Pathophysiology of Sepsis

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Pathophysiology of Sepsis

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What is Sepsis?

- Sepsis is defined as an exaggerated host response to infection that is dysregulated, and leads to organ dysfunction (Tidswell, 2018).
- Sepsis is a medical emergency that requires prompt recognition and treatment.
- Sepsis leads to 1.6 million hospitalizations, and more than 250,000 deaths per year in the United States (Venkatesh et. al., 2018, p. 10).
- Sepsis survivors experience lasting morbidities related to the organ damage caused by sepsis.
- Sepsis is very expensive to treat, contributing to increasing healthcare costs.

Important Terms:

Systemic Inflammatory response syndrome (SIRS) – presence of two or more of the following criteria:
- Fever
- Hypothermia
- Tachycardia
- Tachypnea
- Leukocytosis
- Leukopenia
- Normal WBC with >10% immature cells

Sepsis – Systemic response to infection, clinically identified by the presence of SIRS criteria.
- Severe Sepsis – The dysfunction of at least one organ system.
- Septic Shock – Severe sepsis with persistent hypotension. (McCance & Huether, 2014, p. 1676)

Pathophysiology of Sepsis

- Host is infected by bacteria or fungi = Bacteremia
- Proinflammatory mediators are released = Activation of complement, coagulation, kinin, & basophils
- Anti-inflammatory mediators released = Complementary Response
- Proinflammatory & anti-inflammatory mediators respond to one another = Mixed antagonistic response syndrome
- Compensatory responses intensify causing hyperinflammation leading to Multiple Organ Dysfunction Syndrome (MODS)
- MODS is the result of hyperperfusion leading to tissue hypoxia & lactic acidosis. (McCance & Huether, 2014, p. 1677).

CLINICAL DIAGNOSIS: Early detection is the key to successful treatment! SIRS Criteria (see important terms) are used as a screening tool for sepsis, it is important to note that a patient may meet SIRS criteria related to a non-infectious source (trauma, burns, surgery). These patients are NOT septic. Diagnosis of sepsis requires the presence of a proven infection (Laszlo et al., 2015, p. 3).
- Complete history must be performed for any patients meeting SIRS criteria. This includes recent travel, infectious contacts, recent procedures, immunization record.
- Complete physical exam to assess possible source of infection.
- Possible sources include pneumonia, urinary tract infection, cellulitis and/or abscess, meningitis, etc.
- Diagnostic tests are completed to diagnose the source of infection as well as the extent of organ dysfunction.
- Urinalysis with micro 
  - Chest X-ray 
  - Lactic Acid to assess for lactic acidosis which results from hyperperfusion tissues. 
  - Blood culture 
  - Arterial Blood Gas (ABG) to respiratory status & assess acid/base disturbances 
  - Blood tests: BMP, CBC, & Coagulation factors

Quality Improvement: SEP-1 Core Measure

- Created by Centers for Medicare & Medicaid Services (CMS) and Joint Commission (JC) to improve early recognition and treatment of sepsis.
- Similar to core measure programs to reduce complications relating to acute MI, venous thromboembolism, and stroke (Motzkus & Lilly, 2017, p. 955).

SEPSIS SYMPTOMS

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Sepsis – “The hidden public health disaster” (Liu et. al., 2016)

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SEP-1 Bundles

Time | Severe Sepsis | Septic Shock
---|---|---
3-hour Bundle | 1. Initial Lactate measurement | 1. All severe sepsis bundle
2. Broad-Spectrum ATB administration | 2. 30 mL/kg bolus crystalloid fluid
3. Blood Cultures drawn prior to ATB
6-hour Bundle | 1. Repeat lactate measurement ONLY if first reading was elevated | 1. Vasopressors if hypotension persists after fluid bolus
2. If hypotension persists after fluid or initial lactate >4 mmol/L
   a. Focused exam to assess: vital signs, cardiodiopulmonary status, cap refill, peripheral pulses, and skin
   b. Any two of the following: Central Venous Pressure Central Venous Oxygen bedside cardiovasular ultrasonography Passive leg raise or fluid challenge

CDC’s Surviving Sepsis Campaign

- The CDC recommends use of a “1-hour Bundle” in order to initiate treatment quicker. Interventions should be completed within one hour of arrival to ED:
  - Lactate level with reflex if >2 mmol/L
  - Initiate 30mL/kg fluid bolus as soon as possible for hypotension and/or elevated lactate.
- Early and adequate fluid administration has decreased mortality related to sepsis. Even in patients with history of heart failure and/or chronic kidney disease (Liu et al., 2016),
- Obtain blood cultures
- Antibiotic Administration (Lieu et. al., 2018, p.998).

“Without adequate initial management, providing even the highest level of intensive care would be in vain” (Laszlo et al., 2015, p. 1).

References

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