FLEXIBLE FIBREOPTIC BRONCHOSCOPY IN ANAESTHESIA AND ICU PATIENTS

An Essay study

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Presented by

Mohamed Mahmoud Mohamed

M.B.B.Ch

Faculty of Medicine, Cairo University

Supervised by

Prof. Dr. Jehan Ali Elkholy

Professor of anaesthesia

Faculty of Medicine, Cairo University

Prof. Dr. Sahar Mohamed Mostafa Elshal

Assistant Professor of anaesthesia

Faculty of Medicine, Cairo University

Dr. Ahmed Mostafa Kamal

Lecturer of anaesthesia

Faculty of Medicine Cairo University

Faculty of Medicine

Cairo University

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Abstract

- Flexible fiberoptic bronchoscopy is the most valuable single tool available for the anaesthesiologist to manage the difficult airway.

Flexible fibreoptic bronchoscopy is used in anaesthesie in:

- management of difficult tracheal intubations, evaluation of the upper airway
- Verification of endotracheal tube placement
- Repositioning or checking patency of endotracheal tubes
- Changing endotracheal tubes
- Placement of double lumen tubes and placement of endobronchial blockers.

Flexible fibreoptic bronchoscopy (FFB) has become an indispensable tool in the optimal management of intensive care unit (ICU) patients with both diagnostic and therapeutic goals. Its safety and usefulness, in well trained hands with appropriate precautions, have led to its increasing use even in unstable and mechanically ventilated patients.

(Key Words: - fiberoptic bronchoscopy – difficult airway – (ICU) patients – safety and usefulness)

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Introduction

The flexible fiberoptic endoscope (FFE) is the most valuable single tool available to the anesthesiologist faced with a difficult airway. When faced with potentially difficult tracheal intubation, the FFE should be the first, not the last, tool.[32]

The name endoscope is derived from two Greek words which are ***endom*** (within) and ***skopein*** (view). The endoscope is an optical instrument used for viewing internal organs through natural openings. Generally, a flexible endoscope is refereed to as a fiberscope.[21]

flexible fiberoptic bronchoscope could be used in anaesthesia in: management of difficult tracheal intubations, evaluation of the upper airway. [59]

- Verification of endotracheal tube placement

- Repositioning or checking patency of endotracheal tubes

- Changing endotracheal tubes

- Placement of double lumen tubes and placement of endobronchial blockers.

The diagnostic and therapeutic utility of flexible fibreoptic bronchoscopy (FFB), coupled with its minimal morbidity and mortality, have led to its increasing use in the care of the critically ill patients. FFB allows direct inspection of the upper and lower airway, and facilitates the diagnosis and management of a variety of pulmonary disorders.[70]

An awareness of the higher risks associated with certain clinical conditions, and an understanding of the pathophysiological consequences associated with FFB should alert the bronchoscopists to take the necessary precautions to prevent and deal with these problems.[71]

Chapter I

Anatomy Of The Respiratory Tract

I. ANATOMY OF THE RESPIRATORY TRACT :

The respiratory tract begins at the anterior nares (nostrils) and the lips and ends in the alveoli of the lungs. It is divided into an upper and lower airway at the level of the vocal cords.

The Upper Airway:

The Nose and Nasal Cavity:

The nasal airway extends from the anterior nares (nostrils) to the posterior nares (or choanae) before the nasopharynx. The nose itself contains the two nasal vestibules, each approximately 2 cm long and 1 cm wide, and leads to a nasal cavity. The skeleton of the nose is mainly cartilaginous, although the nasal bones contribute to the 'bridge' superiorly.

The nasal cavity is a narrow passage that extends back almost horizontally from the vestibule and is lined mainly by a ciliated columnar epithelium. Its arched ceiling extends superiorly to the olfactory area with olfactory epithelium overlying the cribriform plate. This ceiling is supported by the nasal, frontal, ethmoid (containing the cribriform plate) and sphenoid bones. The medial wall (nasal septum) separating the two nasal cavities is formed mainly by the plate of the ethmoid bone and by the vomer. The floor of the nose is formed by the palatine process of the maxilla and the palatine bone, which make up the hard palate, and by the soft palate posteriorly. The lateral wall of the nasal cavity (Fig. 1.1) is supported by the maxillary and ethmoid bones.[1]

Its surface area is increased by three horizontally running bony folds: the superior, middle and inferior conchae (turbinates). The inferior concha runs 1 cm above the floor of the nasal cavity and is the largest; the nasolacrimal duct empties into its meatus beneath.

The middle meatus receives the openings of the frontal, anteriorethmoidal, middle ethmoidal and maxillary sinuses. The posterior ethmoidal sinus opens into the superior meatus, while the sphenoid sinus joins the spheno-ethmoid recess situated above the superior concha. These paranasal sinuses develop as diverticulae from the wall of the nasal cavity. [1]

Nerve supply

The olfactory mucosa is supplied by the olfactory (1st cranial) nerve. The trigeminal (Vth cranial) nerve supplies the remaining majority of the nasal cavity through its ophthalmic (first) and maxillary (second) divisions.[1]
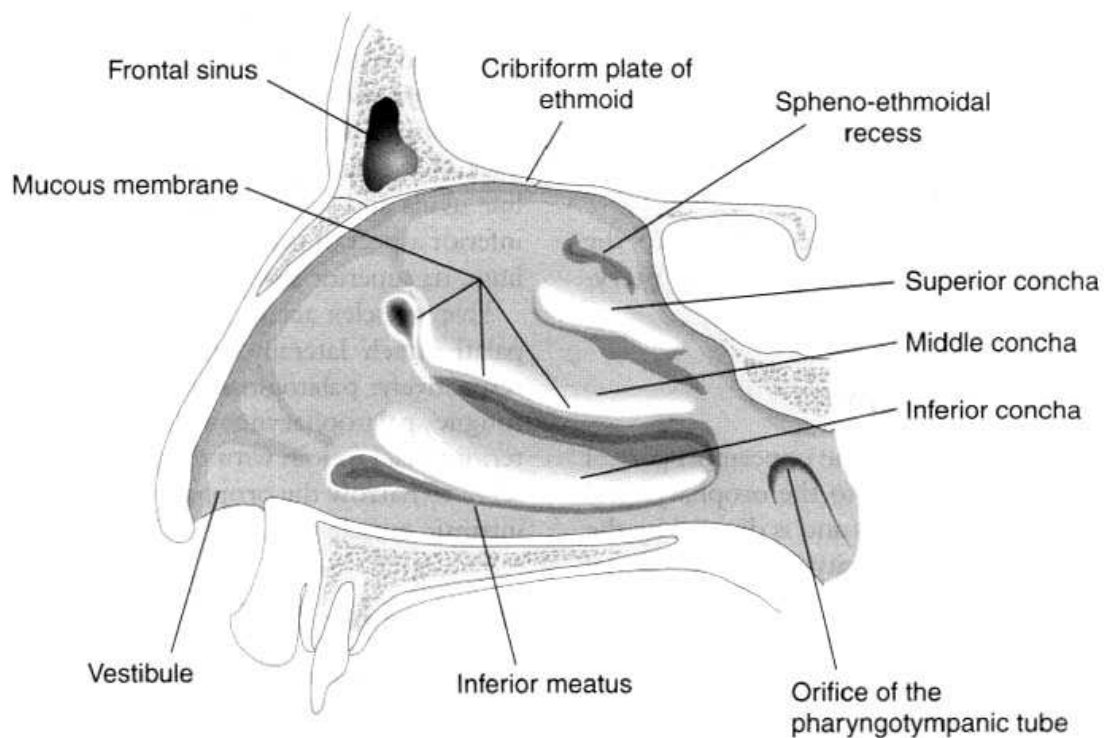

Fig. 1.1

Sagittal section of the nose and nasal cavity. [1]

THE MOUTH AND ORAL CAVITY

The mouth, while part of the airway, is also the uppermost part of the digestive tract. It extends from the lips to the oropharyngeal isthmus at the level of the palatoglossal folds and is divided by the teeth into an outer vestibule and the oral cavity proper. A sagittal section of the mouth is shown in Figure [1.2]

It is bounded anterolaterally by the teeth and gums and superiorly by the hard and soft palates. The palatoglossal fold (anterior pillar of the tonsil) runs between the soft palate and the tongue and marks the oropharyngeal isthmus. It joins the tongue at the junction of its anterior two-thirds and posterior third. [1]

The tongue sits on the floor of the mouth and resembles an inverted shoe in shape with its toe directed anteriorly. This muscular organ almost fills the closed mouth. It contains intrinsic muscle and several extrinsic muscles connecting it to associated structures: genioglossus, to the mandible; hyoglossus, to the hyoid bone; styloglossus, to the styloid process of the skull base; and palatoglossus, to the soft palate. The undersurface of the tongue is attached by a fold of mucous membrane, the frenulum, to the floor of the mouth in the midline anteriorly. The posterior third of the tongue has embryologically different origins and is contained within the oropharynx.

The soft palate consists of an aponeurotic sheet into which several muscles are inserted laterally. It is attached anteriorly to the back of the hard palate, and its free posterior edge bears the midline uvula and separates nasopharynx from oropharynx. While the inferior aspect of the soft palate is covered with a squamous epithelium, its superior aspect bears a ciliated columnar epithelium. [1]

Five muscles act on the soft palate: tensor palati and levator palati attach laterally and act to tense and elevate the palate, respectively;

palatoglossus passes in the palatoglossal fold to the tongue; palatopharyngeus lies in the palatopharyngeal fold (posterior pillar) to join with the pharyngeal constrictor muscle – both serve to narrow the oropharyngeal opening; musculus uvulae is an intrinsic muscle that acts to draw up the uvula. [1]
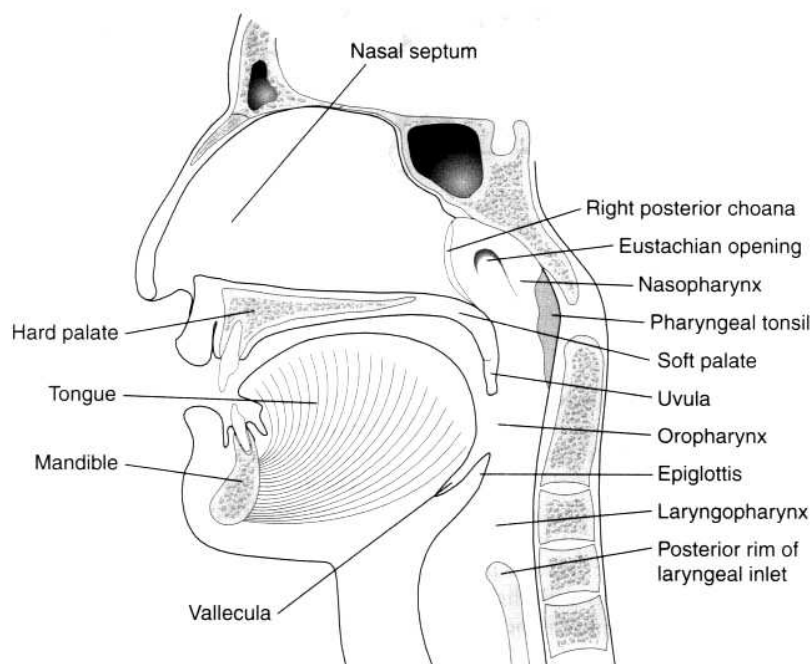
Fig. 1.2

Sigittal section of the mouth and pharynx. [1]

Nerve supply

Common sensation is supplied by branches of the maxillary and mandibular divisions of the trigeminal nerve. The lingual nerve, a branch of the mandibular division, conducts afferent fibres from taste buds in the anterior two-thirds of the tongue and floor of the mouth. These fibres then pass along the chorda tympani to join the facial (Vllth cranial) nerve.

Parasympathetic secretomotor fibres to the submandibular and sublingual salivary glands pass in the opposite direction along the chorda tympani to join the lingual nerve [the secretomotor input to the parotid gland originates from the glossopharyngeal (IXth cranial) nerve].

All the muscles of the tongue are supplied by the hypoglossal (Xllth cranial) nerve with the exception of palatoglossus, which is supplied through the pharyngeal plexus by the vagus (Xth cranial) nerve. The pharyngeal plexus also supplies the other muscles of the soft palate with the exception of tensor palati. This striated muscle is supplied by a branch of the mandibular division of the trigeminal nerve. [1]

THE PHARYNX

The pharynx is a fibromuscular tube at the 'crossroads' between mouth, nose, larynx and oesophagus. It extends from the skull base to the level of the sixth cervical vertebra, where it is in continuity with the oesophagus. The pharynx lies immediately anterior to the cervical spine and prevertebral fascia. A sagittal section through the pharynx is shown in Figure 1.2. Figure 1.3 shows a coronal section.

The pharynx is divided into three parts: the nasopharynx, the oropharynx and the laryngopharynx. [2]

The nasopharynx sits behind the posterior nares (choanae) and is in continuity with the oropharynx at the level of the soft palate.

In common with the nasal cavity, it is lined by a ciliated columnar epithelium. A Eustachian tube opens onto each lateral wall, and the posterior wall bears the pharyngeal tonsils (adenoids). [2]

The oropharynx is in continuity below, with the laryngopharynx at the level of the tip of the epiglottis. Anteriorly it meets the oral cavity at the oropharyngeal isthmus formed by the palatoglossal folds. The lateral wall contains the palatine tonsil in its fossa between the palatoglossal and palatopharyngeal folds. Beneath the oropharyngeal isthmus, the posterior third of the tongue sits anterior to the epiglottis. It is connected to the front of the epiglottis by a medial and two lateral glosso-epiglottic folds; the two pockets thus formed between the medial and each lateral fold are

termed the valecullae. It is here at laryngoscopy (in adults) that the tip of the laryngoscope is placed before lifting the epiglottis. [2]

The laryngopharynx is lined by stratified squamous epithelium. Anteriorly, in the midline, are the laryngeal opening and mucosa covering arytenoid and cricoid cartilages. The laryngopharynx extends anterolaterally around the larynx towards the laminae of the thyroid cartilage. The two longitudinal channels thus created are termed the pyriform fossae and are a common site for impaction of foreign bodies. Each fossa is bounded anterolaterally by mucosa overlying thyroid cartilage, and medially by the aryepiglottic folds and cricoid cartilage. [2]

Beneath the mucosa of the pharynx is a fibromuscular sheath, the fibrous layer being relatively dense superiorly where muscle is absent. These muscles are intimately involved in the act of swallowing.

The *superior, middle* and *inferior constrictor muscles* encircle the pharynx and overlie each other like a stack of paper cups. *Stylopharyngeus, salpingopharyngeus* and *palatopharyngeus* insert into the fibromuscular tube thus formed. [2]

Nerve supply

The pharyngeal plexus supplies sensory, motor and autonomic nerves. Sensory fibres pass principally in the glossopharyngeal nerve which also carries taste sensation from the posterior third of the tongue. Motor supply arises mainly from the vagus nerve. [2]
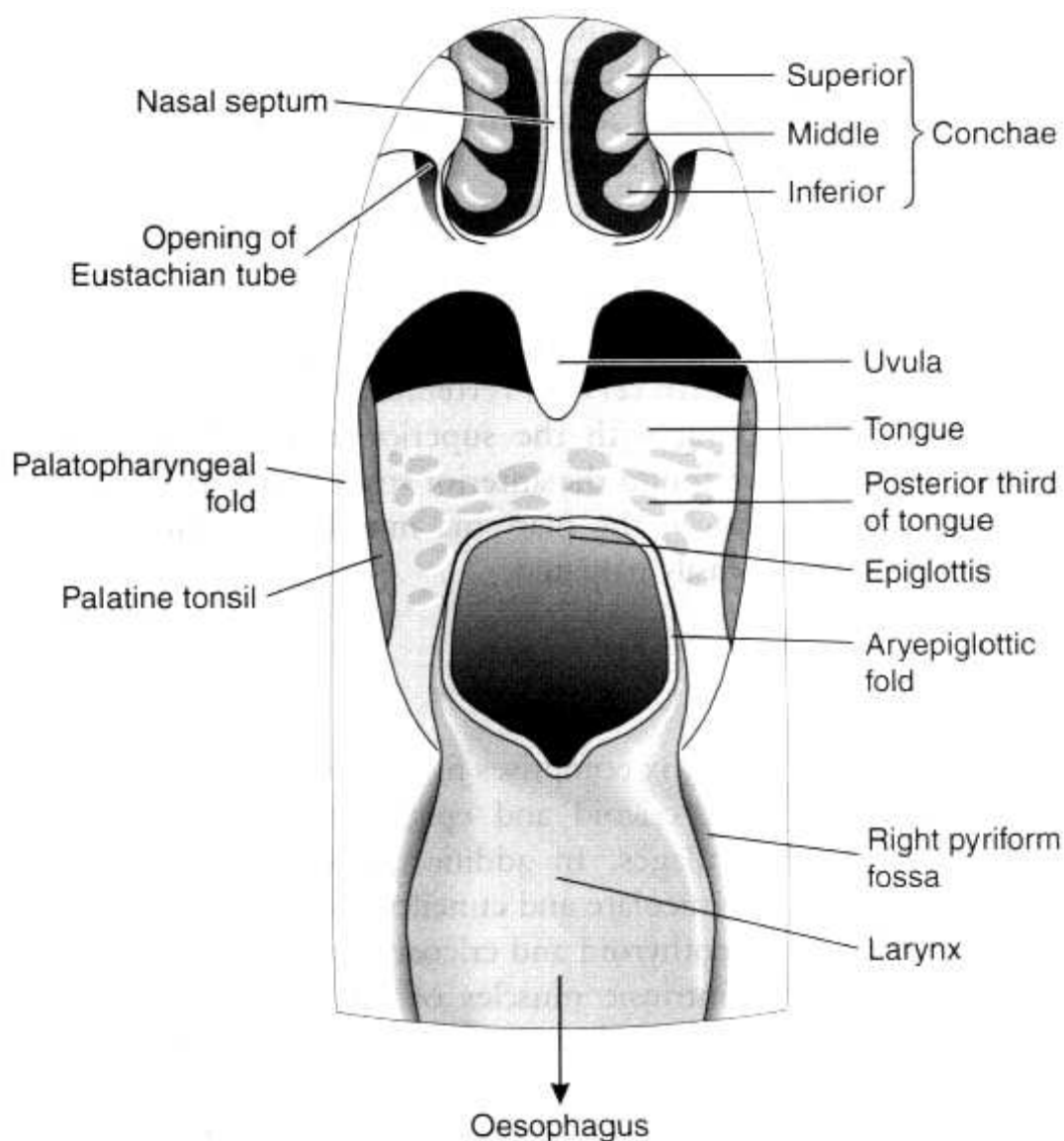
Fig. 1.3

Coronal section of the pharynx showing the view of the posterior choanae,the oropharyngeal isthmus, the larynx and laryngeal inlet from behind. [2]

THE LARYNX

It has a skeleton made of cartilages, ligaments and membranes. The larynx is lined by stratified squamous mucous membrane that is in continuity with that of the laryngopharynx. This membrane is thinner and more tightly adherent over the vocal cords where there are no mucous glands. Below the cords, the mucous membrane has a ciliated columnar epithelium. In the adult male, the larynx is approximately 45 mm long and has an anteroposterior diameter of 35 mm. It is smaller in the adult female; 35 mm by 25 mm. The larynx lies anterior to the proximal