Thoracic Anaesthesia

Physiology of OLV.

Lung Isolation.

One Lung Hypoxia.
V:Q Mismatch

- Lung disease
- Age
- EAVs dilate as Lung Volume Increases
- IAVs compressed ++ during IPPV/PEEP
- Hence PVR increases at both extremes of lung volume
Ventilation: LDP

A) Awake SV
- Zone 1 (dead space) rare
- "Down" lung Vent predominates
- Qs:Qt 2-4%

B) Anaesthetised SV
- FRC ↓
- Atelectasis ("Down" lung ++)
- Qs:Qt 6-8%

C) Anaesthetised IPPV
- Diaphragmatic tone lost.
- Compliance reduced (down lung+)
- Qs:QT 8-10%

D) Thoracotomy
- ↑↑ compliance of "up" lung.

Endobronchial Apparatus 1
A. Carlen Tube

B. Placement at the Carina

C. Right Robertshaw Tube

D. Placement at the Carina

Carlen = Left
White = Right

Endobronchial Apparatus 2
- **Bronchocath** (Mallinckrodt)
  - 35,37,39,41 (+28 L ~ 30kg)
  - PVC
  - RUL slot distal to cuff

- **Robertshaw**
  - XS, S, M, L
  - Disposable (phoenix)
  - RUL slot within cuff
  - Fewer RUL obstructions

- R-Tube reserved for L-Pneumo, Transplant or Stent (?)
Tube Sizing

Tracheal Sizing

- >18mm: 41f
- 17 - 18mm: 39f
- Male > 170cm: 41f
- Male < 170cm: 39f

- Male < 160cm / Female > 160cm: 37f

- Female < 160cm: 35f
- Female < 152cm: 32f

- **Depth**: 29cm in 170cm M/F
  + 1cm for each 10cm increase in height.

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**Tube Placement**

- **Insertion**:
Insertion:
- Stylet out
- Tube & Head Rotation

**Confirmation:**
- Auscultation - TLV / OLV (apices)
- FOB**
  - Tracheal lumen - carina / cuff
  - Bronchial lumen - carina / upper lobe

➢ **Malposition (cepod 1996/7):**
- 48% oesophagectomy †: chest infection
- 30% †: problems with DLT
- 50 - 80% blindly placed tubes require repositioning
- Incidence of OLV Hypoxia reduced with FOB use.

**Bronchial Blockers**

➢ **Univent / TCBU** (1982/2001)
Arndt Blocker

- www.vitaidltd.com
- Built in blocker
- OD 1-2mm > std ETT
- Difficult / small airway & RSI
- Avoids tube change.

- Arndt (1999)
- www.cookgroup.com
- Independent blocker
- 7/9f catheter 65/78cm
- FOB positioning

-Nasal / Trachy
- Wire-free
- Stiff
- Advantages as for Arndt blocker.

**General Ventilatory settings**

PCV < 25cmH2O

Vt 4-6 ml/kg (10-12: VILI ++ )
PEEP: Normal ~ 5-10 / Obstructive ~ 3-5 cm H2O

I:E ratio 1:1.5 max / RR ~ 12-15 bpm

FiO2: Low or High?
- High - De-nitrogenation & “Apnoeic Oxygenation”
  (Beware bleomycin/mitomycin/amiodarone)
- Low - Minimises O2 toxicity & Atelectasis

OLV Hypoxaemia
Qs:Qt ~ 40% in LDP / OLV
Reduced to ~ 20-25% by intact HPV*

*: PAO2 and Pmv.O2 dependant (3:1)*
*: Maximal stimulus @ PAO2 ~ 8kpa
*: Timecourse ~ 10 - 15 minutes

Modification of HPV

➢ Volatile Anaesthetics (Hal/Enf > Iso/Des/Sevo)
➢ ↑PaCO2 (Augments: “permissive hypercapnoea”)
➢ PAP > 15mmHg (high lung volumes)
Tissue Handling
- Hypothermia
- Haemodilution
- Vasodilators
- Endotoxins

Prediction of OLV Hypoxia

Current incidence 7-10%

- Right Thoracotomy (bigger lung)
- Right Thoracotomy (bigger lung)
- Hypoxia during TL Ventilation (Derrrr!)
- V:Q scan (well perfused “up lung”)
- Supine position (less gravitational effect)
- Preserved FEV1 (absence of Auto-PEEP?)

Prevention

- Exercise & bronchodilators
- FOB
- Good ventilation strategy
- Reduce dependant atelectasis (peep)
- Avoid excessive AP (PVR ⬆)

- Recruitment Manouevres

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**Alveolar Recruitment**

- 10 consecutive breaths at a plateau pressure of 40 with 20 cm H₂O PEEP.
- Before and after OLV.
- Vd:Vt reduced
- Oxygenation improved


Management of Hypoxaemia

- FiO2 1.0
- Circuit / Tube check
- Apnoeic Oxygenation
- Intermittent inflations
CPAP
PA occlusion (clamp or PAFC)
PVR manipulation

Easy / Cheap
Effective at low levels (nb: opening pressure)
Surgeons like it
May prevent ALI
Use routinely

Applying external PEEP
PEEP / AUTO PEEP

Causes:
- RR
- I:E ratio

Effects:
- Prevents atelectasis

Flow has not returned to baseline before the start of the next breath.
PVR Manipulation

- A) Increase PVR in non ventilated lung
- B) Reduce PVR in ventilated lung
- C) Both!
Studied drugs (PVR)

- Nitric Oxide (an “EDRF”)
  - 40 ppm some effect on high QS:QT (> 45%)

- Almitrine (Pulm. Vasopressor)
  - 4mcg/kg/min PLUS 10ppm NO effective
• 8 mcg/kg/min effective alone but PVR increased

Any Questions?