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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 over 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 = **Compensatory 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 hypoperfusion 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, 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 hypoperfusion tissues.
  - Blood cultures
  - Arterial Blood Gas (ABG) to respiratory status & assess acid/base disturbances
  - Blood tests: BMP, CBC, & Coagulation factors

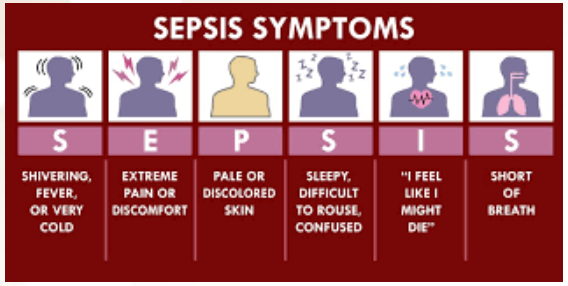

Photo courtesy of simtalkblog.com

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

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).

SEP-1 Bundles

Time	Severe Sepsis	Septic Shock
3-hour Bundle	1. Initial Lactate measurement 2. Broad-Spectrum ATB administration 3. Blood Cultures drawn prior to ATB	1. All severe sepsis bundle 2. 30 mL/kg bolus crystalloid fluid
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, cardiopulmonary status, cap refill, peripheral pulses, and skin b. Any two of the following: • Central Venous Pressure • Central Venous Oxygen • Bedside cardiovascular ultrasonography • Passive leg raise or fluid challenge
	Motzkus & Lilly, 2017, p. 956	

Quality Improvement of Emergency Care for Sepsis: E-QUAL

- Emergency Quality Network (E-QUAL) Sepsis Initiative was launched in 2015 by the American College of Emergency Physicians (ACEP)

Best Practices for Early Recognition & Treatment of Sepsis

1. Sepsis metrics data dashboard
2. Nurse Sepsis Screening
3. Electronic alert for patients meeting sepsis criteria
4. Sepsis alert protocol with a multidisciplinary sepsis team that will respond. Similar to STEMI and/or Stroke Alerts.
5. Lactate Testing : use of point of care testing and automatic repeated testing (Venkatesh et. al., 2017, p. 13)

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:
  1. Lactate level with reflex if >2 mmol/L
  2. Initiate 30mL/kg fluid bolus as soon as possible for hypotension and/or elevated lactate. Early and adequate fluid administration has decrease mortality related to sepsis. Even in patients with history of heart failure and/or chronic kidney disease (Liu et al., 2016).
  3. Obtain blood cultures
  4. Antibiotic Administration

  (Levy 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).

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