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### Acute Respiratory Distress Syndrome

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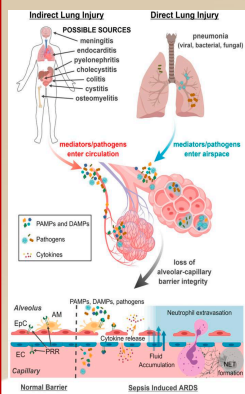
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# Acute Respiratory Distress Syndrome

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## What is the Topic?

- Acute Respiratory Distress Syndrome (ARDS)



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## Why choose ARDS?

- ARDS is a prevalent and complex disease process that is managed by bedside nurses and advanced practice nurses in the critical care unit
- ARDS is characterized as an inflammatory process in the lungs, resulting from a direct or indirect injury to the lung, that manifests as hypoxic respiratory failure (Stoelting, Hines, & Marshall, 2018, p. 40)
- It affects 190,000 Americans annually (Drahnak, 2015)
- Mortality ranges from 20-40% (Drahnak, 2015)
- ARDS is a complicated diagnosis and requires a multimodal approach to manage

## Presentation of Case/Process

**Hospital day 1:** A 57 year old male presents to the emergency room complaining of shortness of breath, a productive cough, and chest pain. His vital signs read: HR 101, BP 110/70, O2 saturation 86% on room air, RR 26. The patient is placed on bipap and admitted to the stepdown unit. He is diagnosed with community acquired pneumonia.

**Hospital day 2:** The patient has a worsening respiratory status and altered mental status overnight. Vital signs read: HR 118, BP 90/54, O2 saturation 84% on 100% bipap, RR 32. Respirations are labored and the patient is using accessory muscles to breathe. Bilateral rhonchi are present upon auscultation. The patient was given 1L 0.9% NS. The patient's ABG results are: pH: 7.30, CO2: 50, PaO2: 59, HCO3: 26. The chest X-ray shows bilateral infiltrates. The patient is taken to the ICU and intubated.

**Hospital day 3:** The patient's condition is worsening and clinicians are having a difficult time oxygenating the patient. Overnight, the patient's oxygen saturation remained in the 80's. The patient's vital signs read: HR 120, BP 86/49, O2 saturation 87%, RR 28. The patient is started on a Levophed drip to maintain blood pressure. The patient's ventilator settings are TV 400/PEEP 10/RR 28/FiO2 90%. The patient's ABG results are: pH: 7.33, CO2: 47, PaO2: 59, HCO3: 27. Following this ABG, the nurse practitioner increased the PEEP to 12 and the FiO2 to 100%. An ABG is obtained 30 minutes later and the patient is still hypoxic with a PaO2 of 61 and his O2 sats are 87%. A chest X-ray shows worsening bilateral infiltrates. The patient classifies as having severe ARDS with a PaO2/FiO2 ratio of < 100mmHg. The decision is made to prone the patient. The nurse prepares for pronation and the patient is prone within 30 minutes. After being prone for 20 minutes, the patient's O2 saturation is 92%. An ABG is obtained and the results are: pH: 7.36, CO2: 44, PaO2 72, HCO3: 25. The patient is left in the prone position for 24 hours before trialing supine position. Once the patient tolerates supine position, the ventilator settings are beginning to be weaned.

## Underlying Pathophysiology

- ARDS results from a direct or indirect injury to the lungs (Drahnak, 2015)
- Direct causes include:
  - Pneumonia
  - Aspiration
  - Inhalation injury
  - Pulmonary contusion
  - Near drowning (Drahnak, 2015)
- Indirect causes include:
  - Sepsis
  - Blood transfusion
  - Shock
  - Burns
  - Drug overdose
  - Cardiopulmonary bypass
  - Severe trauma (Drahnak, 2015)
- Sepsis is the most common cause of ARDS (Keddissi, Youness, Jones, & Kinasewitz, 2019)
- There is injury to the alveolar epithelium and pulmonary vasculature (Drahnak, 2015)
- This leads to increased permeability causing edema around the alveoli (Drahnak, 2015)
- Damage to the type II alveolar cells causes surfactant to be rendered inactive (Drahnak, 2015)
- Inflammatory cells (macrophages and neutrophils) accumulate in the interstitium (Fujishima, 2014)
- Interleukin-8 has been identified as the main chemotactic factor for neutrophils (Nagelhout & Plaus, 2014)
- Proinflammatory cytokines and tumor necrosis factor are released into the lung (Fujishima, 2014)
- Phospholipids are converted into prostaglandins and leukotrienes by the enzyme cyclooxygenase and lipoxygenase (Nagelhout & Plaus, 2014)
- Prostaglandins are believed to mediate pulmonary vasoconstriction and can cause airway constriction (Nagelhout & Plaus, 2014)

## Significance of Pathophysiology

- Inactive surfactant leads to:
  - Atelectasis
  - Decreased lung compliance
  - Refractory hypoxia
  - Respiratory failure
  - Impaired gas exchange (Drahnak, 2015)
- Edema in the interstitial fluid compresses the alveoli and leads to alveolar collapse (Drahnak, 2015)
- Alveolar collapse and damage to the alveolar-capillary membrane leads to difficulty oxygenating and ventilating the patient adequately (Nagelhout & Plaus, 2014)
- Prolonged alveolar hypoxia and hypercapnia along with injury to the alveolar tissue can lead to increased pulmonary vascular resistance (Nagelhout & Plaus, 2014)
- Cor Pulmonale develops in 25% of cases due to high pressure in the lungs (Nagelhout & Plaus, 2014)

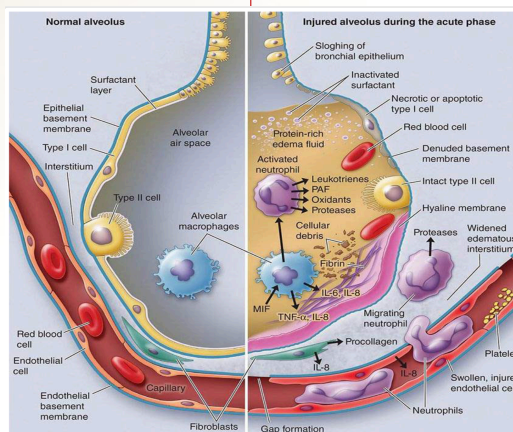
## Signs and Symptoms

Signs and symptoms of ARDS include:

- Dyspnea
- Hypoxemic respiratory failure
- Often patients require mechanical ventilation (Nagelhout & Plaus, 2014)
- Bilateral radiographic infiltrates on chest X-ray (Keddissi et al., 2019)
- Consolidation with alveolar filling shown on a chest CT scan (Keddissi et al., 2019)
- Signs and symptoms must be shown within one week of a known clinical insult or new or worsening respiratory symptoms (Drahnak, 2015)
- Edema is present that cannot be explained by a cardiac origin (Drahnak, 2015)
- P/F ratio criteria as follows:

|             |   |
|-------------|---|
| Oxygenation | 200 mm Hg < PaO <sub>2</sub> /F <sub>i</sub> O <sub>2</sub> < 300 mm Hg with PEEP or CPAP > 5 cm H <sub>2</sub> O |
| Moderate    | 100 mm Hg < PaO <sub>2</sub> /F <sub>i</sub> O <sub>2</sub> < 200 mm Hg with PEEP > 5 cm H <sub>2</sub> O         |
| Severe      | PaO <sub>2</sub> /F <sub>i</sub> O <sub>2</sub> ≤ 100 mm Hg with PEEP > 5 cm H <sub>2</sub> O                     |

Retrieved from Drahnak, 2015



A normal alveolus (left) and a damaged injured alveolus in the acute phase of acute respiratory distress syndrome (right). Retrieved from [http://www.davidardling.info/encyclopedia/A/acute\\_respiratory\\_distress\\_syndrome.html](http://www.davidardling.info/encyclopedia/A/acute_respiratory_distress_syndrome.html)

## Implications for Nursing Care

- There are many nursing implications for managing patients with acute respiratory distress syndrome
- One of the more prominent treatment modalities for patients with ARDS is to place them in prone position (Drahnak, 2015)
- In the prone patient, the nurse must maintain a patent airway, perform frequent skin assessments, maintain adequate sedation, and perform frequent respiratory assessments (Drahnak, 2015)
- The nurse must hold enteral feeding prior to pronation (Drahnak, 2015)
- Additionally with a prone patient, the nurse must educate the family, as this can be difficult for family members to see (Drahnak, 2015)
- The nurse must be aware that increased PEEP is usually used in patients with ARDS (Drahnak, 2015)
- The nurse must understand that the patient needs optimal fluid volume status (Keddissi et al., 2019)
- Another treatment modality the patient might see is extracorporeal membrane oxygenation (ECMO) and must know how to manage this type of patient (Sahetya, Brower, & Stephens, 2018)
- The patient may be on antiplatelet therapy (Wang et al., 2016)

## Conclusions

In conclusion, acute respiratory distress syndrome is a complex and serious condition that patients develop. Managing a patient with ARDS requires a thorough understanding of the pathophysiology and the different treatment modalities available.

It is a prevalent disease that affects many Americans each year and has a high mortality rate. Early identification of the signs and symptoms is key to managing this patient. Nurses must remain vigilant in assessing the patient and pay close attention to nursing considerations when managing a patient with ARDS

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