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A Unique Challenge: Right One-Lung Ventilation in a Patient Who Had Prior Right Lower Lobectomy

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A Unique Challenge: Right One-Lung Ventilation in a Patient Who Had Prior Right Lower Lobectomy

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Introduction

Ventilation of two lobes of the right lung during surgery on the left lung (OLV) is a challenge! Here we describe our goals— ventilation and optimum anesthetic management—to maintain hypoxic pulmonary vasoconstriction (HPV) in the nondependent lung.

Case Description

A 45-year-old, 101 kg woman presented for left pulmonary upper lobe segmental resection for squamous cell carcinomatous lesion. Patient had prior right lower lobe resection for Hodgkin's lymphoma. Right OLV with a limited, two-lobe pulmonary reserve is extremely challenging. She was ventilated with lower tidal volumes in order to minimize higher peak airway pressure induced barotrauma. Fluid was restricted to 1900 ml for the 6 hour surgery. Mild hypercarbia was permitted and sevoflurane minimum alveolar concentration (MAC) was limited to 1.0 to maintain HPV. Perioperative course was uneventful.

Optimum anesthetic goals during OLV of the right lung with two remaining lobes

- ➢ Lower tidal volumes
- ➢ Maintain normovolemia and avoid excess fluid transfusion
- ➢ Maintain HPV

Physiology of OLV

- o Lateral positioning increases blood flow to the dependent lung
- o HPV directs the blood to the dependent lung
- o The effects of shunt are minimized during OLV.

Tricks to maintain HPV during OLV[1]

- ✓ Maintain normocarbia or mild hypocarbia
- ✓ Avoid hypercarbia, which decreases HPV
- ✓ Avoid inspired concentration of volatile anesthetic agents >1.0 MAC, which also decreases HPV

Factors inhibiting HPV[1]

1. Hypocarbia
2. Higher concentration of volatile anesthetic agents
3. Vasodilators (nitroglycerine, nitroprusside, hydralazine, angiotensin receptor blockers, ACE inhibitors, etc.)
4. Hypothermia

Gas Exchange during OLV

- o OLV increases shunt. Gravitational increase in blood flow to the dependent lung and HPV in the nondependent lung minimizes the shunt.
- o Oxygenation: Increase in shunt decreases $PaCO_2$
- o $PaCO_2$: Carbon dioxide elimination is not a problem during OLV

Management of Hypoxia during OLV

- ✓ **At onset of OLV:** Begin two-lung ventilation, confirm the position of double lumen tube and bronchial blockers with bronchoscopy.
- ✓ **During OLV:** Confirm position as per the above, add PEEP to the dependent lung, then add CPAP to the nondependent lung.
- ✓ Avoid factors that inhibit HPV (see above)
- ✓ Clamp the ipsilateral pulmonary artery early during pneumonectomy

Predictors of hypoxia during OLV [2]

✓ Left OLV	✓ OLV in supine position
✓ Preoperative hypoxia	✓ Decreased FEV1 preoperatively

Bronchoscopic identification of double lumen tube

- ❑ Identify right and left bronchus by identifying tracheal rings anteriorly
- ❑ Right upper lobe bronchus take-off at 12 o'clock position within 2.5 cm of carina and identify the trifurcation of right upper lobe bronchus
- ❑ Left upper lobe bronchus take-off at 5 cm from carina. Both upper and lower lobe bronchus must be patent during left OLV. Identify the bifurcation of left upper lobe bronchus.

CONCLUSION

We managed oxygenation in this patient during OLV with limited reserve by ventilating with low tidal volumes and maintaining HPV.

REFERENCES: 1. Lumb AB, Slinger P; Hypoxic pulmonary vasoconstriction: Physiology and anesthetic implications. Anesthesiology 2015; 122:932-46.
2. Karzai W, Konrad Schwarzkopf; Hypoxemia during one-lung ventilation: Prediction, prevention, and treatment. Anesthesiology 2009; 110:1402-11.