medigraphic Artemisa en línea

Revista Mexicana de Anestesiología

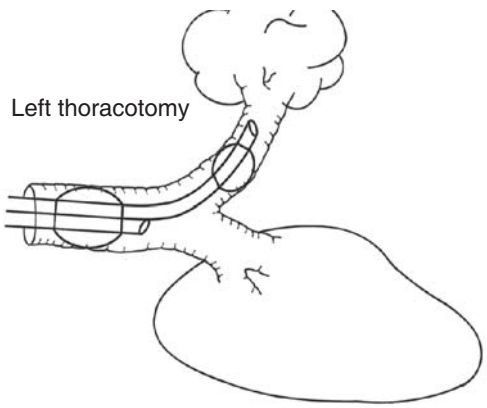
PROFESORES EXTRANJEROS
Vol. 32. Supl. 1, Abril-Junio 2009
pp S227-S233

New concepts in the management of one-lung ventilation

Peter Slinger MD, FRCPC*

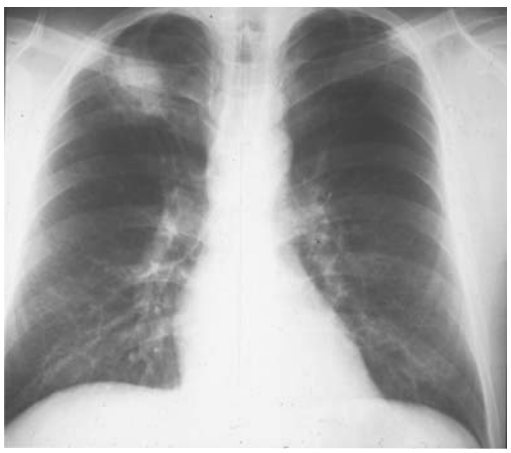
*Dept. Anesthesia, University of Toronto

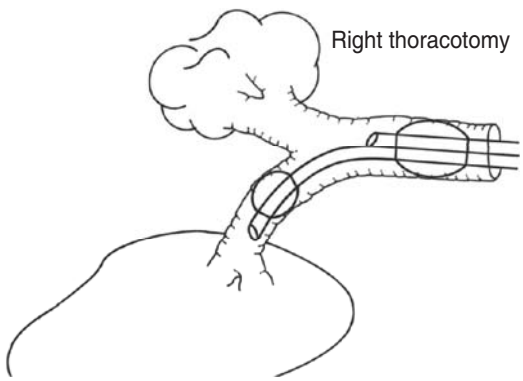
CASE #1: 70 Y.O. MALE, LUNG CA., SMOKER, LEFT THORACOTOMY, LEFT DLT,



- During one-lung ventilation
- Sudden paw ↑ 50 cmH_2O
- $PETCO_2$ 10 mmHg
- Rapid SpO_2 60%
- ? Rx

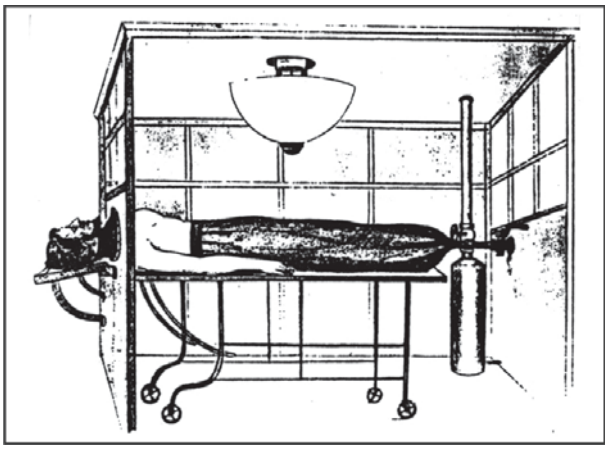
CASE #2: 60 Y.O. MALE, LUNG CA., NON-SMOKER, R. THORACOTOMY, LEFT DLT, FEV1 = 98%





www.medigraphic.com

- 20 min one-lung vent
- No change paw 24 cm
- $PETCO_2$ 44 mmHg
- Grad. SpO_2 89%
- ? Rx

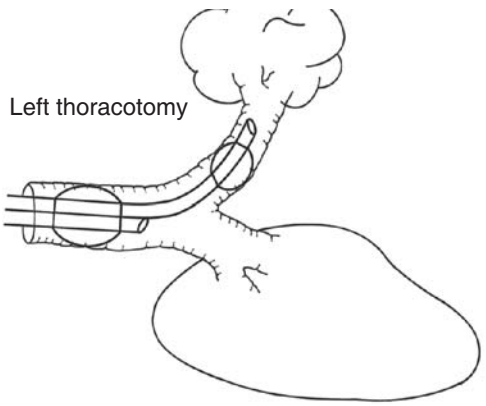


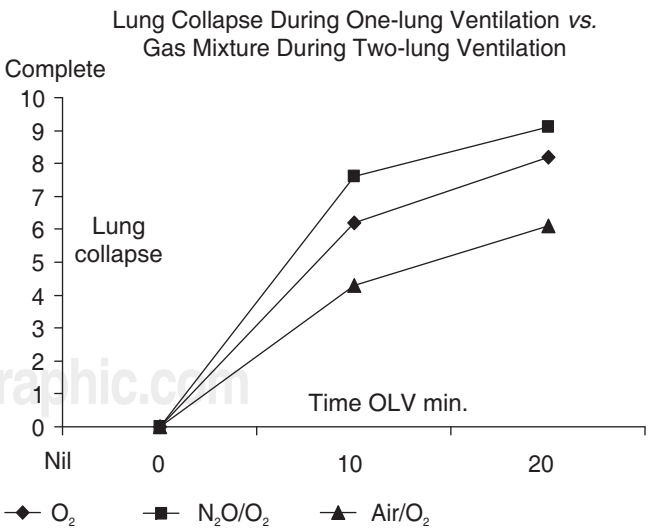
INCIDENCE OF HYPOXEMIA DURING ONE-LUNG ANESTHESIA (FIO_2 1.0)

Study	Year	Hypoxemia
Tarhan	1973	25%
Kerr et al	1974	24%
Slinger et al	1993	8%
Sticher et al	2002	10%

(Why did hypoxemia decrease?)

CASE #3: 67 Y.O. MALE, LUNG CA., EMPHYSEMA, LEFT VATS UPPER LOBECTOMY

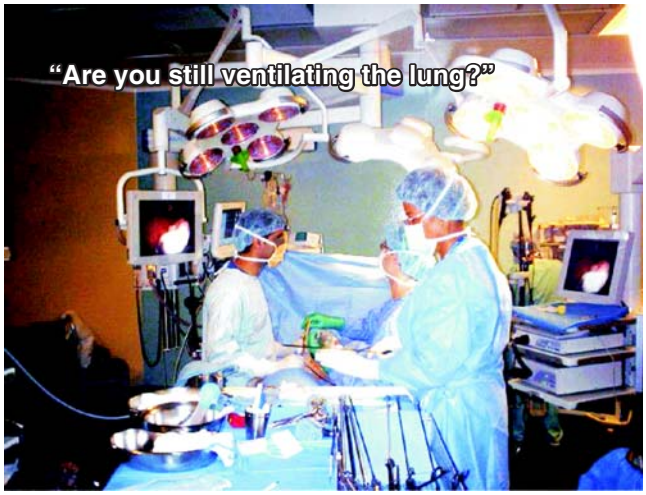




Ko, et al. Anesth Analg 108: 1092-6, 2009

- 20 min. of OLV
- Grad. SpO_2 86 %
- No improvement with recruitment/PEEP
- Surgeon refuses CPAP
- ? Rx

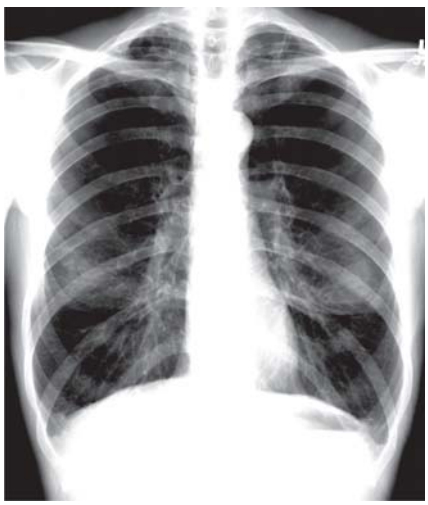
www.medigraphic.com



PREDICTION OF DESATURATION DURING ONE-LUNG VENTILATION

- Right *vs.* left thoracotomy
- Lung elastic recoil
- Low PaO_2 during
- 2-lung ventilation
- V/Q ratio to surgical side

WHICH PATIENT MORE LIKELY TO DESATURATE DURING OLV?



55 y.o. F,
emphysema
FEV1 = 28%

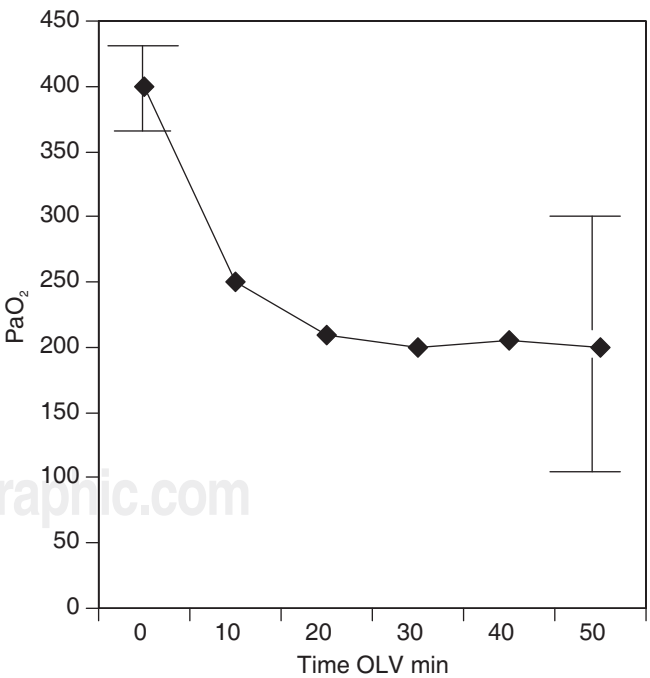
Left VATS
Lung Bx

60 y.o. M,
lung Ca.
Non-smoker,
FEV1 = 98%

R thoracotomy,
upper lobx.

60 y.o. M, lung Ca.
Non-smoker, FEV1 = 98%

VENTILATION DURING OLV PREVENTION AND TREATMENT OF HYPOXEMIA



www.medigraphic.com

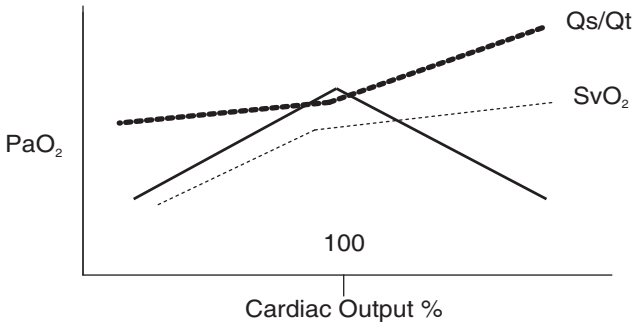
- High FiO_2
- CPAP non-ventilated lung
- PEEP ventilated lung
- HFPPV, partial vent.
- Selective pulmonary vasodilation

BEST ANESTHETIC AGENTS DURING ONE-LUNG VENTILATION?

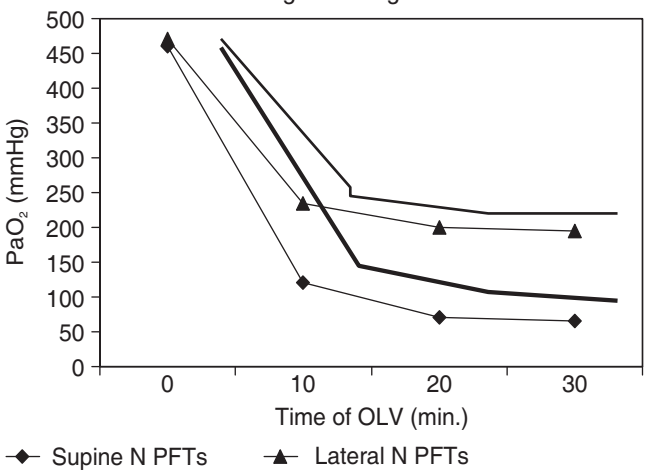
- Halothane/enflurane
- Isoflurane/desflurane/sevoflurane
- Total intravenous anesthesia (TIVA)
- Combined TEA plus general anesthesia

Oxygenation *vs.* Cardiac Output During One-lung Ventilation

Slinger P, Scott WA. Anesthesiology 1995, 82:940
RusselWJ, James MF. Anaesth Intens Care 2004, 32: 644

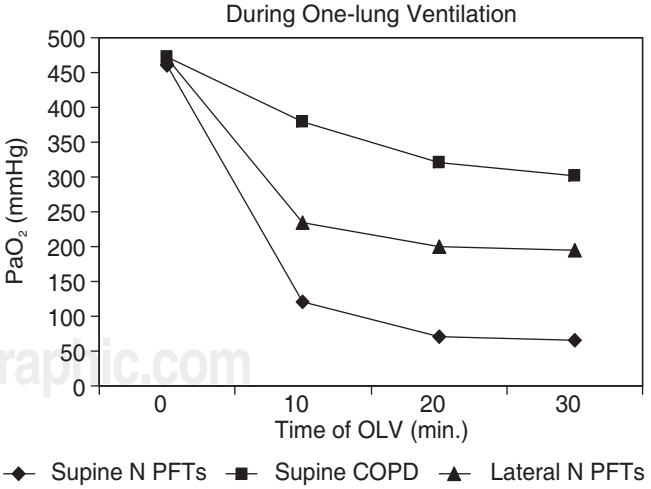


Intraoperative Position vs. PaO_2 During One-lung Ventilation



Watanabe S, et al. Anesth Analg 90:28, 2000

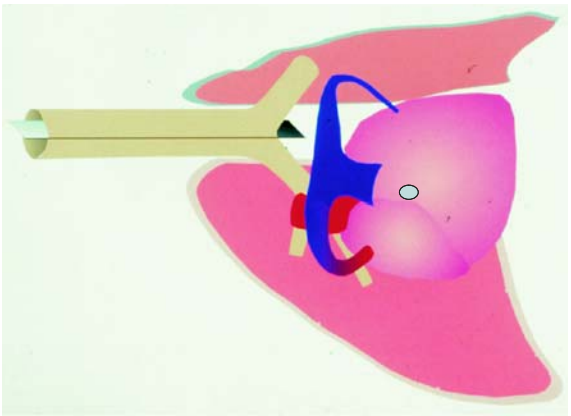
Intraoperative Position *vs.* PaO_2 During One-lung Ventilation



Watanabe S, et al. Anesth Analg 90:28, 2000
Bardoczky GI, et al. Anesth Analg 90: 35, 2000

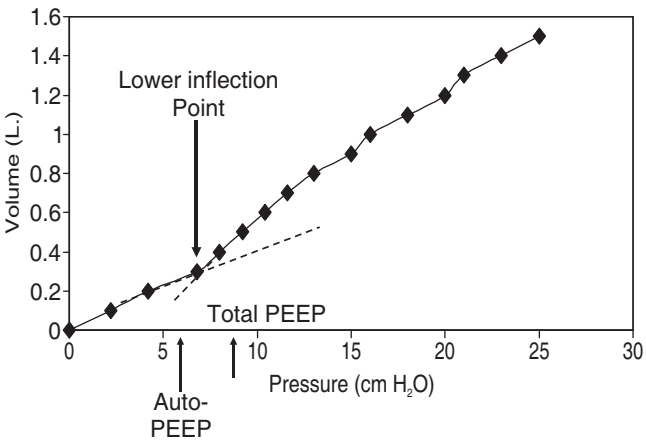
www.medigraphic.com

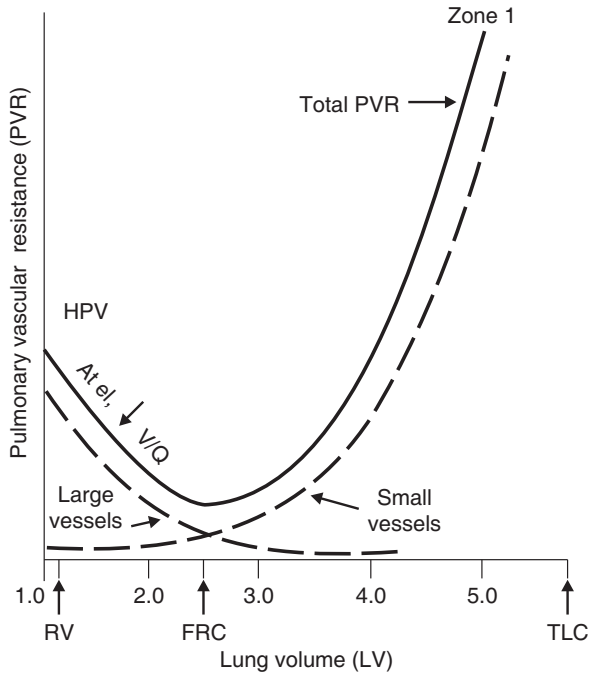
Imagine That You're a Red Cell in the RV…



Static Compliance Curve of the Ventilated (dependent) Lung, 57 y.o. Female, FEV1= 72%

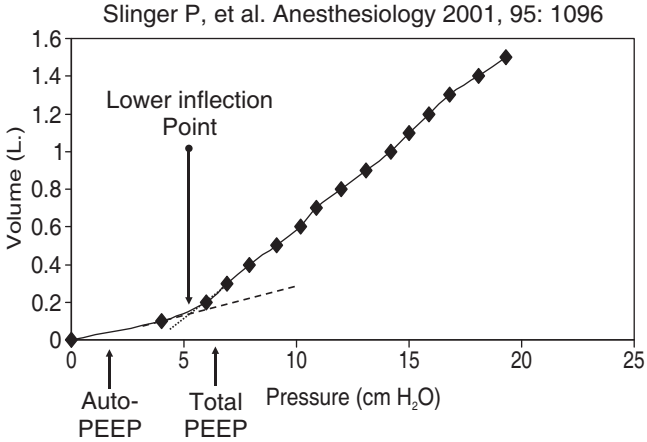
Slinger P, et al. Anesthesiology 95:1096, 2001



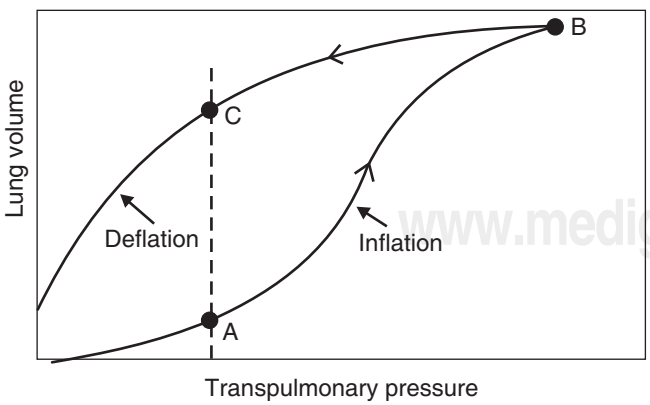


One-Lung, Static Compliance Curve

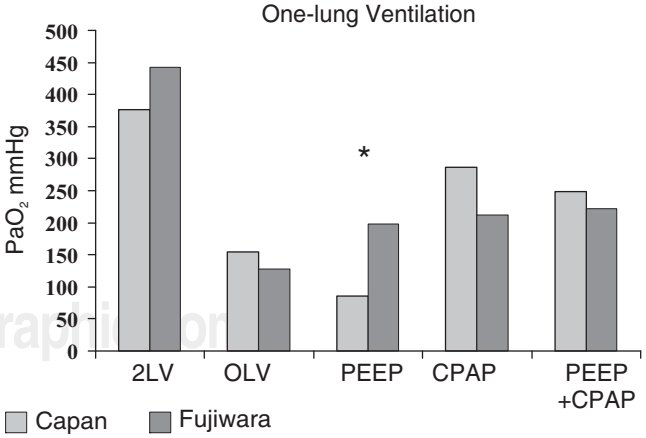
Slinger P, et al. Anesthesiology 2001, 95: 1096



32 y.o. Male, FEV1= 102%



Treatment of Hypoxemia during One-lung Ventilation



Capan L, et al. Anesth Analg 59: 847, 1980, Lung Ca., FEV1= 70%

Fujiwara M, et al. J Clin Anesth 13: 473: 2001, Esoph. Ca.

www.medigraphic.org

55 Y.O. MALE , DAY 3 POSTOP. RIGHT PNEUMONECTOMY

- Gradual onset dyspnea x 24 h
- SpO_2 90% with FiO_2 0.5
- Hemodynamics stable

POST-PNEUMONECTOMY PULMONARY EDEMA: ANALYSIS AND RISK FACTORS

Parquin F, et al. Eur J Cardiothorac Surg 10: 929, 1996

« …we see so often our anesthetic colleagues believe that you can actually oxygenate the patient with ringer's lactate…

…I think it is up to us to control what our anesthesia colleagues do, both in the operating theater and post-operatively.» B Ross

POST-PNEUMONECTOMY PULMONARY EDEMA

Turnage WS, Lunn JL. Chest 103: 1646-50, 1993

- 806 pneumonectomies, 21 cases
- Right pneumonectomy 16 *vs.* left 5
- Mortality 21/21 (ARDS)
- Cases *vs.* controls:
  - Fluid balance (n.s.)
  - Fluid administration (n.s.) mean PAOP: initial 10, final 13 (n.s.)

POSTPNEUMONECTOMY PULMONARY EDEMA

- Incidence 2-4%
- Onset day 1-3 postop.
- Mortality 50-100%
- R > L pneumonectomy
- Assoc. excess fluids
- ARDS pathology

CAUSES OF POST-PNEUMONECTOMY PULMONARY EDEMA

Probable:
- Endothelial injury
- Capillary pressure
- Lung lymphatic damage
- Fluid overload
- Lung hyperinflation

Possible:
- RV dysfunction
- Cytokines
- Oxygen toxicity

PULMONARY ENDOTHELIAL PERMEABILITY CHANGES AFTER MAJOR LUNG RESECTION PNEUMX. = 24, LOBX. = 11, RAD-LABL. ALB., 8 H POST-OP

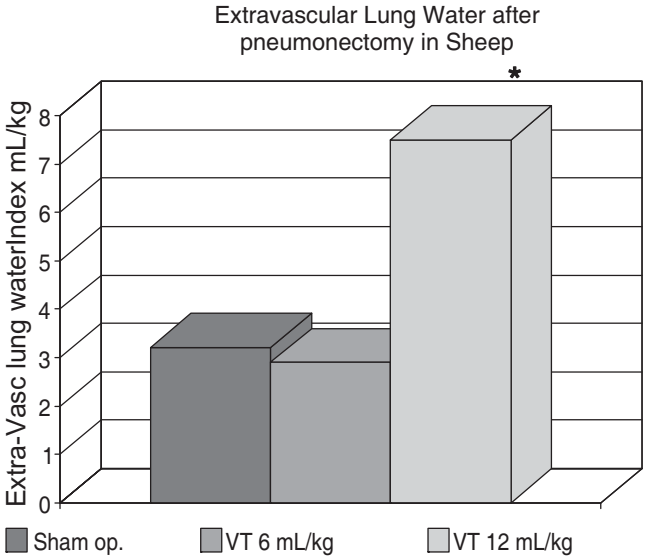
- Permeability pneumx. > Lobx. (p <.01) (Low-Press., hi-Prot. PE fluid)
- Increase perm. α increase PVR
- Increase MPAP α 1/ pre MPAP

Waller DA, et al. Ann Thorac Surg 1996, 61: 1435-40

THE MORTALITY FROM ACUTE RESPIRATORY DISTRESS SYNDROME AFTER PULMONARY RESECTION IS DECREASING

	1991-1997	2000-2005
ARDS incidence	3.2%	1.6% (p = .01)
ARDS mortality	72%	45% (p = .05)
Incidence of pneumonectomy	17.4%	6.4%

Tang SK, et al. Eur J Cardiothorac Surg 2008, 34: 898-902
[n = > 1,300 Pulm. resections (2000-5)]
[decreased postop. tidal vol. (p = .001)]



Kuzkov V, et al. Crit Care Med 35: 1550-9, 2007 *p < .05

MANAGEMENT OF HYPOXEMIA DURING ONE-LUNG VENTILATION:

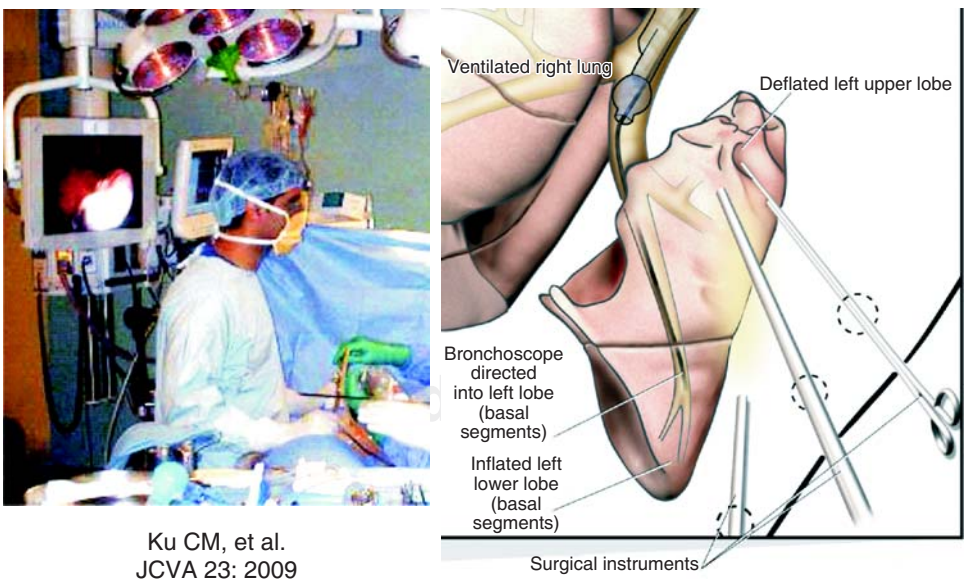
Severe/acute:
Resume two-lung ventilation

Gradual desaturation:
1. Assure $FiO_2 = 1.0$
2. Check DLT/BB: FOB
3. Optimize cardiac output
4. Recruit ventilated lung
5. Apply PEEP 5 cm vent lung (except COPD)
6. Apply CPAP 1-2 cm non-vent. lung (Recruit 1st)
7. Intermit. Re-inflation
   N-V Lung
8. Partial vent. N-V lung:
   i) Lobar re-inflation
   ii) Lobar collapse
9. Mechanical restriction of non-vent. lung pulmonary blood flow

INDIVIDUALIZING ONE-LUNG VENTILATION

		Exceptions
Tidal vol.	5-6 mL/kg	Pk. a/w $P < 35$ Plat. a/w $P < 25$
PEEP	Total 5 cm	Not added if COPD
FiO_2	1.0	Decreas. as tol.
Resp. rate	12	Mild hypercap. OK
Mode	Vol-C Vent./P-C Vent.	P-C V: COPD, LTx, Pneumnx

FOB-Guided lobar insufflation with O_2



Ku CM, et al.
JCVA 23: 2009