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Fall 2014

### Acute Respiratory Distress Syndrome

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#### Recommended Citation

Flowers, Brian, "Acute Respiratory Distress Syndrome" (2014). *Nursing Student Class Projects (Formerly MSN)*. 5.

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# Acute Respiratory Distress Syndrome

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## Introduction

In healthcare, there are many interesting and intriguing conditions that are vital to understand from both a clinical and a pathophysiological standpoint. Comprehending and knowing how to treat these conditions effectively, ultimately leads to the best care and patient outcomes. As a current critical care nurse and future advanced practice nurse, it was important to select a research topic of interest to explore that would benefit a high risk group of patients. Based on this precedent, acute respiratory distress syndrome (ARDS) was chosen. As a critical care nurse, exposure to respiratory conditions and mechanical ventilation management is something nurses are subjected to each day in practice. Having a further understanding of the underlying pathophysiology of acute respiratory distress syndrome and identifying the common signs and symptoms associated is the end objective. Dissecting and examining this condition from a pathophysiological stand point will lead to significant research that can be extremely beneficial in the clinical setting. As a health care provider and future advanced practice nurse, it is evident that obtaining this type of pathophysiological research related to acute respiratory distress syndrome will only pose positive implications for nursing care now and in the future based on the advanced knowledge and care improvements that will result.

Acute respiratory distress syndrome (ARDS) is a unique medical condition that has various clinical signs and symptoms and direct and indirect causes. Hariprashad and Rizzolo (2013) describe acute respiratory distress syndrome as "an acute-onset, progressive, diffuse, inflammatory lung injury that causes increased pulmonary vascular permeability or leaky capillaries within the lung, impairing ventilation and leading to hypoxemia" (p. 23). There are a distinct set of common signs and symptoms that are associated with the development of acute respiratory distress syndrome. Specific signs and symptoms include a patient presenting with dyspnea, severe hypoxia, cyanosis, tachypnea, tachycardia, diaphoresis, accessory muscle use with respirations, chest pain, diffuse crackles on auscultation, decreased lung compliance, and a cough (Fujishima, 2014). Clinical manifestations of acute respiratory distress syndrome normally appear within 6 to 72 hours after the causative event and are associated with a hallmark sign of bilateral fluffy or white infiltrates on a chest radiograph (Hariprashad and Rizzolo, 2013).



FIGURE 3. Chest radiograph showing infiltrates in a patient with ARDS

In relation to the development of acute respiratory distress syndrome, there are numerous direct and indirect causes. Direct causes are due to direct lung injury and include pneumonia, aspiration of gastric contents, inhalation injury, pulmonary contusion, fat embolism, near drowning event, and reperfusion pulmonary edema post lung transplantation or pulmonary embolectomy (Udobi et al., 2003).

## Signs and Symptoms

Indirect causes are due to indirect lung injury and include sepsis which is most common, severe trauma, acute pancreatitis, massive transfusions, cardiopulmonary bypass, and drug overdose (Udobi et al., 2003). Presentation of a patient with acute respiratory distress syndrome including the multiple signs and symptoms associated are an immediate and progressive result of the underlying pathophysiology of this syndrome.

## Underlying Pathophysiology

Following a direct or an indirect injury or insult to a patient's lung, the resulting pathophysiologic presentation of acute respiratory distress syndrome occurs. According to Hariprashad and Rizzolo (2013), acute respiratory distress syndrome is caused by damage to the affected lung alveoli leading to acute inflammation of the alveolar walls and hyaline membranes after direct or indirect injury. After the initial lung insult, proinflammatory cytokines are released which aid in recruiting neutrophils to the lungs. Once the activated neutrophils reach the lungs they release toxic mediators that damage the pulmonary capillary endothelium and alveolar epithelium which causes pulmonary edema due to loss of oncotic proteins from the intravascular space (Hariprashad and Rizzolo, 2013). Losing oncotic proteins from the intravascular space also leads to a malfunction of the oncotic gradient that normally aids in reabsorption of fluid and in result leads to a release of fluid into the interstitial space. Typical physiological fluid clearance in the lung is also altered or destroyed and leads to lung tissue edema infused with blood and proteins. Working surfactant in the lungs is lost and results in underlying alveolar collapse (Hariprashad and Rizzolo, 2013). Ventilation-perfusion mismatch occurs causing impaired gas exchange in the lung as well as shunting of blood which leads to hypoxemia. Physiological dead space is also increased and ultimately decreases the elimination of carbon dioxide from the body resulting in respiratory acidosis, decreased level of conscious and altered hemodynamics such as hypotension and decreased respiratory rate (Hariprashad and Rizzolo, 2013). Impaired pulmonary compliance is a classic hallmark sign of acute respiratory distress syndrome. Decrease in pulmonary compliance is caused by stiffness of an inadequate or completely non-aerated lung. Insufficient lung expansion during inhalation occurs due to this stiffness. Ultimately, this alters the normal pressure-volume capability of working lung tissue in a negative way causing increased airway pressures (Hariprashad and Rizzolo, 2013). A right-to-left shunt occurs due to the loss of aeration in the lung. As progressively less gas is retained in the alveoli, the blood circulating through the alveolar capillaries is increasingly less oxygenated producing an enormous

intrapulmonary shunt (Hariprashad and Rizzolo, 2013).

In addition to the underlying pathophysiology previously mentioned, acute respiratory distress syndrome proceeds through three different progressive stages. According to Walkey et al. (2012), progression of acute respiratory distress syndrome includes three cohesive stages known as the exudative stage, proliferative stage, and fibrotic stage. A direct or indirect lung injury initiates the exudative phase which is characterized as the acute inflammation stage of this syndrome when proinflammatory cytokines are released, and activated neutrophils cause damage to the endothelial cell barrier that mediates substance in and out of the cell and tissue. Respiratory failure can occur during this phase due to edema in the distal airspaces and a lack of surfactant from type two epithelial cells (Walkey et al., 2012). Following the exudative phase is the proliferative phase which occurs two to seven days after the initial lung injury. This phase is identified by the proliferation of type two pneumocytes, thickening of alveolar capillaries, and early fibrotic changes (Walkey et al., 2012). In some patients, the third phase known as the fibrotic phase occurs and is characterized by a ventilation-perfusion mismatch, increased collagen accumulation, and decreased lung compliance (Walkey et al., 2012). Understanding of the underlying pathophysiology and the recognition of the potential direct and indirect causes of lung injury related to respiratory distress syndrome is essential and significant when diagnosing and treating patients in the clinical setting.

## Significance of Pathophysiology

Acute respiratory distress syndrome is a unique and serious pulmonary condition. Identifying and outlining the pathophysiology of this syndrome is extremely important when educating health care professionals, planning for pharmacological treatment, and when developing an affective plan of care for patients diagnosed with this condition. Without a clear detailed knowledge base of what occurs at the cellular level during acute respiratory distress syndrome, treating and caring for patients with ARDS would be very difficult and ultimately unsafe. Healthcare practitioners in all areas of specialty should be aware of and have a general foundation of knowledge about the pathophysiology of this severe respiratory condition and how it manifests and what risk factors and signs and symptoms are associated.

## Implications of Nursing Care

Advanced clinical knowledge and treatment methods of a vast majority of medical conditions are extremely important for healthcare professionals such as nurses, advanced practice nurses and physicians. As future advanced practice nurses, an adequate pathophysiological foundation in regards to these conditions is even more essential in understanding why patients are treated how they are for different medical illnesses. Without the underlying pathologic knowledge, practitioners of all types would not have the bases and critical thinking capacity to anticipate what may occur next in a medical condition or syndrome and how to prevent it from worsening or progressing. Acute respiratory distress syndrome is a condition that can be seen and diagnosed in a number of healthcare settings. Advanced practice nurses such as nurse practitioners, nurse anesthetists, and clinical nurse leaders can benefit immensely from having a strong knowledge base underlying pathophysiology, clinical signs and symptoms, and potential causes of acute respiratory distress syndrome. Having this background solidified is crucial in order to recognize and provide the best care possible for patients who develop this syndrome, in order to ensure the best possible patient outcome and return to physiological homeostasis.

## Conclusion

Acute respiratory distress syndrome is a clinical condition that can occur in any patient and is associated with numerous direct and indirect causes of acute lung injury as the igniter of its pathophysiology and further development. Identifying related signs and symptoms of this disorder can help lead to early diagnosis and treatment and can potentially lead to better patient outcomes. Having a further understanding of the underlying pathologic process of acute respiratory distress syndrome is essential and will lead to more efficient care and advanced critical thinking skills while diagnosing and treating this specific syndrome. Healthcare professions such as nurse practitioners, nurse anesthetists, and clinical nurse leaders can benefit significantly by having a defiant knowledge base of clinical precursors and pathophysiology related to the cause, development and furthermore the appropriate treatment and care for patients who are suffering from acute respiratory distress syndrome.

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