

Acute Resp. Failure/Acute Lung Injury

ARF: sudden deterioration in pulmonary gas exchange = CO₂ retention & inadequate oxygenation

paO₂ < 60 mmHg (should be 80-100)

paCO₂ 60 mmHg (should be 35-45)

arterial pH < 7.35 (pts usually acidotic)

Causes

Direct Indirect

Aspiration

Sepsis

Pneumonia

Burns

Contusions/trauma

Truama

Upper airway obstruction

TRALI

Toxic inhalation

Drug reaction/OD

SARS

Cardiopulm. bypass

Pancreatitis

Multiple fractures

Lung/bone marrow tx

Stages of ARF

Stage 1: inc. SOB, RR, few CXR changes... within 24 hr → signs of ARDS (CXR changes)

- Tachypneic, dyspneic

Stage 2 (Exudative): vent. required

- Address underlying issues

Stage 3 (Proliferative): hemodynamically unstable

- Can't maintain BP, tachy, compen. mechanisms, inflammation & cascade of events

Stage 4 (Fibrotic): lung fibrosis issues; vent. management issues

- Dec. compliance, stiffness

Types of Respiratory Failure

Type 1 - Acute Hypoxemic: abnl. transport of O₂ w/ resultant inadequate oxygenation

Type 2 - Hypercapnic: inadequate alveolar ventilation; marked elevation in paCO₂

Type 3 - Mixed Hypoxemic-Hypercapnic: inadequate alveolar ventilation & abnormal O₂ transport

- Often most common type

Management of ARF

Warrants immediate intervention!

GOALS:

Correct the cause

Alleviate hypoxemia & hypercapnia

Indications for Intubation

Altered mental status or coma

Severe respiratory distress

Extremely low or agonal RR (gasping)

- Cerebral issue r/t O₂

Obvious respiratory muscle fatigue - r/t inc. work of breathing = mechanical vent.

Peripheral cyanosis - fingers, lips dusky

Impending cardiopulm. arrest - heart starts to compensate (tachy, arrhythmias) → cardiac arrest

Better to intubate electively rather than emergently!

Mechanical vent. - helps to breathe, protects airway

Systemic Inflammatory Response Syndrome (SIRS)

2+ of...

Temp. > 100.4°F (38°C) or 98.6°F (36°C)

HR > 90 bpm

RR > 20 breaths/min or paCO₂ < 32

WBC > 12,000 or < 4,000 or/ >10% bands

Older adults - inc. risk for MODS w/ less chance of recovery from ARDS

Acute Respiratory Distress Syndrome (ARDS)

Severe end of continuum

Complex syndrome w/ high mortality risk

Precipitated by *direct* or *indirect* lung injury

Pathophysiology:

Lung injury → Dec. blood flow to lungs (inflamm. mediators thin lung lining) →

Alveolar membrane damage (membranes thicken, gases can't exchange) →

Inc. membrane protein permeability ("Leak syndrome"; changes osmotic pressure) →

Interstitial & intra-alveolar edema (alveolar area flooded = pulm. edema) → **Further impaired oxygenation** → **Pulm. edema** → **Inflamm. changes can lead to fibrosis** (may cause permanent lung change)

Surfactant gets lost & makes process worse...

- Dec. gas exchange

- Dec. lung compliance (resistance, pressure)

ARDS (cont.)

Symptoms can develop very quickly after lung insult

Assessment:

- Accessory muscle use

- **Tachypneic**

- **Tachycardia**

- Restless, air hunger = change in O₂

- Confusion

- New/worsening lung sounds (crackles, wheezes) → steroids

- Change in SpO₂

- Lethargy (lose ability to protect airway)

- **Dyspnea**

- At risk for arrhythmias

- Change in renal status

Bolded are the earliest signs

ARDS Diagnostic Criteria

paO₂-FiO₂ ratio < 200 - shunt formula;
normally > 300

B/L infiltrates on CXR - white out

Elevated serum lactate levels - indicates
anaerobic metabolism, tissue hypoxia

No cardiac etiology for pulm. edema

Deterioration of ABG's despite intervention -
resistant to O₂

ARDS Management

GOALS:

- Correct the cause
- Prevent further damage
- Supportive care

Care bundles to improve outcomes

5 P's of ARDS:

- **Perfusion** (max O₂ transport)
- **Position**
- **Protective** lung vent.
- **Protocol** weaning
- **Prevent** complications

Mechanical ventilation

Fluid status: **RA/CVP, JVD, BP, urinary output**

Mechanical Ventilation

Improves O₂, figures out CO₂, buys time

Lowest FiO₂ possible, smallest TV possible

Modes of MV:

- **Volume cycled:** pushes air in until preset volume delivered
- **Time cycled:** pushes air in until preset time reached
- **Assist modes:** pt can assist but vent can take over work of breathing
- **Pressure support:** weaning mode; depends on pt's breathing (used for weaning)
- **Pressure control:** preset volume (based on age, sex, height)
- **Airway Pressure-Release Ventilation (APRV)**

Mechanical Ventilation (cont)

Weaning ASAP!

- Infection
- Dependent on machine
- Muscles dependent
- Vent may cause trauma (barotrauma, pressure trauma)

Positive End Expiratory Pressure (PEEP):
back pressure prevents alveolar collapse; helps to keep fluid out of alveoli

- Inc. PEEP = inc. intrathoracic pressure → dec. perfusion = dec. CO
- Affected intrathoracic pressure = organ failure

Management of Ventilated Patients

3 Priorities:

1) Monitor & evaluate pt response

- Vent setting, trach appropriately
- Assess s/s of distress (*lung sounds, chest expansion, ABC & disynchrony r/t proper setting [change vent settings]*)

2) Manage vent safely

- Not alone, daily CXR for placement

3) Prevent complications

- Oral care (*dec. bacteria*), turn & repo. (*changes lung perfusion*), VAP protocol (*elevate HOB >30°, aspiration precautions*), DVT prophylaxis, skin care

Note:

- Breath sounds should be equal & symm.
- Document safety, measurement

Proning: no shock, inc. ICP, unstable spine

Pharmacotherapy:

- **Antibiotics** (*if known microorganism*)
- **Bronchodilators** (*airway patency*)
- **Surfactant?** (*not really used, expensive*)
- **Corticosteroids?** (*immunosuppressed, glycemic control*)
- **Diuretics** (*dec. lung/general edema, watch electrolytes*)
- **Neuromuscular blocking agents** (*paralytic agents, sedatives = dec. work of breathing*)
- **Flolan?** (*new; inc. flow, V/Q mismatch*)
- **Epinephrine**
- **Low dose dopamine**

Management of Ventilated Patients (cont)

Ex. Neuromuscular Blocking Agents - propofol, Nimbex, + inotropes
+ Inotropes: dilate vascular bed = inc. CO (dibutamine, watch for dec. BP - r/t dose; vasopressors)

Nutrition:

- Dec. mortality, days of not eating → prophylactic enzyme release
- Avoid inc. carb feeds

Prevent complications - VAP, SIRS, MODS, DVT, infection, skin breakdown

Nursing Diagnoses

ARDS	Mechanical Vent
Impaired gas exchange	Risk for infection
Dec. tissue perfusion	Risk for injury - r/t airway
Airway clearance	Risk for injury - r/t immobility

NO ineffective breathing pattern