

### Acute Resp. Failure/Acute Lung Injury

**ARF:** sudden deterioration in pulmonary gas exchange = CO<sub>2</sub> retention & inadequate oxygenation

**paO<sub>2</sub> < 60 mmHg** (should be 80-100)

**paCO<sub>2</sub> 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 O<sub>2</sub> w/ resultant inadequate oxygenation

**Type 2 - Hypercapnic:** inadequate alveolar ventilation; marked elevation in paCO<sub>2</sub>

**Type 3 - Mixed Hypoxemic-Hypercapnic:** inadequate alveolar ventilation & abnormal O<sub>2</sub> 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** (gaspings)  
- Cerebral issue r/t O<sub>2</sub>

**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 paCO<sub>2</sub> < 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 O<sub>2</sub>

- Confusion

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

- Change in SpO<sub>2</sub>

- Lethargy (lose ability to protect airway)

- **Dyspnea**

- At risk for arrhythmias

- Change in renal status

*Bolded are the earliest signs*

### ARDS Diagnostic Criteria

**paO<sub>2</sub>-FiO<sub>2</sub> 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 O<sub>2</sub>

### ARDS Management

#### GOALS:

- Correct the cause
- Prevent further damage
- Supportive care

Care bundles to improve outcomes

5 P's of ARDS:

- **Perfusion** (max O<sub>2</sub> transport)
- **Position**
- **Protective** lung vent.
- **Protocol** weaning
- **Prevent** complications

Mechanical ventilation

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

### Mechanical Ventilation

Improves O<sub>2</sub>, figures out CO<sub>2</sub>, buys time

Lowest FiO<sub>2</sub> 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 & dysynchrony 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*)
- **Fiolan?** (*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
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Impaired gas exchange	Risk for infection
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Dec. tissue perfusion	Risk for injury - r/t airway
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Airway clearance	Risk for injury - r/t immobility
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#### NO ineffective breathing pattern