ANESTHETIC MANAGEMENT OF PEDIATRIC THORACIC SURGERIES

Essay

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SUMMARY

Thoracic surgery in the neonate or the child may be indicated because of a variety of reasons. Congenital anomalies, acquired diseases, or a tumoral process may justify an intervention. Several disease states and abnormalities that may or may not be present at birth are the result or a consequence of underlaying genetic disorder or immunodeficiency. Although they are slowly evolutive, they will sooner require the patient to undergo thoracic surgery. Because of diversity in pathologies, which is associated with the complexity of the structures involved within the chest, the anesthetic considerations and the clinical management will require a good understanding of the physiopathology engaged in these processes.

The anesthesiologist caring for infants and children undergoing thoracic surgery faces many challenges. An understanding of the primary underlying lesion as well as associated anomalies that may affect perioperative management is paramount. Preoperative and intraoperative communication with the surgeon is also essential. A working knowledge of respiratory physiology and anatomy in infants and children is required for the planning and execution of appropriate intraoperative care. Familiarity with a variety of techniques for single-lung ventilation suited to the child’s size will provide optimal surgical

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List of Abbreviations

AMM	Anterior Mediastinal Masses
ASRA	American Society of Regional Anesthesia
CDH	Congenital Diaphragmatic Hernia
CPAP	Continuous Positive Airway Pressure
DLT	Double Lumen Tube
ECMO	Extracorporeal Membrane Oxygenation
FIO_2	Fraction of Inspired Oxygen
FOB	Fibro-Optic Bronchoscopy
HbA	Adult Hemoglobin
HbF	Fetal Hemoglobin
Hct	Hematocrit
ICU	Intensive Care Unit
KVO	Keep Vain Open
LMWH	Low-Molecular-Weight Heparin
MAP	Mean Arterial Pressure
OLV	One-Lung Ventilation
OR	Operation Room
PACU	Post Anesthesia Care Unit
PCA	Patient Controlled Analgesia
RDS	Respiratory Distress Syndrome
SLV	Single-Lung Ventilation
TEE	Transesophageal Echo
TEF	Tracheoesophageal Fistula
URTI	Respiratory Tract Infection
V/Q	Ventilation- perfusion ratio
VATS	Video Assisted Thoracic Surgery
VS.	Versus

INTRODUCTION

A variety of congenital intrathoracic lesions for which surgery is required may present in the newborn period, within the first few months of life or in childhood.

Thoracic surgery can be used for many indications like lobectomy, thoracic duct ligation, sequestration resection cyst excision, decortications, repair of diaphragmatic hernia, patent ductus arteriosus ligation, esophageal myotomy, mediastinal mass excision, thymectomy, pericardial window, anterior spine fusion sympathectomy and can be used in repair of tracheo-esophageal fistula ***(Ferson et al., 1993).***

Anesthetic care during thoracic surgical procedure in children combined component of knowledge bases of pediatric anesthesia with those of thoracic anesthesia.

The principles of anesthesia during thoracic surgery in children include pre-operative evaluation, anesthetic induction techniques, maintenance anesthesia and options of post operative analgesia.

One lung ventilation in pediatric patient may be required, technique and principles of anesthetic ca re during one lung ventilation will be discussed ***(Allman, 2006).***

Knowing the anatomical and physiological difference in the respiratory tract of a child and that of an adult is

essential for anesthetists in order to practice safe anesthesia ***(Edward Morgan, 2006 and George A Gregory, 2002).***

It is important to understand the physiology of one lung ventilation and perfusion during surgery, monitoring requirements, appropriate anesthetic techniques and methods of providing single lung ventilation safely and effectively ***(Benumof, 1995).***

The throacocscopic repair is feasible and safe for children with congenital diaphragmatic hernia, cyst excision, esophageal atresia, tracheo-esophageal fistula, including selective newborn, the technique causes minimal trauma, results in good respiratory function, and promotes early recovery ***(Edmund et al., 2005).***

Pre-operative history and physical examination are directed to identify acute problems and underlying medical condition as well as previously undiagnosed problems that may place patient a t increased risk during preoperative management ***(Smith, 1980).***

AIM OF THE WORK

The aim of this essay is to highlight the value of thoracic surgeries in pediatrics, and discuss the anesthetic management for such an advanced procedures.

Special attention will be given to the commonly performed procedures like congenital diaphragmatic hernia, tracheo-esophageal fistula, ligation of patient patent ductus arteriosus.

Methods of one lung ventilation in pediatrics will be illustrated different ways of postoperative analgesia and potential complications that may occur for such cases will also be discussed.

Chapter (1)

ANATOMICAL AND PHYSIOLOGICAL CONSIDERATIONS IN PEDIATRIC THORACIC ANESTHESIA

Knowing the differences between the respiratory tract of a child and that of an adult is essential for anesthetists in order for them to safely administer anesthesia ***(Morgan et al., 2006).***

Anatomy of airway:

A child's nostrils, oropharynx and trachea are relatively narrow. Breathing can be hindered by irritation of the mucous membrane due to edema buildup in this area. The mouth is small in children and infants, relative to the head. It is divided into the vestibule and the mouth cavity. The vestibule is the area between the gums and the teeth inside, the lips and the cheeks outside. The mouth cavity is bounded by alveolar arch and teeth in front, the hard palate and soft palate above, the anterior two-third of the tongue and the reflection of its mucosa forward onto the mandible below and the oropharyngeal isthmus behind. The tongue of the infant is relatively large in proportion to the oropharynx making it more liable for soft tissue airway obstruction ***(Morgan et al., 2006).***

Because of the large tongue, a straight blade that elevates this distensible anatomy out of the way is preferred

in children below the age of 3, instead of a curved blade that accomplishes this less effectively. The tongue is relatively large and tends to fall backwards under anesthesia ***(Steward and Lermen, 2001).***

The epiglottis is relatively large and shaped like a U. The salivary secretions of children are more pronounced than those of adults. The size of the tonsils and the adenoid in children can complicate the intubation process. The adenoids are present on the roof and posterior wall of the nasopharynx. When attempting nasal intubation the adenoid may prevent passage of the tube, become dislodged; obstruct the lumen of the tube, be displaced into the larynx or causes severe bleeding ***(Gregory, 2002).***

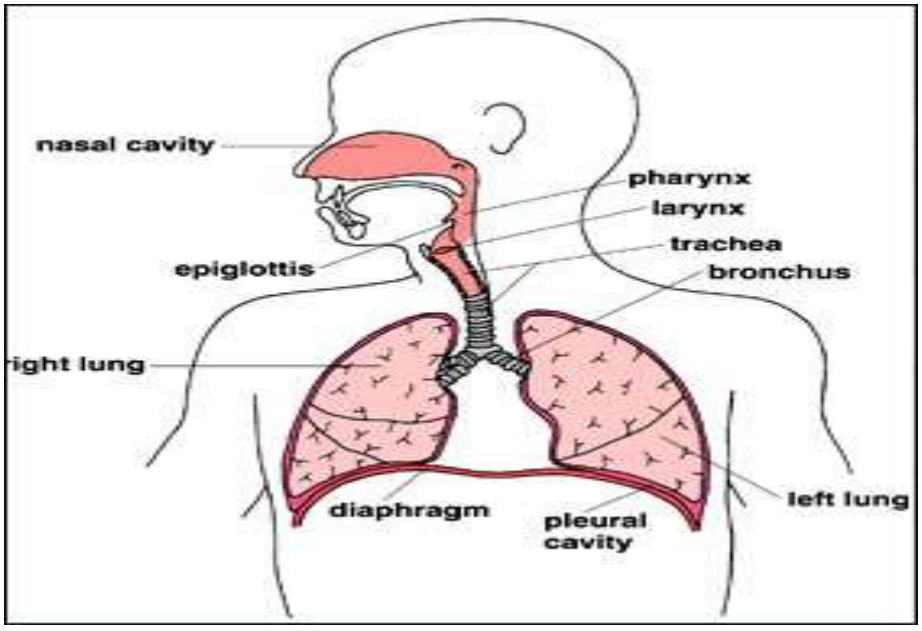

Fig. (1): Airway anatomy ***(George et al., 2002).***

Nose:

Infants breath through their nose until they reach an age of 5 months. The nose is anatomically divided into the external nares and nasal cavity. The external nares are oval and small, and it is said that the diameter of the nostril is the same as the cricoid cartilage, so an endotracheal tube which passes the nostril can pass through the cricoid cartilage.

Each side of the nasal cavity has a roof, a medical wall and lateral wall. The roof is the cribriform plate of ethmoid bone, separating it from the cranial cavity. The floor is the hard palate, separating it from the oral cavity. The medial wall is the nasal septum formed by septal cartilage anteriorly, vomer and perpendicular plate of ethmoid posteriorly. The lateral wall is irregular and has 3 conchae (superior, middle, inferior) arching over three Channels. Furthermore, the orifices of paranasal sinuses and the nasolacrimal duct open into lateral wall ***(Gregory, 2002).***

Pharynx:

The pharynx extends from the base of the skull down to the sixth cervical vertebra. The wall is formed mainly by constrictor muscles and fibrous tissue.