Anestesi vid lungkirurgi

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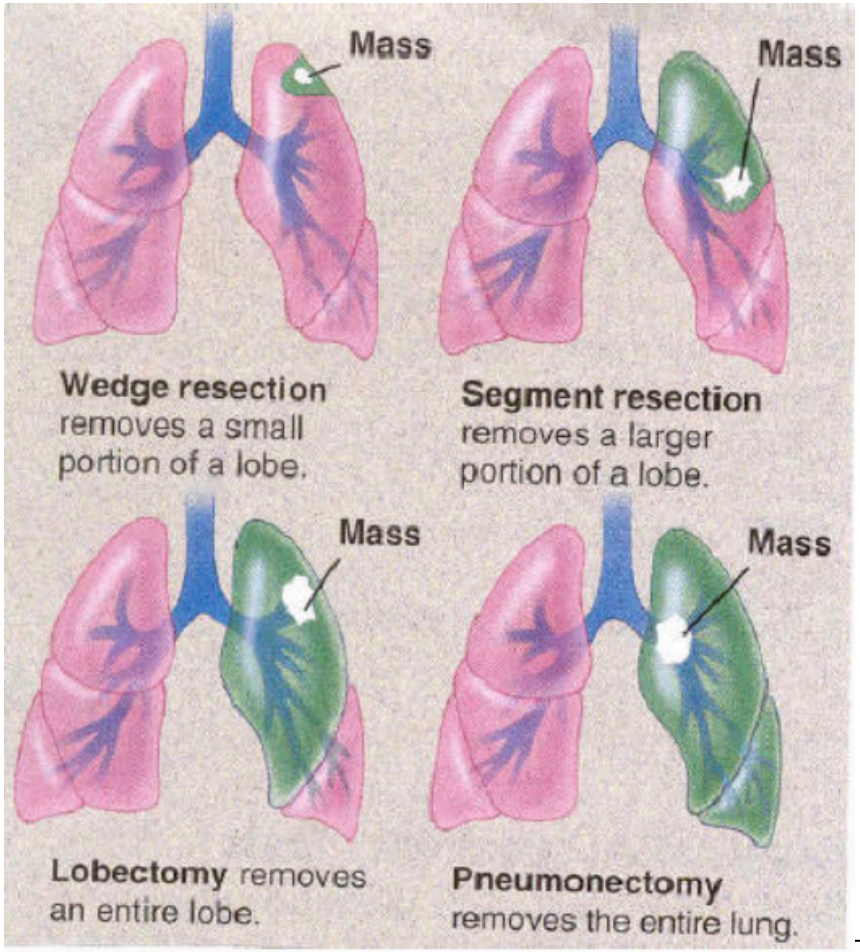
Lungkirurgi

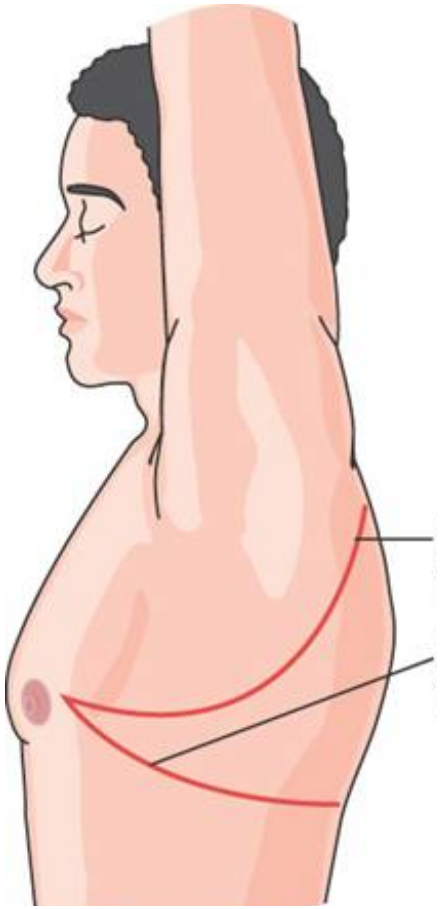
- primär lungcancer, lokaliserad sjukdom
- metastas
- recidiverande pneumothorax
- infektioner
- emfysem reducering

Lungkirurgi



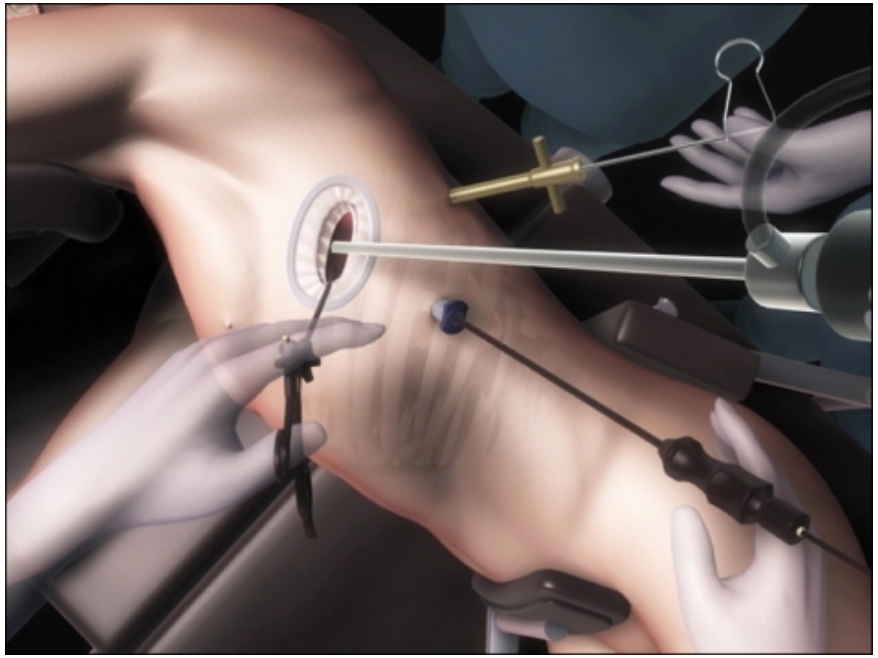
- Kilexcision
- Segment resektion
- Lobektomi
- Pulmektomi

Thorakotomi/VATS (Video-Assisted Thoracoscopic Surgery)



Posterolateral incision

Anterolateral incision



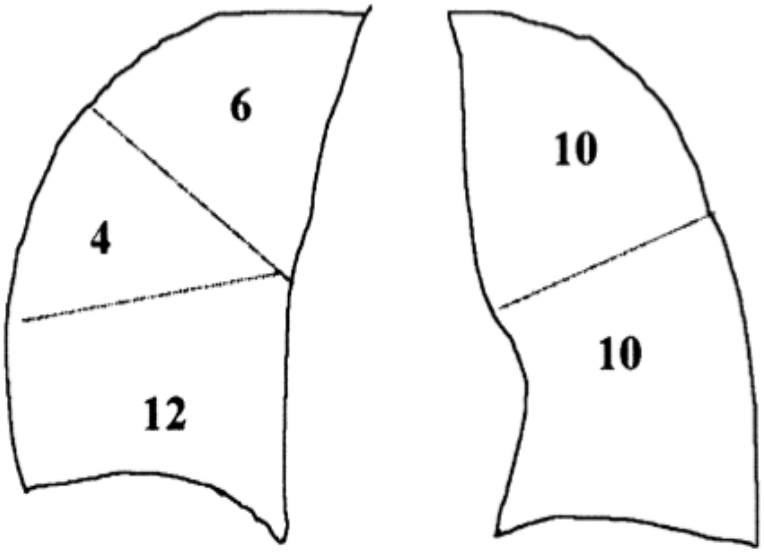
Preoperativ bedömning

- Kan cancern avlägsnas? (resectable?)
- Kan patienten opereras? (operable?)
- Perioperativ morbiditet och mortalitet:
  - Respiratoriska komplikationer (atelektas, pneumoni och resp svikt)
  - Kardiella komplikationer (arytmi, ischemi)

Preoperativ bedömning

- Patientens respiratoriska funktion (3-legged stool of pre-thoracotomy respiratory assesment):
  - "Lungmekanisk" funktion
    - spirometri, ffa FEV_1 %
  - Lungparenkymets funktion
    - DLCO
    - PaO2 < 8 kPa eller PaCO2 > 6 varning!!
  - Kardiopulmonell interaktion
    - Arbetsprov, VO_2 max < 15 ml/kg/min nedre gräns
    - Trappgång, 3 trappor = lägre mortalitet
    - SpO_2 < 90% vid gång på plan mark innebär hög risk
- Ventilation/perfusion scint inför pulmectomi

Uppskattning postoperativ lungfunktion



Antal subsegment för höger och vänster lunga, totalt 42.

Förenklat: hö övre och mellan =1 lob

***ppoFEV1 %** = preoperative FEV1 % x (1 - % functional lung tissue removed / 100)*

ppoFEV1 > 40 % - ingen eller lindriga postoperativa respiratoriska komplikationer
ppoDLCO < 40 % - kopplad till ökade postoperativa respiratoriska komplikationer

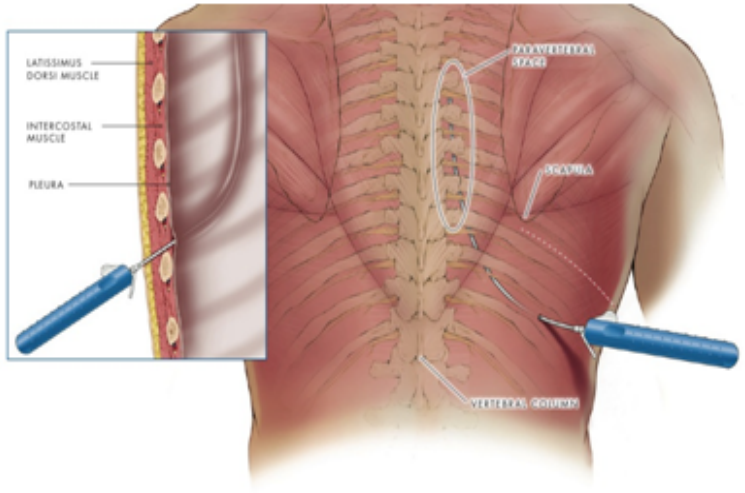
Anestesi

- Luftväg – isolera lungan:
  - DLT (Dubbel Lumen Tub) vänster >>> höger
  - Bronchial blocker
  - SLT (Singel Lumen Tub)
- Cirkulation:
  - Pulmektomi: a-nål, grova pvk x 2, sannolikt CVK, KAD
  - Lobektomi/pleurektomi: a-nål, grova pvk x 2, KAD
  - Kilexcision: NIB, pvk x 1, KAD?
- Vätsketillförsel:
  - Snålt, liberalt med vasokonstriktor, NA i första hand, evidens för dopamin?

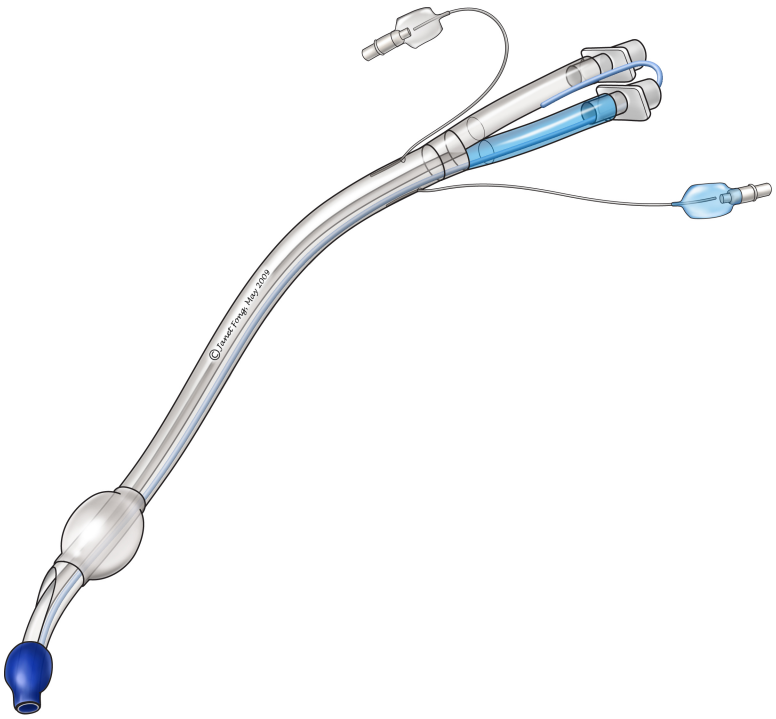
Anestesi

- Smärtlindring:
  - Paravertebral kateter
  - ThEDA Th 3-6
  - PCA och ketanest
- Exposure:
  - Värmetäcke
  - Kontrollera tryckpunkter I sidoläge

Paravertebral kateter

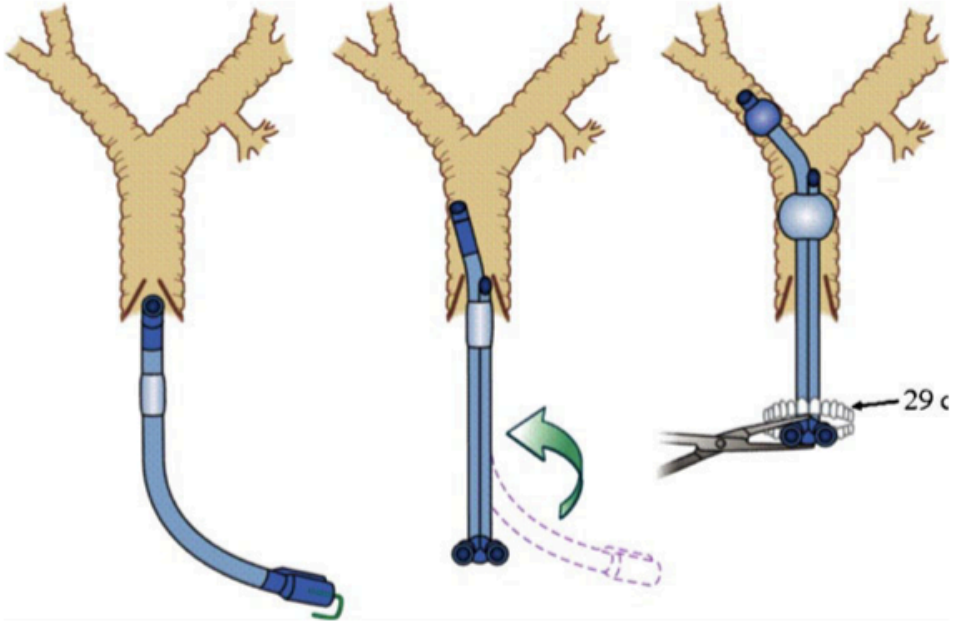


DLT (Dubbel Lumen Tub)



- Vänstersidig > Högersidig
- Tracheal lumen (kuff) och bronkial lumen (kuff)
- Tumregel 37 Ch för kvinnor och 39 Ch för män
- DLT 35 Ch > SLT 8,0 !!
- Stel
- 2 kurvor, lätt att få punka
- Ledare
- Intubation blind eller över bronkoskop

Intubation med DLT



- Bronkial lumen uppåt, böj eventuellt till tubspetsen, gel på tuben
- Ställ tuben på stämbanden och be assistent att dra ledaren
- För in tuben mellan stämbanden och efter det rotation 90 ° motsols medan du för ned tuben
- Bronkoskopisk kontroll!!

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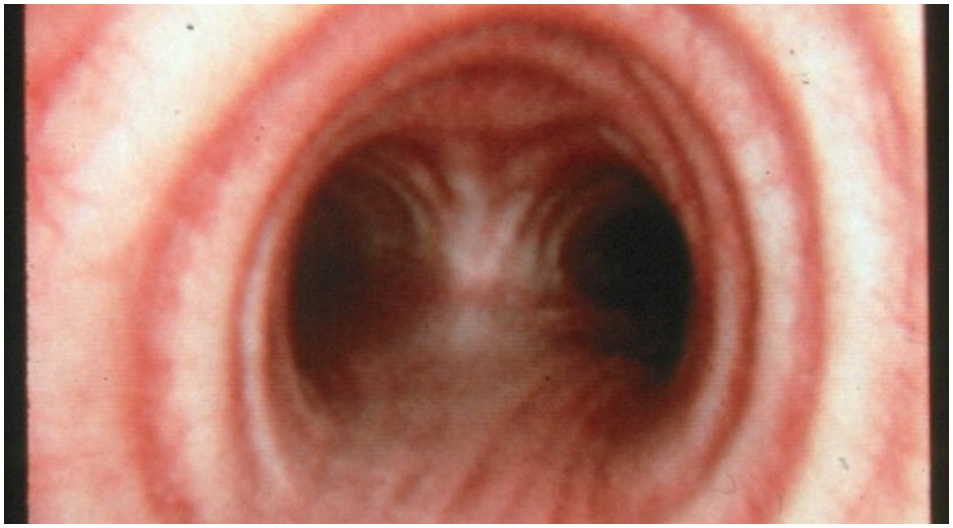
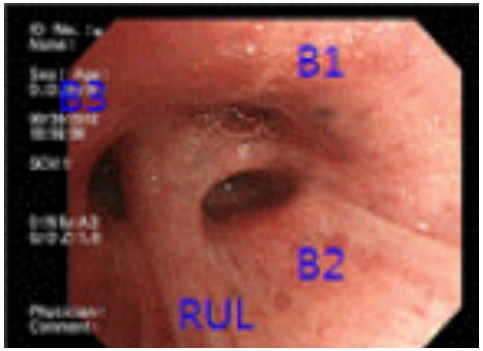
DLT lägeskontroll

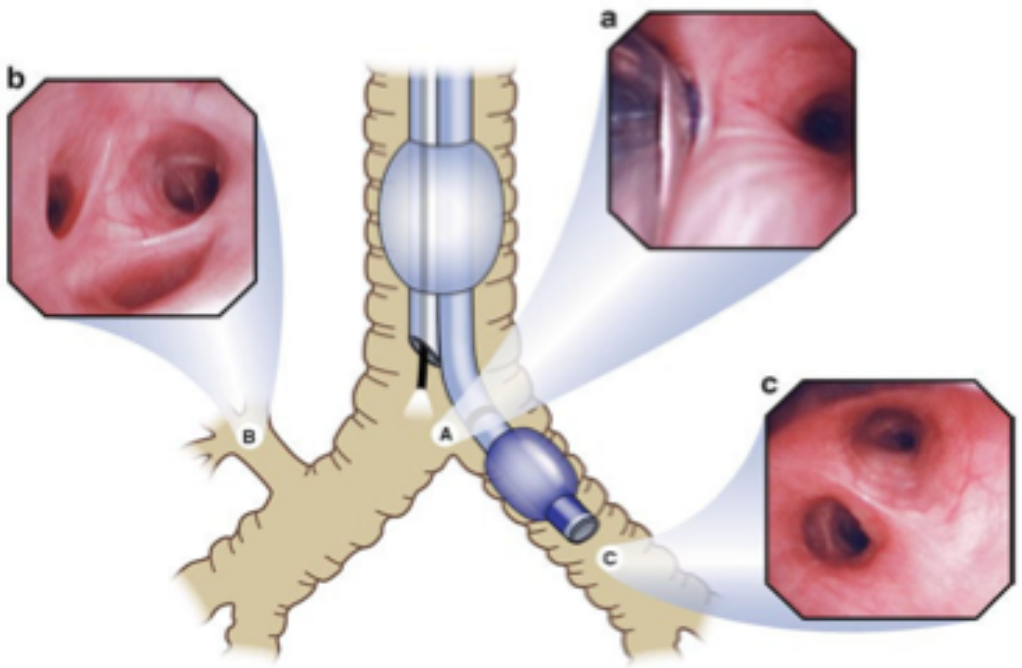




http://www.anesthesia.utoronto.ca/edu/cme/bronch.htm

DLT lägeskontroll

FIG. 16.7. The optimal position of a left-sided DLT. (**a**) View from the tracheal lumen of the unobstructed entrance of the right mainstem bronchus. (**b**) View from the tracheal lumen of the right-upper bronchus. (**c**) View from the bronchial lumen of the left-upper (*above*) and left-lower (*below*) lobe bronchi [29].

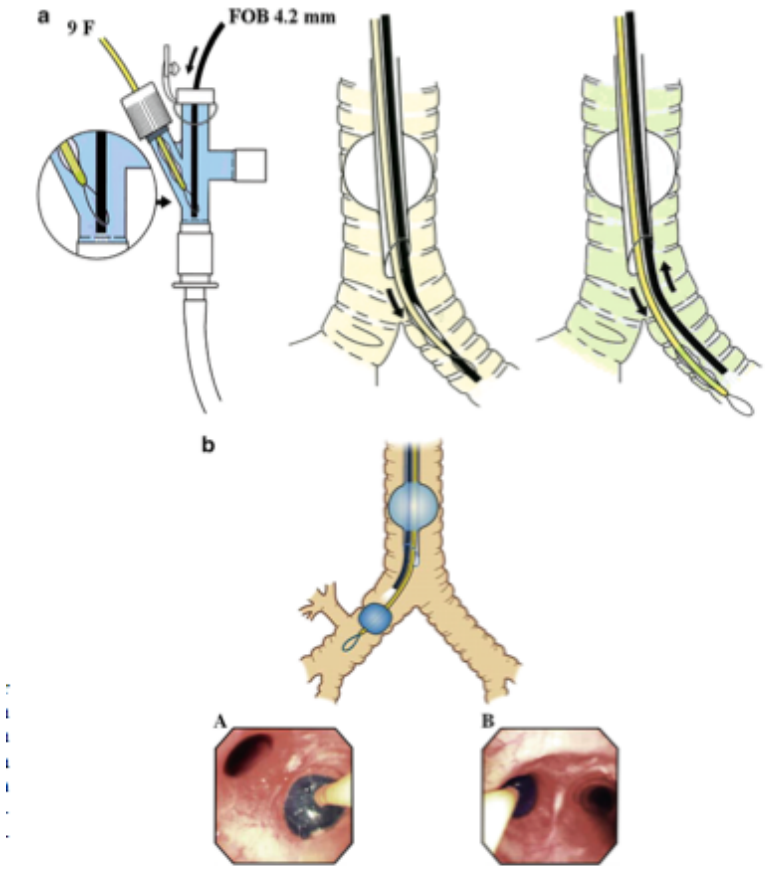


A new sheriff in town…..

Video-DLT, kontinuerlig kontroll

- Män 37Ch i stället för 39Ch
- Kvinnor 35 Ch i stället för 37Ch
- Bronkoskopi sällan

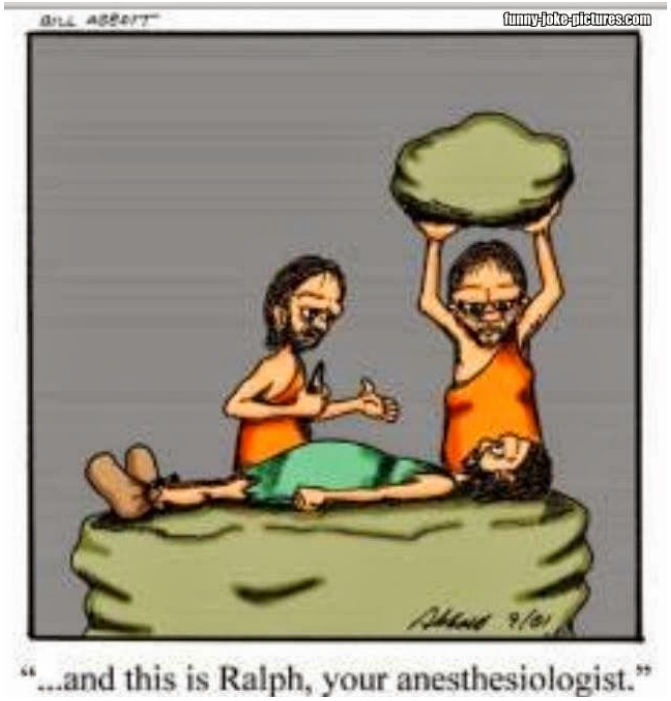
Bronchial blocker



Arndt blocker:

- Fånga upp tråden med bronkoskopet och guida
- Kan isolera på lob nivå
- Redan intuberad patient
- Svårare att suga rent och kan inte inspektera nedom

OLV (One Lung Ventilation)



Konsten att låta lungan som ska opereras falla ihop (maximal atelektas) och undvika atelektasbildning i den andra lungan.

Ventilation

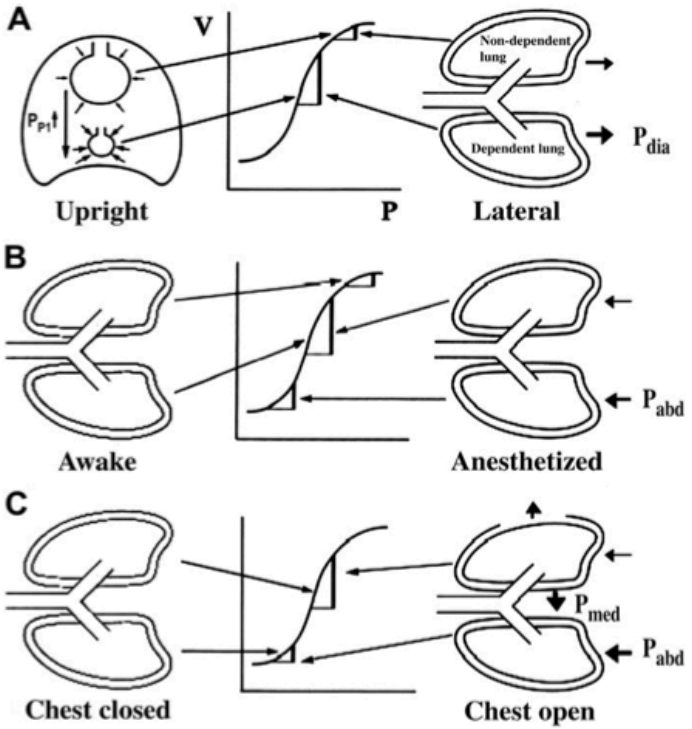


Fig. 3. Positional changes of ventilation as they relate to the pressure–volume curve. Transitions from upright to lateral (*A*), from lateral awake to anesthetized (*B*) and from lateral, anesthetized with chest closed to open (*C*) are illustrated. (*Adapted from* Benumof JL. Anesthesia for thoracic surgery. 2nd edition. Philadelphia: WB Saunders; 1995. p. 127–9; with permission.)

Perfusion: West Zones

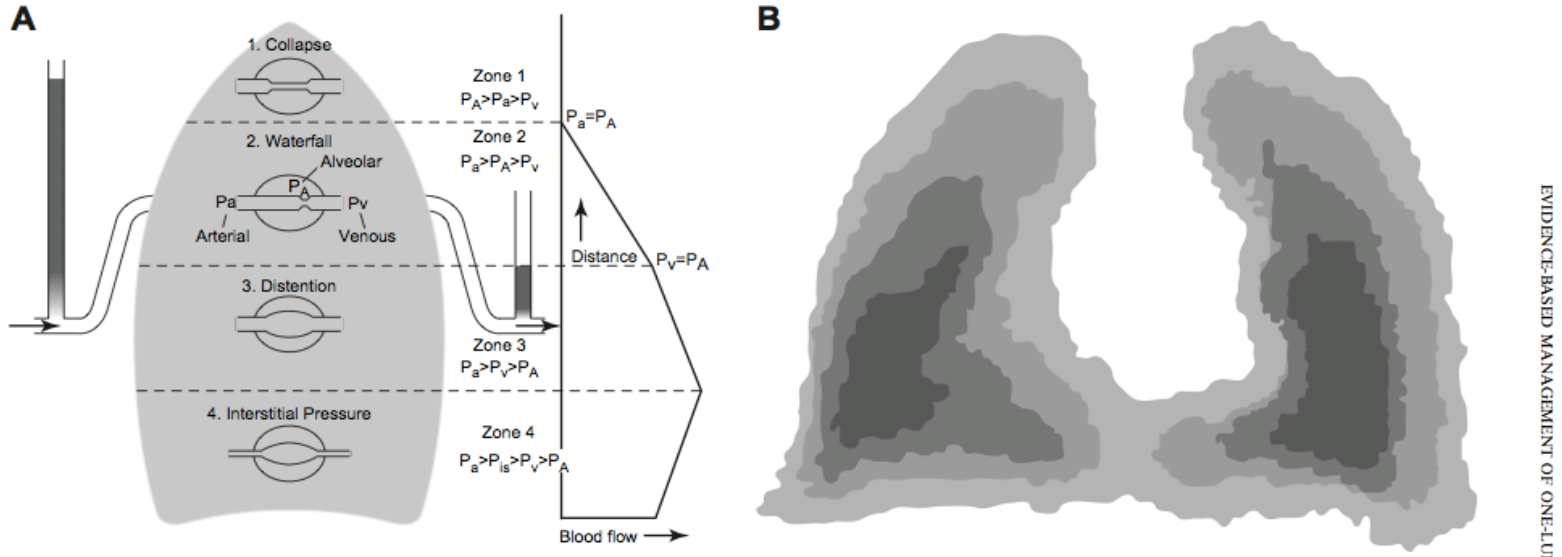


Fig. 1. Pulmonary blood flow distribution relative to the alveolar pressure (P_A), the pulmonary arterial pressure (P_a), the pulmonary venous pressure (P_v), and the interstitial pressure (P_{is}) at various gravitational levels. (*A*) Classic West Zones of blood flow distribution in the upright position. (*Adapted from* West JB. Respiratory physiology: the essentials. 6th edition. Baltimore: Williams and Wilkins; 2000. p. 37; and Hakim TS, Lisbona R, Dean GW. Gravity-independent inequality in pulmonary blood flow in humans. J Appl Physiol 1987;63:1117; with permission.) (*B*) In vivo perfusion scanning illustrating central-to-peripheral, in addition to gravitational blood flow distribution, in the upright position. See text for further details.

V/Q matching

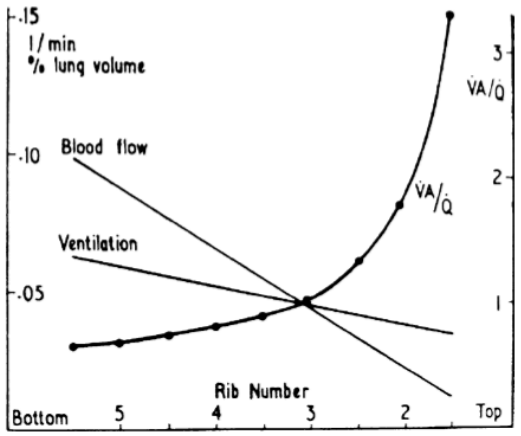


FIG. 5.10. Schematic representation of the effects of gravity on the distribution of pulmonary blood flow in the lateral decubitus position. The vertical gradient in the lateral decubitus position is less than that in the upright position (Fig. 5.2). Consequently there is less zone 1 and more zones 2 and 3 blood flow in the lateral decubitus position compared with the upright position (alveolar pressure (P_A), pulmonary arterial pressure (P_a), pulmonary venous pressure (P_v)) (modified from Benumof [2]. © Elsevier 1995).

Anestesi + muskelrelax + sidoläge:

- Q högst i nedre lungan
- V högst och ökar i övre lungan

➢V/Q mismatch

OLV-taktik: optimal ventilation till den nedre lungan! Glöm inte cardiac output.

Strategiförslag OLV

Table 1 Step-by-step clinical management of one-lung ventilation

Modalities \ Stages		Two-lung Ventilation (Pre-OLV)	OLV	Selective lung re-expansion	Two-lung Ventilation (Post-OLV)	Emergence	Post extubation
FiO_2	*Fraction*	1.0	**0.4-0.8**	0.21	0.5	0.5	0.5
PEEP	*cm H_2O*	3-10	3-10		3-10	3-10	
SaO_2	%		92-96		92-96	92-96	92-96
Tidal volume	*mL·kg^{-1} of IBW*[a]	6-8	**4-6**		6-8 (4-6)[e]	spontaneous	
Respiratory Rate	*Breaths·min^{-1}*	10	**14-16**		10-14	spontaneous	
I:E ratio		1:2	**1:2**[b]		1:2		
Peak / Plateau pressure	*cm H_2O*	30/20	**30/20**	PIP 30 (20)[c]	30/20		
Ventilatory mode		VCV PCV	**VCV PCV**	Manual[d]	VCV PCV	PSV[g]	NIV[h]
Recruitment		Post intubation	**At beginning of OLV and as needed**		As needed[f]		

Hur hantera hypoxemi?

Box 3. Approach to hypoxemia during OLV

Mild hypoxemia (90% to 95%)
Confirm position of lung isolation device
Recruit ventilated lung
Ensure adequate cardiac output
Increase F_iO_2 toward 1.0
CPAP or HFJV to operative lung (after recruitment)
Optimize PEEP to nonoperative lung (up or down; toward lower inflection point)
Consider reduction in vapor anesthetic and/or total intravenous anesthesia
Ensure adequate oxygen carrying capacity (hemoglobin)

Severe (<<90%) or refractory hypoxemia
Resume two-lung ventilation with 100% O_2
If not possible, consider
- Pulmonary artery clamp on operative side during pneumonectomy, transplant
- Inhaled nitric oxide and/or infusions of almitrine/phenylephrine
- Extracorporeal support during lung transplantation (Nova lung [Novalung GmbH, Hechingen, Germany], cardiopulmonary bypass, extracorporeal membrane oxygenation)

Risk för lungskada efter kirurgi

Box 1. Risk factors for acute lung injury after OLV

Patient

Poor postoperative predicted lung function

Preexisting lung injury

- Trauma
- Infection
- Chemotherapy

EtOH abuse

Female gender

Procedure

Lung transplantation

Major resection (pneumonectomy > lobectomy)

Esophagectomy Large perioperative fluid load

Transfusion

Prolonged OLV (> 100 minutes) Peak pressure > 35–40 cm H_2O

Plateau pressure > 25 cm H_2O

Lungskada efter kirurgi

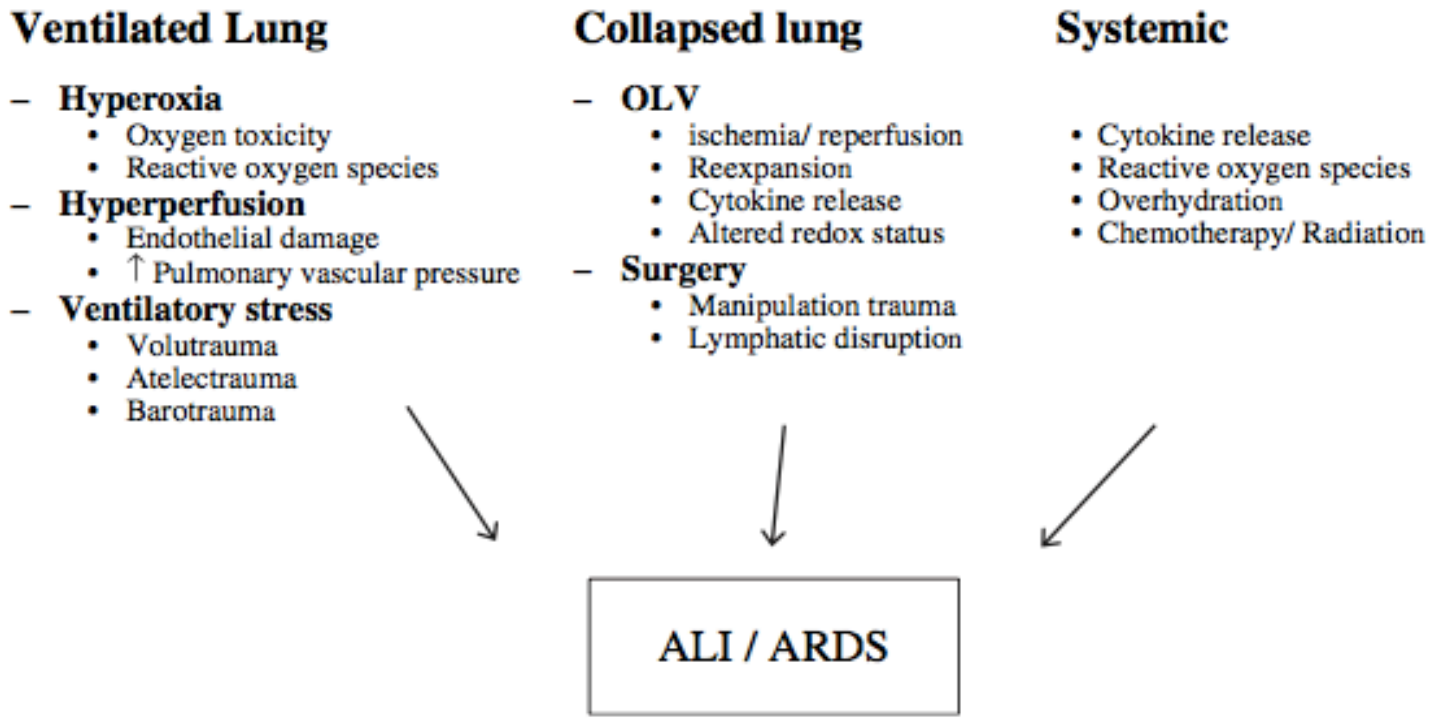


Fig. 4. Proposed mechanisms for Acute Lung Injury and Acute Respiratory Distress Syndrome after lung resection surgery.

“How-to” lista lunganestesi

- Intravenös eller gas anestesi – vilken rutin finns?
- Förbered DLT, smörj, anti-fog, böj till. Bomullsband.
- Vid behov: förbered bronkoskop, smörj, anti-fog
- ***Var 100% säker på tubläge innan op-start!***
- Rekrytera och PEEP, ev FiO_2 100% för N_2-ursköljning
- Kontrollera upplägg och tryckpunkter, testa OLV
- Stäng av lungan så sent som möjligt. Behåll PEEP, sänk tidalvolym, sänk FiO_2 om möjligt, P_aCO_2 5-9 kPa
- (Spola igenom bronkoskop efter varje “titt”)

referenser

- Principles and practice of Anesthesia for Thoracic Surgery. P Slinger. ISBN 978-1-4419-0183-5
- Step-by-step clinical management of one-lung ventilation: Continuing Professional Development. Brassard C et al. Can J Anesth (2014) 61:1103-1121
- Evidence-based Management of One-Lung Ventilation. Lohser J. Anesthesiology Clin 26(2008) 241-272