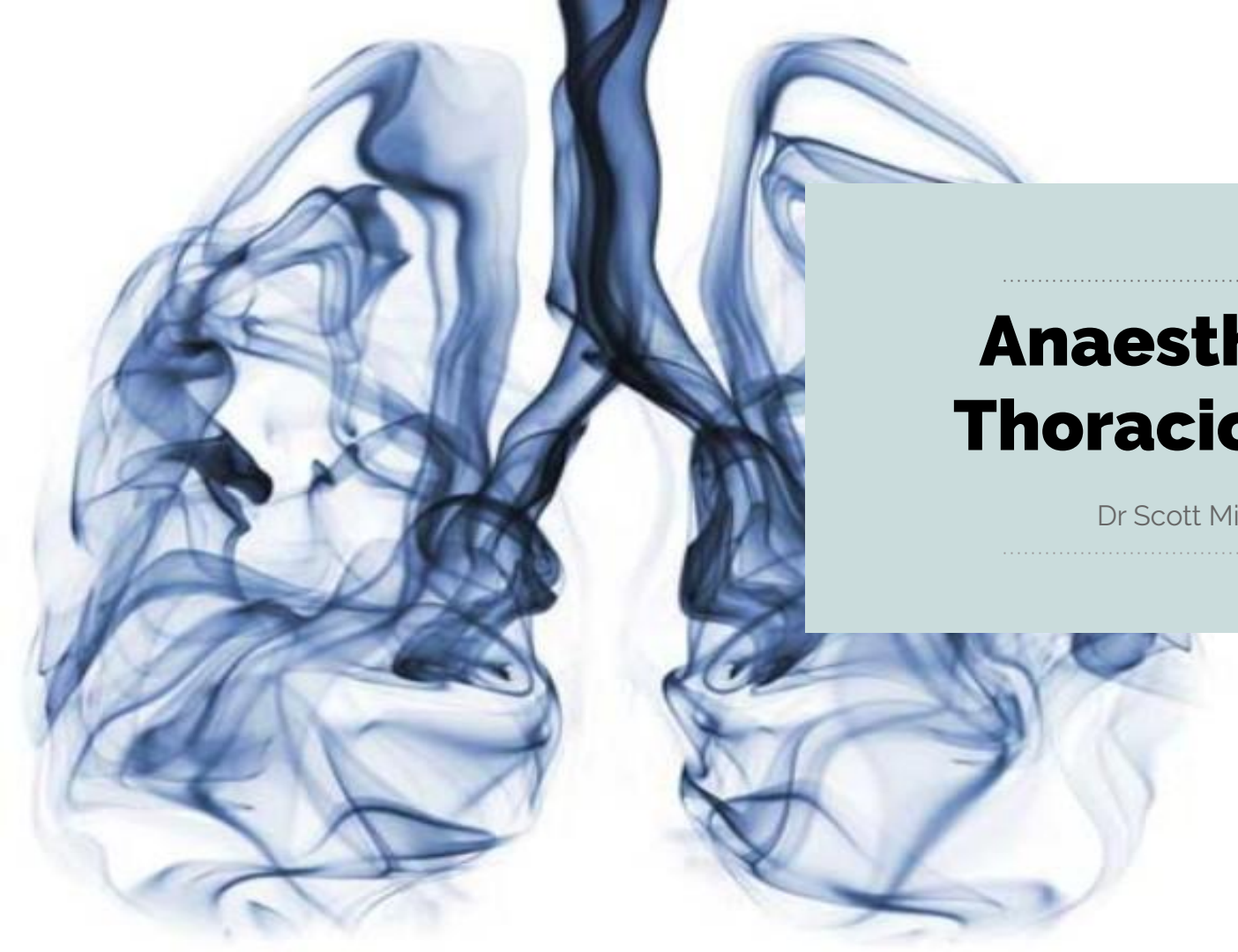

Anaesthesia for Thoracic Surgery

Dr Scott Minns ST5

THORACIC			
CT_IK_17	Explains the significance of preoperative functional investigations of respiratory and cardio-respiratory performance	A,C,E	1
CT_IK_18	Describes specific risks associated with induction and maintenance of anaesthesia in patients requiring thoracic surgery and precautions to be taken to minimise these risks	A,C,E	1,2
CT_IK_19	Describes commonly performed thoracic surgical procedures and the relevant anaesthetic problems	A,C,E	1
CT_IK_20	Describes commonly used methods of local and general anaesthesia for bronchoscopy including techniques of ventilation	A,C,E	1
CT_IK_21	Describes the airway management of a patient undergoing one-lung ventilation and anaesthesia including placement of double lumen endobronchial tubes and bronchial blockers [Ref; EN_IK_11]	A,C,E	1
CT_IK_22	Recalls/explains the changes that occur during one lung ventilation and the strategies to manage these changes	A,C,E	1
CT_IK_23	Recalls the causes, symptoms and signs of a pneumothorax and explains the principles of its management	A,C,E	1
CT_IK_24	Describes the common problems associated with the postoperative care of patient who have had thoracic surgery and the methods that can be used to minimise these	A,C,E	1,2

TABLE OF CONTENTS

01 Who gets thoracic surgery

02 Ventilation

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01

Who gets surgery

Here you could describe the topic of the section

Approximately (2014)

5,657 cases/ year

Pneumonectomy

302

90% 90 day survival

Lobectomy

4,517

96.3% survival

Sublobar

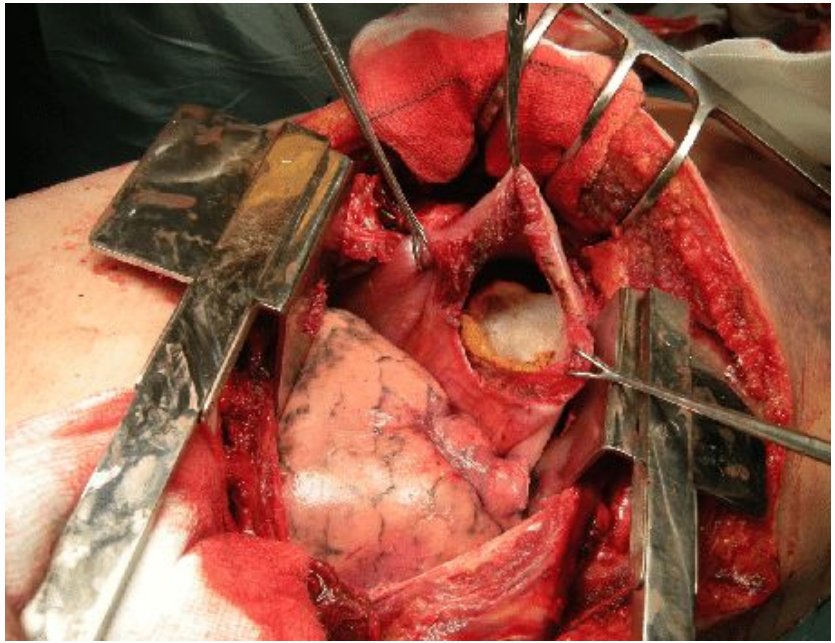
1,115

97.7% survival

Thoracic surgery

- Thoracotomy
- VATS
- Mediastinoscopy

- Lung Cancer
  - Wedge resection
  - Segmentectomy/Lobectomy
  - Pneumonectomy
- Plural disease
- Thoracic Sympathectomy
- Thymectomy
- Lung reduction surgery
- Rib fracture plating



Other indications for OLV

- Cardiac surgery
- Oesophageal surgery
- Spinal surgery
- Lung isolation
- Certain ventilatory scenarios

Indications for OLV

Absolute

- Isolation
  1. Infection
  2. Hemorrhage
- Ventilation
  1. Bronchopleural fistula
  2. Tracobroncial tree injury
  3. Surgery on main bronchi
- Lavage

Relative

- Surgical Access
  1. Pneumonectomy
  2. Lobectomy
  3. Oesophagectomy
  4. Spinal surgery
  5. Thoracic AAA

Contraindications

1. Large airway obstruction
2. Unstable c-spine
3. Difficult intubation
4. Full stomach
5. Children <10

Pre-op assessment

1. History and examination
2. Based on pulmonary function tests FEV1 (BTS guidelines)
    a. Lobectomy > 1.5l
    b. Pneumonectomy > 2l
3. Diffusion capacity
4. Predicted post op FEV1/DLCO
5. CPEX

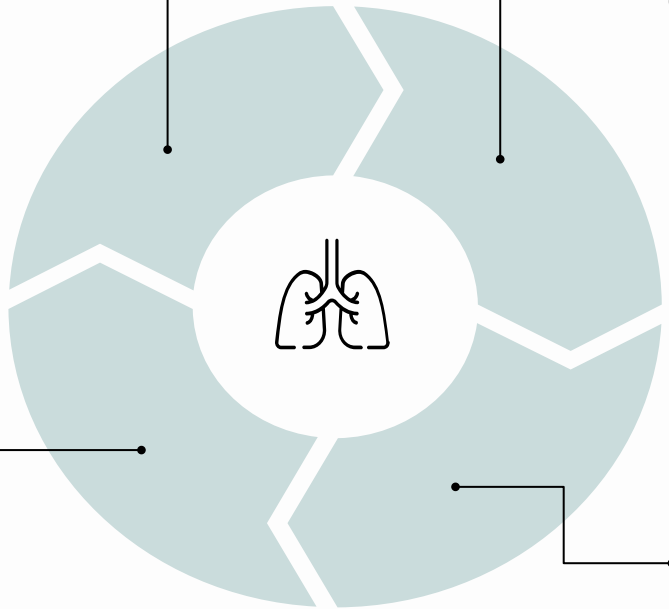
Acceptable values for surgery

Step 1

Spirometry
FEV1>1.5 Suitable for lobectomy
FEV2>2.0 Suitable for pneumonectomy

Step 2

Quantitative lung scan
Post op predicted FEV1>**40%**
Post-op predicted TLCO>**40%**



Step 3

Exercise testing
VO2 Max > 15
AT > 11

Step 4

Consider other options

Calculating predicted post op values

Calculating post op predicted FEV1

If pre op FEV1 is 1.8 l 80% predicted how do we calculate post op?

……

This can be combined with V/Q scans to assess how much the diseased lung is contributing to FEV1

What are the following and how are they calculated
Diffusion capacity?
Transfer factor for carbon monoxide (TLCO) ?
Transfer coefficient KCO ?
Alveolar Volume VA ?

Why bother? (courtesy of Dr Burri)

- Flights of stairs: 3 = > 1.7 FEV1 and 5 = > 2L FEV1

- DLCO < 60% increased mortality
- DLCO < 80% increased complication rate

- ppoFEV1 : 0.7 – 0.8 L advisable post lung resection for daily function

- VO2 Max (ml/kg/mt)
  - > 20 No risk (5 Flights of stairs)
  - < 15 Increased risk
  - < 10 40 – 50% mortality (< I Flight of stairs)

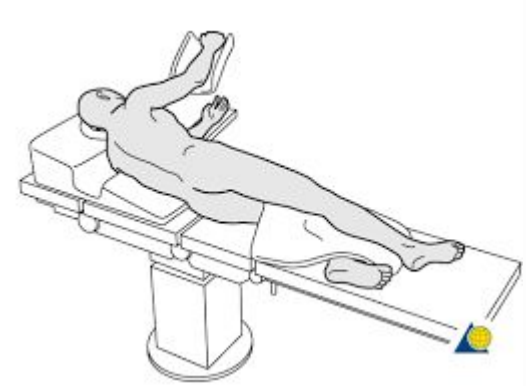
02

Ventilation for thoracic surgery

Skills lab

Rigid Bronchoscopy and Jet ventilation
One lung tube placement
    Options for tubes robertshaw vs Mallinckrodt
Bronchial blockers
Troubleshooting one lung
LMA (in some centers)

Physiology of OLV



- Lateral decubitus position
  - Surgical side is uppermost
  - Non ventilated lung is the non dependant lung

- Gravity determines blood flow with ~60% to the dependant lung
  - Preferential ventilation of the non dependant lung

- Compression causes decreased compliance and FRC of the dependant lung

  =V/Q mismatch

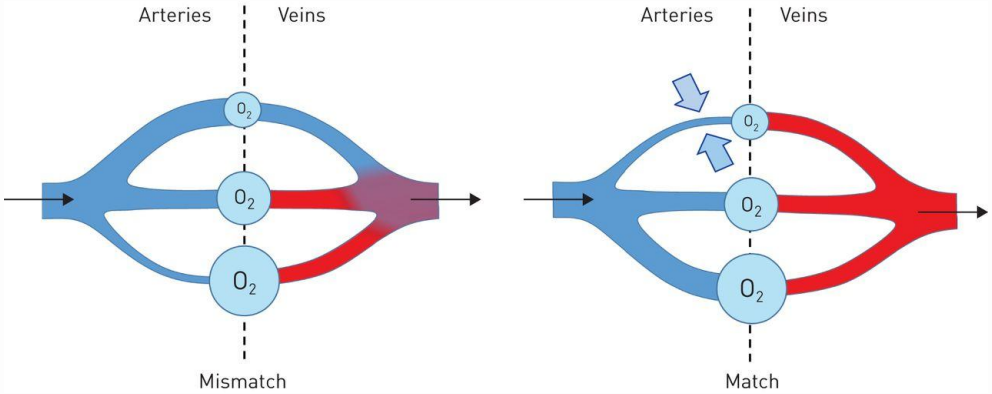
- Opening the chest
  - Increases compliance of the the non dependant lung
  - Increases shunt
  - Increases dead space

- When ventilation of the non dependant lung is discontinued:
  - This creates a shunt
  - This is partially decreased due to gravity and surgical compression
  - It can be further reduced by clamping vessels

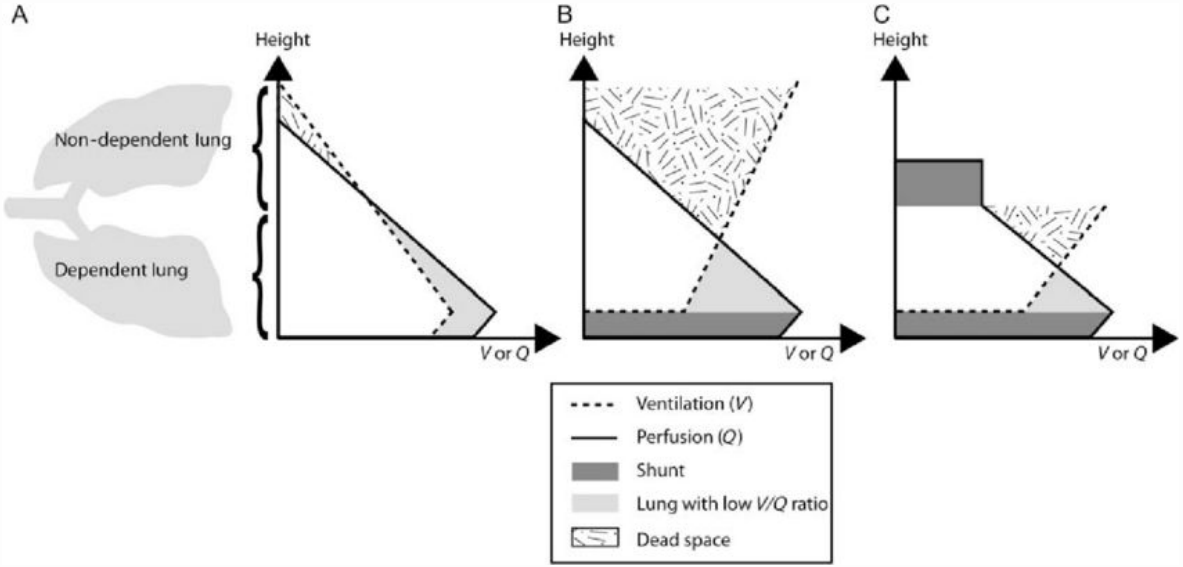
Hypoxic Pulmonary Vasoconstriction

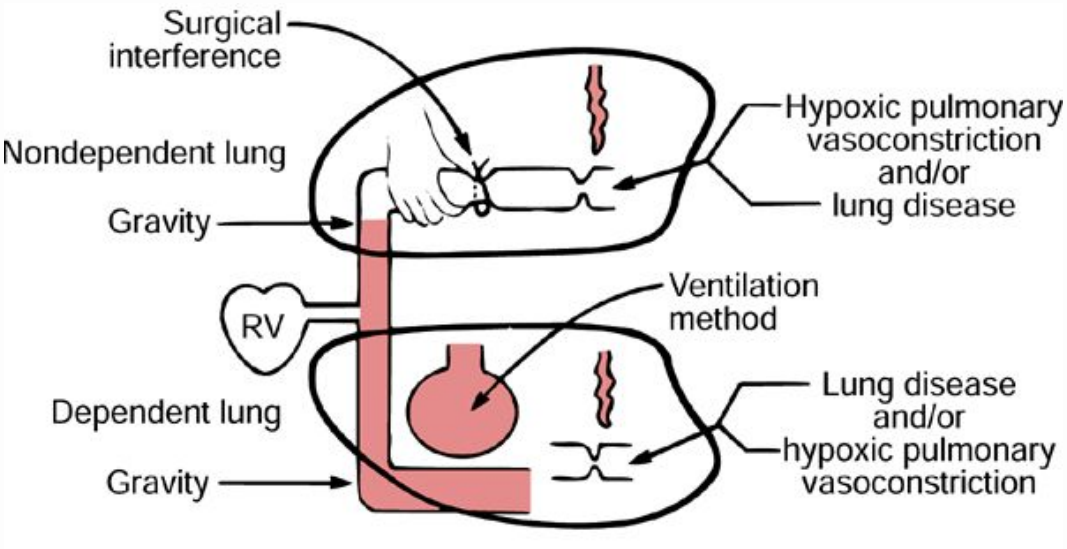
- HPV will supervene in one lung ventilation and decrease flow by about 50% leaving a shunted fraction of about 30%
- Final common mediator is NO

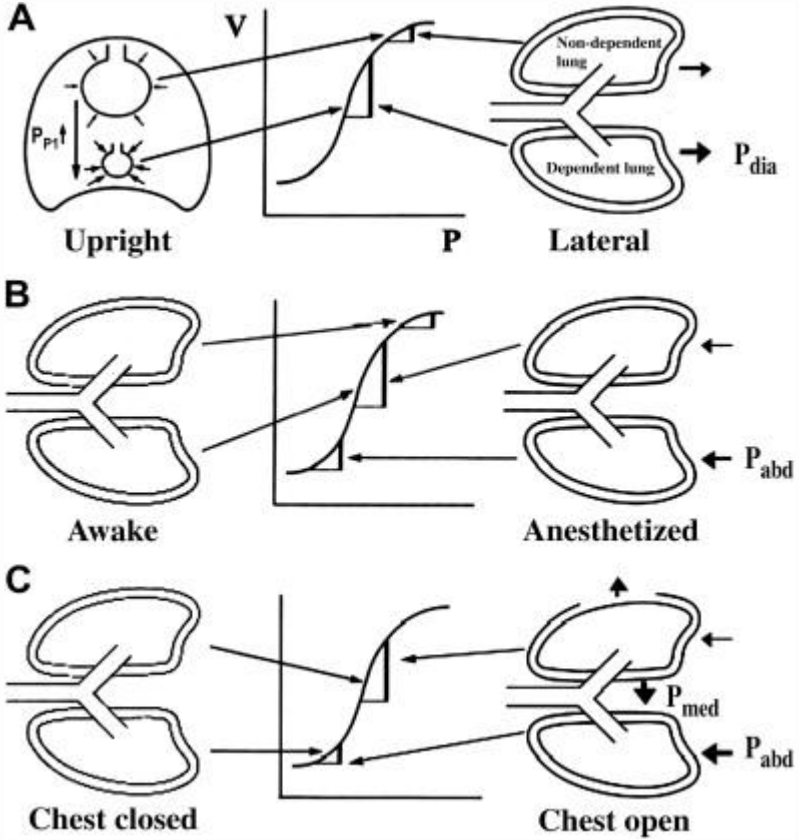
- Phase 1 begins within a few seconds and is maximal at 15 min
  - Probably mediated by potassium channels
- Phase 2 occurs when moderate hypoxia is sustained for >30–60 min
  - Reaches a peak at 2 h
  - Probably a result of increased release of endothelin
- Restoration of normoxia
  - May take several hours for PVR to return to baseline



Physiology of OLV




Surgical interference
Nondependent lung
Gravity
Hypoxic pulmonary vasoconstriction and/or lung disease
RV
Ventilation method
Dependent lung
Gravity
Lung disease and/or hypoxic pulmonary vasoconstriction


A
V
Non-dependent lung
P_{Pl}
Dependent lung
P_{dia}
Upright
P
Lateral
B
P_{abd}
Awake
Anesthetized
C
P_{med}
P_{abd}
Chest closed
Chest open

Factors influencing HPV

Iron deficiency
Increases HPV

Anaesthesia
Volatiles Ed50 2MAC
Vasopressors and dilators
PEEP
Oxygen

Acid/Base
Acidosis and
hypercarbia potentiate
alkalosis attenuates

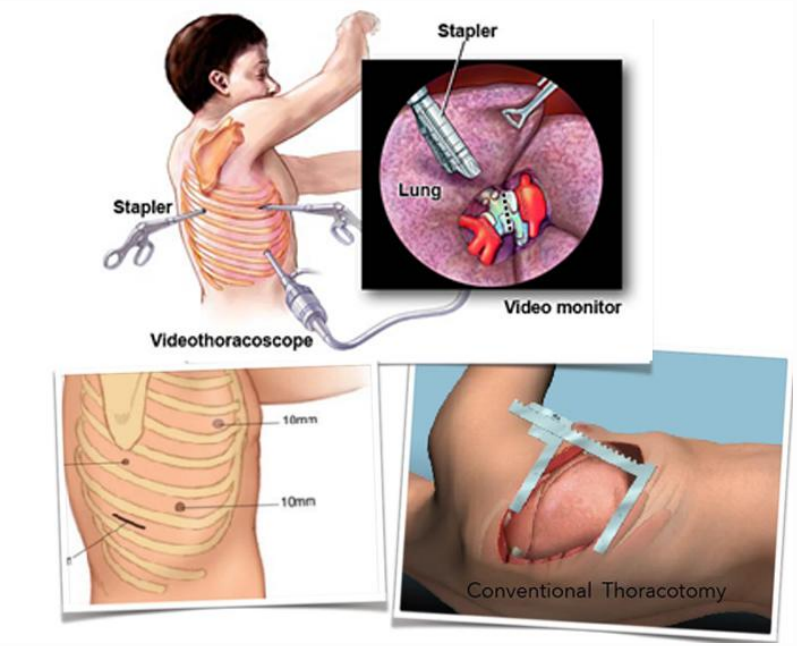
Cardiac Output
Decreased CO increases HPV
due to decreased mixed
venous oxygenation

03

Typical conduct of a thoracic case

How does a case usually run?

1. Usual checks
2. Cannula
3. A-Line awake/asleep (depends on patient)
4. GA - IV/Inhalational/TIVA
5. Rigid bronch
6. Intubation
7. Typically volatile anaesthesia from this point
8. Position check and confirm lung isolation
9. Position patient and reconfirm lung isolation
    a. Aim to inhibit airway reflexes/irritation
    b. Maintain oxygenation
    c. Maintain HPV
    d. Maintain CO/lung perfusion
10. VATS vs Open
11. Suction DLT
12. Inflate lung
13. Excellent analgesia
14. Fully reversed muscle relaxation
15. Spontaneous ventilation
16. Avoid hypoxia and hypercapnia
17. Recovery CXR



04

Post op analgesia

Pain is a big issue

Acute pain with a high conversion rate to chronic pain
Acute pain leaves to respiratory failure
Even with good analgesia chest drains will often cause pain

Manage with multimodal analgesia!

Regional

- LA infiltration
- Intercostal nerve blocks
- Serratus anterior
- Erector spinae
- PVB
- Thoracic epidural

Systemic

- Paracetamol
- NSAIDS
- Opiates (inc PCA)
- $MgSO_4$
- Ketamine

05

Cases

06

Conclusions

We have covered:

1. Pre-op risk stratification/ suitability for surgery
2. Ventilation for thoracic surgery
3. Physiology of one lung
4. The typical thoracic case
5. Post op analgesia
6. Possibly some cases

We have not covered:

- Management of hypoxia on one lung
- Types of tube
- Tube position/Check
- Management of pneumothorax/chest drains
- Anatomy of blocks

THANKS!

Does anyone have any questions?

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