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Acute Respiratory Distress Syndrome

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What topic?

Acute Respiratory Distress Syndrome (ARDS)

- Inflammatory response causing diffuse alveolocapillary membrane damage (McCance & Huether, 2018)

Why ARDS?

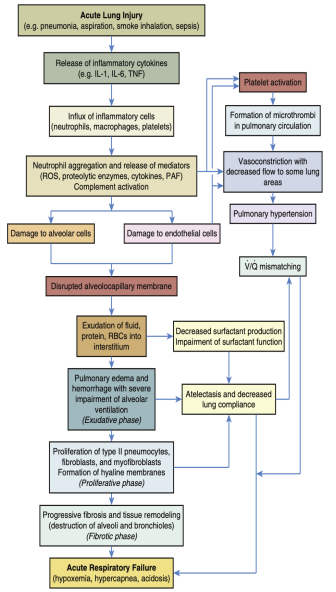
- Mortality rates up to 40% (Jin et al., 2020)
- "The cause of death for patients in ARDS is not usually pulmonary related but extrapulmonary organ dysfunction. Early mortality is often related to the causal factor of the lung injury, and late mortality is more associated with complications (eg, sepsis, and multiple organ system failure)" (Máca et al., 2017)
- Incidence on average is 27.6 cases per 100,000 (Jin et al., 2020)
- Affects about 190,000 Americans per year (Drahnak & Custer, 2015)
- The inflammatory process that causes ARDS occurs throughout the body causing multiple organ dysfunction syndrome (McCance & Huether, 2018)

Signs & Symptoms

- ARDS manifests quickly and progresses rapidly (Drahnak & Custer, 2015)
- Hypoxia refractory to supplemental oxygen (Máca et al., 2017)
- Decreased lung compliance (Gattinooni et al., 2017)
- Bilateral pulmonary infiltrates on chest radiograph (Máca at al., 2017)
- Pulmonary edema noncardiac related (Máca at al., 2017)
- Tachycardia (Schreiber, 2018)
- Tachypnea (Schreiber, 2018)
- Dyspnea (Schreiber, 2018)
- Late symptoms (Schreiber, 2018):
  - Right sided heart failure
  - Pulmonary hypertension
  - Hypercarbia
  - Cyanosis

Underlying Pathophysiology

- ARDS is not a primary disease but a secondary process (Drahnak & Custer, 2015)
- ARDS severity definition based on hypoxemia (McCance & Huether, 2018)
  - Mild: 200 mmHg < PaO2/FIO2 ≤ 300 mmHg
  - Moderate 100 mmHg < PaO2/FIO2 ≤ 200 mmHg
  - Severe: PaO2/FIO2 ≤ 100 mm Hg
- Triggering events for ARDS include (Schreiber, 2018):
  - Sepsis (Most frequent cause)
  - Trauma
  - Pulmonary injury (i.e. pneumonia, pulmonary emboli)
  - Smoke inhalation
  - Burns
  - Pancreatitis
  - Drug overdose
  - Multi-organ failure
  - Chronic alcoholism
  - Blood transfusion



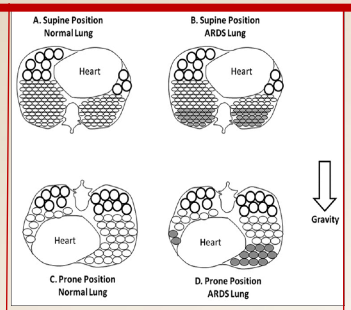
(McCance & Huether 2018 p. 1262)

Three Phases of ARDS Pathophysiology

- Acute Exudative Phase (0-3 days)
  - Damage to alveolocapillary bed
  - Uncontrolled inflammation
  - Type II alveolar cells that produce surfactant are attacked, decreasing compliance
  - Activation of neutrophils, macrophages, platelets, and cytokines→ All leading to micro-clots and V/Q mismatch
  - (McCance & Huether, 2018)
- Proliferation Phase (4-21 days)
  - Intra-alveolar hemorrhagic exudate becomes cellular granulation and scarring causing worsening hypoxemia (McCance & Huether, 2018)
  - Pulmonary hypertension occurs causing right sided heart failure (Schreiber, 2018)
- Fibrotic Phase (14-21 days) (McCance & Huether, 2018)
  - Remodeling and fibrosis begin worsening heart failure and respiratory failure
  - Large reduction in functional reserve capacity, increasing left to right shunting

Significance

- The goal for treatment of these patients in ARDS is maintaining oxygenation
- Early detection is key to help initiate treatments to protect the lungs (Drahnak & Custer, 2015)
- Prone positioning therapy has been shown to decrease mortality and improve extubation rates (Arias et al., 2017)
  - Prone therapy helps with aeration to the alveoli decreasing the risk of lung injury (Drahnak & Custer, 2015)
  - Prone position is cost-effective as well (Bloomfield et al., 2018)
- Patients with ARDS do not always return back to their normal respiratory function after ARDS (Jin et al., 2020)



- The above picture shows the improved aeration when the ARDS patient is placed in a prone position (Indian Journal of Anesthesia, n.d.)

Treatments

- Continue treatment of initial injury
- Mechanical ventilation (Sahetya et al., 2020)
  - PEEP (Drahnak & Custer, 2015)
  - Tidal volumes of 6ml/kg predicted body weight (Gattinoni et al., 2017)
  - High levels of inspired oxygen (McCance & Huether, 2018)
  - Lung-protective mechanical ventilation began highly in 2001 after the American-European Consensus Conference (Máca et al., 2017)
- Neuromuscular blocking agents (NMBAs)- Help maintain synchronization with the ventilator (Bass et al., 2019)
- Prone position early is best- time frames of prone positioning needs more research (Arias et al., 2017)
- New study the use of antiplatelet therapy pre-hospital to decrease incidence (Jin et al., 2020)
- Fluid management to limit the amount of pulmonary edema (Drahnak & Custer, 2015)
- Last minute rescue maneuvers include (Drahnak & Custer, 2015)
  - Inhaled pulmonary vasodilators (Nitric oxide or prostacyclin)
  - Partial liquid ventilation
  - Alternative ventilation
  - Exogenous surfactant
  - Intravascular oxygenation
  - Extracorporeal membrane oxygenation

Nursing Care

- Early identification of patient's risk factors for ARDS (Schreiber, 2018)
- Assess for complications and provide preventative measures when possible (Drahnak & Custer, 2015)
- Continuous monitoring of sedation and analgesia levels especially on a NMBAs (Bass et al., 2019)
- Family education throughout illness (Drahnak & Custer, 2015)
- Preventative measures for ventilator-associated pneumonia (Schreiber, 2018)
- Airway maintenance with patients in prone positioning (Bloomfield et al., 2018)
- Critical care nurses need to be trained in placing patients in prone positioning based on hospital policy
- Pictured below is the padding recommendations to decrease risks for pressure sores when in a prone position

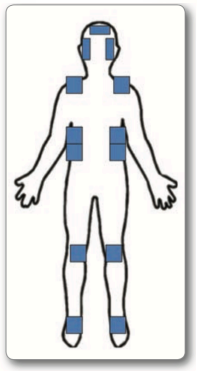
Padding Guide

(Anterior view)
(Patient specific)

Placement of padding before turning the patient prone (dependent on device/ procedure used to attain prone position: manual, Vollman frame, or auto-mated bed)
- Foam dressings
- Blanket rolls
- Foam bolsters
- Pillows

Pad chest tubes, drains, feeding tubes, etc.

Transfer electrocardiography electrode pads to posterior



(Drahnak & Custer, 2015 p.34)

Complications of ARDS Therapy

- Prone therapy complications (Bloomfield et al., 2018):
  - Pressure sores
  - Low blood pressure
  - Heart arrythmias
  - Tube blockage
  - Unplanned extubation
- Ventilator-associated pneumonia- Preventative bundles (Ayzac et al., 2016)
- Ventilator-induced lung injury -Utilizing lower drive pressures to help minimize, use prone therapy as well (Gattinoni et al., 2017)

Conclusion

- Multifactorial disease process early identification can improve outcomes (Máca et al., 2017)
- Continuous assessments by the critical care nurse to identify changes (Drahnak & Custer, 2015)
- Preventative measures for complications of therapy whenever possible (Drahnak & Custer, 2015)
- Changes to smaller tidal volumes on the mechanical ventilator to minimize damage to the alveoli (Gattinoni et al., 2017)
- Continued research to help identify the best treatment and therapy regiments for these patients affected by ARDS

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