



Cambodia Obstetrics Forum

ការសម្របសម្រួលពេលមានផ្ទៃពោះ

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Protective mechanical ventilation



Protective mechanical ventilation

Richard Plavka, MD., Ph.D., Professor



Protective mechanical ventilation

Era of modern neonatology (1960-) started by artificial lung ventilation by interruption of flow enabling artificial breath

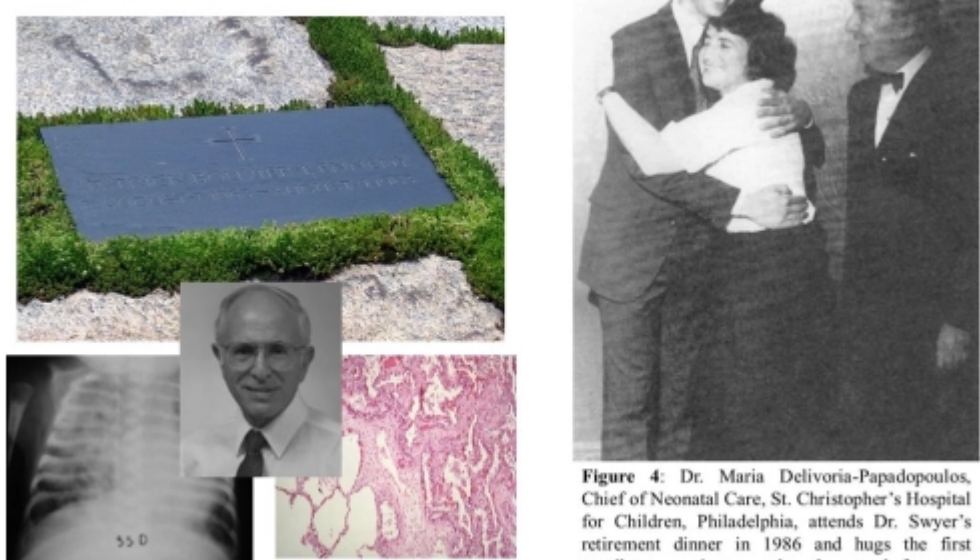
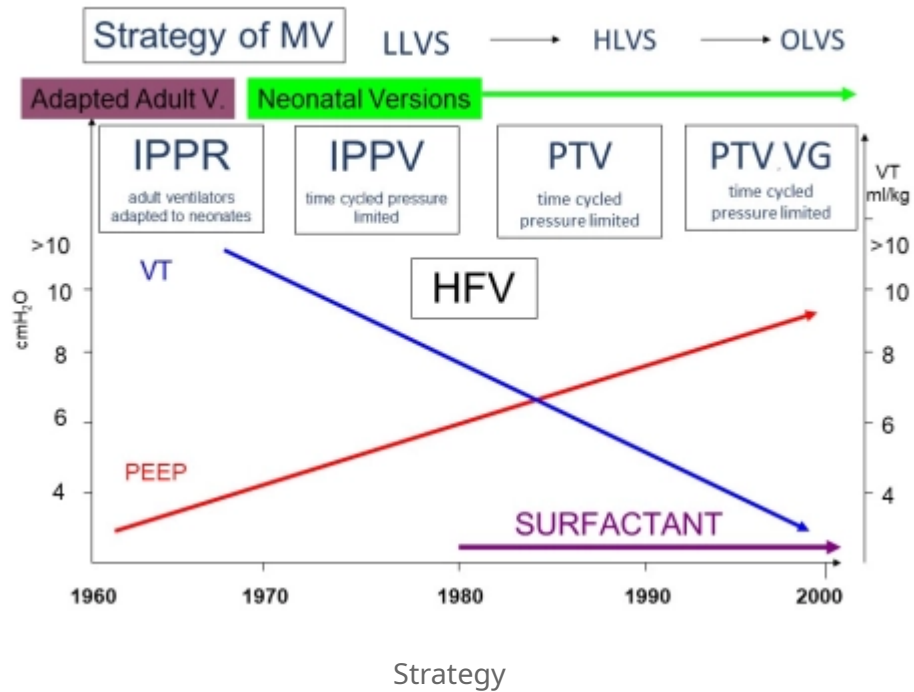
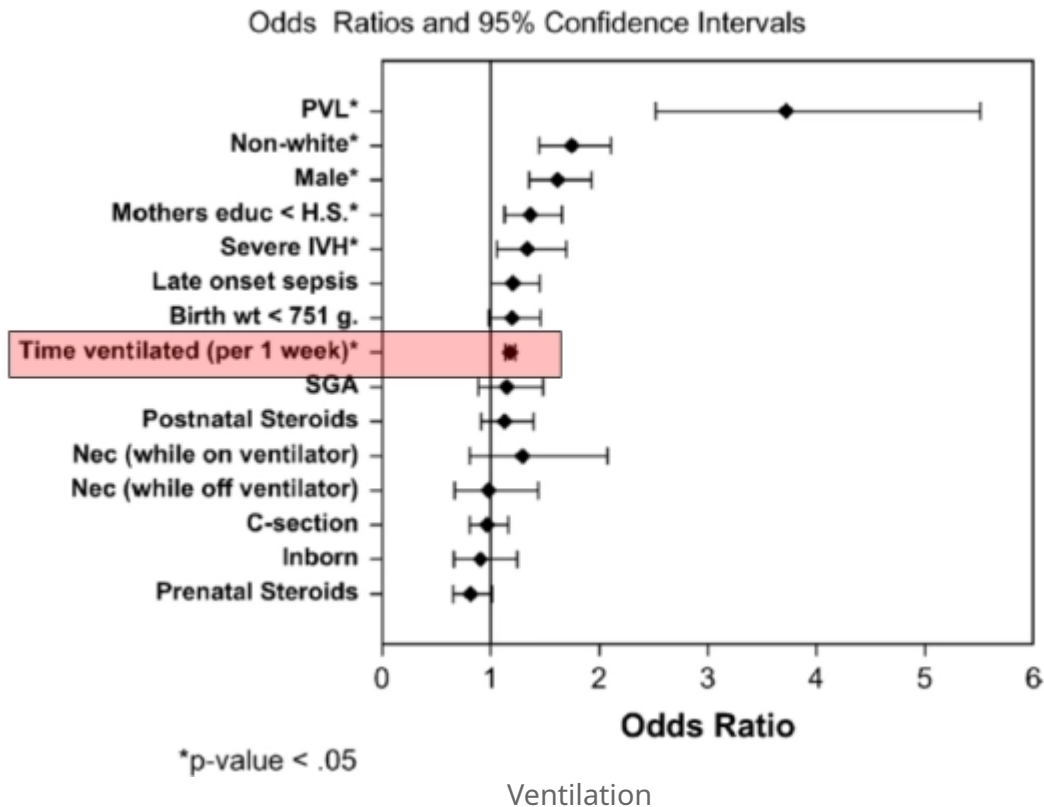


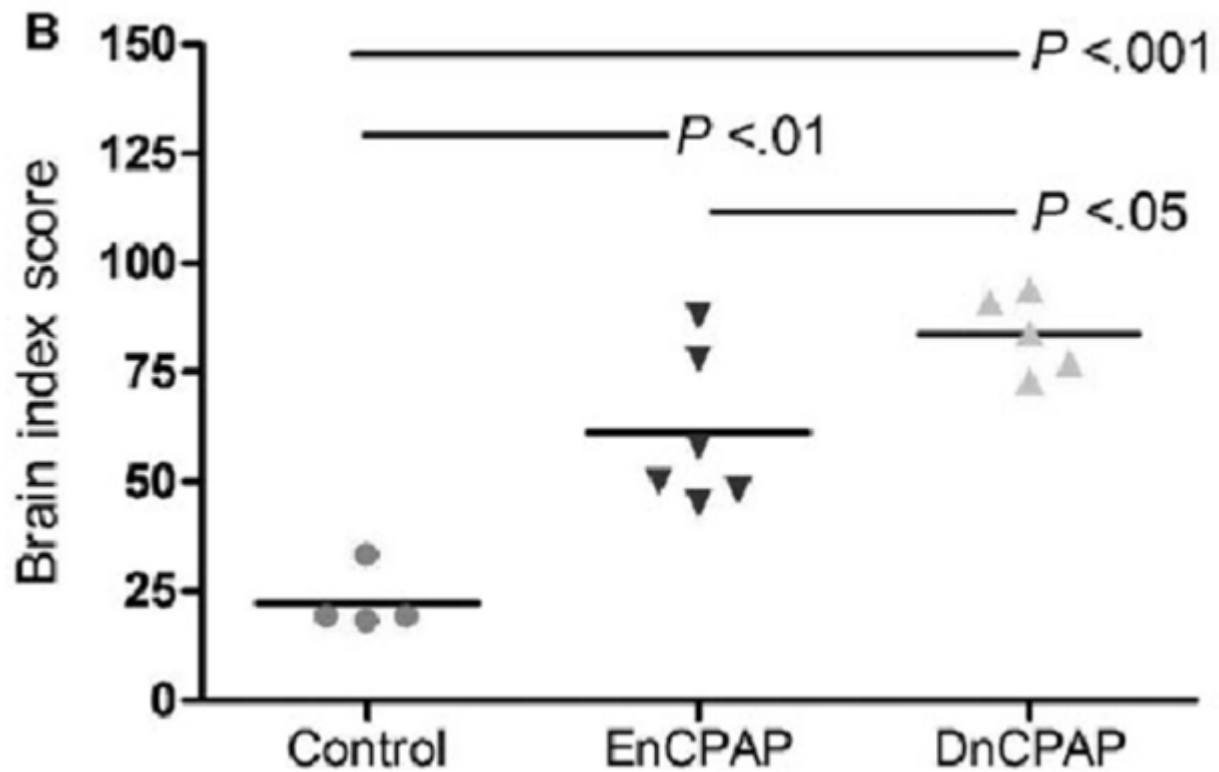
Figure 4: Dr. Maria Delivoria-Papadopoulos, Chief of Neonatal Care, St. Christopher's Hospital for Children, Philadelphia, attends Dr. Swyer's retirement dinner in 1986 and hugs the first ventilator survivor – who she cared for as a Fellow in the early 1960s.



Mechanical ventilation in newborns
Risk of neurodevelopmental impairment



Mechanical Ventilation and Brain Injury Risks after 1 or 5 days of ventilation



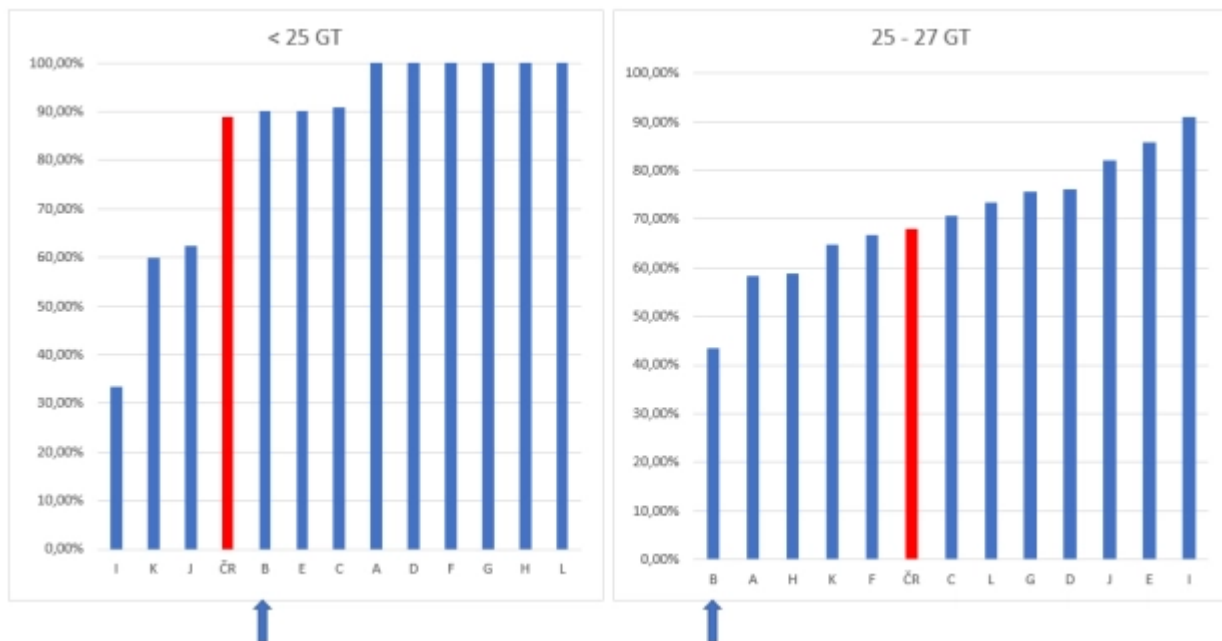
"There is a lower risk of BPD development, if infants do not require artificial invasive ventilation"

Association between mechanical ventilation and lung injury (VALI)

However there is still more than 50% of ELGA infants, who require mechanical ventilation.

Need for Mechanical Ventilation

12 PCIP in 2017



Traumas Contribute To Ventilator Induced Lung Injury- VILI

- Barotrauma 1973
- Volutrauma 1988
- Atelectrauma 1997

Oxygen toxicity

- Ergotrauma 2016

Ergotrauma

Absorption of mechanical energy exceeding a compensation ability of lung tissue

- $T_{pt} = K \times \Delta V / V_0$
- Tpt...transpulmonary pressure
- K...specific lung compliance
- ΔV ...change of lung volume
- V_0 ... initial lung volume

Specific lung compliance = pressure needed for two time FRC achievement

VENTILATOR INDUCED LUNG INJURY -VILI

3 main mechanisms:

OVERDISTENSION

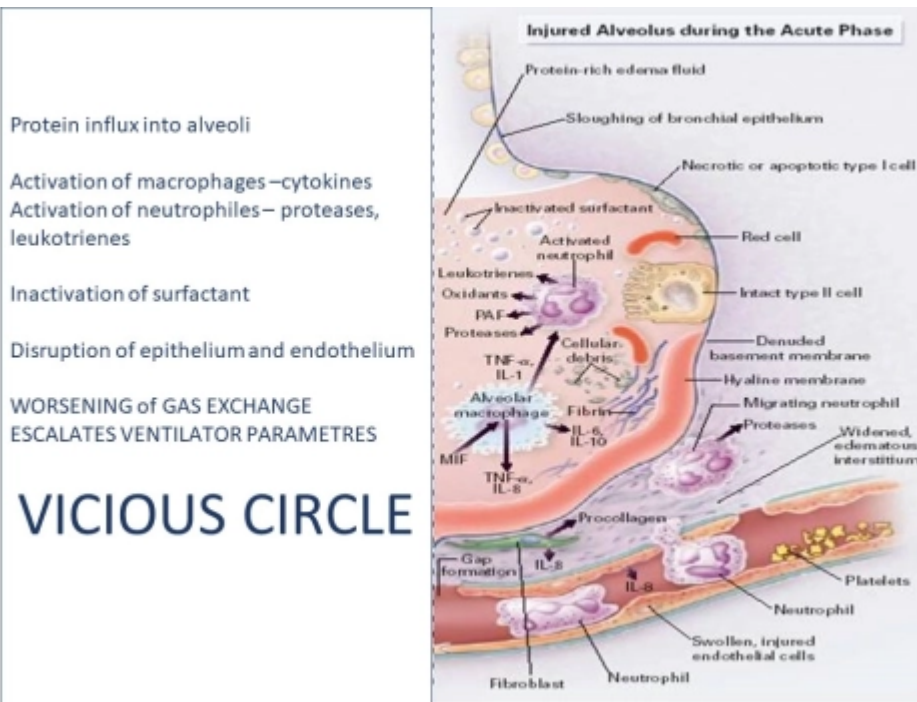
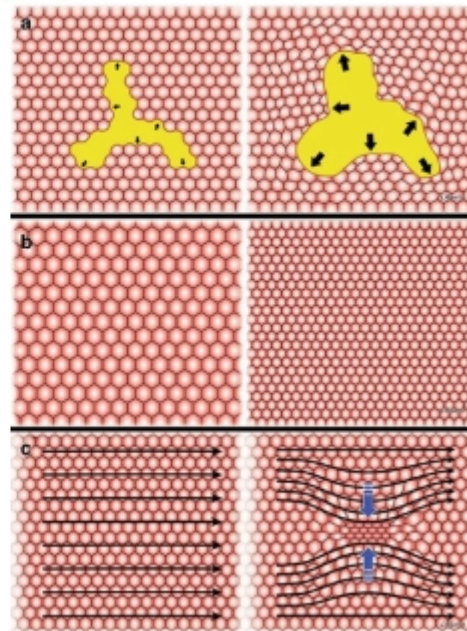
- high volume/pressure

RECOREX

repeated collapse and reexpansion

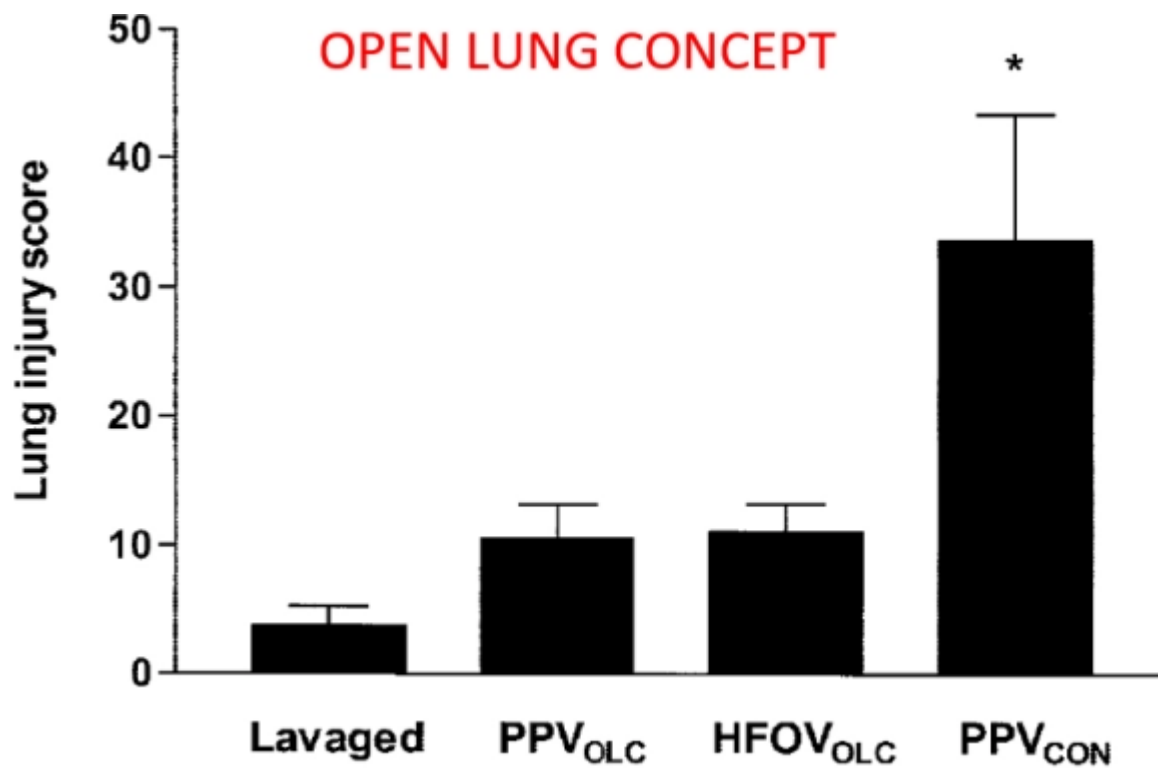
Heterogeneous ventilation

Overdistended alveoli collapse the nearby ones

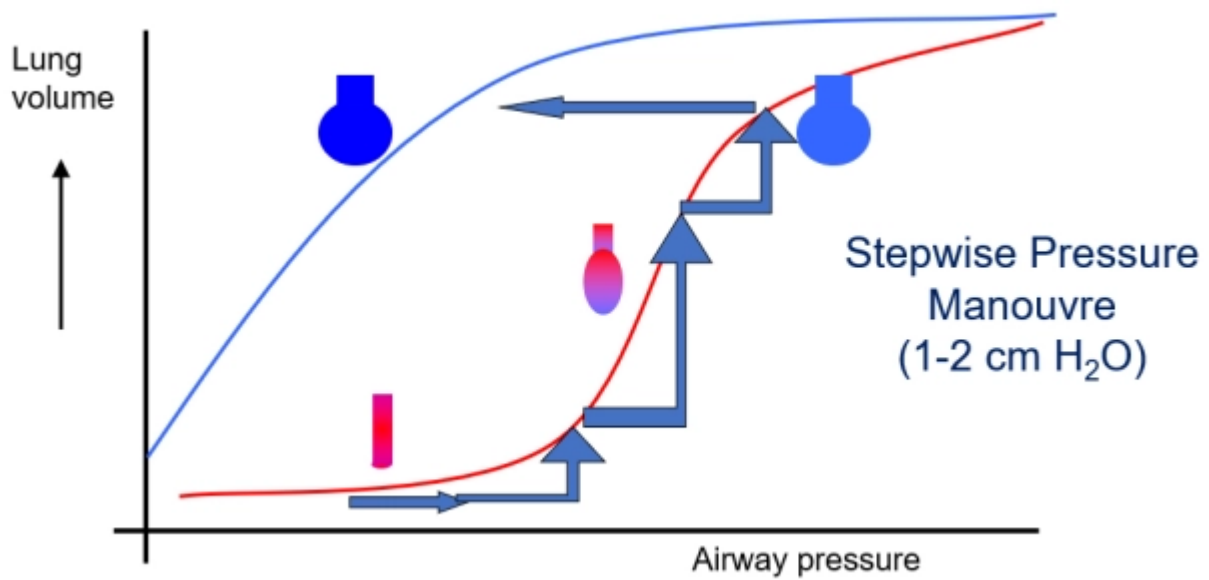


PREVENTION OF LUNG INJURY

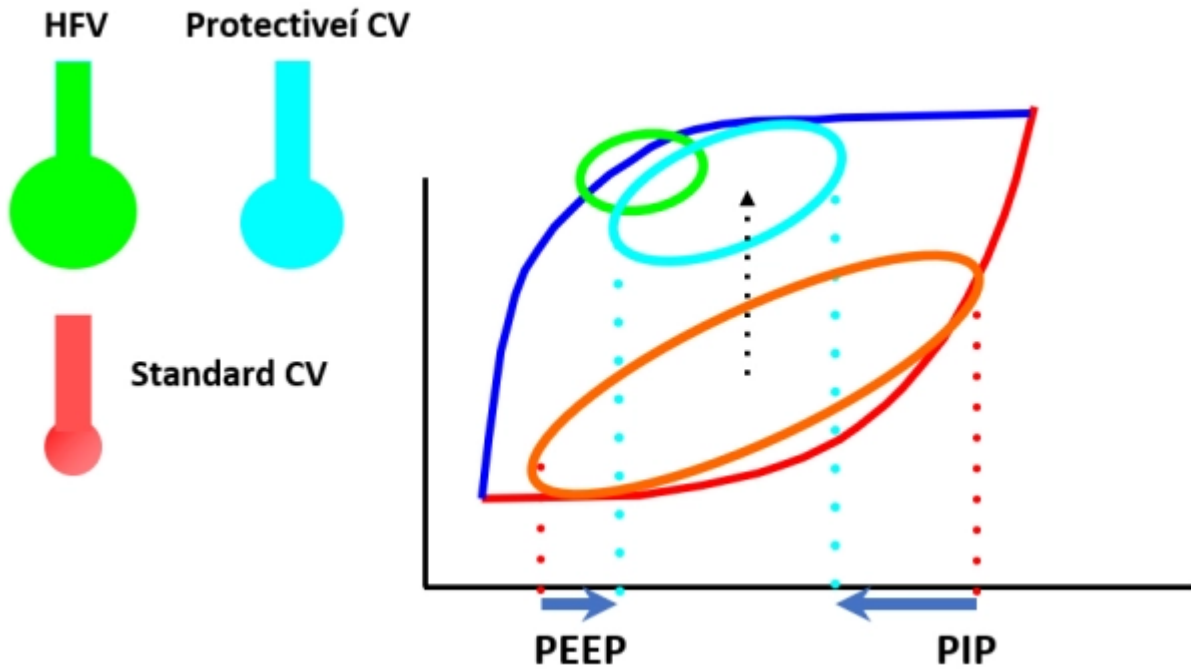
„Keeping the lung open“



Recruitment and Stabilization



Approximation Of Protective CV and HFV



Strategy OPTIMUM LUNG VOLUME with minimal V/Q imbalance

	AC (SIPPV)
HFOV	PSV
HFJV	SIMV
	VG

What is the optimum mode of MV ?



Keep in your mind!

Characteristic of lung disease

- Homogeneous, IRDS
- Heterogeneous, disperse, focal
- Acute or chronic

Biophysical properties of lung

- Compliance, $C_{rs} = \Delta V / \Delta P$
- Resistance, $R = (P_1 - P_2) / V$
- Time Constant, $TC = C \times R$

Phase of MV related to lung

- Recruitment
- Stabilisation
- Weaning and extubation

Postulates of "KNOWLEDGES" to minimise iatrogenic lung injury:

- **ALL TOGETHER**

1. Biophysical properties of lung (dg. and pathophysiology of lung)

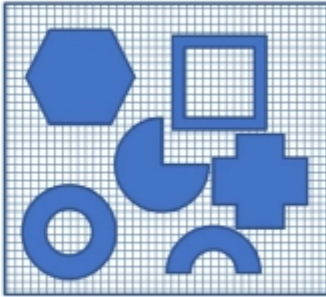
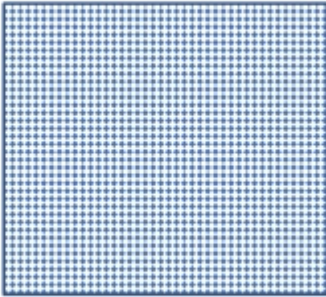
- 2. Phase of lung disease (recruitment-stabilization-weaning)
- 3. Specifics of ventilatory devices and modes



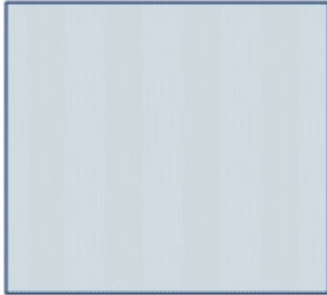
↑ HETEROGENEOUS
Factors



> ↓ HOMOGENEOUS
Factors

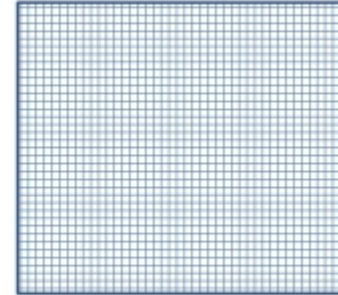
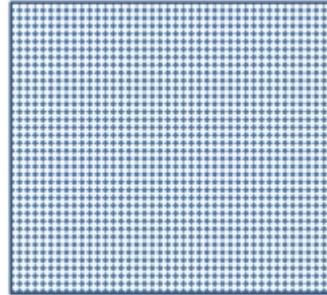


↑ HETEROGENEOUS
Factors



>

↓ HOMOGENEOUS
Factors



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Basics of „LUNG HOMOGENIZATION“

- Adequate alveolar distension during the whole of respiratory cycles
- Respecting of *time constants* in different lung compartments
- Positioning

Ventilatory parameters related to homogenization of lung:

In favor of...:

- ↑MAwP/FiO₂
- ↑Frequency (Hf)
- ↓ VT

Against...:

- ↓ MAwP/FiO₂
- ↑ Frequency IMV
- ↑ VT

Adverse effect of high intrathoracic (intrapulmonary pressure):

- Dopamin 2-5 ug/kg/min
- Dobutamin 10-20ug/kg/min
- Volumexpansion

Prone position during ventilators support

- 1. Increases the elasticity of thorax**
- 2. Homogenize distribution of lung liquid content**
- 3. Facilitate recruitment of dorsal regions of lung** (dependent regions)

Improvement

- V/Q proportion
- Distribution and exchange of gases
- Mobilisation of secretion

TRIAS of SUCCESS:

STRATEGY - VENTILATORY MODE - MANAGEMENT

STRATEGY „OPTIMUM LUNG VOLUME“

With adequate distribution of VTs to stabilized alveoli (PEEP a MAwP) during the all whole respiratory cycles

IS A KEY

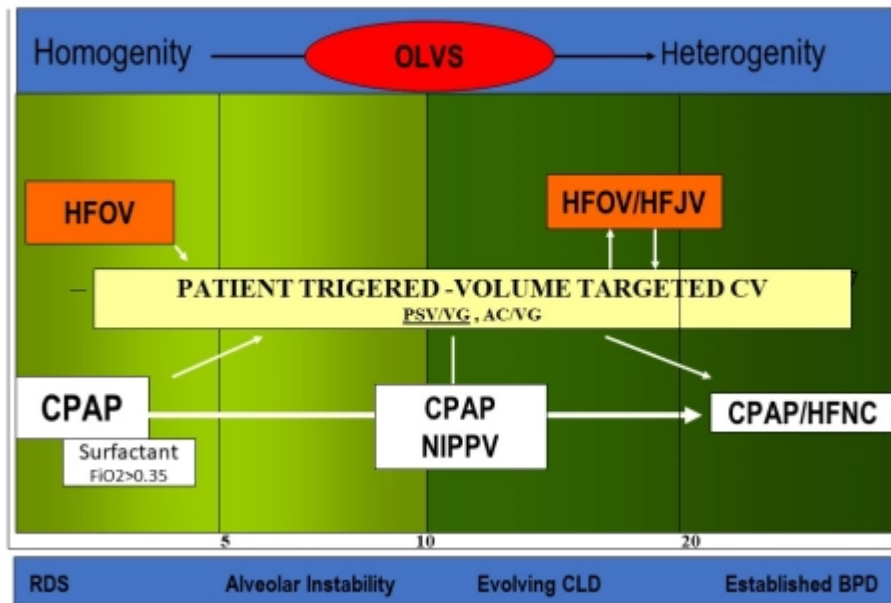
Appropriate choice of ventilatory mode related to the current lung pathology makes management easier may attenuates negative effects of MV.

MODE IS A MEDIATOR

Only educated and well skilled doctors familiar with device can provide successful management

MANAGEMENT IS A PROCESS!

LUNG PROTECTIVE VENTILATORY SUPPORT



Ventilatory

Back Up

Keep always in your mind!

Mechanisms VALI/VILI

- Excessive VT and Low EEP
- High FiO₂
- Low lung volume and very uneven distribution of gas

Phases of MV

- Recruitment
- Stabilisation

- Weaning and Extubation

