ARDS

- The acute respiratory distress syndrome (ARDS) is characterized by
- noncardiogenic pulmonary edema, lung inflammation, hypoxemia, and decreased lung compliance.

DEFINITION

- ARDS is a form of pulmonary edema characterized by severe hypoxemia that can rapidly lead to acute respiratory failure

- Acute onset
- Severe hypoxemia

- Diffuse bilateral pulmonary infiltrates on frontal chest radiograph
- Absence of left atrial hypertension OR pulmonary artery wedge pressure <18 mm Hg if measured

CAUSES

- The pathogenesis of ARDS is a result of two different pathways: a direct (pulmonary) insult to lung cells and an indirect (nonpulmonary)insult occurring as a result of an acute systemic inflammatory response.

CAUSES

- Examples of a **direct** lung injury include:
  - gastric aspiration
  - pneumonia
  - pulmonary contusion
  - near drowning
  - prolonged inhalation of high concentrations of oxygen, smoke, or toxic substances

- Examples of an **indirect** injury include:
  - sepsis
  - drug overdose
  - nonthoracic trauma
  - acute pancreatitis
  - disseminated intravascular coagulation.
  - shock (any cause)
  - fat embolism
  - uremia

- ARDS is caused by an insult to the alveolar-capillary membrane i,e includes injury to both the alveolar epithelium and pulmonary capillary endothelium.
- leads to alveolar edema.

The loss of epithelial integrity in ARDS leads to:

1. alveolar flooding.
2. injury to type II cells reduces the production and turnover of surfactant.
3. lead to sepsis in patients with bacterial pneumonia.
4. pulmonary fibrosis can develop.

Alveolar filling leads to decreased respiratory system compliance as well as functional right-to-left shunting and profound hypoxemia.

ARDS DEFINITION IS BASED UPON 5 KEY CLINICAL FEATURES:

(1) a risk factor for the development of acute respiratory distress(e.g., sepsis, trauma, severe pneumonia, aspiration, pancreatitis).

(2) severe hypoxemia despite a relatively high fraction of inspired oxygen (FIO2).

(3) decreased lung compliance.

(4) bilateral pulmonary infiltrates.

(5) lack of clinical evidence of cardiogenic pulmonary edema.

- and hypoxemia as measured by the ratio of the arterial partial pressure of oxygen (Pao2) to the fraction of oxygen inspired (Fio2).
- PaO2 = partial pressure of arterial oxygen; FiO2 = percentage of inspired oxygen. *—A normal person breathing room air (FiO2 = 0.20), whose PaO2 is approximately 100 mm Hg, would have a PaO2/FiO2 ratio of approximately 500.

- ARDS was the most severe form of ALI acute lung ijury and was diagnosed with Pao2/Fio2 of 200 or less.

SIGNS AND SYMPTOMS

- The acute phase of ARDS is marked by rapid onset of severe dyspnea, usually occurring12 to 48 hours after the initial injury

- The patient will experience arterial hypoxemia that doesn't respond to supplemental oxygen

- Other signs of ARDS include:
  - rapid, shallow breathing
  - intercostal retractions
  - altered mental status
    anxiety
  - tachycardia
  - decreased urine output
  - cyanosis
  - pulmonary crackles
  - hypotension

DIFFERENTIAL DIAGNOSIS

- Cardiogenic pulmonary edema.
- Alveolar hemorrhage.
- Pneumocystis carinii pneumonia.
- Acute interstitial pneumonia.

DIAGNOSTIC CRITERIA

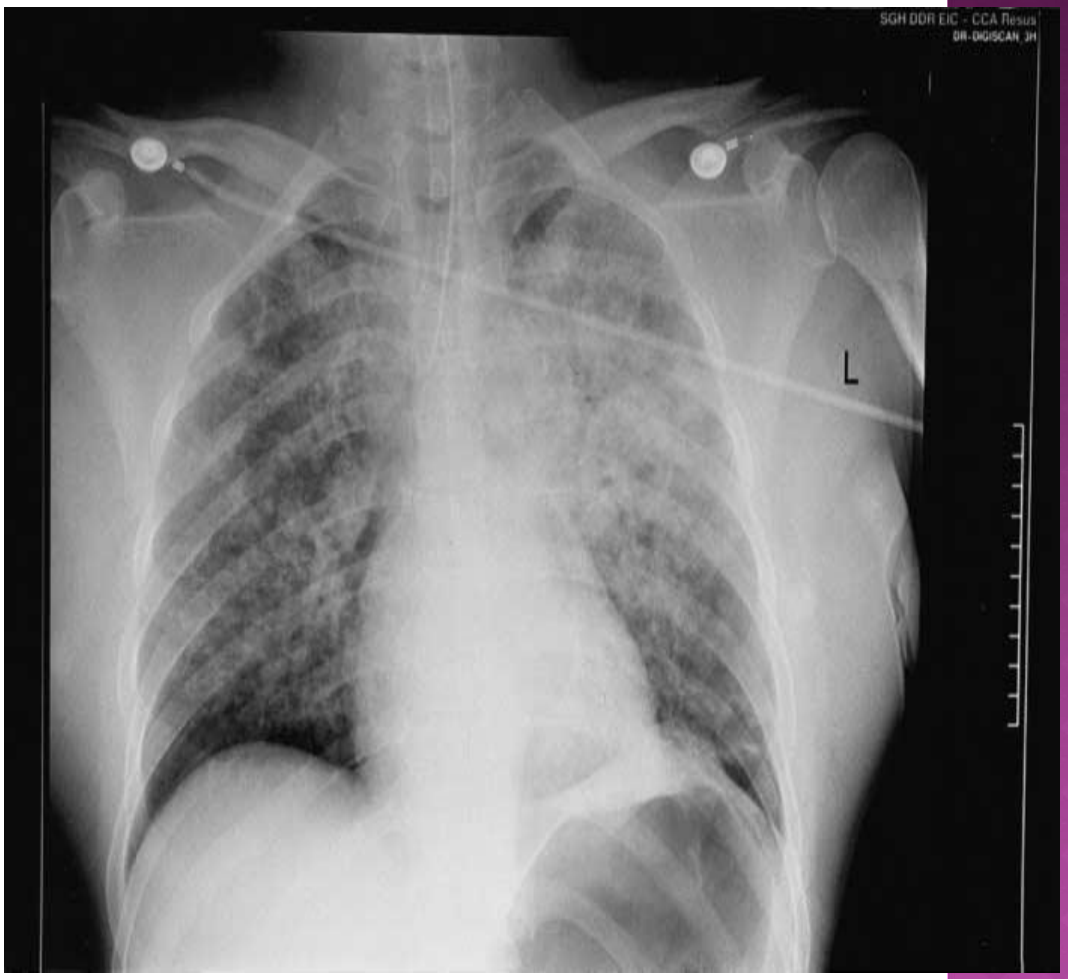
- Occurrence of an acute lung injury or a history of systemic or pulmonary risk factors
- Acute onset of respiratory distress
- Diffuse, bilateral infiltrates on chest X-ray
- Severe refractory hypoxemia, demonstrated by a P/F ratio of less than 200 mm Hg
- No clinical evidence of left-sided heart failure (left atrial hypertension), demonstrated by a PCWP of less than 18 mm Hg

INVESTIGATION

- ABG
- CXR
- CT scan of chest
- Brain natriuretic peptide — Measurement of plasma BNP may be helpful in distinguishing ARDS from cardiogenic pulmonary edema
- Echocardiography
- Pulmonary artery catheterization
- Other investigations to detect the underlying cause or to detect complications.

CHEST X RAY

Bilateral infiltrate sparing costophrenic angles



- The mortality rate for ARDS has fallen since the 1980s and is now about 35%.

GENERAL TREATMENT AND SUPPORT OF ARDS

- Treatment of **underlying cause** of lung injury

- Avoidance of **preventable complications** suchas venous thromboembolism and GI hemorrhage with appropriate prophylactic regimes
- Recognition and treatment of **nosocomial infections**
- Adequate **nutritional support.**
- **I/V fluid** only to maintain adequate cardiac output

MANAGEMENT STRATEGIES

- Treatment for ARDS primarily involves supportive care in the ICU, including:

- Supportive therapy almost always includes endotracheal intubation and mechanical ventilation with a low tidal volume, pressure-limited approach and low to moderately high PEEP (lung protective strategies).

MECHANICAL VENTILATORY SUPPORT LUNG PROTECTIVE STRATEGIES

- use low tidal volumes (6 mL/kg predicted body weight)
- Low tidal volumes are combined with the use of positive end-expiratory pressure (PEEP) at levels to achieve adequate oxygenation with the lowest FIO .
- Other techniques that may improve oxygenation while limiting alveolar distention include extending the time of inspiration on the ventilator and placing the patient in the prone position.

LUNG PROTECTIVE STRATEGIES

- The current ventilation strategy is to deliver a low tidal volume (titrate to 6 mL/kg) and low to moderately high PEEP (5 to 20 cm H_2O) to keep the alveoli open and diminish the negative effects of high-pressure settings

DRUG THERAPY

- A gold standard medication regimen for ARDS has yet to be developed
- Antibiotic therapy is often used in the treatment of sepsis-related ARDS or to treat confirmed or suspected underlying infection
- A diuretic may be used to increase renal excretion of water, which decreases pulmonary interstitial and alveolar edema
- A mechanically ventilated patient may need to be sedated
- The administration of fluids in patients with ARDS remains somewhat controversial

NUTRITIONAL SUPPORT

- Nutritional support is critical for the patient with ARDS
- Because metabolic demand is high, his caloric needs will be increased; enteral nutrition is preferred
- Enteral nutrition formulas have been developed that provide a large amount of fat calories rather than carbohydrates

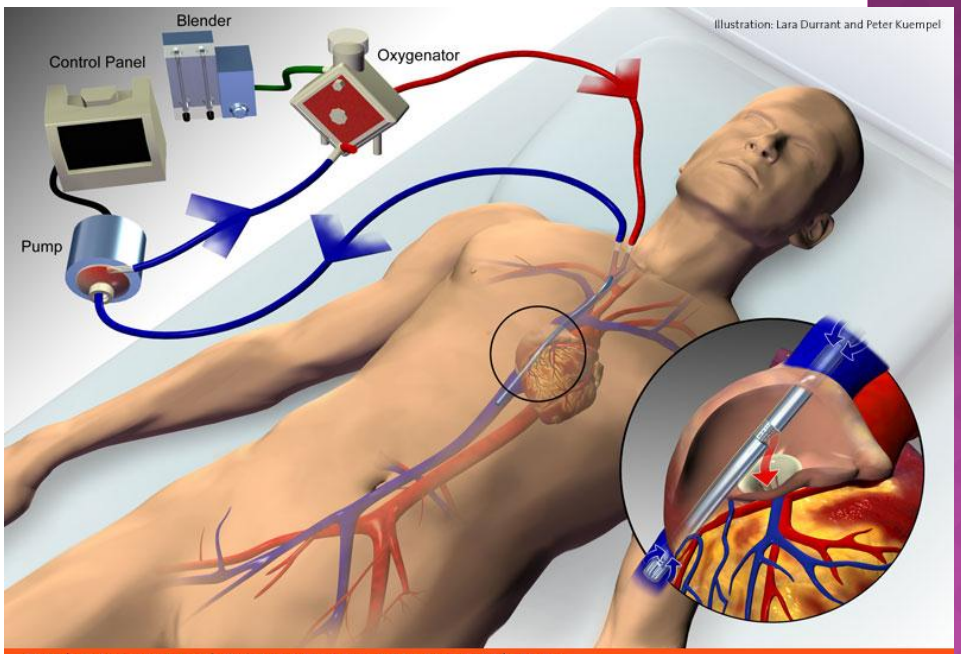
PRONE POSITIONING

- Prone positioning is a treatment modality that can be used for mechanically ventilated patients with ARDS who require high FiO_2 levels.

- Prone positioning may potentially trigger complications, such as pressure ulcers, corneal abrasions, and brachial nerve injury

ECMO

- ECMO, extracorporeal membrane oxygenatio



Single-site approach to venovenous ECMO cannulation:
A dual-lumen cannula is inserted in the internal jugular vein (extending through the right atrium and into the inferior vena cava). Venous blood is withdrawn through one "drainage" lumen with ports in both the superior and inferior vena cava. Reinfusion of oxygenated blood occurs through the second lumen, with a port situated in the right atrium. Inset: The two ports of the "drainage" lumen are situated in the superior and inferior vena cavae, distant from the reinfusion port. The reinfusion port is positioned so that oxygenated blood is directed across the tricuspid valve and directly into the right ventricle. This arrangement significantly reduces recirculation of blood when the cannula is properly positioned.

OTHER

- ***Continuous lateral rotational therapy*** —involves placing the patient in a bed that turns or repositions him from one side to the other; it's recommended that rotational therapy be performed a least 18 hours/day for optimal effectiveness

- ***Partial liquid ventilation***—involves gradually filling the lungs with a fluid called perfluorocarbon, which is believed to help carry oxygen to areas of the lungs that are filled with fluid and other substances; the patient must be sedated for this treatment

- ***Corticosteroids***—the use of steroids to reduce inflammation in ARDS remains controversial;

- ***Inhaled NO gas***—NO may be used as a rescue therapy for refractory hypoxemia in ARDS because it relaxes vascular smooth muscle, reducing pulmonary hypertension and improving oxygenation; the benefits generally don't last more than 24 hours

- ***Surfactant replacement therapy***—this therapy has been used successfully in neonates with respiratory distress syndrome but the effectiveness in adults remains unclear.

- thanx