The Pathophysiology of Sepsis: Early Recognition and Intervention in the Healthcare Setting

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Introduction

Sepsis is the leading cause of death in the United States (Cawcutt, 2014). There are 750,000 Americans who are diagnosed with sepsis annually and 220,000 of those diagnosed with the condition die; this makes the mortality rate for sepsis between 25 and 50 percent nationally (Butcher, 2016). The学堂 suggests that sepsis presents a higher risk of occurrence in people who are immunocompromised, individuals with comorbidities, patients with invasive devices, and those at both ends of the age continuum. “That means that just about every acute inpatient, outpatient, and even emergency room patient is at risk” (Cawcutt and Peters, 2014, p.18).

“Every clinician should be able to recognize the signs and symptoms of sepsis, along with early management strategies, to expediently provide appropriate care and decrease resultant morbidity and mortality” (Cawcutt & Peters, 2014, p.572). Nurses and other healthcare professionals encounter patients across the entire lifespan in a wide array of settings. The ability to recognize sepsis and promptly manage the triage of the septic patient is imperative in promoting optimal patient outcomes in the realms of emergency medicine.

Pathophysiology

“Sepsis is an injury to the body resulting from the immune system’s attempt to eradicate an infection” (Butcher, 2016, p. 18). The overarching condition of sepsis contains within it varying degrees of severity which include sepsis, severe sepsis, and septic shock (Butcher, 2016).

SIRS: Meets 2 of the following 4:
- Temperature >38°C or <36°C
- Heart rate >90 beats/min
- Respiratory rate >30 breaths/min orintravenous fluid administration, such as colloids and blood
- White blood cell count <4,000 cells/mL or >10% band forms

SIRS: Definition of SIRS:
- SIRS documented or suspected infection
- Current definition: Documented or suspected infection plus systemic manifestations of infection (any of the SIRS criteria count, in addition other possible manifestations include elevations of procalcitonin, C-reactive protein, hyperglycemia in those without diabetes, altered mental status)

Sepsis: SIRS plus evidence of organ dysfunction
- Arterial hypotension
  - [P(a)O2/FiO2] <300
- Acute oliguria (urine output <0.5 mL/kg/hour for at least 2 hours despite adequate fluid resuscitation)
- Increase in creatinine >0.5 mg/dL
- Grogginess (alertness:<15 cm on Nasso’s, AVPU= Alert, Voice, Pain, Unresponsive)
- Purpuric class
- Decreased capillary refill or skin mottling
- Septic shock: Sepsis with hypotension despite adequate fluid resuscitation
- Hyperlactatemia
- Refractory hypotension persists despite resuscitation with bolus fluid loading
- Hyperlactatemia >1 mmol/L

The following highlights the clinical progression of sepsis throughout its continuum (Cawcutt and Peters, 2014, p.157).

Signs and Symptoms

Hypoperfusion

Hypoperfusion leads to a change in the microcirculation of a cellular level. Furthermore, “This alteration causes changes in the glycocalyx and cytoskeleton leading to myocardial injury, decreased perfusion to vital organs, such as the kidney and brain” (Tazbir et al., 2012, p. 266).

Additionally, the vasculature which occurs during septic shock comes as a result of the release of nitric oxide with endothelial dysfunction changes on the venous walls. “As a result of vasodilation and capillary leakage, the patient exhibits hypotension, and there is a decrease perfusion to vital organs, such as the kidney and brain” (Tazbir, 2012, p. 26).

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The septic patient may not always be easy to identify as early stages of the condition may be subtle. Early signs and symptoms may begin with a feeling of being chilled or cold, with symptoms of fever, sweating, and being cold. Furthermore, “It is essential that an arterial line and central venous catheter be placed and maintained in the patient, and continuous hemodynamic monitoring in order to achieve the resuscitative goals” (Nolan, 2012, p. 8). Central venous access may be used to establish a fluid challenge and to monitor central venous pressure in the septic patient (Cheng, Puatk, & West, 2008). In addition to being able to recognize sepsis, it is important that the advanced practitioner be knowledgeable of the pathophysiological process involved. Since its formulation, the Surviving Sepsis Campaign has attempted to increase awareness of sepsis through the establishment of guidelines for use in clinical practice (Jones & Puatk, 2014). An encompassing theme of the campaign involves early recognition and treatment of sepsis and septic shock. Such early recognition can be achieved by the advanced practitioner nurse most effectively through an understanding of the underlying pathophysiological processes of sepsis. Furthermore, a move for decreased mortality in the septic patient can be achieved through a familiarity with updated sepsis guidelines and research. “In recent decades, advances in the management of patients with severe sepsis and septic shock have demonstrated a great reduction in mortality from greater than 80% to approximately 20%” (Cawcutt & Peters, 2014, p.157).

References

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Early recognition and treatment of sepsis and septic shock is paramount in preventing morbidity and mortality. “Sepsis and septic shock are in fact the leading cause of death in the United States and the most common cause of death among critically ill patients in non- coronary intensive care units (ICU)” (Temple and Angels, 2014, p. 4). Refractory hypotension persists despite adequate fluid resuscitation or use of vasoactive drugs may be a predictor for patients with sepsis is $14 billion in the United States (Temple & Angels, 2014, p. 4). These factors make sepsis an important public health problem. Furthermore, “Increasing compliance is associated with a statistically significant decline in mortality rates” (Levy, Phillips, Rhodes, Schor, & Townsend, 2014, p.1632). An inadequate approach to working up a septic patient carries a broad range of potential detrimental possibilities which include failing to recognize when infection is present, administering inappropriate empiric antibiotics, and performing an inadequate examination. Additionally, the survival rates of severe sepsis are low. “Increasing care for patients with sepsis remains an important public health problem” (Cawcutt and Peters, 2014, p.26).

In regards to the management of the septic patient in the perioperative setting, “anesthesia practitioners should anticipate this cascade of events, noting the importance of starting perioperative, goal directed therapy” (Nolan, 2012, p. 7). Hypotension, for example, is an ominous sign of septic shock and can progress to multi-organ system failure (Nolan, 2012). Furthermore, goals should focus on: • resuscitating acidic conditions • providing optimal oxygen delivery to the tissues • intravenous fluid administration, such as colloids and blood products • use of vasoactive drugs when appropriate • invasive monitoring such as arterial lines with the use of vasoactive drugs

Conclusion

Ongoing advancements in the management of sepsis along with the established guidelines put forth by the Surviving Sepsis Campaign have provided tools for practitioners to use in their fight against sepsis. “Increasing compliance with the Surviving Sepsis Campaign guidelines is associated with a statistically significant decline in mortality rates” (Levy, Phillips, Rhodes, Schor, & Townsend, 2014, p.1632). An understanding of the pathophysiology of sepsis can for early detection and intervention which are both key factors involved in optimizing its management (Jones & Puatk, 2014). An awareness of sepsis and signs of sepsis should be appreciated. Furthermore, “Knowledge of guideline treatment of the septic patient would undoubtedly assist the nurse anesthetist to fulfill his role as a competent provider in the perioperative setting and in the realm of anesthesia.”