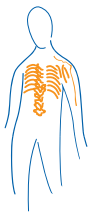
89



Bacteremia and Sepsis

Russell J. McCulloh and Steven M. Opal

DEFINITION

Sepsis is a leading cause of morbidity and death among hospitalized patients. The disease process results from a complex interplay of host immune responses and infectious microorganisms. As defined by the Surviving Sepsis Campaign, sepsis consists of proven or suspected infection combined with systemic manifestations of infection. Manifestations can include fever, altered mental status, and abnormalities in inflammation and coagulation. Severe cases can progress to multiple organ system dysfunction followed by organ failure and death.

Diagnostic criteria for sepsis are provided in Table 89-1. Severe sepsis results from sepsis-induced tissue hypoperfusion and consequent organ dysfunction. Septic shock is a combination of severe sepsis and persistent hypotension despite adequate fluid resuscitation or the need to use vasopressors to maintain a mean arterial pressure (MAP) higher than 65 mm Hg. The continuum of disease manifestations from localized infection to multiorgan failure and refractory septic shock is depicted in Figure 89-1.

Recently, a revised set of definitions was proposed. The term *sepsis* as currently used lacks specificity. Sepsis should imply a deleterious situation in which the infection-induced systemic inflammatory and coagulopathic responses have become injurious to the host. Sepsis is an infectious process characterized by tissue injury from hypoperfusion and immune dysregulation. Because sepsis always has severe ramifications for the patient, the term *sepsis* should be used instead of the current "severe sepsis." *Severe infection* should be used to describe an infection that is accompanied by systemic inflammation but without evidence of organ dysfunction remote from the site of infection (i.e., the former definition of sepsis). Whether these revised definitions can resolve the current confusion in terminology remains to be seen.

Understanding the pathophysiology of sepsis syndrome has proved helpful in differentiating and treating severe inflammatory processes that manifest with symptoms similar to sepsis, including pancreatitis, severe trauma, thermal burns, and certain toxin or environmental exposures. These processes can produce a systemic inflammatory response syndrome (SIRS), but they lack the component of infection needed to establish a diagnosis of sepsis. The remarkable clinical similarity between these severe, "sterile" inflammations and septic shock reflects their molecular profiles. Identical signaling pathways for the immune response are activated by highly conserved pathogen-associated molecular patterns (PAMPs), which are molecular motifs recognized by cells of the host's innate immune system. Damage-associated molecular patterns (DAMPs) are molecules released by injured host cells that act as endogenous danger signals to promote the inflammatory response (see Pathophysiology of Septic Shock).

EPIDEMIOLOGY

The worldwide incidence of sepsis is difficult to assess due to limited data from developing countries. In industrialized countries, reported rates of sepsis range from 22 to 300 cases per 100,000 people. Sepsis may account for up to 6% of adult deaths. In the United States, more than 750,000 cases of sepsis and 200,000 sepsis-related deaths occur annually. The risk of mortality depends on the severity of illness and multiple host factors (discussed later). Overall, estimates of death from sepsis range

TABLE 89-1 DIAGNOSTIC CRITERIA FOR SEPSIS*

GENERAL VARIABLES
Fever (>38.3° C)
Hypothermia (core temperature <36° C)
Heart rate>90 beats/min or more than 2 SD above the normal value for age
Tachypnea
Altered mental status
Significant edema or positive fluid balance (>20 mL/kg over 24 hr)
Hyperglycemia (plasma glucose >140 mg/dL or 7.7 mmol/L) in the absence of diabetes
INFLAMMATORY VARIABLES
Leukocytosis (WBC count >12,000 mm^3)
Leukopenia (WBC count <4000 mm^3)
Normal WBC count with more than 10% immature forms
Plasma C-reactive protein >2 SD above the normal value
Plasma procalcitonin >2 SD above the normal value
HEMODYNAMIC VARIABLES
Arterial hypotension (SBP <90 mm Hg, MAP <70 mm Hg, or an SBP decrease [40 mm Hg in adults or <2 SD below normal for age])
ORGAN DYSFUNCTION VARIABLES
Arterial hypoxemia (Pao_2/FIO_2 <300)
Acute oliguria (urine output <0.5 mL/kg/hr for at least 2 hr despite adequate fluid resuscitation)
Creatinine increase (0.5 mg/dL or 44.2 µmol/L)
Coagulation abnormalities (INR >1.5 or aPTT >60 sec)
Ileus (absent bowel sounds)
Thrombocytopenia (platelet count <100,000/mm^3)
Hyperbilirubinemia (plasma total bilirubin, 4 mg/dL or 70 µmol/L)
TISSUE PERFUSION VARIABLES
Hyperlactatemia (1 mmol/L)
Decreased capillary refill or mottling

From Dellinger RP, Levy MM, Rhodes A, et al: Surviving Sepsis Campaign: international guidelines for management of severe sepsis and septic shock, 2012, Intensive Care Med 39:165–228, 2013.

aPTT, Activated partial thromboplastin time; FIO_2, fraction of inspired oxygen; INR, international normalized ratio; MAP, mean arterial pressure; Pao_2, partial pressure of oxygen; SBP, systolic blood pressure; SD standard deviations; WBC, white blood cell.

*The criteria include documented or suspected infection and some of the variables listed.