Pediatric Airway Management for One-Lung Ventilation

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Foundations:

- An 8-year-old male, ASA (3) patient presented for a robotic thoracoscopic posterior mediastinal cyst excision combined with a flexible bronchoscopy & upper endoscopy.
- Chief complaint originated as an acute URI but morphed into a diagnostic finding of bronchogenic cyst on CT. Patient's medical history is solely remarkable for asthma.
- To facilitate exposure and removal of the mediastinal cyst, as well as, visualization of the great vessels, one-lung ventilation (OLV) was required.
  - Due to the patient's age and body habitus, the selection of appropriate lung isolation equipment posed a peculiar challenge.

Learning Objectives:

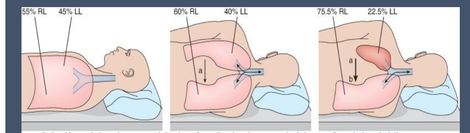
- Compare appropriate lung isolation techniques for pediatric patients.
- Discuss challenges & limitations of bronchial blockers.
- Describe anesthetic & physiologic relationship of lateral decubitus positioning, hypoxic pulmonary vasoconstriction (HPV), and one-lung ventilation (OLV).

Background:

- The age of (8) is the branch point for lung isolation equipment determination, primarily between double-lumen tubes (DLT) & bronchial blockers.
- HPV is the intrinsic ability of the lungs to preserve ventilation/perfusion (V/Q) matching, even in the case of denervated & transplanted lungs.

Case Flow:

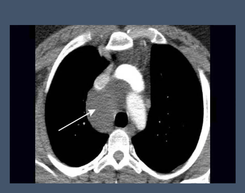
- The frontline therapy following the patient's initial emergency room encounter for acute URI was a combination of an albuterol nebulizer and decadron.
  - Since this initial encounter was only (2) weeks prior to the operating date, a prophylactic albuterol breathing treatment was initiated on the morning of surgery as there were concerns for persistent airway hyper-reactivity.
- Upon entering the OR, ASA standard monitors were applied to the patient followed by an inhalational induction. As vital signs steadied, (2) peripheral IVs were placed. A "secondary" induction followed utilizing: lidocaine (numbing of airway reflexes), rocuronium, and fentanyl. A Phillips (1) provided a Cormack-Lehane Grade I view which facilitated placement of a (5.5) ETT.
- The (5.5) ETT was the perfect conduit to allow for the placement of a 5 Fr bronchial blocker, which had placement confirmed via a bronchoscope.
  - While the primary objective of the bronchoscope was to initially confirm blocker placement, the secondary role was to assess the trachea for any potential communications with the cyst.
- Upon securing the bronchial blocker, the final assessment prior to excising the cyst was to perform the upper endoscopy.
  - Again, this endoscopy served to assess the esophagus for any potential communications with the cyst. Since the degree of involvement concerning the cyst was unknown, esophageal temperature monitoring was avoided.
- Prior to docking the Da Vinci Robot, the patient was positioned in (R) lateral decubitus position.

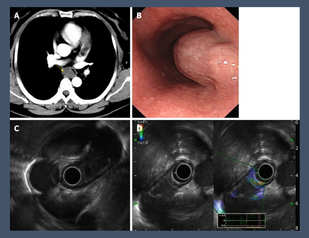


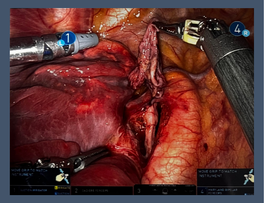
Supine position, closed chest		
Two-LV	Shunt	No-shunt
	% blood flow	
Left lung	2.5	42.5
Right lung	2.5	55.5

Right lateral, closed chest		
Two-LV	Shunt	No-shunt
	% blood flow	
Left lung	1	39
Right lung	4	56

Right lateral, open chest		
Two-LV	Shunt	No-shunt
	% blood flow	
Left lung	20	0
Right lung	<5	75



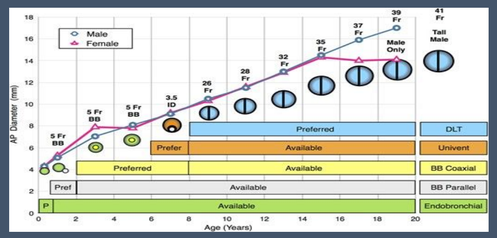


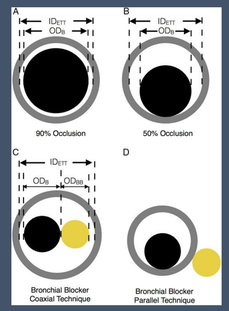


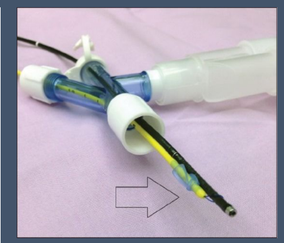
Discussion:

- Anteroposterior (AP) tracheal diameter is the driving force in choosing appropriate lung isolation equipment in pediatrics. Due to our patient's age (8), if a (DLT) was selected based on their height (4'7") this would have indicated a 37 Fr DLT. The external diameter of this tube would have totally occluded the child's airway. Thus, a 5 Fr bronchial blocker facilitates OLV in a much less traumatic manner.
- The 5 & 9 Fr Arndt Endobronchial blocker possess a removable internal lasso for suctioning and CPAP via the central lumen. However, only in the 9 Fr model is the lasso replaceable for additional repositioning.
  - The smallest recommended ETT for use with the 5 Fr model is a (4.5).

Discussion: (cont.)







- Factors that attenuate HPV include nitric oxide, inhaled anesthetics, nitroprusside, nitroglycerin, and prostacyclin.
- If HPV is weakened to a degree that hypoxia ensues, treatment regiment goes as follows: 100% O2, verify placement of blocker, recruitment on dependent lung, PEEP on dependent lung, CPAP on non-dependent lung, (2) lung ventilation, clamping of non-dependent pulmonary artery.

References:

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