

UNIVERSITY *of* WASHINGTON

# Identification and Management of Sepsis in Pregnancy

## Obstetric Consensus Statement

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# IDENTIFICATION AND MANAGEMENT OF SEPSIS IN PREGNANCY

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## RATIONALE

Maternal sepsis, especially puerperal sepsis, is a common pregnancy-related condition and in the United States (US) is a leading cause of maternal mortality, accounting for 13% of maternal deaths and up to 15% of maternal admissions to the intensive care unit (ICU), with a cause-specific mortality ratio of 2.2 deaths per 100,000 live births (1–6). Especially concerning is that sepsis has been increasingly reported as the cause of maternal death, rising by up to 10% per year between 2000 and 2010 (3,7). This is due, in part, to a greater than 200% increase in the incidence of pregnancy-associated severe sepsis over that same time period in parts of the US (8).

Maternal sepsis is also associated with an increase in fetal morbidity including increased risk of preterm delivery, low birth weight, and perinatal mortality. In fact, fetal mortality approaches 33% in the setting of maternal sepsis requiring ICU admission (9–12).

## PREVENTION

One contributing and modifiable factor to sepsis-related maternal deaths is failure to recognize sepsis, leading to delays in treatment (1,13). Therefore, rapid and accurate diagnosis and appropriate initial management of sepsis in pregnancy is paramount.

## DIAGNOSIS

In 2016, the Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) were released and a new definition of sepsis was proposed: a life-threatening organ dysfunction caused by a dysregulated host response to infection with organ dysfunction quantified by use of the Sequential [Sepsis-related] Organ Failure Assessment (SOFA) (14). The definition of sepsis in pregnancy is not different, however it is not known how the SOFA score performs in the identification of sepsis in pregnant women and likely will perform poorly in its ability to predict morbidity and mortality. This is because there is considerable overlap between the SOFA score and normal physiologic changes during pregnancy (15–20). The major physiologic changes seen in pregnancy that will impact a diagnosis of sepsis using the SOFA criteria include a decrease in blood pressure, an increase in heart rate, a decrease in bilirubin and creatinine, and an increase in leukocyte count. These physiologic changes are especially pronounced in labor. Notably, lactic acid levels can be used as a screening tool in pregnant women just as the test would be used outside of pregnancy, except that elevations may be seen during labor (21). Pregnancy-specific scoring systems have been developed, but prediction of morbidity and mortality in pregnancy is difficult given the overall low-likelihood of adverse outcomes in this otherwise generally healthy population. However, use of modified vital sign criteria is recommended in order to more accurately account for the physiologic changes seen in pregnancy. An example of pregnancy specific vital sign cut-offs that could be used to more accurately identify sepsis in pregnancy

include the following: temperature > 38.5 °C, systolic blood pressure < 90mmHg, heart rate > 120 beats per minute, oxygen saturation < 92%, white blood cell count > 17,000/ $\mu$ L, and lactic acid > 4 mmol/L (22). Clearly, sepsis in pregnant and postpartum women requires a high index of suspicion.

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**Table 1. Sepsis Management in Pregnant and Postpartum Women: Key Points**

- *Consult Maternal-Fetal Medicine promptly in cases of suspected sepsis in pregnant or recently postpartum patients.*
  - *Maternal stabilization is the priority.*
  - *Provide standard initial fluid resuscitation per Surviving Sepsis Campaign guidelines.*
  - *Use vasopressors early for hypotension management, given elevated pulmonary edema risk.*
  - *Aggressively utilize acetaminophen and cooling protocols to reduce maternal fever.*
  - *Initiate broad-spectrum antibiotics within one hour (most are safe in pregnancy; avoid fluoroquinolones).*
  - *Monitor fetal heart rate as appropriate for gestational age and maternal condition.*
  - *Consider source control through surgical intervention as appropriate.*
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## MANAGEMENT

Table 1 summarizes the key strategies for management of sepsis in pregnant and postpartum women. Consult Maternal-Fetal Medicine promptly in cases of suspected sepsis in pregnant or recently postpartum patients. In general management principles of sepsis in pregnancy are the same as in a non-pregnant patient. This includes Early Goal Directed Therapy with early fluid resuscitation and early administration of antimicrobial therapy, ideally within one hour, directed toward the most likely source of infection (23). Standard fluid resuscitation for hypotension should be rapidly initiated; however ongoing fluid resuscitation should be undertaken with caution because of an increased risk for pulmonary edema in pregnancy. Early consideration of vasopressors may be indicated for hypotension, even prior to completion of the entire 30mL/kg bolus of crystalloid. In general, an oxygen saturation on room air of < 92% with hypotension should lead to pressor support. This is particularly true if a pulmonary source is suspected. In pregnancy, the most common sites of infection are the genitourinary tract (chorioamnionitis, endometritis, pyelonephritis) followed by the respiratory tract (pneumonia) (7). The antimicrobial selected should therefore include coverage for the common obstetric infections and could include a combination of ampicillin, gentamicin, and clindamycin or vancomycin and piperacillin/tazobactam. If a pulmonary source is considered, oseltamivir should also be started. The vast majority of cases of pneumonia in pregnant women are viral even when the first chest x-ray appears to indicate a lobar consolidation. Fluoroquinolone use is contraindicated in pregnancy and should be avoided. As many obstetric infections are amenable to surgical intervention, source control should be utilized as soon as is feasible if appropriate.

Although the effects of maternal therapy on the fetus should be considered, treatment of the mother has first priority. Overall, fetal status is best optimized by meeting maternal treatment goals. When a pregnant woman presents with sepsis, if the pregnancy is beyond viability (traditionally beyond 24 weeks gestation), continuous fetal monitoring is utilized and if below the limit of viability, a fetal heart rate should be documented. However, caution is necessary when monitoring a viable fetus in a critically ill woman because maternal stability is always the primary goal. Attempts to deliver an asphyxiated fetus may worsen a mother's condition and result in prematurely delivering a fetus who may have recovered with adequate resuscitation in utero. In the setting of maternal sepsis, fetal optimization is frequently best accomplished by meeting maternal hemodynamic, oxygenation, and infection treatment goals (24). As maternal acidemia and/or hypoxia resolves, fetal status will often improve.

Without clear pregnancy-specific data, recommendations are to follow the current guidelines for non-pregnant adults while being cognizant of the ways in which pregnancy may change maternal physiology and impact fetal well-being. Prompt identification and treatment of maternal sepsis will undoubtedly lead to the best possible maternal and neonatal outcomes.

Following are example order sets from UW Medical Center, illustrating pregnancy-specific modifications to the UWMC Sepsis Protocol.

### EMERGENCY DEPARTMENT RESUCITATION PHASE

SOS - Sepsis Order Set ED/Acute Care UWMC Multiphase, ED Resuscitation Phase (Planned Pending)

**ED RESUCITATION PHASE**

See separate Antimicrobial Phase for antibiotics. ED Pyxis contains only cefepime, ceftriaxone, and levofloxacin. Other antibiotics are delivered from the pharmacy.  
 <--- See Sepsis Flow Sheet for reference

IV Line Management: Insert, 1 site

Resuscitation Fluid Orders

**30ml/kg resuscitation fluids recommended for hypotension in Sepsis**  
 40-50kg = 1500 mL bolus  
 51-60kg = 2000 mL bolus  
 61-80kg = 2500 mL bolus  
 >80kg = 3000 mL bolus

**For patients who are pregnant or <6 weeks postpartum, initiate PowerPlan and consult OB team regarding management.**

Sodium Chloride 0.9% (Sodium Chloride 0.9% - IV Bolus) mL, IV Infusion, Once, wide open, IV SOLN

**Labs**

<input type="checkbox"/>	<input checked="" type="checkbox"/>	Basic Metabolic Panel	Stat
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Comprehensive Metabolic Panel	Stat
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Prothrombin Time w/ INR and PTT	Stat
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Complete Blood Count w/Diff	Stat
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Lactate Level, VEN PLASMA	Stat

A 2nd venous lactate level will be ordered automatically by the SYSTEM if initial venous lactate >= 2.

<input type="checkbox"/>	<input checked="" type="checkbox"/>	Blood Gas, ART	Stat
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Blood Gas, VEN	Stat

**ORDER 2 sets of blood cultures prior to antibiotic administration.**  
 - At least one set from a peripheral site.  
 - Each site/lumen requires a separate order.  
 - Add more culture orders using Add to Phase (e.g. additional Central Line lumen).

<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Culture Blood, Bact, Peripheral Collect	Stat, Blood
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Culture Blood, Bact, Peripheral Collect	Stat, Blood
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Culture Blood, Bact, Line Collect	Stat, Blood
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Culture Resp Lower, Bact w/ Stain	Stat
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Urinalysis Complete	Stat
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Culture Urine, Bact	Stat
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Direct Exam Gram Stain	Stat, Urine
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Influenza A/B & RSV by Rapid PCR	Stat

**For neutropenic patients or other immunocompromised patients, consider ordering Extended Respiratory Virus Panel**

Extended Respiratory Virus PCR Panel Stat

**Radiology**

<input type="checkbox"/>	<input checked="" type="checkbox"/>	XR Chest 1 View	Reason for Exam: Sepsis with suspected pulmonary source., Stat, Transport: Portable
<input type="checkbox"/>	<input checked="" type="checkbox"/>	XR Chest 2 Views	Reason for Exam: Sepsis with suspected pulmonary source., Stat

**If indicated, order Advanced Imaging** (e.g., CT, US, or MRI) using **Add To Phase**.

### OB SEPSIS SUB-PHASE

SOS - Sepsis Order Set ED/Acute Care UWMC Multiphase, Antimicrobials, OB Sepsis UWMC (Planned Pending)

Medications

**GENERAL GUIDELINES:**  
 1. Do not give fluoroquinolones to pregnant patients  
 2. Covers Streptococcus species and most Gram-negative

**If CrCl > 20 mL/min, order BOTH Load & Maintenance doses:**

<input type="checkbox"/>	<input checked="" type="checkbox"/>	piperacillin-tazobactam	4.5 q, IVPB, Once, Loading Dose, GU Infection / CAUTI
<input type="checkbox"/>	+4 hr	<input checked="" type="checkbox"/>	piperacillin-tazobactam 3.375 g, IVPB, Q8 Hours (non std), GU Infection / CAUTI Start 1st dose 4hrs after 4.5 g loading dose.

**If CrCl < 20 mL/min, NO loading dose:**

<input type="checkbox"/>	<input checked="" type="checkbox"/>	piperacillin-tazobactam	3.375 q, IVPB, Q12 Hours, GU Infection / CAUTI
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**AND Vancomycin**

order BOTH the INITIAL dose and the CONTINUING order (maintenance dosing/adjustment by pharmacy).

<input type="checkbox"/>	<input checked="" type="checkbox"/>	vancomycin	Select an order sentence
<input type="checkbox"/>	<input checked="" type="checkbox"/>	vancomycin - Managed by Pharmacy	Pharmacy Managed Dosing, 10 - 20 mcq/mL

**FOR PENICILLIN ALLERGY (anaphylaxis ONLY):**  
 Give Aztreonam + Clindamycin + Vancomycin:

<input type="checkbox"/>	<input checked="" type="checkbox"/>	aztreonam	2 q, IVPB, Q8 Hours, GU Infection / CAUTI
<input type="checkbox"/>	<input checked="" type="checkbox"/>	AND clindamycin	1,200 mg, IVPB, Q6 Hours, GU Infection / CAUTI
<input type="checkbox"/>	<input checked="" type="checkbox"/>	AND Vancomycin	

order BOTH the INITIAL dose and the CONTINUING order (maintenance dosing/adjustment by pharmacy).

<input type="checkbox"/>	<input checked="" type="checkbox"/>	vancomycin	Select an order sentence
<input type="checkbox"/>	<input checked="" type="checkbox"/>	vancomycin - Managed by Pharmacy	Pharmacy Managed Dosing, 10 - 20 mcq/mL

Return to Antimicrobials

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### **CITATION**

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