

Maternal Sepsis and Septic Shock



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KEYWORDS

• Pregnancy • Sepsis • Severe sepsis • Septic shock

KEY POINTS

- Sepsis and septic shock are leading causes of intensive care unit admission as well as maternal and fetal morbidity and mortality.
- Early identification and management can be facilitated by various scoring systems.
- Physiologic changes of pregnancy and fetal oxygenation must be considered during resuscitation and management.
- The sites of infection as well as the organisms responsible for sepsis evolve throughout pregnancy, delivery, and postnatal intervals.
- Although not specifically developed for the pregnant patient, the Surviving Sepsis guidelines provide a useful paradigm for management.

INCIDENCE AND MORTALITY

Sepsis is the leading cause of death in the intensive care unit (ICU) and a common cause of morbidity and mortality worldwide.^{1,2} Sepsis is also recognized as one of the major factors accounting for admission of pregnant patients to the ICU and for maternal death. Multiple studies over the years have documented an increase in the awareness of the precipitating factors and risks for sepsis in this special population.^{3–10} The causative organisms, timing, prophylactic methods, and preventive strategies have been reviewed. Factors associated with the progression from severe sepsis to septic shock have also been identified. For pregnant women, there is a rapid progression from initial recognition of sepsis via defining parameters to development of severe sepsis and shock. In

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this regard, the normal underlying physiologic changes during pregnancy can critically alter hemodynamic stability when overlapped with sepsis. In concert with the most recent Surviving Sepsis campaign,¹¹ emphasis remains on timely recognition of sepsis and early administration of fluids and antibiotics. Sepsis accounted for 10.7% of maternal deaths from 2003 to 2012 according to the World Health Organization systematic analysis on the global causes of maternal death.¹² Trends of maternal mortality worldwide have been falling, but in the most recent report from the Centre for Maternal and Child Enquiries Mission statement in the United Kingdom, sepsis secondary to genital infections has become the leading cause of death, particularly from group A streptococcus (GAS).⁹ There was an increase in maternal deaths related to sepsis from 0.85 of 100,000 pregnant women in 2003 to 2005 to 1.13 of 100,000 in 2006 to 2008.⁹ Similarly, in a review of 2 tertiary referral maternity hospitals in Dublin, Ireland from 2005 to 2012 that included more than 150,000 pregnant women, the sepsis rate was 1.81 per 1000 pregnant women, of which 17% of the episodes occurred antenatally, 36% occurred intrapartum, and 47% occurred postpartum.¹⁰ In a retrospective review on 74 patients admitted to the ICU, the rates of systemic inflammatory response syndrome (SIRS), severe sepsis, and septic shock are 59%, 24%, and 3%, respectively.¹³ In a prospective study of 298 obstetric patients admitted to a tertiary referral ICU in Brazil, 14.2% of the admissions were caused by sepsis.¹⁴ This increase may be attributed to women becoming pregnant after age 35 and presenting with higher rates of comorbidities.¹⁵ Sepsis led to a high perinatal mortality as well as preterm delivery.¹⁰ In the United States, similar trends have been observed. The incidence of pregnancy-associated severe sepsis (PASS) has increased by 236% over the last decade according to a study on 4,060,201 pregnancy-associated hospitalizations and 1077 PASS hospitalizations from 2001 to 2010.¹⁶ The Centers for Disease Control and Prevention's Pregnancy Mortality Surveillance System recorded an increase in the number of reported pregnancy-related deaths in the United States. The pregnancy-related mortality ratio was 17.8 deaths per 100,000 live births according to the data from 2011, and 14% of the deaths were attributed to infection or sepsis, which was among the top 3 leading causes of pregnancy-related deaths (**Fig. 1**). As stated earlier, sepsis is also a major cause for admission of pregnant women to the ICU, together with hemorrhage, abortion, and complications of hypertension.¹⁷

DEFINITION

The definitions of SIRS, sepsis, severe sepsis, and septic shock for the nonpregnant patient are delineated in **Table 1**. However, there is currently no standard definition for severe sepsis for pregnant and peripartum women. There are multiple physiologic changes that occur in an obstetric patient during the antepartum and postpartum periods, which can mask some of the objective findings required to identify SIRS. Also, the accepted SIRS definition to identify patients with sepsis may be flawed. A recent study used data from 172 ICUs in Australia and in New Zealand that reviewed 1,171,797 patients admitted from 2003 to 2011 and found that using the current SIRS definition failed to identify up to 15% of patients with similar infections, organ failure, and risk of death.¹⁸

Accordingly, investigators have attempted to define severe sepsis, particularly for the pregnant patient. Barton and Sibai¹⁵ defined a different set of parameters for severe sepsis and septic shock among obstetric patients that included a heart rate greater than 110 beats/min and respiratory rate greater than 24 breaths/min.

In addition, SIRS criteria may overlap with normal hemodynamic and other parameters during pregnancy and the peripartum period.¹⁹ Those investigators conducted a

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