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Cardiogenic Shock

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Introduction

What is Cardiogenic Shock?

- Cardiogenic shock (CS) is a severe form of acute heart failure (Kataja & Harjola, 2017).
- Severe impairment of myocardial function leads to end-organ hypoperfusion (Vahdatpour et al., 2019).
- Characterized by:
  - Hypotension,
  - Low cardiac output (CO)
  - Systemic hypoperfusion
- The most common cause of cardiogenic shock is Acute Coronary Syndrome (ACS) (Kataja & Harjola, 2017).

Why Cardiogenic Shock?

- In my current practice as a cardiovascular intensive care (CVICU) nurse, cardiogenic shock is one of the most frequently seen diagnoses.
- Despite significant research into the process, it remains a significant cause of mortality (Vahdatpour et al., 2019).
- Cardiogenic shock is a complex disease process, which requires vigilance and timely interventions.

Pathophysiological Processes

Signs and Symptoms

Cardiogenic shock presents with a variety of signs and symptoms. Each patient is unique in their presentation, but generally all patients with cardiogenic shock present in a similar manner. As a result of a poorly functioning ventricle, an inadequate amount of blood is supplied to the tissues and patients experience significant hemodynamic compromise. Both physical examination, and hemodynamic monitoring parameters/ monitoring techniques can be used to evaluate patients (Mebazaa et al., 2018). The most common symptoms include the following:

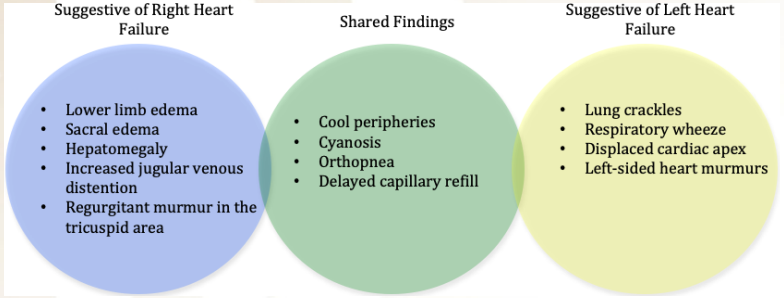
- Tachycardia
- Hypotension
- Low cardiac output/ index
- Elevated central venous pressure (CVP)
- Elevated pulmonary capillary wedge pressure (PCWP)
- Cool extremities
- Weak pulse
- Tachypnea
- Shortness of breath
- Confusion
- Elevated lactate
- Low pH
- Peripheral edema
- Jugular venous distension
- Low urine output

(Vahdatpour et al., 2019)

Underlying Pathophysiology

- Cardiogenic shock is an imbalance between myocardial oxygen supply and demand. An insult to the myocardial tissue leads to a greater oxygen demand than the heart can supply.
- Acute coronary syndrome accounts for about 80% of all CS cases (Kataja & Harjola, 2017, p. 121).
- As a result of an acute myocardial infarction (MI), the myocardium is deprived of oxygen, and becomes damaged, leading to left ventricular systolic dysfunction.
- The decreased systolic function leads to a decrease in cardiac output, hypotension and hypoperfusion of vital organs (Kataja & Harjola, 2017).
- Cardiogenic shock can also occur as a result of valvular, electrical or primary myocardial issues (Brener et al., 2020).
- With a decrease in oxygenation at the tissue and cellular level, the body attempts to compensate by increasing peripheral vasoconstriction, which further increases the workload of the damaged myocardium.
- Catecholamines are released, which help to stimulate contractility of the heart to generate better forward blood flow, but at the same time increase the myocardial oxygen demand (Kataja & Harjola, 2017).

"Physical findings suggestive of the ventricle primarily involved in cardiogenic shock. Often pro-inflammatory states induced by shock physiology causes a blunted performance of the less affected side. Both sides often contribute to the clinical presentation and physical exam findings" (Vahdatpour et al., 2019, p. 3).



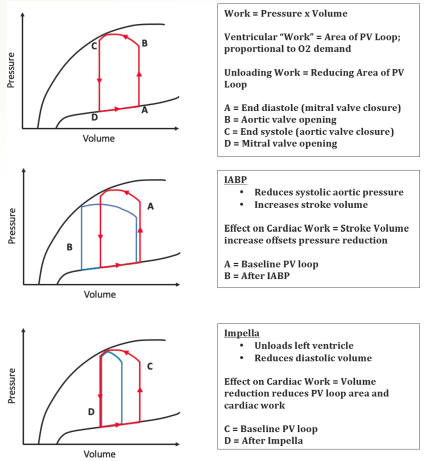
Significance of Pathophysiology

- Because of the viscous cycle that occurs with CS, the pathophysiology is significant.
- In normal physiology there is an equal balance between the right and left sides of the heart. The amount of blood ejected over one minute or cardiac output is the same.
- In cardiogenic shock, this balance is disrupted leading to the backup of blood into the lungs and periphery.
- The poor systolic function of the left ventricle in patients with cardiogenic shock leads to a downward spiral of compensatory mechanisms within the body.
- The poor compensatory mechanisms are significant and require medical intervention.
- "Compensatory peripheral vasoconstriction may initially improve coronary and peripheral perfusion, however it contributes to increased cardiac afterload that overburdens damaged myocardium. This results in diminished oxygenated blood flow to peripheral tissue and, ultimately, the heart" (Vahdatpour et al., 2019, p. 1).

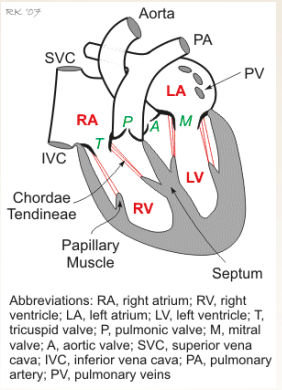
Treatment

- The main treatment for CS is identifying the underlying cause and reversing or treating the underlying cause if possible.
- Mechanical support devices which help to maintain adequate cardiac output and help decrease the workload of the heart. Examples include:
  - Intra-aortic balloon pumps
  - Extracorporeal membrane oxygenation (ECMO)
  - Impella devices

  (den Uil et al., 2017)
- Intravenous fluids with a goal of maintaining a euvolemic status (Kataja & Harjola, 2017).
- Vasoactive medications with the goal of restoring adequate blood pressure and end-organ perfusion (Vahdatpour et al., 2019).
- Hemodynamic monitoring of cardiac output, stroke volume, blood pressure, CVP, PCWP
- Echocardiogram



(Vahdatpour et al., 2019, p. 8)



Abbreviations: RA, right atrium; RV, right ventricle; LA, left atrium; LV, left ventricle; T, tricuspid valve; P, pulmonic valve; M, mitral valve; A, aortic valve; SVC, superior vena cava; IVC, inferior vena cava; PA, pulmonary artery; PV, pulmonary veins

(Klabunde, n.d.)

Implications for Nursing Care

- Most often, patients with cardiogenic shock require admission to the intensive care unit.
- With mechanical support devices such as intra-aortic balloon pumps or ECMO, these patients require diligent care and a heightened level of awareness.
- Understanding the signs, symptoms and pathophysiology behind this disease process is crucial for nurses and other health care professionals to be able to adequately care for such patients.
- The ability to recognize signs of CS can help aid in prompt diagnosis and treatment.
- Advanced knowledge of hemodynamic parameters and the subtle changes of each parameter is an important skill to have and crucial while caring for cardiogenic shock patients.

Conclusion

- Despite significant knowledge and understanding of cardiovascular physiology and the pathophysiology of cardiogenic shock, mortality rates remain as high as 35-50% (Kataja & Harjola, 2017).
- Advanced knowledge of the treatment modalities, and pathophysiology of cardiogenic shock could help aid in the reduction of mortality rates.
- Vigilant nurses who can identify deteriorating patients and understand the pathophysiology of CS can notify necessary healthcare professionals and help improve patient outcomes.

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