

Lung Recruitment and PEEP Titration for ARDS using PCV Mode of Ventilation

พ.อ.นพ.ดุสิต สถาวร
โรงพยาบาลพระมงกุฎเกล้า

Acute Respiratory Distress Syndrome (ARDS)

A syndrome of acute and persistent lung inflammation with increased vascular permeability. It is characterized by three clinical features:

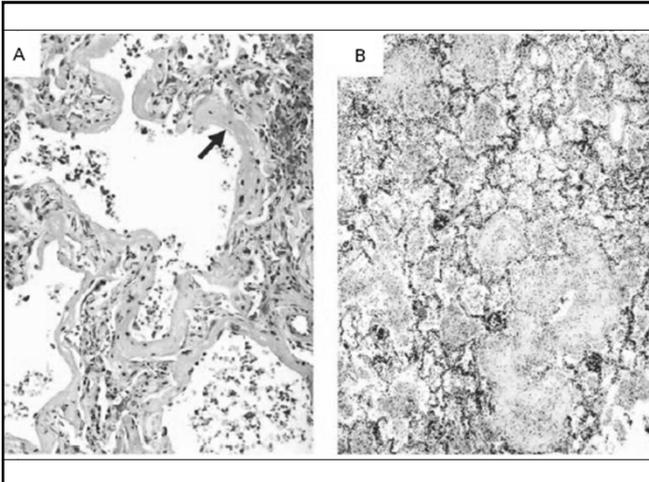
- Widespread, bilateral radiographic infiltrates.
- PaO₂/FiO₂ less than or equal to 200 mm Hg, regardless of the level of PEEP.
- No clinical evidence for an elevated left atrial pressure. If measured, the pulmonary capillary wedge pressure is 18 mmHg or less.

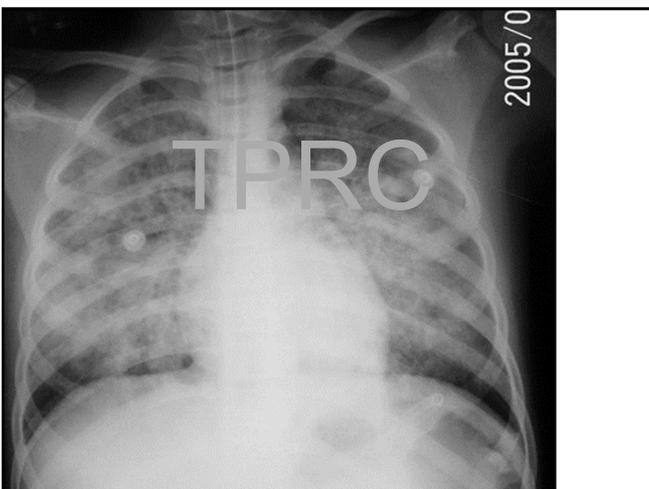
ARDS

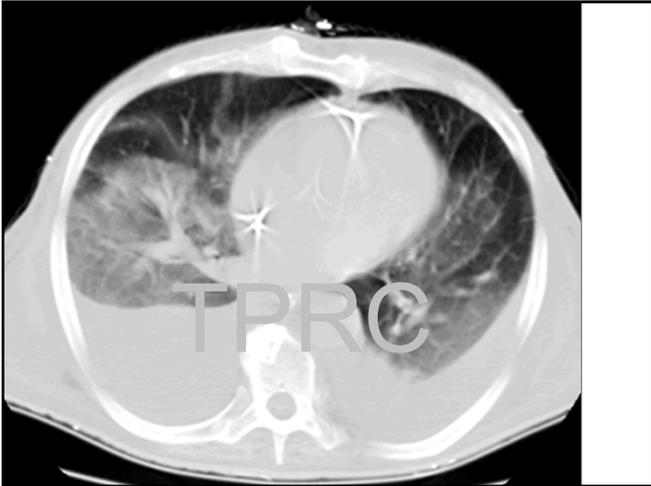
กลุ่มอาการ ARDS เป็นกลุ่มอาการที่เกิดจากการอักเสบอย่างรุนแรงของปอดส่งผลให้ alveolar capillary membrane ซึ่งประกอบด้วย alveolar epithelial cells และ endothelial cells ได้รับอันตรายและเกิดการรั่วซึมของสารน้ำและโปรตีนออกจากหลอดเลือดเข้าไปสะสมในบริเวณ interstitium และ alveolar air spaces จนกระทั่งเกิดภาวะ pulmonary edema ขึ้นในที่สุด

Pathogenesis

- Exudative phase
 - Macro: Heavy, rigid, dark
 - Micro: Edema, hyaline membrane, neutrophils, epithelial and endothelial cells damage
- Proliferative phase
 - Macro: Heavy, grey
 - Micro: Edema, barrier disruption, Type II cells proliferation, myofibroblast infiltration
- Fibrotic phase
 - Macro: Cobblestoned
 - Micro: Fibrosis, matrix organization







Ventilating the Patient with ARDS in 2009 and beyond

- Adopt "Lung-protective ventilation strategy".
- Adhere to the 'open up the lung and keep the lung open' concept which is the state of the art in ventilation at the present day in adults and pediatrics.*

* Marraro GA. *Pediatr Anesth* 2005;15:630-37

Lung-Protective Ventilation Strategy in ARDS

Lung-Protective Ventilation Strategy in ARDS

- Maintenance of adequate gas exchange
- Avoidance of ventilator-associated lung injury (VALI)

Maintenance of adequate gas exchange

- Targeted goals of CO₂
 - $7.30 \leq \text{Arterial pH} \leq 7.45$
 - End-inspiratory alveolar (Plateau) pressure $< 30 \text{ cm H}_2\text{O}$
- Targeted ranges for oxygenation
 - $55 \text{ mm Hg} \leq \text{PaO}_2 \leq 80 \text{ mm Hg}$
 - $88\% \leq \text{SpO}_2 \leq 95\%$

Avoidance of ventilator-associated lung injury

- High lung volume injury
 - Small tidal volume: 6 ml/kg predicted BW*
 - Plateau pressure $< 30 \text{ cm H}_2\text{O}$
- Low lung volume injury
 - Optimal PEEP
 - Recruitment maneuver (RM)

*NIH ARDS Network 2000 Protocol .



Lung Recruitment: The Open Lung Concept

Lung Recruitment: The open lung concept

- It involves the application of methods to open and recruit the lung immediately at the start of artificial ventilation and whenever atelectasis occurs.

Lung Recruitment: The open lung concept

- Opening up all recruitable alveoli by applying high inflation pressures (Critical opening pressure to 'open up the lung')
- Once the lung is thought to be recruited, keeping the lung open using optimal PEEP (Critical Closing pressure)
