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Acute Respiratory Distress Syndrome

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Introduction

- Acute Respiratory Distress Syndrome (ARDS) burdens intensive care units (ICU) and their patients across the world.
- Despite advances in treatment, mortality rates remain over forty-percent (Keddissi, Youness, Jones, & Kinasewitz, 2019).
- Even if patients survive the disease, they can have frequent hospital readmissions and deteriorations in their physical health (Wozniak, Pfoh, Dinglas, Pronovost, Needham, & Colantuoni, 2019).
- ARDS occurs due to an inflammatory process within the lungs due to either direct or indirect lung injury (Stoelting & Hiller, 2015).
- ARDS most often presents with acute hypoxemic respiratory failure and usually occurs in already hospitalized patients (Keddissi, Youness, Jones, & Kinasewitz, 2019).
- Common causes of ARDS include, but are not limited too:
    - Sepsis
    - Pneumonia
    - Aspiration of gastric contents
    - Blunt trauma to the lungs

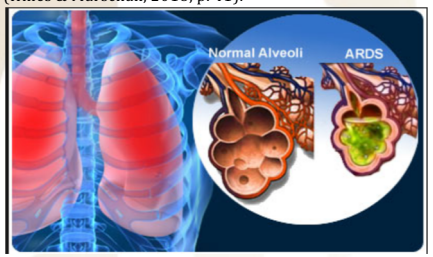
  (Hines & Marschall, 2018)

Signs & Symptoms

ARDS often presents itself through patient symptoms such as refractory hypoxemia, dyspnea, tachypnea, tachycardia, crackles, confusion and cyanosis (Siegel, 2018a). The Berlin Definition of ARDS currently guides diagnosis and helps determine the severity of the disease (Hines & Marschall, 2018). The criteria include:

- "Lung injury of acute onset with 1 week of an apparent clinical insult and with progression of pulmonary symptoms
- Bilateral opacities on lung imaging not explainable by other lung pathology
- Respiratory failure not explained by heart failure or volume over- load
- Decreased arterial PaO2/FiO2 ratio- Mild ARDS: ratio is 201–300; Moderate ARDS: ratio is 101–200; Severe ARDS: ratio is <101"

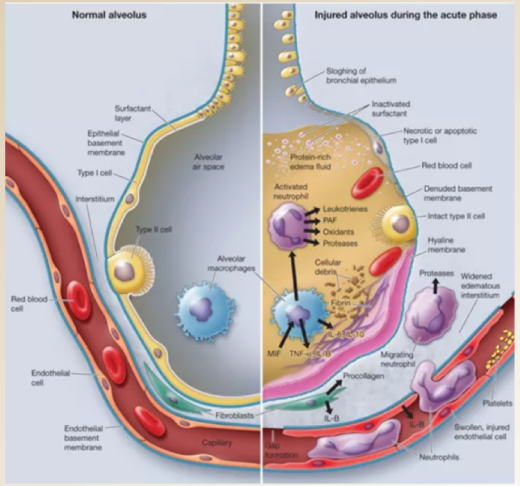
(Hines & Marschall, 2018, p. 41).



(Hacking, n.d.)

ARDS Pathophysiology

Normal lung function requires that inflated alveoli are in contact with well perfused blood vessels, so that oxygen and carbon dioxide diffusion can occur across the alveolar-capillary membrane (ACM) (Siegel, 2018b). The ACM is semi-permeable, so fluid can cross depending on hydrostatic and osmotic pressures, but proteins remain in the vasculature (Siegel, 2018b).



(Gas Exchange Alveoli. n.d.)

Tissue Injury and Inflammation

Regardless of the initiating event, when an injury occurs to the lungs and ARDS develops, it is a result of widespread alveolar damage (Siegel, 2018b). This tissue damage leads to a release of inflammatory cytokines such as tumor necrosis factor, interleukin (IL)-1, IL-6, and IL-8 (Siegel, 2018b). These cytokines communicate with the immune system and recruit neutrophils and T cells to the lungs where they infiltrate alveoli and lung tissue (Kyung, 2017). Neutrophils release cytotoxic material including granular enzymes, reactive oxygen species, and cytokines, which cause tissue injury and cell death (Fujishima, 2014). Damage to the ACM allows proteins to leak out of the vascular space which causes a loss of osmotic gradient in the capillaries (Siegel, 2018b). This results in fluid and blood leaking into the alveoli. The previously air filled alveolar sacs become filled with a bloody, proteinaceous fluid (Fujishima, 2014). Additionally, alveolar collapse occurs due to loss of surfactant (Siegel, 2018b).

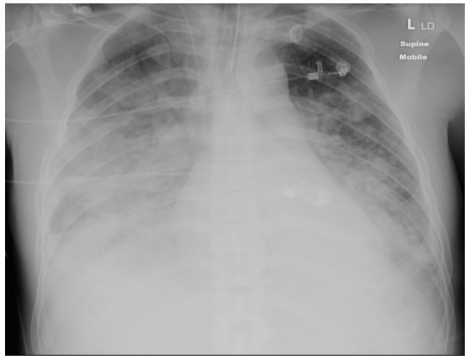
Significance of Pathophysiology

The tissue injury and inflammatory process that takes place during ARDS is extremely detrimental to the patient and especially their respiratory function.

Impaired gas exchange is a major consequence of this pathophysiology. It results due to a ventilation-perfusion mismatch which occurs, because the patient is perfusing, but can not ventilate and diffuse oxygen across the alveoli (Siegel, 2018b). Carbon dioxide (CO_2) elimination is also impaired due to decreased diffusion (Siegel, 2018b). This explanation is the reason why a major sign of ARDS is refractory hypoxemia – the patient's arterial oxygen levels do not improve despite increasing oxygen requirements (Siegel, 2018a).

ARDS also results in a decrease in lung compliance (Keddissi, Youness, Jones, & Kinasewitz, 2019). The loss of compliance is due to both the decrease in pulmonary surfactant, as well as the stiffness of the lungs due to their lack of ventilation (Siegel, 2018b). The lungs can no longer expand as usual or account for the increased pressure from inhalation. Special consideration must be taken for patients on the ventilator, because high tidal volumes can result in further damage to the alveoli and lung tissue (Hafiz, Stahl, & Zahtabchi, 2019).

Pulmonary hypertension is another common element in patients with ARDS (Kallet 2015). It occurs in about 25% of patients with ARDS who are mechanically ventilated and results from hypoxic vasoconstriction, vascular compression from positive pressure ventilation, tissue destruction, and increased CO_2 levels (Siegel, 2018b). An echocardiogram will most likely show right heart strain as the heart tries to overcome the resistance of the lungs (Hines & Marschall, 2018).



(Acute Respiratory Distress Syndrome, 2016)

Nursing Implications

- Most often patients suffering from ARDS require mechanical ventilation and therefore, will be in the intensive care unit.
- Understanding the signs and symptoms as well as the progression of the disease is crucial for early diagnosis and appropriate treatment.
- Current treatment is centered around supportive care, improving the patient's hypoxic state, and treating the underlying cause (Hines & Marschall, 2018).
- Current research shows the benefit of lung-protective strategies: low tidal volume, plateau pressures < 31 cmH20, and appropriate PEEP (Hafiz, Stahl, & Zahtabchi, 2019). Nurses must work closely with the respiratory therapists to ensure appropriate ventilator settings.
- In patients with severe ARDS, extracorporeal membrane oxygenation (ECMO) may be used as adjunctive therapy (Kallet, 2015). If ECMO is sufficient enough to maintain a patient's oxygenation and ventilation, then the patient can be liberated from the ventilator sooner (Parekh, Abrams, Brodie, & Yip, 2018). This aids in the achievement of lung-protective ventilation and can have a significant impact on patient outcomes.
- Fluid management in ARDS patients remains a major challenge for physicians and nurses. Generally, a conservative approach to fluid management is the most beneficial (Keddissi, Youness, Jones, & Kinasewitz, 2019). However, ARDS patients are often suffering from conditions such as sepsis, so the patient may need fluids in order to avoid hypotension and maintain perfusion (Keddissi, Youness, Jones, & Kinasewitz, 2019).
- Prone positioning has become a standard of treatment for patients with ARDS due to its beneficial effects on gas exchange and lung recruitment (Kallet, 2015). Early intervention with prone positioning is more effective, so nurses must be vigilant if ARDS is suspected and be able to suggest the use of pronation (Kallet, 2015).

Conclusion

ARDS is a condition with a high mortality rate that requires exceptional interprofessional teamwork and knowledge (Siegel, 2018b). It is essential that nurses have an understanding of the entire pathophysiological process, because early detection could save a patient's life. Because nurses work at the beside with patients, they must be the eyes and ears for physicians in order to notice small changes in the patient's conditions. Research must continue in order to develop the most efficient standard of care to improve mortality rates among this patient population. Staff education is crucial to ensure prompt diagnosis and treatment.

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