ARDS

Acute Respiratory Distress Syndrome

What is it?

Acute respiratory failure characterized by non-cardiogenic pulmonary edema, lung inflammation, and poor lung compliance. On pathology, diffuse alveolar damage is seen. It can be caused by direct lung injury or systemic inflammation. We are primarily concerned about COVID-19 as a cause of ARDS at this time.

Pulmonary Causes

- Pneumonia: Viral Or Bacterial
- Aspiration
- Inhalational Injury
- Pulmonary Contusion

Non Pulmonary Causes

- Sepsis
- Pancreatitis
- Severe trauma/burns
- Massive transfusion
- Overdose/toxins

Four criteria for diagnosis

1. Timing: Acute onset (< 1 week post-insult)
2. Oxygenation: PaO_2/ F_IO_2 ratio < 300mmHg on PEEP ≥ 5
3. Chest imaging: Bilateral airspace disease
4. Origin of edema: Not explained by cardiogenic cause (if no obvious insult, need to rule out)

Severity

Severity is based on the PaO_2/FiO_2 ratio with patient on PEEP ≥ 5.

Severity	PaO_2/FiO_2	Mortality
Mild	200-300	~25%
Moderate	100-199	~35%
Severe	< 100	~45%

Major Management Principles

Treat the underlying cause while avoiding additional lung injury from the patient's own respiratory efforts or the mechanical ventilator. **Lung protective ventilation strategies and prone positioning are the only interventions with proven mortality benefit.** Whenever possible engage a RT in setting the ventilator and optimising patient ventilation.

1 Lung Protective Ventilation

- **Tidal volume (VT) should be = 6mL/kg** using ideal body weight (IBW) (range 4-8ml/kg)
  - IBW Men = 50 + (0.91 × [height in centimeters − 152.4])
  - IBW Women as 45.5 + (0.91 × [height in centimeters − 152.4])
- Volume control ventilation may be preferred to ensure VT compliance. If pressure control is used, VT must be monitored regularly to avoid recurrent VT above 6mL/kg.
- **Plateau pressures should be < 30cmH_20 -** Plateau pressure is calculated by performing an end-inspiratory hold maneuver on the ventilator and is used to estimate the pressure the alveoli and small airways are seeing
- Permissive hypercapnia: pH ≥ 7.25

2 Sedation

- Sedation is important to improve ventilator synchrony and decrease the patient's oxygen consumption
- Almost all patients will require sedation to meet the lung protective ventilation targets

3 Paralysis

- **While mortality benefit is controversial, paralysis should still be considered in the following situations**:
  a. Evidence of ventilator-patient asynchrony
  b. PaO_2/F_IO_2 < 100
  c. High plateau pressures
  d. Refractory hypoxia/hypercapnia
  e. Prior to prone positioning

Can initially trial bolus dose paralytic (i.e. rocuronium 50mg IV x 1) and reassess need for continuous infusion based on response

- If paralysis is going to be used, patients must be very deeply sedated before it is administered. **Sedation should never be lightened in paralyzed patients** as level of awareness cannot be assessed.

4 Prone Positioning

- Prone positioning should be considered in all patients with **severe ARDS (PaO_2/FiO_2 < 100)** despite high ventilatory support (F_IO_2 ≥ 60 and PEEP > 5)
  - Some centres implement proning when PaO_2/F_IO_2 < 150
- Patients should be placed in the **prone position for > 12 hours/day**
- Contraindications → Refractory shock, unstable cardiac arrythmias, elevated intracranial pressure, spinal instability, open wounds on the chest or abdomen, unstable facial or pelvic fracture

5 PEEP Titration

- In general, **a higher PEEP strategy (PEEP ≥ 10) is preferred** for moderate to severe ARDS
- Recruitment maneuvers and PEEP titration studies could be considered in consultation with a respiratory therapist or ICU physician. The F_IO2/PEEP table can be used as a guide to appropriate PEEP levels. However, when using PEEP ≥ 16, suggest ICU physician input.

F_IO_2	0.3-0.5	0.6-0.8	0.9-1.0
PEEP	5-12	12-18	16-20

6 Rescue Therapies for Severe Hypoxemia

- Inhaled nitric oxide or prostacyclin, two pulmonary vasodilators, may improve oxygenation; especially in patients with concomitant RV failure. Consider a trial if refractory hypoxemia and treatments above have failed. However, there is no proven mortality benefit and may even be harm associated with them.
- ECMO referral can be considered in cases of refractory hypoxemia (inadequate oxygen delivery) or hypercapnia despite the above interventions.

7 Other Supportive Measures

- A conservative fluid strategy should be implemented → Drop IV fluids to to keep vein open once initial resuscitation is complete.
  - Consider diuretics to avoid a positive fluid balance, even in patients on low dose vasopressors.
- **If COVID-19 positive with severe ARDS, may consider steroids** (limited evidence). If COVID positive without ARDS, do not give steroids.
- For patients with COVID-19 and ARDS, empiric antibiotics should be administered. However, antibiotics should be reassessed in 48-72 hours, pending culture results.