

OB Serious Infection / Sepsis Evaluation Pathway

Pathway Purpose: To guide early detection and treatment of serious infection/sepsis in perinatal patients.

Inclusion Criteria: Any antepartum, intrapartum or postpartum patient with suspected infection.

Step 1: Serious Infection Screen

Evaluate patient for signs of serious infection:

- Oral temperature $< 36^{\circ}\text{C}$ or $\geq 38^{\circ}\text{C}$
- Heart rate > 110 bpm sustained
- Respiratory rate > 24 bpm sustained
- WBC $> 15,000$ or $< 4,000$ or $> 10\%$ bands

2 or more signs of serious infection?

Yes

Bedside evaluation (by RN or MD/APP) within 30 min to assess:

- Patient and family concerns/symptoms
- Alternative diagnoses (e.g., hemorrhage, preeclampsia, CVD)
- Exam for source of infection (always consider chorioamnionitis)

In absence of alternative diagnosis, proceed to Step 2

Continue to reassess patient for development of signs of serious infection.

Notify MD of any sign(s) of serious infection.

No

No

Step 2: Serious Infection Evaluation & Empiric Treatment

Notify MD/APP of positive serious infection screen immediately. Goal to obtain orders as below in < 10 minutes.

- MD/APP to order "OB Sepsis, Chorioamnionitis or Endometritis" order set for care below

- Fluid bolus STAT: 1-2L Lactated Ringers over 1-2 hrs
- Start source directed antibiotics STAT (within 1 hr): See Page 3 & 4
- Draw labs STAT to evaluate for End Organ Injury (EOI):
 - Complete Blood Count (CBC) with Differential
 - Complete Metabolic Panel (CMP)
 - Lactic Acid
 - If source unknown
 - Urinalysis (UA) with reflex culture
 - Blood cultures – 2 Sets per Orders
- Increase vital sign monitoring*:
 - Continuous pulse oximetry
 - Continuous Electronic Fetal Monitoring (EFM) if pregnant with Gestational Age (GA) ≥ 23 weeks
 - Vital signs (including SpO₂ and mental status) q30min
 - Urine output q60min

* Adjust monitoring once labs resulted, see STEP 4

Proceed to Step 3 for Sepsis/EOI evaluation

Owner: Natali Aziz, Lauren Puckett, Taryn Ng

Team: Ron Gibbs, Deirdre Lyell, Krystle Cabico, Evelyn Ndaki, Brittany Reynolds, Catherine Martin

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Associated Epic CDS: OB Chorio / Endometritis / Serious Infection / Sepsis Order Set & OB Sepsis OPA

Associated Policies: None

Packard Clinical
Pathway Program



Feedback?

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Step 3: Confirmation of Sepsis/End Organ Injury (EOI)/Septic Shock Diagnosis

Evaluate Sepsis/EOI Confirmatory Criteria

*Sepsis/EOI is confirmed if any **ONE** of the criteria below are met in setting of positive Infection Screen (step 1)

Clinical Criteria for EOI:

CNS Patient agitated, confused or unresponsive

Hypoxia O₂ requirement, O₂Sat < 92%

Oliguria Urine output <60 mL in 2 hrs

Laboratory Criteria for EOI:

Platelets < 100 K/ μ L

Creatinine \geq 1.2 mg/dL OR doubling of creatinine from baseline

Total Bilirubin > 2 mg/dL

Lactic Acid

(measure of severity of infection rather than a true EOI criteria)

No labor: >2mmol/L

In labor: >4mmol/L

DO NOT collect in the 2nd stage OR within 1 hr of delivery

Step 4: Management based on EOI Criteria

All EOI Criteria Negative

Is patient in labor with lactate \geq 4 mmol/L?

No

Yes

SERIOUS INFECTION

Patient remains at high risk for sepsis/EOI:

- Continue antibiotics and maintenance fluids
- Monitor vital signs q30min until normal
- Bedside reevaluation if vital signs worsen
- I&O q shift

Lactate \geq 4 mmol/L, in setting of positive serious infection screen, is concerning even if EOI negative.

- Repeat lactate q2hr for trends until improving
- Continue antibiotics and monitor vital signs q30min until return to normal
- Perform bedside reevaluation if vital signs worsen or if lactate does not decline
- Consider additional fluids

\geq 1 EOI Criteria Positive

SEPSIS

- Activate OB Rapid Response
- Ensure blood cultures drawn
- Continue antibiotic therapy – broaden antibiotics as needed (see Page 3&4)
- Increase fluids to total **30mL/kg (ideal body weight)** within 3 hours
- Check Coags (PPT, INR, PT)
- Repeat lactate q2hrs for trends
- Continue monitoring at same frequency for 1st 12 hrs after positive serious infection screen:
 - if HR, BP, or RR outside ordered parameters, then increase to q15min
- After 12 hrs reassess monitoring cadence with MD/APP
- Notify MFM
- Notify OB Anesthesiologist
- Notify NICU if pregnant
- Consider transfer to ICU

SEPTIC SHOCK

Vasopressor requirement to maintain MAP >65 mmHg (despite adequate fluid load) AND lactate >2 (no labor) or >4 (in labor) in setting of infection

- Activate OB Rapid Response Team and Transfer to ICU
- For care, see Sepsis steps

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Infection	Preferred Therapy	Penicillin (PCN) / Cephalosporin Allergy
Chorioamnionitis	<p>Ampicillin AND Gentamicin*</p> <p>IF anticipate Cesarean delivery ADD: Metronidazole</p> <p>IF history of MDRO REPLACE Ampicillin & Gentamicin with: Meropenem†</p> <p>IF concern for Enterococcus or MRSA REPLACE Ampicillin OR Cefazolin with: Vancomycin‡</p>	<p>Cephalosporin tolerant with Non-Severe PCN Allergy: REPLACE Ampicillin with Cefazolin</p> <p>Severe PCN or Cephalosporin Allergy: REPLACE Ampicillin with Vancomycin‡</p>
Endometritis	<p>Ampicillin, Gentamicin* AND Metronidazole</p> <p>IF GBS negative, can discontinue Ampicillin.</p> <p>IF history of MDRO REPLACE Ampicillin, Gentamicin & Metronidazole with: Meropenem†</p> <p>IF concern for Enterococcus or MRSA REPLACE Ampicillin OR Cefazolin with: Vancomycin‡</p>	<p>Cephalosporin tolerant with Non-Severe PCN Allergy: REPLACE Ampicillin with Cefazolin IF GBS negative, can discontinue Cefazolin.</p> <p>Severe PCN or Cephalosporin Allergy: REPLACE Ampicillin with Vancomycin,‡ IF GBS negative, can discontinue Vancomycin.</p>
Pyelonephritis	<p>Ceftriaxone</p> <p>IF multiple antibiotic exposures or prior MDRO, then REPLACE Ceftriaxone with: Meropenem†</p>	<p>Cephalosporin tolerant with Non-Severe PCN Allergy: Preferred therapy acceptable.</p> <p>Severe PCN or Cephalosporin Allergy: Levofloxacin</p>
Septic Abortion	<p>Meropenem† AND Doxycycline#</p> <p>IF concern for Streptococcal Toxic Shock Syndrome, then also ADD: Clindamycin</p>	<p>Non-Severe PCN or Cephalosporin Allergy: Preferred therapy acceptable.</p> <p>Severe PCN or Cephalosporin Allergy: Preferred therapy may be acceptable (see † footnote) OR use Levofloxacin AND Metronidazole</p>
Abdominal Source (complicated)	<p>Meropenem†</p>	<p>Non-Severe PCN or Cephalosporin Allergy: Preferred therapy acceptable.</p> <p>Severe PCN or Cephalosporin Allergy: Preferred therapy may be acceptable (see † footnote) OR use Aztreonam AND Metronidazole AND Vancomycin‡</p>
Skin & Soft Tissue (necrotizing)	<p>Piperacillin-tazobactam,[§] Vancomycin,[‡] AND Clindamycin</p>	<p>Non-Severe PCN or Cephalosporin Allergy: REPLACE Piperacillin-tazobactam with Meropenem†</p> <p>Severe PCN or Cephalosporin Allergy: REPLACE Piperacillin-tazobactam with Meropenem (see † footnote) OR REPLACE Piperacillin-tazobactam with BOTH Aztreonam AND Metronidazole 500 mg IV q6h</p>
Community Acquired Pneumonia	<p>Ceftriaxone AND Azithromycin#</p> <p>IF influenza positive, then also ADD: Osetamivir</p>	<p>Cephalosporin tolerant with Non-Severe PCN Allergy: Preferred therapy acceptable.</p> <p>Severe PCN or Cephalosporin Allergy: Levofloxacin</p>
Hospital Acquired Pneumonia	<p>Vancomycin‡ AND Meropenem†</p>	<p>Non-Severe PCN or Cephalosporin Allergy: Preferred therapy acceptable.</p> <p>Severe PCN or Cephalosporin Allergy: Preferred therapy may be acceptable (see † footnote) OR REPLACE Meropenem with Levofloxacin</p>
Unknown Source	<p>Vancomycin‡ AND Meropenem† AND Consult ID</p> <p>IF concern for Streptococcal Toxic Shock Syndrome, then also ADD: Clindamycin</p>	<p>Non-Severe PCN or Cephalosporin Allergy: Preferred therapy acceptable.</p> <p>Severe PCN or Cephalosporin Allergy: Preferred therapy may be acceptable (see † footnote) OR REPLACE Meropenem with BOTH Aztreonam AND Metronidazole</p>

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Antimicrobial Dosing for OB Serious Infection / Sepsis Indications

Antimicrobial	Dose	Route	Frequency
Ampicillin	2 g	IV	q6h
Azithromycin [#]	500 mg	IV	q24h
Aztreonam	2 g	IV	q8h
Cefazolin	2 g	IV	q8h
Ceftriaxone	2 g	IV	q24h
Clindamycin	900 mg	IV	q8h
Doxycycline [#]	100 mg	IV	q12h
Gentamicin [*]	5 mg/kg	IV	q24h
Levofloxacin	750 mg	IV	q24h
Meropenem [‡]	1 g	IV	q8h
Metronidazole	500mg	IV	q8h (EXCEPT q6h in necrotizing skin and soft tissue infection)
Oseltamivir	75mg	PO	q12h
Piperacillin-tazobactam [§]	4g-500mg	IV	q8h
Vancomycin [¥]	20mg/kg (max 2g)	IV	q12h

^{*}Gentamicin: Refer to the [Guideline for Aminoglycoside Use](#) for drug monitoring recommendations.

[‡]Meropenem: Use extended-infusion if access is available: Loading dose 1g IV once over 30 minutes, then starting 4 hours later, 1g over 3 hours q8h.

[‡]Meropenem (and all Carbapenems): Can be safely used in some patients with prior penicillin/cephalosporin reactions if reaction was not IgE-mediated (e.g., anaphylaxis, urticaria, bronchospasm) and not a Type II-IV hypersensitivity reaction (e.g., SJS/TEN, serum sickness, acute interstitial nephritis, DRESS, hemolytic anemia/cytopenia, or drug fever).

[§]Piperacillin-tazobactam: Use extended-infusion if access available: Loading dose 4g -500mg IV once over 30 minutes, then starting 3 hours later, 4g-500 mg IV over 3 hours q6h.

[¥]Vancomycin: If severe vancomycin allergy, replace with Linezolid 600 mg IV q12h. Note Obstetric services do NOT require ID approval prior to use of Linezolid.

[¥]Vancomycin: Vancomycin per Pharmacy is preferred for suspected sepsis. Pharmacy will adjust dosing as appropriate based on renal function and vancomycin levels. Refer to the [Guideline for Vancomycin Use in Obstetric Patients](#) for details.

[#]Convert Azithromycin or Doxycycline from IV to oral as soon as patient stabilized and able to tolerate enteral medications.

Indications for Delivery:

- Sepsis by itself is not an immediate indication for delivery.
- In cases of chorioamnionitis/intraamniotic source infection, delivery should be part of management plan.
- The timing of delivery in a pregnant patient who is septic should be individualized, taking into consideration gestational age and maternal-fetal status.
- Cesarean delivery is usually reserved for supervening obstetric indications after the patient is stabilized by instituting appropriate supportive and antibiotic therapy.
- Corticosteroids for fetal lung maturity are not contraindicated in sepsis.
- Notify NICU if delivery is indicated.

Anesthetic Considerations:

- In patients with confirmed or suspected bacteremia, a joint decision-making conversation should occur between the patient and the obstetric anesthesiologist, and if the decision is to proceed with a neuraxial procedure, appropriate antibiotic therapy should be administered, and infusion(s) completed prior to placement.
- In a patient with clinical signs and/or symptoms consistent with a diagnosis of sepsis or septic shock, avoidance of neuraxial procedures should be strongly considered in the risk assessment.



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Definitions:

Sepsis -A life-threatening organ dysfunction caused by a dysregulated host response to infection,

Septic shock – Septic shock is a type of vasodilatory or distributive shock. Defined as sepsis that has circulatory, cellular, and metabolic abnormalities that are associated with a greater risk of mortality than sepsis alone. Clinically, this includes patients who fulfill the criteria for sepsis and who, despite adequate fluid resuscitation, require vasopressors to maintain a mean arterial pressure (MAP) ≥ 65 mmHg and have a lactate >2 mmol/L (>18 mg/dL).

Source control – Treatment of infection by surgical drainage or interventional radiologic procedure.

* Indications for delivery and Anesthetic Considerations, see page 4.

Differential Diagnoses

This is very broad and may include:

- Infection without sepsis
- Hypovolemia eg: from hemorrhage (may occur in combination with sepsis).
- Amniotic fluid embolism
- Pulmonary embolism
- Myocardial infarction
- Addisonian crisis

Pathophysiology:

- Sepsis is difficult to diagnose in pregnancy because physiologic changes of pregnancy mimic early signs of sepsis, eg: increased heart rate and decreased blood pressure.
- Sepsis develops when the host response to infection becomes dysregulated. Specifically, a cascade of inflammatory / anti-inflammatory proteins results in dysfunction of one or more organ symptoms.
- Sepsis is treated by antibiotic therapy, source control when indicated and supportive therapy.

Pathway Measure	Target
Time to antibiotics from Infection Screen Positive (OPA)	< 60 min
Time to order set placed from Infection Screen Positive (OPA)	< 10 min
Length of Stay	n/a
OB RRTs for Serious Infection/Sepsis per Month	n/a
ICU Transfers for Serious Infection/Sepsis per Year	0

References:

- 1) [CMQCC Improving Diagnosis and Treatment of Maternal Sepsis](#)
- 2) [SMFM & CMQCC Guidelines: Management of Sepsis in Pregnancy](#)
- 3) [Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock: 2016](#)
- 4) <https://med.stanford.edu/bugsanddrugs/guidebook.html>

