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Acute Respiratory Distress Syndrome

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Pathophysiology of ARDS

Introduction

Acute respiratory distress syndrome (ARDS) is a lung condition characterized by acute hypoxemia and bilateral infiltrates after a triggered injury (Senapathi et al., 2020). ARDS causes damage to pulmonary capillaries leading to fluid accumulating in the alveoli. The accumulation of fluid in the alveoli causes an increase in work of breathing and systemic hypoxemia ultimately leading to mechanical ventilation. ARDS has a high mortality rate of 35-46% (Weiss et al., 2021). Those who do survive ARDS can have permanent lung damage and continued health problems (McCance & Huether, 2014).

ARDS has become more prevalent with the 2020 Covid-19 pandemic. "COVID-19 causes acute respiratory distress syndrome (ARDS) in approximately 20% of hospitalised subjects with Covid-19" (Weiss et al., 2021, p. 49). Covid-19 is a global pandemic that has affected more than 200 countries, resulting in 1.1 million deaths so far (Weiss et al., 2021).

Underlying Pathophysiology

Lung injury due to ARDS causes release of inflammatory mediators including platelet-activating factors, complement cytokines, arachidonic acid metabolites, and reactive oxygen species (McCance & Huether, 2014). These inflammatory mediators cause damage to the lung epithelium causing damage to lung capillaries. Neutrophils play a large role in the progression of ARDS by releasing more inflammatory mediators that cause more damage to lung capillaries increasing capillary permeability. This increase in pulmonary capillary permeability causes proteins, fluids, and blood cells to leak into the pulmonary interstitium resulting in pulmonary edema. The increased pulmonary edema causes decreased lung compliance and impairs alveoli ventilation. Once the alveoli are damaged, they can no longer produce surfactant leading to atelectasis (McCance & Huether, 2014).
After about 2 to 3 weeks of injury remodeling and fibrosis begins to occur further damaging the alveoli. Persistent hypoxemia and hypercapnia lead to respiratory failure, metabolic acidosis, multiple organ failure and eventual death (McCance & Huether, 2014).

Significance of Pathophysiology

It is important to understand the pathophysiology of ARDS due to the high mortality rate and the risk of permanent damage to the body. Understanding the pathophysiology and signs and symptoms can help diagnosis ARDS early before there is significant damage to the lungs.

Treatment Strategies

- Early detection
- Management of contributing etiologies
- Support therapy to stop progression of lung injury
- Prevent complications such as pneumonia and peptic ulcers

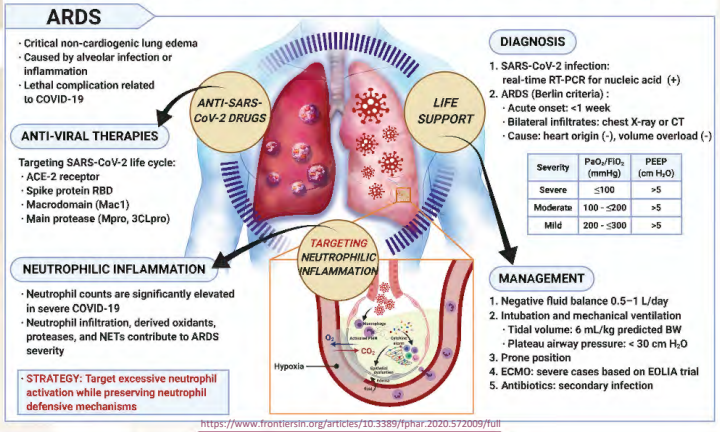
(McCance & Huether, 2014)

Therapies

- Mechanical ventilation with PEEP and high oxygen concentrations
- Prone positioning
- Deep sedation and paralytics
- Low-volume ventilation

(Xie et al., 2020)

Targeting neutrophils for COVID-19 associated ARDS



https://www.frontiersin.org/articles/10.3389/fphar.2020.572009/full

Risk Factors

- Genetic factors
- Sepsis
- Multiple trauma
- Aspiration
- Pneumonia
- Burns
- Cardiopulmonary bypass surgery
- Radiation therapy
- Overdose
- Smoking
- Pancreatitis
- Disseminated intravascular coagulation (DIC)

(McCance & Huether, 2014)

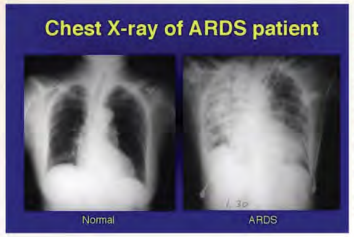
Signs and Symptoms

- Acute onset of bilateral infiltrates on x-ray
- Low ratio of partial pressure of arterial oxygen to the fraction of inhaled oxygen
- Fine inspiratory crackles

(McCance & Huether, 2014)

- Shortness of breath
- Refractory hypoxia
- Tachypnea
- Tachycardia
- Fatigue
- Fever
- Altered mental status

(NIH, 2019)



https://www.hmedtool.com/us/lessons/teach/Fire-Breathing/Introduction-1/Firebreather&-39;s-Lung-or-ARDS

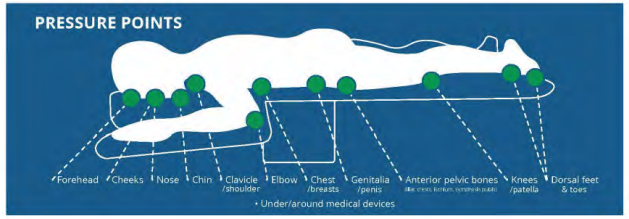
Prone Positioning

Prone positioning can be used as a therapy for the management of ARDS. Patient positioning can play a large role in improving lung oxygenation. Prone positioning can help by:

- Improving ventilation and perfusion
- Move fluid in the lungs to improve ventilation
- Improve atelectasis

(NIH, 2019)

Prone positioning can either be achieved manually with three or more nurses and a respiratory therapist, watching the airway, or by an automatic prone positioning device such as the Rotaprone bed. When placing a patient in the prone position it is important to apply foam pressure injury prevention stickers in high pressure areas (Morata et al., 2021) .



https://www.medline.com/skin-health/npiap-wants-know-prone-positioning-covid-19-patients/

Nursing Implications

Nurses play a large role in early detection of ARDS and can have an impact in the management of the disease. Some implementations that nurses can apply are:

- Assessing for signs of sepsis
  - Fever
  - Tachycardia
  - Altered mental status
  - Tachypnea
  - Hypoxia
  - Diaphoresis

(McCance & Huether, 2014)

- Maintain the airway
- Frequent change in patient positioning
- Weaning protocol
- Pulmonary toileting
- Monitor frequent arterial blood gases

(NIH, 2019)

- Prevent complications
  - Pressure injury prevention
  - Patient oral hygiene
  - Nurse hand hygiene
  - Adequate patient nutrition
  - SCD device to prevent deep vein thrombosis

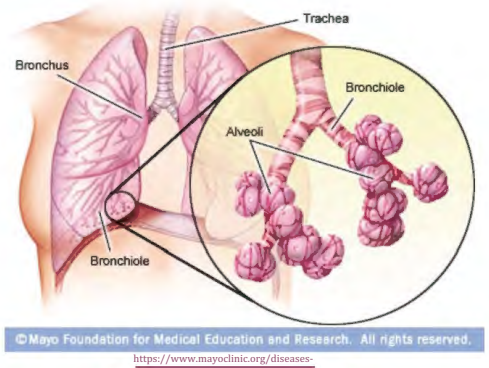
(NIH, 2019)

- Administer ordered medications
  - Steroids to help with inflammation
  - Antibiotics
  - Fluids or vasopressors

(NIH, 2019)

Conclusion

ARDS is a serious life-threatening condition that is crucial for health care professionals to understand. By understanding the pathophysiology of ARDS and knowing the signs and symptoms can aid in early detection and prevention of severe lung injury. It is imperative for the bedside nurse to detect early signs of ARDS due to the high mortality rate and long-lasting effects of the disease.



https://www.mayoclinic.org/diseases-conditions/ards/symptoms-causes/syc-20355576

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Additional Sources

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