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Neutropenic Sepsis in the Intensive Care Unit

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What is Sepsis in the Neutropenic Patient?

Neutropenic Sepsis is a complication and oncological emergency that results from cancer and treatment of cancer. According to Vioral & Wentley (2015), neutropenic sepsis remains the leading cause of death in oncology patients.

Sepsis occurs due to overwhelming infection (bacterial, viral, or fungal) being present and the body's immune response is inadequate (Vioral & Wentley, 2015).

Neutropenic Sepsis has been defined in the National Institute of Health (NIH) as a neutrophil count of $<0.5 \times 10^9/L$ and either a temperature higher than 38 degrees Celsius or other signs or symptoms consistent with clinically significant sepsis (Wells, et al. 2-15).

As a RN in the Medical Intensive Care Unit at the James Cancer Hospital, sepsis in the neutropenic patient is the most commonly seen diagnosis. Educating the care providers at the bedside on early intervention and proper sepsis intervention is instrumental in improving outcomes for these patients.

Signs & Symptoms

- Hypotension
- Altered Mental Status
- Fever
- Tachycardia
- Tachypnea
- Increased Lactate levels, acidosis.
- Oliguria and anuria
- Hypoxia
- Cold, clammy, cyanotic skin
- Bounding pulses



Underlying Pathophysiology

An organism or microbe enters the bloodstreams, colonizes, and reproduces in a host. The body's inflammatory response initiates in the presence of infection. When the localized inflammatory response cannot manage the infection, sepsis occurs (Vioral & Wentley, 2015).

According to Dunkley and McLeod (2015), there may be a delay of local inflammatory response and absence of pyrexia due to the lack of neutrophils present in the oncological patient.

Infection also stimulates the release of cytokines, triggering a number of responses such as vasodilation, increased capillary permeability, and clot formation. (Dunkley and McLeod, 2015).

The complement system is a part of the innate immune system, with three purposes: recruitment of inflammatory cell to infected area, mark pathogens by covering the bacterial membrane, and destroy pathogens (Dunkley and McLeod, 2015). However, in sepsis, the complement system can be overactive, leading to complications such as DIC and multisystem organ failure.

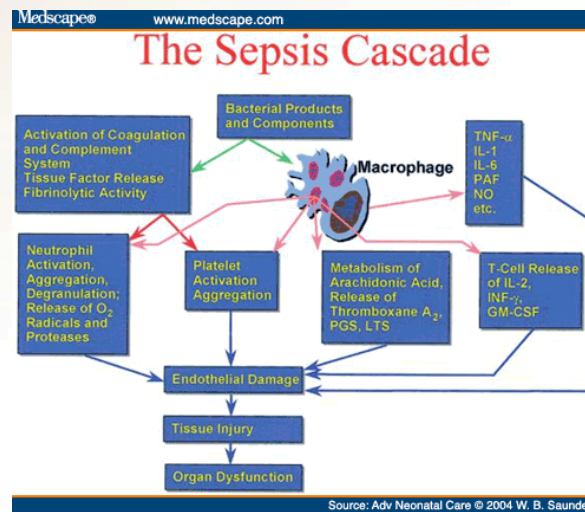
According to Dunkley and McLeod (2015), the inflammatory response disrupts normal coagulation, causing excessive platelet plugs and fibrin in microvasculature in conjunction with a deficit of clotting factors leading to coagulopathies.

Significance of Pathophysiology

Neutropenic patients face greater complications and poorer prognosis in sepsis. According to Kruse, et al (2016) patients with neutropenic sepsis, prognosis of the initial insult, is determined primarily by the severity of multiple organ dysfunction.

Clotting abnormalities and coagulopathies can further be complicated in the neutropenic setting causing DIC and decreased perfusion to the tissues. Oncology patients have baseline coagulopathies related to chemotherapy treatment, that should be considered, and potentially exaggerated in sepsis.

According to Dunkley and McLeod (2015), The release of cytokines into the blood stream, leads to leakage of fluid from circulation into interstitial tissues, decreased intravascular volume, hypotension, hypoxia, and lactic acidosis.



Implications of Nursing Care

It is imperative practitioners are highly suspicious when caring for this patient population.

Dunkley and McLeod (2015) encourages practitioners to reflect that neutrophil counts are lowest 5-7 days after chemotherapy administration and it is the nadir time period that neutropenic patients are at highest risk for infection.

Best, et al (2013), supports current practice of standardized order sets in the sepsis treatment protocol. Early administration of antibiotics, fluid resuscitation, obtaining blood, urine, and stool cultures, and stabilization of vital signs are all shown to improve outcomes and decrease mortality.

Wells, et al (2015), stresses the importance of continued education of providers caring for neutropenic patients as well as the patients and families themselves. Early recognition is instrumental.

Patient's may require mechanical ventilation in the critically ill period of sepsis management in order to control hypoxia and dyspnea. Dyspnea may occur as a compensatory mechanism related to metabolic acidosis (Dunkley & McLeod, 2015).

Transfusion Red Blood Cells to maintain hemoglobin greater than 7.

Consider corticosteroids if hemodynamic instability continues despite fluid resuscitation and vasopressor support. Hydrocortisone 200mg/ daily is the recommended dose (Dunkley & McLeod, 2015).

Dunkley and McLeod (2015) describe the three hour care bundle as a part of nursing intervention. This includes obtaining blood cultures prior to administration of antibiotics, administration of broad spectrum antibiotics, administration of 30ml/kg crystalloid for sepsis induced hypotension and/or lactate greater than 4, and measuring lactate levels.

Maintaining adequate perfusion with a mean arterial pressure (MAP) of 65 or greater is necessary to adequately perfuse organs. Hypotension must be promptly managed with fluids and vasopressors if necessary to prevent further damage. Strict intake and output measurement is crucial as well.

Control blood glucose levels. Insulin resistance can occur related to stress in the critically ill patient. This along with administration of steroids contribute to hyperglycemia, requiring insulin administration and close monitoring of blood glucose levels (Dunkley & McLeod, 2015).

Conclusion

Infection is the most common complication in patients receiving chemotherapy treatment, with neutropenia being the primary risk factor (Kruse, et al, 2016). Early recognition and intervention are necessary to decrease mortality and improve overall outcomes. Acknowledging neutropenic sepsis as an oncological emergency while understanding the pathophysiology of the disease allows patients to receive optimal care.

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