Sepsis in Obstetrics

Martina Burn, MD
Maternal-Fetal Medicine
University of Minnesota
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A collaboration among the University of Minnesota, University of Minnesota Physicians and Fairview Health Services

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Objectives

- Review the definition, incidence and pathophysiology of sepsis
- Review pregnancy related diagnostic challenges
- Understand the importance of the golden hour
- Review 10 tips for recognizing, evaluating and managing sepsis to prevent morbidity and mortality

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Sepsis

Background

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Definition

- **Sepsis**: life-threatening organ dysfunction caused by a dysregulated host response to infection
- **Septic shock**: a subset of sepsis in which profound circulatory, cellular, and metabolic abnormalities are associated with a greater risk of mortality

Bauer et al | PMID: 40570351

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New Terminology

	Surviving Sepsis Campaign Definition	Sepsis-3 Definition
SIRS	At least 2 of the following: • T > 38°C or < 36°C • HR > 90 • RR > 24 • PaCO2 <32 mmHg • WBC >14,000 or <4,000	Not used
Sepsis	At least 2 SIRS criteria and known or suspected infection	**Sepsis is a life-threatening organ dysfunction caused by dysregulated patient response to infection**
Severe Sepsis	Sepsis-induced hypotension • SBP <90 mmHg • MAP <70 mmHg or SBP reduction of 40 mmHg from baseline • Serum lactate >2 mmol/L • Signs of organ dysfunction	Not used
Septic Shock	Sepsis-induced hypotension that persists despite adequate fluid resuscitation and requires vasopressors to support perfusion	**Sepsis-induced hypotension that persists despite adequate fluid resuscitation and requires vasopressors to support perfusion**

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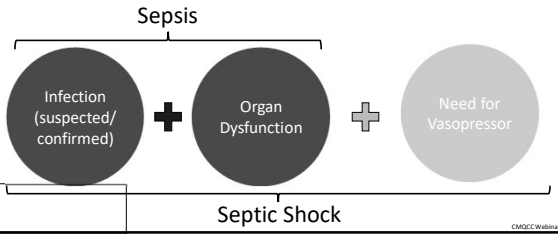
Sepsis-3 Definition

- WHO, ACOG, SMFM, CDC have adopted the Sepsis-3 definition of sepsis requiring end-organ dysfunction



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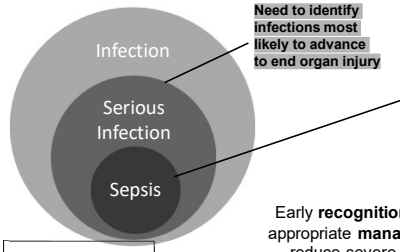
Sepsis-3 Issue



Need to identify infections most likely to advance to end organ injury

TABLE 2
Organ damage caused by sepsis

System	Description of damage
Central nervous system	Altered mental status
Cardiovascular system	Hypotension from vasodilation and third-spacing; myocardial dysfunction
Pulmonary system	ARDS
Gastrointestinal system	Paralytic ileus
Hepatic system	Hepatic failure or abnormal transaminases
Urinary system	Oliguria or acute kidney injury
Hematologic system	Thrombocytopenia or disseminated intravascular coagulopathy
Endocrine system	Adrenal dysfunction and increased insulin resistance

ARDS, acute respiratory distress syndrome.
Society for Maternal-Fetal Medicine. Maternal sepsis. Am J Obstet Gynecol 2023.

Early **recognition**, expedient **evaluation**, appropriate **management** are necessary to reduce severe morbidity and mortality

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SMFM CS#67 | PMID: 37236495

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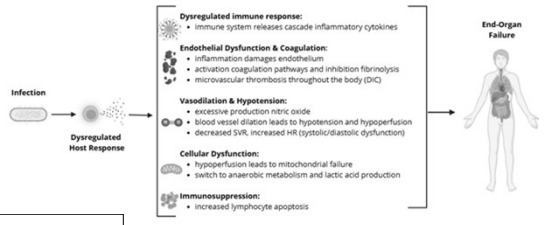
Pathophysiology



Bauer et al | PMID: 40570351

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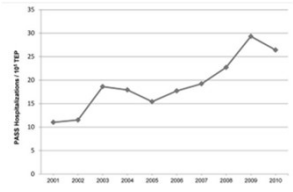
Incidence

- **Incidence: 5-29 per 10,000 deliveries**
  - Antepartum: 1:855
  - Intrapartum: 1:475-1:2,500
  - Postpartum: 1:769-1:840
- **Rate of maternal sepsis is increasing**



Bauer et al | PMID: 40570351
Ouzt et al | PMID: 25883702

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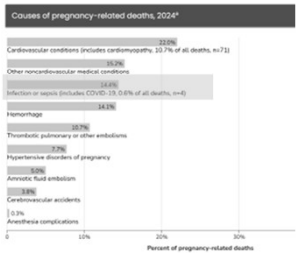
Significance

- **3rd** leading cause of maternal death in 2024
- Accounts for **14.4%** of all pregnancy-related deaths
- For each death, ~50 patients experience **life-threatening morbidity**
- Most sepsis related deaths are **preventable**



CDC Pregnancy Mortality Surveillance System | Accessed: 3/30/2026
Acosta et al | PMID: 25003759

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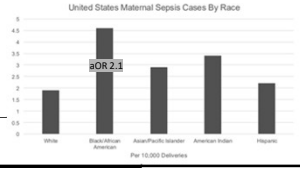
Risk Factors

- Of sepsis deaths >50% have **≥ 1 medical comorbidity**
  - Occurs in absence of risk factors
- Significant **racial inequities**



Box 2. Risk Factors Associated With Maternal Sepsis

Patient factors

- Obesity
- Impaired immunity or immunosuppressant therapy aOR 3.2
- Anemia
- Impaired glucose tolerance aOR 1.1
- Vaginal discharge
- History of pelvic infection
- History of group B streptococcal infection
- Group A streptococcal infection in close contacts
- Age older than 35 y aOR 1.5
- Disadvantaged socioeconomic background aOR 1.6
- Congestive heart failure aOR 135
- Chronic renal failure aOR 33.7
- Chronic liver failure aOR 55.9
- Systemic lupus erythematous aOR 9.4

Obstetric factors

- Cesarean delivery
- Retained products of conception aOR 4.5
- Prolonged rupture of membranes
- Multiple gestation aOR 1.8
- Cervical cerclage aOR 3.4-9.8
- Amniocentesis or other invasive procedure
- Complex perineal lacerations
- Wound hematoma

Bauer et al | PMID: 24023020
Shields et al | PMID: 34237760
SMFM CS#67 | PMID: 37236495

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Sepsis

Clinical Approach

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10 Tips for Sepsis Care

Recognition	1. Provide patient education 2. Maintain high index of suspicion 3. Use available diagnostic tools
The Golden Hour	4. Identify the source 5. Select appropriate antibiotics 6. Aid end organ perfusion 7. Escalation of care
Additional Care	8. Anticipate/Prevent pregnancy complications 9. Prevent additional complications 10. Debrief with the patient

Shields et al | PMID: 34237760

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10 Tips for Sepsis Care

Recognition	1. Provide patient education 2. Maintain high index of suspicion 3. Use available diagnostic tools

Shields et al | PMID: 34237760

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Tip 1: Provide Patient Education

- Many patients do not remember being counseled on urgent maternal warning signs (including sepsis)
- Build trust with patients so they are comfortable sharing concerns
- Proactive patient education is critical in order to avoid delays
- Many resources are available (ACOG, CDC)

Shields et al | PMID: 34237760

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Resources

- ACOG: Council on Patient Safety
- Urgent Maternal Warning Signs
- Identifies **15 key symptoms/signs** for multiple causes of severe morbidity
- **91 languages available**

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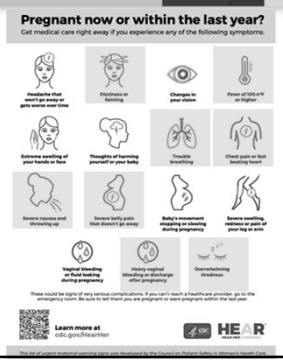
Resources

- CDC: Hear Her Campaign
- Identifies **15 key symptoms/signs** for multiple causes of severe morbidity
- **29 languages available**



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Tip 2: Maintain a high index of suspicion

- **Early recognition is critical** in order to reduce severe morbidity and mortality
  - Deadly "D"s of Sepsis: Denial, Delay, Dismissal
- Consider infection/sepsis in the context of normal pregnancy physiology

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Pregnancy and Sepsis

Pregnancy Factor:	Results in:
Population • Relatively young/healthy	Wellness Bias: • Signs of sepsis may be masked until moment of cardiovascular collapse
Pregnancy Physiology • ↑ HR, WBC count, GFR • ↓ BP • Shortness of breath, palpitations, abdominal pain	Diagnostic Challenge: • Limits the ability to use classic screening tools • Pregnancy/sepsis symptoms overlap
External Influences • Blood loss, anesthesia, medications, fluid administration, mode of delivery	Diagnostic Challenge: • Changes in hemodynamics may mask signs of sepsis

Shields et al | PMID: 34237760

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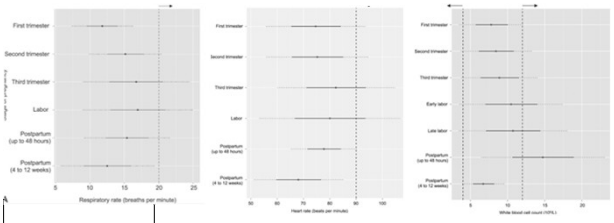
Pregnancy Physiology

Solid Line = 1 SD
Dotted Line = 2 SD
Vertical line = SIRS criteria

Respiratory Rate | **Heart Rate** | **WBC Count**



Bauer et al | PMID: 25162253

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Tip 3: Use available diagnostic tools and understand their limitations

- **Screening tools result in better adherence to sepsis bundles**
  - Reduce mortality: OR 0.66 (95% CI 0.61-0.72)
- **Current systems perform poorly in pregnancy**
  - Example: SOFA score (table 1)
  - Cr 1.2 = abnormal for pregnancy (under-estimates)
  - MAP <70 = can be normal for pregnancy (over-estimates)
- **Pregnancy-specific tools are available**
  - Help identify early warning signs in context of pregnancy
  - Not without limitations

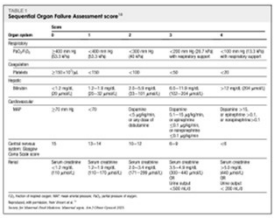
TABLE 1
Sequential Organ Failure Assessment score[a]

Shields et al | PMID: 34237760
SMFM CS#67 | PMID: 37236495

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Pregnancy Specific Screening Tools

Pregnancy Scoring System	Parameters Evaluated	Threshold	Advantages	Disadvantages
MOEWS[16]	Heart rate, respiratory rate, oxygen saturation, systolic blood pressure, temperature, and mental status changes	Varies	Simple bedside screening tool	Marked variation of thresholds and formats Sn = low PPV = low
omqSOFA[18]	Systolic blood pressure, [illegible] altered mental status	6	Uses only clinical data, allowing for rapid diagnosis	Overdetects severe sepsis Need for secondary testing to identify true-positives Low specificity; low PPV [illegible] in nonseptic causes in obstetric patients Need for secondary testing Sn = low PPV = low
S.O.S.[17,*]	Temperature, heart rate, respiratory rate, oxygen saturation, systolic blood pressure, leukocyte count, percentage neutrophils, and lactic acid	6	Excellent NPV Does not use altered mental status in criteria	Complex scoring system with need for ICU data, which can delay diagnosis Sn = 64% Sp = 88% PPV = 15%

MOEWS, modified Obstetric Early Warning Signs; PPV, positive predictive value; omqSOFA, obstetric modified quick Sepsis-related Organ Failure Assessment; S.O.S. Sepsis in Obstetrics Score; NPV, negative predictive value; ICU, intensive care unit.
* Free online calculator available at https://www.perinatology.com/calculators/Sepsis%20Calculatechtm.

Each have limitations

Best early warning system has not been clearly defined

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CMQCC 2-Step Approach

- California Maternal Quality Care Collaborative (CMQCC) developed a promising 2-step approach to identify sepsis and sepsis shock in pregnancy
  - Sensitivity: 97%, Specificity: 99%
- Step 1: **Initial Sepsis Screen**
  - Follows high vigilance approach
  - Uses standard assessments: vital signs, white blood cell count
- Step 2: **Confirmation of Sepsis Evaluation**
  - Step 1 triggered evaluation

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≥20 weeks and ≤72 hours

Step 1: Initial Screen

FIGURE 1
California Maternal Quality Care Collaborative 2-step system for diagnosis of maternal sepsis[38]

Suspected Infection | Routine Vital Signs / WBC Screening

- These pregnancy adjusted screen criteria should be used ≥20 weeks gestation and ≤72 hours postpartum
- At other times use standard non-pregnancy adjusted screen criteria

Step 1: Initial Sepsis Screen
- Oral temp < 36°C (96.8°F) or ≥ 38°C (100.4°F)
- Heart rate > 110 beats per minute
- Respiratory rate > 24 breaths per minute
- WBCs > 15,000/mm³ *or* < 4,000/mm³ *or* > 10% bands

Positive if any 2 of 4 criteria met

2 criteria

Perform bedside evaluation within 30 minutes
(RN, CNM, MD, DO)

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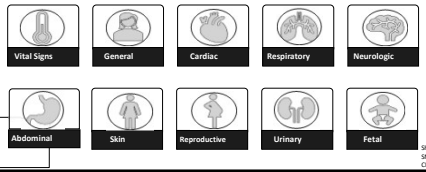
Bedside Evaluation

Step 2 - Bedside Sepsis Evaluation:

Assess for:
- Patient and family concerns/symptoms
- Alternative diagnoses (e.g. hemorrhage, preeclampsia)
- Infection possibility and potential source

In the absence of any alternative diagnosis, proceed to Action



Shields et al | PMID: 34237760
SMFM CM67 | PMID: 37236405
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Step 2: Confirmation of Sepsis

Step 2: Confirmation of Sepsis Evaluation
- Respiratory: New need for mechanical ventilation *or* PaO_2/FiO_2 < 300
- Coagulation: Platelets < 100 x 10^9/L ***or*** INR > 1.5 *or* PTT > 60 secs
- Liver: Bilirubin > 2 mg/dL
- Cardiovascular: SBP < 85 mm Hg *or* MAP < 65 mm Hg ***or*** > 40 mm Hg decrease in SBP (after fluids)
- Renal: Creatinine ≥ 1.2 mg/dL ***or*** doubling of creatinine *or* urine output < 0.5 mL/kg/hr x 2 hrs
- Mental Status: Agitated, confused, ***or*** unresponsive
- Lactic Acid: > 2 mmol/L in absence of labor

Confirmed if 1 or more criteria met

1 criteria

Remember: 25% pregnant patients who die of sepsis never develop a fever

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SMFM CM67 | PMID: 37236405
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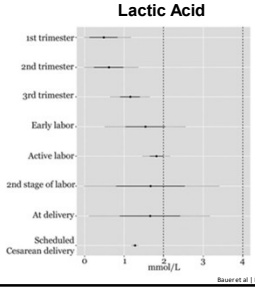
Quick Note: Lactate in Labor

- No longer marker of end organ damage
- Marker of severity (and recovery)
- Marker of tissue hypoperfusion
- Mild elevations in all stages of labor
  - >2mmol/L (abnormal)
  - >4mmol/L (abnormal in labor)



Bauer et al | PMID: 30396223

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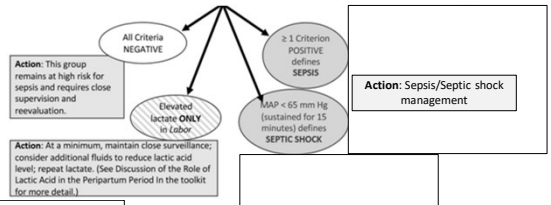
Step 2: Sepsis Confirmation



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10 Tips for Sepsis Care

Recognition

1. Provide patient education
2. Maintain high index of suspicion
3. Use available diagnostic tools

The Golden Hour

4. Identify the source
5. Select appropriate antibiotics
6. Aid end organ perfusion
7. Escalation of care

Shields et al | PMID: 34237760

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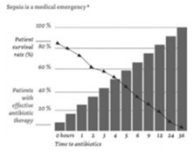
The Golden Hour

- Early recognition + therapy reduces morbidity and mortality
- **Early treatment matters**
  - Treatment within 1 hour: 80% survival
  - **Each hour delay = 8% decrease in survival**
  - Start treatment during confirmation step
- Sepsis bundles/response teams help to adhere to standards of care
- **Opportunity to alter outcome**



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SMFM CS#67 | PMID: 37236495
Kumar et al | PMID: 16625125

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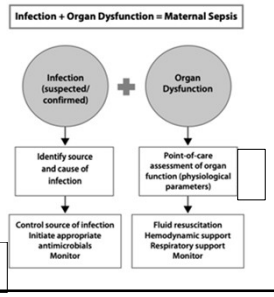
The Golden Hour Focus



Goal = Maternal stabilization

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Tip 4: Identify the Source of Infection

- History and physical exam should guide workup
- Potential assessment may include:
  - Blood cultures
  - Urinalysis/Urine Culture
  - Peripheral blood smear
  - Other cultures (sputum, wound, surgical site, body fluid)
  - Imaging (CXR, US, CT)
  - Labs (CBC with differential, CMP, coagulation studies, lactate, ABG)

Shields et al | PMID: 34237760

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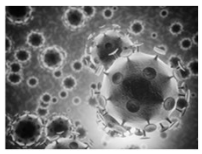
Early Identification of Source

- Identification of source important for:
  - Tailoring antibiotics
  - Obtaining source control
    - Intra-amniotic infection → delivery
    - Abscess → drainage
    - Intravascular access device → prompt removal
- **Antibiotics should never be delayed more than 1 hour for culture collection**



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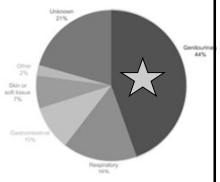
Know the common differential

Antepartum	Intrapartum/ Immediate Postpartum	Post-discharge
Septic abortion	Chorioamnionitis/ intraamniotic infection	Pneumonia/influenza
Chorioamnionitis/ intraamniotic infection	Endometritis	Pyelonephritis
Pneumonia/influenza	Pneumonia/influenza	Wound Infection/ necrotizing fasciitis
Pyelonephritis	Pyelonephritis	Mastistis
Appendicitis	Wound Infection/ necrotizing fasciitis	Cholecystitis



In 30% of cases no source identified

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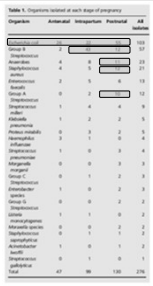
Tip 5: Early initiation of antimicrobial therapy

- Antimicrobial therapy should:
  - Target the most likely source
  - Be consistent with local antibiogram
  - If source is unknown use broad-spectrum coverage
    - Gram + (including MRSA)
    - Gram -
    - Anaerobic organisms
    - *often polymicrobial



Knowles et al | PMID: 24862293

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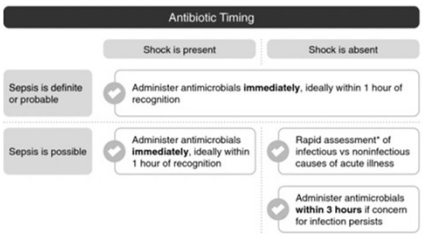
Goal Antibiotic Timing



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Evans et al| PMID: 34599691

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Antibiotic Selection – Known Source

TABLE 4
Proposed broad-spectrum empiric antibiotic coverage in sepsis complicating pregnancy

Source infection	Recommended antibiotics
Community-acquired pneumonia	Cefotaxime, ceftriaxone, ertapenem, or ampicillin plus azithromycin, clarithromycin, or erythromycin.[55]
Hospital-acquired pneumonia	Low-risk patients may be treated with ceftriaxone, ampicillin-sulbactam, ertapenem, meropenem, imipenem, or cefepime. Patients at high risk of mortality may need double coverage for *Pseudomonas* (beta lactam plus an aminoglycoside or a quinolone) and MRSA coverage with vancomycin or linezolid.[56,57]
Chorioamnionitis	Ampicillin plus gentamicin.[58] Add anaerobic coverage with clindamycin or metronidazole if cesarean delivery required.
Endomyometritis	Ampicillin, gentamicin, and metronidazole (or clindamycin). Alternatively, may use cefotaxime or ceftriaxone plus metronidazole.[59]
Urinary tract infections	Gentamicin with ampicillin Alternatively, may use monotherapy with a carbapenem or piperacillin-tazobactam.[60]
Abdominal infections	Ceftriaxone, cefotaxime, ceftazidime, or cefepime plus metronidazole.[61] Complicated cases may require monotherapy with a carbapenem or piperacillin-tazobactam.
Skin and soft tissues (necrotizing)	Vancomycin plus piperacillin-tazobactam.[62] If group A *Streptococcus* or *Clostridium perfringens* are present, use penicillin G plus clindamycin.

MRSA, methicillin-resistant Staphylococcus aureus.
Society for Maternal-Fetal Medicine. Maternal sepsis. Am J Obstet Gynecol 2023.

SMFM CS#67 | PMID: 37236495

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Antibiotic Selection – Unknown Source

Piperacillin/tazobactam 4.5g IV q8h **AND** Vancomycin – per institutional protocol (target AUC_{24} 400-600)
For Type I Penicillin Allergy (immediate hypersensitivity-hives, wheezing, anaphylaxis): Cefepime 2g IV q8h **AND** Metronidazole 500mg IV/PO q8h **AND** Vancomycin – per institutional protocol (target AUC_{24} 400-600)

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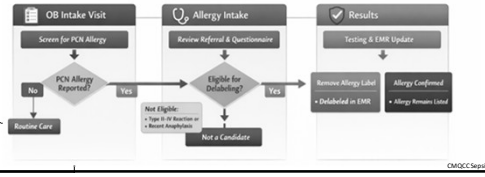
Quick Note: Penicillin Allergy

- 1 in 10 patients report a penicillin allergy (90% of these are inaccurate)
- Penicillin allergy label ≠ no beta lactams
- Major opportunity to improve care through referral + allergy de-labeling



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Quick Note: Intraamniotic Infection

- Common cause of intrapartum fever
- Most patient with IAI will not develop sepsis
- Classic management
  - Antibiotics
  - Fluids
  - Source control (delivery)
- **Requires ongoing vigilance/assessment**

Empiric Management of Chorioamnionitis/Endomyometritis-1

Setting	Preferred Regimens	Type I Allergy to Penicillin (immediate hypersensitivity)	Type I Allergy to cephalosporins or type II-IV Penicillin Allergy
Uncomplicated Chorioamnionitis and Endomyometritis	Ampicillin 2g IV q6h AND Aminoglycoside **If having a cesarean,** ADD Clindamycin 900mg IV q8h OR Metronidazole 500mg PO/IV q8h OR Piperacillin-tazobactam 4.5g IV q8h, 4-h infusion OR Ceftriaxone 2g IV q24h AND Metronidazole 500mg PO/IV q8h OR Ampicillin-Sulbactam 3g IV q6h AND Aminoglycoside	Ceftriaxone 2g IV q24h AND Metronidazole 500mg PO/IV q8h	Ertapenem 1g IV q24 hours OR Meropenem 1g IV q8 hours

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Quick Note: Intraamniotic Infection

Recommendations for which IAI Patients Need Evaluation with CBC & Chem Panel

- Pulse >120 (sustained for 20 min)
- Respiratory Rate >24
- Temp ≥39C
- Mental Status changes: confused, agitated
- Clinical judgement for "appears sick/toxic"

Empiric Management of Chorioamnionitis/Endomyometritis-2

Setting	Preferred Regimens	Type I Allergy to Penicillin (immediate hypersensitivity)	Type I Allergy to cephalosporins or type II-IV Penicillin Allergy
Serious Illness (signs of end organ injury) (If different from the routine chorioamnionitis regimen above, replace with one of these regimens)	Piperacillin-tazobactam 4.5g IV q8h, 4-h infusion OR Ceftriaxone 2g IV q24h AND Metronidazole 500mg PO/IV q8h	Ceftriaxone 2g IV q24h AND Metronidazole 500mg PO/IV q8h	Meropenem 1g IV q8 hours
Critical Illness (requiring broad spectrum coverage)	Refer to antibiotics for Sepsis of Unknown Source OR Septic Shock		

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Quick Note: Group A Strep (GAS)

- Not part of normal microbiome (0.03% population)
- Organism most associated with **fatal maternal sepsis**
- Range of infections: fulminant endomyonecrosis, necrotizing fasciitis, streptococcal toxic shock syndrome
  - Associated with missed abortion, stillbirth, retained products
- Suspect with rapid deterioration (within hours) + pain out of proportion to exam
- ***Rapid therapy is paramount***
  - High dose antibiotics (Vancomycin/Zosyn/Clindamycin)
  - Fluids
  - Early surgical intervention (debridement, uterine evacuation, hysterectomy)

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Tip 6: Maintain adequate tissue perfusion

- Fluid resuscitation should be part of initial intervention
  - **2021 SSC:** 30cc/kg within first 3 hours
    - Pregnant patients have lower oncotic pressure
    - Only 50% of hypotensive septic patients respond to fluids
    - LV dysfunction, pulmonary edema, cerebral edema, bowel edema –> increased mortality
  - **2023 SMFM**: 1-2L early (within 3 hours) balanced crystalloid solution
    - Fluid response should be carefully monitored (invasive hemodynamic monitoring, urine output, mental status, serial lactate levels every 2-4 hours)

Shields et al | PMID: 34237760
SMFM CS#67 | PMID: 37236495

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Vasopressors and Inotropes

- Necessary if not fluid responsive or not a candidate for further fluids
- Norepinephrine is first-line → **improves hemodynamics in 93% of patients**
  - Alpha-1 agonist: vasoconstriction, increases PVR
  - Beta-1 agonist: increases cardiac output (HR, contraction)
  - *can reduce uterine blood flow
- MAP goals should be individualized
  - Classic: >65 mm Hg (lower targets may be appropriate in some cases)

Shields et al | PMID: 34237760
SMFM CS#67 | PMID: 37236495

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Vasopressors and Inotropes

TABLE 5
Common vasopressors and inotropes used to treat septic shock during pregnancy and the postpartum period[16]

Vasopressor/ inotrope	Mechanism of action	Effects	Comments
Norepinephrine	Potent alpha-1 and beta-1 adrenergic receptor agonist	Increases the mean arterial pressure with a minimal impact on heart rate	• Lower mortality and lower risk of arrhythmias vs dopamine[17] • First-line agent for septic shock[1,3]
Vasopressin	Endogenous peptide hormone produced by the hypothalamus and stored and released by the posterior pituitary gland	Vasoconstrictive activity through binding of V_1 receptors on vascular smooth muscle resulting in increased arterial blood pressure	• Higher doses associated with cardiac, digital, and splanchnic ischemia[18] • Theoretical interaction with oxytocin receptors has been hypothesized[19]
Epinephrine	Potent β-1 adrenergic activity and moderate β-2 and α-1 adrenergic receptor activity	Lower doses (action on β-1 adrenergic receptors) • Increase CO • decrease SVR • variable effects on MAP(Higher doses: increase SVR and CO	• May be used alone in patients with septic shock and myocardial dysfunction[20] • Potential adverse effects include arrhythmias and impaired splanchnic circulation[21,22] • May increase aerobic lactate production via stimulation of skeletal muscle β-2 adrenergic receptors, making the use of serum lactate to guide resuscitation challenging[23]
Dobutamine	Inotrope that stimulates β-1 receptors of the heart	• Increases CO output and oxygen transport • Increases tissue performance • Improves acidosis and hyperlactatemia	Add to norepinephrine for patients with myocardial dysfunction who persist in septic shock[1,3]

CO, cardiac output; MAP, mean arterial pressure; SVR, systemic vascular resistance.
Society for Maternal-Fetal Medicine. Maternal sepsis. Am J Obstet Gynecol 2023.

SMFM CS#67 | PMID: 37236495

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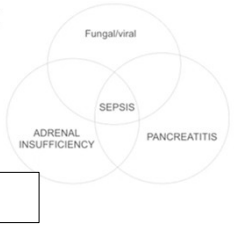
Refractory Septic Shock

- **Defined** as septic shock that persists despite dose of NE or Epi ≥0.25 μg/kg/min for at least 4 hours
- **Reconsider differential**
  - Up to 1/3 have an alternate diagnosis
- **Sepsis-induced adrenal insufficiency**
  - Administration of IV hydrocortisone 200mg/d (50mg q 6 hours) x 7 days
  - May accelerate resolution of shock



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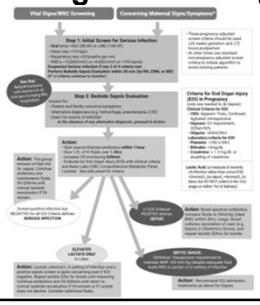
Summary of Diagnosis/Management



Shields et al | PMID: 34237760
SMFM CS#67 | PMID: 37236495
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Tip 7: Escalation of care is critical

- First: provide initial care
  - Stabilize the patient
- Second: escalate care
  - Septic shock increases risk of maternal death and multiorgan failure
  - Early consultation with infectious disease, critical care, maternal-fetal medicine
  - Aim to transfer to ICU **within 6 hours**
  - Source control can continue in the ICU setting

Shields et al | PMID: 34237760
SMFM CS#67 | PMID: 37236495

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10 Tips for Sepsis Care

Recognition
1. Provide patient education
2. Maintain high index of suspicion
3. Use available diagnostic tools

The Golden Hour
4. Identify the source
5. Select appropriate antibiotics
6. Aid end organ perfusion
7. Escalation of care

Additional Care
8. Anticipate/Prevent pregnancy complications
9. Prevent additional complications
10. Debrief with the patient

Shields et al | PMID: 34237760

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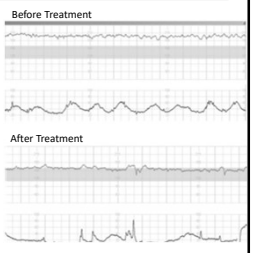
Tip 8: Anticipate and prevent adverse pregnancy outcomes

- **Sepsis alone is not an indication for delivery**
  - Exception: intraamniotic infection (requires source control)
  - Decision to deliver: gestational age, fetal condition, maternal condition
- **Measures that improve maternal hemodynamics improve uteroplacental perfusion and fetal status**
  - SBP >90 mmHg, MAP >65 mm Hg typically maintains uteroplacental circulation



Barton et al | PMID: 22914482
Shields et al | PMID: 34237760
SMFM CS#67 | PMID: 37236495

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Pregnancy Considerations

Complications
- Preterm birth: 29%
- Fetal death: 10-12%
- Placental dysfunction: OR 1.88

Management
- Continuous fetal monitoring (viability)
- Deliver for usual obstetric indications
- Corticosteroids for fetal lung maturity
  - Do not delay delivery for steroids
- Can consider tocolysis (magnesium)
- NICU consultation

Shields et al | PMID: 34237760

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Tip 9: Prevent additional complications associated with critical illness

- **Prevent venous thromboembolism** → VTE prophylaxis
  - 37% risk with sepsis
  - Risk factors: pregnancy, medical comorbidities, immobility
  - VTE prophylaxis recommended
- **Avoid anemia** → Transfuse to Hb >7g/dL
  - Aids with tissue perfusion
- **Avoid hyperglycemia** → Administer insulin
  - Blood glucose >180mg/dL associated with increased mortality
- **Early enteral feeding**
- **Stress ulcer prophylaxis**
- **De-escalation of antibiotics as appropriate**

Bauer et al | PMID: 40570351
Shields et al | PMID: 34237760

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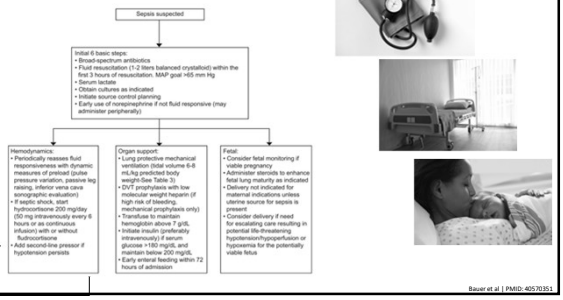
Summary of Therapies



Bauer et al | PMID: 40570351

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Tip 10: Remember to debrief critical events

- Too many patients leave hospital with little or no understanding of what happened to them
- Expected outcomes for birth lie in stark contrast to the critical illness experience → **risk for trauma and poor mental health outcomes**
- **What can we do**:
  - Acknowledge the events and debrief
  - Assess social support
  - Use the CMQCC guide for "pre-discharge care discussion"

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Pre-Discharge Care Discussion

1. Assess patient understanding
2. Provide overarching description of the condition
3. What happened with this specific patient
4. Pause for questions
5. Review what to expect next


Appendix Z

Guide For Pre-Discharge Care Discussion (aka Patient Debrief) After a Severe Maternal Event

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What not to Say

- Words stick with patients
- Goal: mitigate further trauma and start path towards healing
- Examples:
  - Do not say: "You almost died, but we were able to save you" (takes away from patient's strength)
  - Instead: "You were quite sick, but your body is tough and resilient"
  - Do not say: "All that matters is a healthy mom and a healthy baby" (dismissive)
  - Instead: "I know this was not the birth experience you expected. It is okay to have feelings about that"


Appendix Y

Supportive Communication After a Severe Maternal Event: What Not to Say and Why

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Summary

Recognition	1. Provide patient education 2. Maintain high index of suspicion 3. Use available diagnostic tools
The Golden Hour	4. Identify the source 5. Select appropriate antibiotics 6. Aid end organ perfusion 7. Escalation of care
Additional Care	8. Anticipate/Prevent pregnancy complications 9. Prevent additional complications 10. Debrief with the patient

Shields et al | PMID: 34237760

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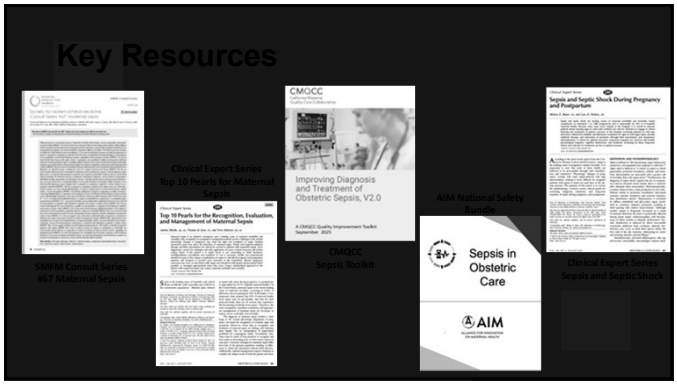
Key Resources
SMFM Consults Series #67 Maternal Sepsis
Clinical Expert Series Top 10 Pearls for Maternal Sepsis
Top 10 Pearls for the Recognition, Evaluation, and Management of Maternal Sepsis
CMQCC
Improving Diagnosis and Treatment of Obstetric Sepsis, V2.0
A CMQCC Quality Improvement Toolkit
September 2021
CMQCC Sepsis Toolkit
AIM National Safety Bundle
Sepsis in Obstetric Care
AIM
Sepsis and Septic Shock During Pregnancy and Postpartum
Clinical Expert Series Sepsis and Septic Shock

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HEALTH FAIRVIEW
Thank you!
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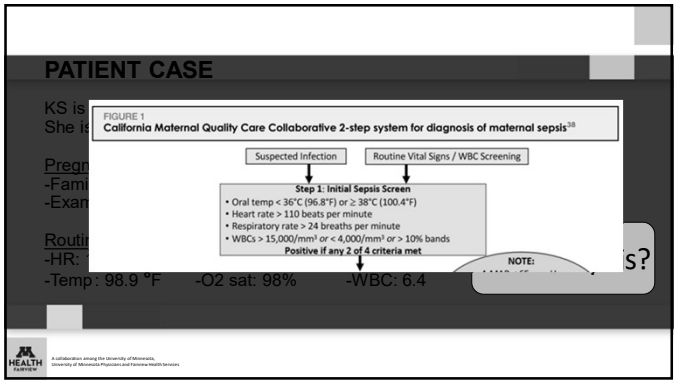
PATIENT CASE
KS is
She is
Pregn
-Fam
-Exam
Routi
-HR:
-Temp: 98.9 °F
-O2 sat: 98%
-WBC: 6.4
FIGURE 1
California Maternal Quality Care Collaborative 2-step system for diagnosis of maternal sepsis[38]
Suspected Infection
Routine Vital Signs / WBC Screening
Step 1: Initial Sepsis Screen
• Oral temp < 36°C (96.8°F) or ≥ 38°C (100.4°F)
• Heart rate > 110 beats per minute
• Respiratory rate > 24 breaths per minute
• WBCs > 15,000/mm³ or < 4,000/mm³ or > 10% bands
Positive if any 2 of 4 criteria met
NOTE:
S?
HEALTH FAIRVIEW
A collaboration among the University of Minnesota, University of Minnesota Physicians and Fairview Health Services

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PATIENT CASE

KS is
She is

Pregn
-Fami
-Exan

Routi
-HR:
-Temp : 99.9 °F -O2 sat: 98% -WBC: 8

FIGURE 1
California Maternal Quality Care Collaborative 2-step system for diagnosis of maternal sepsis[38]

Suspected Infection | Routine Vital Signs / WBC Screening

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- Heart rate > 110 beats per minute
- Respiratory rate > 24 breaths per minute
- WBCs > 15,000/mm³ or < 4,000/mm³ or > 10% bands

Positive if any 2 of 4 criteria met

NOTE:

s?

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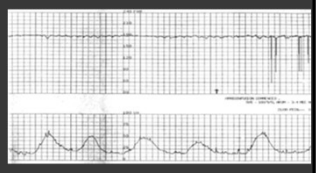
PATIENT CASE

Bedside Evaluation
-chills, fatigue, mild nausea
-mild, generalized abdominal tenderness
-cervix: closed

Fetal Heart Tracing
-Fetal Tachycardia
-Uterine contractions



Differential?

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PATIENT CASE

Step 2: Confirmation of Sepsis Evaluation
- Respiratory: New need for mechanical ventilation or PaO_2/FIO_2 < 300
- Coagulation: Platelets < 100 x 10^9/L ***or*** INR > 1.5 *or* PTT > 60 secs
- Liver: Bilirubin > 2 mg/dL
- Cardiovascular: SBP < 85 mm Hg *or* MAP < 65 mm Hg ***or*** > 40 mm Hg decrease in SBP (after fluids)
- Renal: Creatinine ≥ 1.2 mg/dL ***or*** doubling of creatinine *or* urine output < 0.5 mL/kg/hr x 2 hrs
- Mental Status: Agitated, confused, ***or*** unresponsive
- Lactic Acid: > 2 mmol/L in absence of labor

Confirmed if 1 or more criteria met

-Amylase: 55 U/L
-Lactic Acid: 1.2 mmol/L

Is this sepsis?

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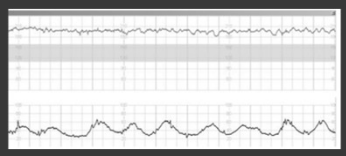
PATIENT CASE

Repeat Vitals:
-HR 112
-Temp: 103.1 F
-O2 Sat: 98%
-BP: 80/55 (MAP 63)
-RR: 20



Hour 1:
-Cultures/labs sent
-Started on vancomycin/Zosyn
-Received 2L crystalloids

30 minutes later:
-MAP <65 mm Hg
-Minimal urine output
-Lactate: 2.4 mmol/L
-Transfer to ICU for norepinephrine

Is this septic shock?

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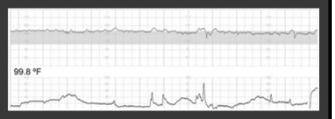
PATIENT CASE

Several Hours Later:
-Blood cultures: Gram positive cocci (Staph aureus)
-MAP: 65 mm/Hg
-Improved urine output
-Lactate: <2mmol/L
-Midline catheter removed
-After stabilization → delivery
-Patient debrief



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The 5 R Framework

Readiness	• Obstetric sepsis educational resources • Preparedness considerations for low-resource hospitals and emergency departments
Recognition & Prevention	• Screening and diagnosis of sepsis in pregnancy • Bedside evaluation • EMR and nurse-driven care
Response	• Fundamentals or care of sepsis during pregnancy • Source control • Antibiotics • Chorioamnionitis/intraamniotic infection • Prophylactic antibiotics on labor and delivery • Management of antibiotic allergies
Reporting & Systems Learning	• Measuring quality in the care of obstetric sepsis • Measures for sepsis bundle implementation • Debriefs and multidisciplinary case review guidance
Respectful, Equitable, & Supportive Care	• Initiating healing after a severe maternal event • Connecting with community and patient advocates

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Antivirals/Antifungals

Common Pathogens	Presenting Symptoms and Signs	Treatment
Seasonal influenza (A, B, H1N1)[43]	Pneumonia Hepatitis Flu-like illness Septic shock ARDS	Oseltamivir 75 mg orally twice daily for 5 d Alternatives: zanamivir two 5-mg inhalations (10 mg total) twice daily for 5 d or peramivir 600-mg dose by IV infusion for 15–30 min
Varicella zoster (chickenpox)[45,46]	Pneumonia Hepatitis Flu-like illness Encephalitis Myocarditis	Acyclovir 10–15 mg/kg of body weight IV every 8 h for 5–10 d for VZV pneumonia and should be started within 24–72 h of rash
Disseminated herpes simplex disease[40,42,51]	Hepatitis Encephalitis, thrombocytopenia, leukopenia Coagulopathy	Acyclovir 5–10 mg/kg of body weight IV every 8 h for 2–7 d or until clinically improved, then oral therapy for primary infection to complete a total of 10 d (if encephalitis, extend treatment to 21 d)
Invasive candidiasis[49,50,52]	Pneumonia Acute renal failure Osteomyelitis Septic shock	Liposomal amphotericin B 3–5 mg/kg/d Alternative: amphotericin B deoxycholate 0.5–1.0 mg/kg/d (treat for at least 2 wk after symptoms have resolved, longer if involvement of bones, joints, heart, or CNS)

ARDS, acute respiratory distress syndrome; IV, intravenously; VZV, varicella zoster virus; CNS, central nervous system.

Shields et al | PMID: 34237760

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Other Antibiotics

Source of Infection	Preferred Regimen	Type I Penicillin Allergy
Septic Abortion or Retained Products of Conception or Pelvic Abscess	Piperacillin-tazobactam 4.5g IV q8h, 4-h infusion **May add** Doxycycline 100mg IV/PO q12h	Cefepime 2g IV q8h AND Metronidazole 500mg IV/PO q8h **May add** Doxycycline 100mg IV/PO q12h
Urosepsis	Ceftriaxone 2g IV q24h **May add** Aminoglycoside	

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