Maternal Sepsis  
Recognition of a Potential Killer

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Objectives

- List at least 4 risk factors for sepsis in pregnancy
- Discuss signs and symptoms of sepsis in pregnancy and how they differ from the non-pregnant patient
- Review treatment options for pregnant patients with sepsis

Why the Concern?

- In the general non-pregnant population, sepsis is a leading cause of death!
- Pregnanacies complicated with sepsis associated with increased rates of preterm labor, fetal infection, and preterm delivery
- Onset of sepsis in pregnancy can be deceptive
- Accounts for 35% of maternal deaths/year worldwide
- 4th leading cause of maternal mortality (US): 13% of maternal deaths; 5% of ICU admissions
Pathophysiology of Sepsis

- Sepsis – Stems from an infection
- Sources of infection
  - Bacteria
  - Viruses
  - Fungi
- Most common sites of infection
  - Lungs
  - Abdomen
  - Kidney
  - Bloodstream
- Factors leading to sepsis
  - Type of microbe
  - Immune System of host

“Normal” Infectious Process

Exposure to microbe

Normal Clean-up Operation
- Cytokines
- Complement
- Coagulation factors

“Normal” Infectious Process

“Normal” Infectious Process

Atypical Inflammatory Reaction

1. Bacterial endotoxin release
2. Massive cytokine release
3. Leads to diffuse cerebral dysfunction, increased leukocyte oxygen consumption, fever, increased metabolic rate, vasodilation and capillary leak, impaired cardiac contractility, decreased renal function, widespread complement/coagulation cascade activation, poor hepatic function
4. Hemodynamic collapse occurs
5. Leads to hypoxic respiratory failure, shock, acute renal failure, DIC, coagulopathy

“Sepsis has been referred to as a process of malignant intravascular inflammation. It is considered malignant because it is uncontrolled, unregulated, and self-sustaining. It is considered intravascular because it represents the blood-borne spread of what is usually a cell-to-cell interaction in the interstitial space. It is considered inflammatory because all characteristics of the septic response are exaggerations of the normal inflammatory response.”

Definitions

- 1992 - SIRS criteria
- 2004 - Surviving Sepsis Campaign
  - Set definitions and guidelines for treatment of sepsis
  - Revised in 2008
- 2012 - SSC added hyperglycemia and altered mental status
- 2015 - SSC discarded term “severe sepsis”
  - Sepsis
  - Infection + a systemic response to the infection with signs of life-threatening organ dysfunction according to SOFA score

Definitions continued...

- Septic Shock
  - Subcategory of sepsis
  - Hypotension that does not respond to fluid boluses
  - Requirement of vasopressors to maintain MAP > 65mmHg
  - Serum lactate level > 2mmol/L

- 2016 - Recommend that hospital systems have a performance improvement program for sepsis
Risk Factors For Infection in Pregnancy

- Physiologic changes of pregnancy
- Home birth in unhygienic conditions
- Low socioeconomic status
- Poor nutrition
- Primiparity
- PPROM
- Multiple VE in labor (more than 5)
- Cesarean section
- Multiple pregnancy
- Obesity
- Obstetrical maneuvers
- Use of antibiotics within 2 weeks of birth (includes prophylaxis for c/sections!)

Kaponis, et al., 2012

Predisposing OB conditions for septic shock:

- Intra-amniotic infection
- Triple I* (Chorioamnionitis)
- Septic abortion
- Septic pelvis thrombophlebitis
- PP endometritis
- Down-regulation of inflammatory response
- Pylonephritis*
- Wound infection (Cesarean sections, included*)
- Cholecystitis
- Appendiceal abscess
- Invasive procedures
- GYN

Surviving Sepsis Campaign
Bamfo, 2013; Kaponis, et al., 2012
Higgins, et al., 2016

Causes

- Aerobic and anaerobic bacteria most common – can be viral or fungal
  - Group B-Strep – 18% higher incidence
  - Group A Streptococcus pyogenes (GAS) – PP 20-fold increased risk
  - E-coli – 15% higher incidence

- Routes
  - Ascending infection leading to intraamniotic infections
  - Genital/urinary tract infections - Pylonephritis
  - Triple I
  - PP endometritis
  - Mastitis
  - Wound infections
  - Retained products of conception
  - Non-obstetric causes
Stats...

• 5-10% of women with intraamniotic infections have bacteremia
• 50% of patients with bacteremia – s/s of sepsis
• 40% of patients with sepsis – progress to septic shock
• This can progress in a few days – or several hours!

Signs and Symptoms

• Problematic for pregnant patients
• Symptoms vary but most common include:
  • Pyrexia (>38°C)/Hypothermia (<36°C)
  • Tachycardia (>110/min)
  • Tachypnea (>24)
  • Abnormally low/elevated WBC
  • Clotting abnormalities
  • N/V
  • Disproportionate pain
  • Abnormal FHR (tachycardia)
  • Altered mental status
  • Necrotizing fasciitis
  • Preterm labor

Signs and Symptoms

• Signs of acute end organ dysfunction
  • Decreased capillary refill/skin mottling/gangrene
  • Lactic acid above normal values (>2mmol/L)*
  • Creatinine > 1.5mg/dl.
  • Bilirubin >2mg/dl.
  • Urinary output < 0.5ml/kg/hr for 2 hours or serum creatinine >1.5mg/dL
  • Increased O2 to maintain sats >92%
  • INR >1.5 or PTT >60 without medication
  • SBP decrease >40mmHg from baseline
  • MAP < 60mmHg
  • ALI with PaO2/FiO2 ratio < 250
  • Platelet count < 100,000

Surviving Sepsis Campaign

Albright, 2015
MEWT Tool

- Maternal Early Warning Trigger Tool
- Primary goal – Timely assessment and management of patients suspected of clinical deterioration
- 4 Categories
  - Infection - Sepsis
  - Cardiopulmonary
  - Hypertension in Pregnancy
  - Obstetrical Hemorrhage

Maternal Triggers (severe/single abnormal trigger values)

*Only need 1 abnormal severe Maternal Trigger to trigger use of early warning tool.

- Heart Rate: > 130/min
- Respiratory Rate: > 30/min
- MAP (Mean Arterial Pressure): < 55mmHg
- Pulse Ox: < 90%
- Nurse clinically uncomfortable with the patient’s status

Maternal Triggers (non-severe abnormal values)

MEWT Non-severe abnormal values

- Temperature: > 38°C (100.4°F) or < 36°C (96.9°F)
- Pulse Ox: < 93%
- Heart Rate: > 110/min or < 50/min
- Respiratory Rate: > 24/min or < 12/min
- Systolic BP: > 155 mmHg or < 80 mmHg
- Diastolic BP: > 105 mmHg or < 45 mmHg
- Altered Mental Status
- Disproportionate Pain
- Fetal Heart Rate: > 160 bpm (Infection pathway only)

*Must have 2 abnormal Maternal Triggers, sustained for greater than (> ) 20 minutes to trigger use of the early warning tool.
Treatment

• Goal of treatment:
  ▪ Restore normal oxygen delivery
  ▪ Improve tissue oxygenation

• Time zero!!!
  ▪ Aggressive support needed!
  ▪ #1 – Draw labs – especially blood cultures
    ▪ Cultures (preferably before antibiotic therapy) – blood, urine, sputum, cerebrospinal fluid, vaginal secretions, wound, pleural fluid (if applicable), amniotic fluid
    ▪ CBC, Metabolic panel with electrolytes, plasma lactate (lactic acid), bilirubin, urine, amniotic fluid, Creatinine, blood gasses if indicated, clotting factors
  ▪ #2 - Broad-spectrum antibiotics (cover gram-positive/negative bacteria and anaerobes)
    ▪ Do not delay antibiotics if unable to obtain cultures (within 1st hour)
    ▪ Must get rid of the source of infection!
  ▪ #3 - Early fluid resuscitation
    ▪ Titration of fluid therapy to a central venous pressure of at least 8 mmHg.
    ▪ 30mL/kg of crystalloids initially, then titrate to a mean arterial pressure >65
    ▪ Addition of pressors as needed
    ▪ Keep MAP > 65!

• #4 - Ventilation support if respiratory issues present – oxygen therapy, noninvasive mechanical ventilation, or intubation and mechanical ventilation if needed

• #5 – Determine the source of infection – begin source control interventions
  ▪ #6 – Clot prophylaxis
  ▪ #7 – Blood glucose management
  ▪ #8 – Continuous fetal monitoring
  ▪ #9 – To feed or not to feed??
  ▪ #10 – Steroids??


4/20/2017
What’s New?

▪ Marik Vitamin C Treatment Protocol
  ▪ Standard ICU care, plus:
    * Intravenous vitamin C 1.5gms q 6 hrs x 4 days or until ICU discharge
    * Hydrocortisone 50mg q 6 hrs x 7 days or until ICU discharge, followed by a taper over 3 days
    * Intravenous thiamine 200mg q 12 hrs x 4 days or until ICU discharge

More research is needed!!

Prognosis

▪ Fatality Rates:
  ▪ Sepsis: 10% - 20%
  ▪ Septic Shock: 40% - 80%

▪ Organ Failures:

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<th>Death Rate</th>
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<td>38%</td>
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<td>3</td>
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<td>4 or more</td>
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Prevention

▪ Patient education

▪ Electronic medical record alert

▪ Early Warning System Tools

▪ Department Sepsis Protocols/drills
Conclusion

- Sepsis compromises tissue perfusion
- Tissue hypoxia
- Cell death
- End-organ failure

- Early detection is needed
  - Early treatment
  - Better patient outcomes