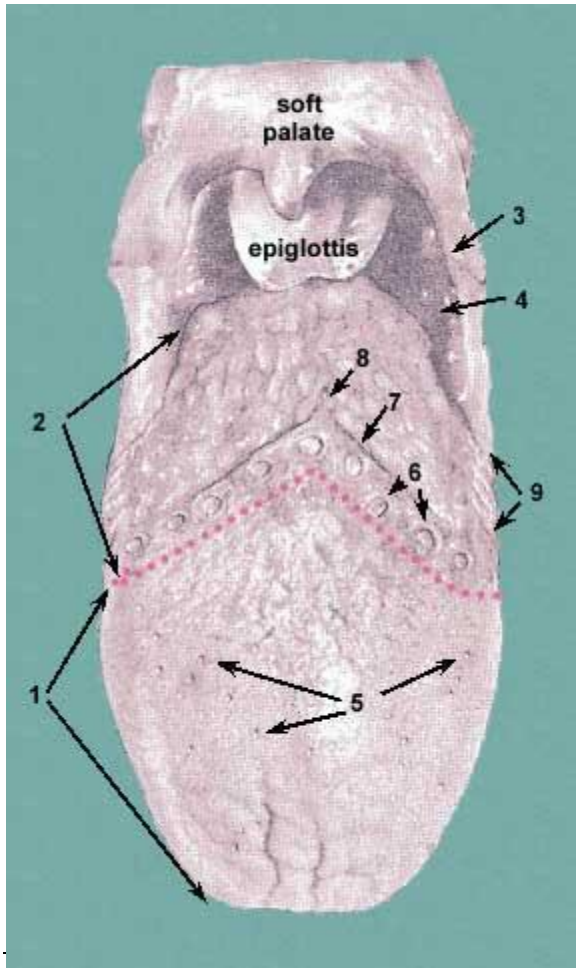
The oral apparatus is the "gateway to the gut". The oral apparatus not only prepares food but also initiates swallowing. One of the major reasons the upper respiratory tract of man developed as it did is partly to facilitate speech.[7]

As man has assumed an upright position, variations have evolved that make the anatomy of humans different from the anatomy of close ancestors and other mammals. The face, eyes, maxilla, and mandible have migrated inferiorly and posteriorly, creating a short face or splanchnocranium. The splanchnocranium consists of the mandible, palate, ethmoid, maxilla, sphenoid bones, a narrow supralaryngeal vocal tract, the oropharyngeal tongue, a descended larynx and shortened soft palate with the loss of an epiglottic–soft palate lockup. [7]

Lungs, the complicated and delicate organs carrying out very precise bodily functions, are safely encased in and protected by the rib cage. The anaesthesiologist commonly has to interfere with the airway passage, so orientation of it is very important. The airway needs to be treated with respect, and the more we understand it, the less the harm that we do to patients.[7]

Oral cavity:

The oral cavity (fig. 1) consists of the upper and lower dentition, the tongue and floor of the mouth, the hard palate and the openings of the major salivary glands. [8]



Identify:

1. anterior 2/3rd of tongue
2. posterior 1/3rd of tongue
3. palatogossal fold
4. palatine tonsil
5. fungiform papillae
6. circumvallate papillae
7. sulcus terminalis
8. foramen cecum
9. foliate papillae

Fig. 1: Oral cavaity[8]

The blood supply is from the branches of the external carotid artery.

The sensory nerve supply of the tongue is from the lingual nerve in the anterior two-thirds and glossopharyngeal nerve (IX) posteriorly. The motor supply is from the hypoglossal nerve (XII). [8]

The palatine tonsil lies adjacent to the posterior one-third of the tongue. There is a complete ring of lymphoid tissue (Waldeyer's ring), which comprises the adenoids (pharyngeal tonsils), the palatine tonsils, and the lingual tonsils.

The pharynx is topographically and functionally separates into thirds- nasopharynx, oropharynx, and laryngopharynx. The anterior limits of the nasopharynx are the internal nares and the posterior border of nasal septum. The roof and the posterior wall abut against the basilar part of the occipital bone and the anterior arch of the atlas and the body of the axis respectively. The lateral wall houses the pharyngotymphanic tube, which communicates with the middle ear. The floor is formed by the soft palate, and when this is elevated it closes off the nasopharynx from the oropharynx. [8]

The oropharynx is bordered by the tonsillar pillars anteriorly, and is roofed by the soft palate (inferior aspect).

The laryngopharynx extends from the superior border of epiglottis above to the lower border of the cricoids cartilage below. The laryngopharynx opens anteriorly into the larynx and its boundaries are therefore the laryngeal inlet with the aryepiglottic fold above and the posterior border of the arytenoids and cricoid cartilage below. [8]