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The Pathophysiology of Sepsis
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Introduction

- Sepsis is a life-threatening organ dysfunction caused by a dysregulated host response to infection (McCance, 2018).
- Sepsis is a disease that has been known and studied for over 2000 years yet there is still so much of it that we do not understand (Ward & Levy, 2017).
- Sepsis means a very heterogeneous population, which varies in etiology and severity; therefore, universally applicable diagnostic criteria and treatment algorithms are difficult to be defined (Lauda, Tray, Molnar, & Farkas, 2015).
- Sepsis is associated with high morbidity and mortality and accounted for $1.2 billion in healthcare expenditures in 2013 (McCance & Huether, 2019).

Pathophysiology

Significance of Pathophysiology

- Host-derived molecules and foreign products of infection converge on molecular mechanisms that cause unbalanced activation of innate immunity. Foreign and endogenous molecules interact with pathogen recognition receptors expressed on or in the immune system. Activation of pathogen recognition receptors culminates in the release of immune mediators that produce the clinical signs and symptoms of sepsis (Ward & Levy, 2017).
- When the host response induced against a local infection fails to control it locally, it progresses to sepsis, septic shock, and death (Bhan, Dupasquier, Chakraborty, & Sarangi, 2016).
- The mortality rate is 20% of hospitalized patients with sepsis and 60-80% of patients with septic shock (Chausse, 2019).
- Restoration of homeostasis in septic patients does not always prevent or repair organ dysfunction (Ward & Levy, 2017).

Cellular Level Pathophysiology

- Sepsis may be life-threatening organ dysfunction caused by a dysregulated host response to infection (McCance, 2018).
- Sepsis is one of the most common causes of death among ICU patients worldwide (Schorr, 2018).
- Sepsis is one of the most common causes of death among ICU patients worldwide (Schorr, 2018).
- Sepsis and septic shock are the leading cause of mortality in the United States (Schorr, 2018).

Implications for Nursing Care

- Patients in septic shock have improved outcomes if antibiotics are administered within the first hour (Schorr, 2018).
- Nurses are instrumental to improved outcomes for patients with sepsis of septic shock (Schorr, 2018).
- Delays in treatment directly influence mortality in patients with sepsis (Ward, 2018).
- Sepsis is one of the most common causes of death among ICU patients worldwide (Schorr, 2018).

Adjunct Therapies

- Immunomodulation strategies
- Extracorporeal removal of cytokines via the addition of devices to hemofiltration or ECMO circuits
- Low-dose glucocorticoids to mitigate the inflammatory process
- Intravenous immunoglobulins to modulate immunological responses
- Thiamine supplementation to support ATP generation via the Kreb’s cycle
- Vitamin C, vitamin E, selenium, and zinc for mitochrondrial protection
- Corticosteroids, and vasopressor of choice in septic shock (McCance & Huether, 2019).

References (cont.)


Case Presentation

Signs and Symptoms

- Fever >38.3°C (100.4°F)
- Hypothermia <36°C (96°F)
- Tachycardia >90 bpm
- Tachypnea >30 bpm
- Progressive deterioration of mental status
- Altered mental status
- Significant oedema of positive fluid balances (>2L/m2/kg/24 hr)
- Hypocapnia (<30 mmHg)
- Hypercapnia (>40 mmHg, in the absence of diabetes)
- Leukocytosis: WBC >12,000/mm³
- Leukopenia: WBC <4,000/mm³
- Normpol: WBC with >10% bands
- CRP ≥ 2.0 times normal value
- PCT ≥ 2.0 times normal value
- Serum creatinine >2.0 mg/dL
- Hypotension (SBP <90 or MAP <70 mmHg)
- SBP decrease >40 mmHg

Treatment

- Svo >70%
- Cardiac index ≥3.5 L/min
- Arterial hypoxemia (PaO2/FiO2 <300 mmHg)
- Acute oliguria (urine output <0.5 mL/kg/hr for at least 2 hr)
- Creatinine increase >0.5 mg/dL
- Compulsory dialysis (HR >15 or PTT >60 seconds)
- Base
- Tachybrhypotensive (platelet count >100,000/mm³)
- Hypophosphatemia (plasma total): Intravenous (≥4 mg/dL to 7 mmol/L)
- Hypocalciemia (>1 mmol/L)
- Decreased capillary refill or mottling

Figure 2. Select mechanisms implicated in the pathogenesis of sepsis-induced organ and cellular dysfunction (Seymour & Angus, 2018).

Figure 3. The goal of the Surviving Sepsis Campaign (SSC) is to begin resuscitation and management immediately (Schorr, 2018).

Figure 4. Time matters (Ward & Levy, 2017).

Figure 5. The threshold for the Surviving Sepsis Campaign (SSC) is in to begin resuscitation and management immediately (Schorr, 2018).

References


