Maternal Sepsis: Recognition and Treatment

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Disclosures

- I have no financial relationships with any commercial interests
- No relevant financial relationships exist
Objectives

- Review the physiological changes of pregnancy that create a vulnerable environment for the development of sepsis.
- Compare and contrast sensitivity and specificity indicators of sepsis for nonobstetric patients and current treatment recommendations.
- Describe the importance of multidisciplinary care teams aimed to provide time-sensitive goal-directed care.
- Discuss proposed obstetric safety bundles aimed to prevent maternal morbidity and death from sepsis.
Definition of Maternal Sepsis
WHO Consensus 2016

- Maternal sepsis is a life threatening condition defined as organ dysfunction resulting from infection during pregnancy, childbirth, post abortion, or postpartum period.

- SIRS – Systemic Inflammatory Response Syndrome
- SOFA – sequential organ failure assessment
- qSOFA – Quick sequential organ system assessment
  - Not validated for obstetric patients
Maternal Mortality Is Rising in the U.S. As It Declines Elsewhere

Deaths per 100,000 live births

U.S.A. (26.4)

U.K. (9.2)
Portugal (9)
Germany (9)
France (7.8)
Canada (7.3)
Netherlands (6.7)
Spain (5.6)
Australia (5.5)
Ireland (4.7)
Sweden (4.4)
Italy (4.2)
Denmark (4.2)
Finland (3.8)

Notes


Source: The Lancet
Credit: Rob Wychert/ProPublica
Prevalence of Maternal Death from Sepsis: 3\textsuperscript{rd} leading cause pregnancy-related Deaths in U.S.

www.CDC.Gov;
Original Research

Maternal Deaths Due to Sepsis in the State of Michigan, 1999–2006

Melissa E. Bauer, DO, Robert P. Lorenz, MD, Samuel T. Bauer, MD, Krishna Rao, MD, MS, and Frank W.J. Anderson, MD, MPH

OBJECTIVE: To identify maternal deaths due to sepsis in the state of Michigan, review the events leading to diagnosis, and evaluate treatment to identify areas for improvement.

RESULTS: Maternal sepsis was the cause of death in 15% (22/151) of pregnancy-related deaths. Of 22 deaths, 13

Method: Retrospective reviews of maternal deaths in Michigan

Results (22/151)

- 15% of deaths due to maternal sepsis
- Of 22 deaths, 13 women presented to hospital with sepsis, two developed sepsis while in hospital, and seven developed sepsis at home without admission to hospital
- Hospital Records (15): 73% revealed delays in initial appropriate ABX treatment
- 53%-delay in escalation of care!
What do we know about SEPSIS?

- Pregnant women are more vulnerable to infection and susceptible to serious complications.
- Clinical signs may be insidious and patient appear deceptively well before rapidly deteriorating.
- Early detection of sepsis is essential for best outcomes for the mother and her baby.
- Septic patients, if left untreated, may progress to develop septic shock, multi-organ failure and death.

Society of Obstetric Medicine of Australia and New Zealand, (SOMANZ)
Maternal Warning Systems

- The Joint Commission (2010) requires hospitals to have written criteria to observe change or deterioration in a patient’s condition and how to recruit staff to manage patient care.

- Signs and symptoms of impending severe maternal illness or collapse went unrecognized in many cases (CEMACH, 2011) due to the relative rarity of such events and normal changes in physiology associated with pregnancy and childbirth compounds the problem.

  - **Recommendation:** Develop and adopting systems to alert the team of maternal deterioration to assist in early recognition, intervention and timely referral of treatment of women (CEMACH, 2011).

- The **National Partnership for Maternal Safety** is a multi-stakeholder consensus effort and is comprised of representatives from organizations in women’s health care and other provider, state, federal, and regulatory bodies which supports early warning criteria to promote patient safety. [http://www.safehealthcareforeverywoman.org/maternal-safety.html](http://www.safehealthcareforeverywoman.org/maternal-safety.html)
Current Commentary
The National Partnership for Maternal Safety
Mary E. D’Alton, MD, Elliott K. Main, MD, M. Kathryn Menard, MD, and Barbara S. Levy, MD

Current Commentary
The Maternal Early Warning Criteria
A Proposal From the National Partnership for Maternal Safety
Mhyre, J., D’ Oria, R., Hameed, A., et al
Maternal Early Warning Systems

- Abnormal physiologic signs and symptoms precede critical illness
- Early intervention will avoid severe M&M occurrence
- Effective policy of escalation of care

Nip it in the bud
# Maternal Early Warning Criteria

<table>
<thead>
<tr>
<th>Measure</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic Blood Pressure (mm Hg)</td>
<td>&lt;90 or &gt;160</td>
</tr>
<tr>
<td>Diastolic Blood Pressure (mm Hg)</td>
<td>&gt;100</td>
</tr>
<tr>
<td>Heart rate (beats per minute)</td>
<td>&lt;50 or &gt;120</td>
</tr>
<tr>
<td>Respiratory rate (breaths per min)</td>
<td>&lt;10 or &gt;30</td>
</tr>
<tr>
<td>Oxygen saturation on room air, at sea level %</td>
<td>&lt;95</td>
</tr>
<tr>
<td>Oliguria, mL/hr for ≥2 hrs</td>
<td>&lt;35</td>
</tr>
<tr>
<td>Maternal agitation, confusion, or unresponsiveness</td>
<td></td>
</tr>
<tr>
<td>Woman with preeclampsia reporting a non-remitting headache or shortness of breath</td>
<td></td>
</tr>
</tbody>
</table>
The problem with MEWS

- Temperature was not included
- Pain was not included
- Sensitivity and specificity for Sepsis is lacking
Infection - Sepsis

- Two or more Triggers
  - HR >110 and/or MAP <65

- Notify Physician, CBC, antibiotics, consider blood cultures
  - Test organ dysfunction: (lactic acid, LFTs total bilirubin, Creatinine, Urine Output)

Severe Sepsis / Septic Shock

- Notify RRT, ICU transfer, and/or consult as appropriate
- Fluid Resuscitation (within 1 hour)
  - MAP < 65 or lactic acid > 4 mmol/L
  - Crystalloid Bolus 30 ml/kg over 1 hr
  - Goal for MAP > 65 and HR < 110

Maternal Triggers
(severe/single abnormal trigger values)
*Only need 1 abnormal severe Maternal Trigger to trigger use of early warning tool.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Rate</td>
<td>&gt; 130/min</td>
</tr>
<tr>
<td>Respiratory Rate</td>
<td>&gt; 30/min</td>
</tr>
<tr>
<td>MAP (Mean Arterial Pressure)</td>
<td>&lt; 55mmHg</td>
</tr>
<tr>
<td>Pulse Ox</td>
<td>&lt; 90%</td>
</tr>
<tr>
<td>Nurse clinically uncomfortable with the patient’s status</td>
<td></td>
</tr>
</tbody>
</table>

Shields, et al., 2016

# Sepsis Terminology

<table>
<thead>
<tr>
<th>SIRS</th>
<th>≥ 2 of the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T &gt; 38°C or &lt; 36°C</td>
</tr>
<tr>
<td></td>
<td>HR &gt; 90 bmp</td>
</tr>
<tr>
<td></td>
<td>RR &gt; 20/min or paCO₂ &lt; 32 mmHg</td>
</tr>
<tr>
<td></td>
<td>WBC &gt; 12 000 cells/μl or &lt; 4000 cells/μl</td>
</tr>
<tr>
<td></td>
<td>or &gt;10% immature bands</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sepsis</th>
<th>Meeting above criteria for SIRS from infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe sepsis</td>
<td>Sepsis + organ dysfunction, hypotension or hypoperfusion</td>
</tr>
</tbody>
</table>

| Septic shock | Sepsis + hypotension despite fluid resuscitation + perfusion abnormalities |

bpm, beats per minute; HR, heart rate; min, minute; RR, respiratory rate; SIRS, systemic inflammatory response syndrome.

Adapted from [4].

**Obstetric Modified qSOFA – Quick sequential organ system assessment**

<table>
<thead>
<tr>
<th>omqSOFA [2]</th>
<th>At least two of the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RR ≥ 25 breaths/minute</td>
</tr>
<tr>
<td></td>
<td>SBP ≤ 90 mmHg</td>
</tr>
<tr>
<td></td>
<td>Altered mentation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MEW [3**]</th>
<th>At least one of the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SBP: &lt;90 or &gt;160 mmHg</td>
</tr>
<tr>
<td></td>
<td>DBP: &gt;100 mmHg</td>
</tr>
<tr>
<td></td>
<td>HR &lt; 50 or &gt; 120 beats/min</td>
</tr>
<tr>
<td></td>
<td>RR &lt; 10 or &gt;30 breaths/minute</td>
</tr>
<tr>
<td></td>
<td>Oxygen saturation on room air &lt;95%</td>
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<td></td>
<td>Oliguria: &lt;35 ml/h for ≥ 22 h</td>
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<tr>
<td></td>
<td>Agitation, confusion,</td>
</tr>
<tr>
<td></td>
<td>or unresponsiveness;</td>
</tr>
<tr>
<td></td>
<td>Preeclampsia with headache</td>
</tr>
<tr>
<td></td>
<td>or shortness of breath</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SIRS [4]</th>
<th>At least two of the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Temperature &gt; 38°C or &lt; 36°C</td>
</tr>
<tr>
<td></td>
<td>Heart rate &gt;90 beats per minute</td>
</tr>
<tr>
<td></td>
<td>RR &gt;20 breaths/min or paCO₂ &lt;32 mmHg</td>
</tr>
<tr>
<td></td>
<td>WBC &lt;4 x 10⁹/l or &gt; 12 x 10⁹/l</td>
</tr>
</tbody>
</table>

HR, heart rate; omqSOFA, obstetrically modified quick Sequential Organ Failure Assessment; qSOFA, Quick Sequential Organ Failure Assessment; RR, respiratory rate; WBC, white blood cell.

Adapted from [1, 2, 3**, 4].
Findings:

- 50% of deaths from sepsis are related to Group A streptococcus
- E.Coli is the most common cause of maternal bacterial infection
- Sepsis can occur anytime during pregnancy & often associated with a delay in diagnosis
- The normal physiological changes of pregnancy may mask early signs of sepsis
- Maternal sepsis with or without hemodynamic instability may present with fetal distress as the uteroplacental circulation is not auto-regulated.
- Consideration for treatment options has to be given to the impact of the maternal condition as well as the effect on the fetus.
Guidelines for the investigation and management sepsis in pregnancy

SOMANZ, 2017

8 Key Points

1. Screen
2. Fever
3. Etiology
4. Golden Hour
5. Timing/Mode of Delivery
6. VTE Prophylaxis
7. Anesthesia
8. ICU Transfer
Guidelines for the investigation and management of sepsis in pregnancy

SOMANZ, 2017

**Action**

1. **Recognise sepsis**
   - Consider sepsis clinically if the woman has signs, symptoms, or risk factors for sepsis. If 2 or more of the following: SBP <90 mmHg, respiratory rate ≥25 breaths/min or altered mentation (anything other than alert) → high risk poor outcome. Senior obstetrician or physician involvement ideal.

2. **Maintain airway, oxygenate**
   - Ensure patent airway, supplemental oxygen may be required.

3. **Resuscitate**
   - **Intravenous access**
     - Establish large bore IV access. Collect FBC, EUC, CRP, LFTs, Coags and lactate. Perform ABG if respiration or oxygenation abnormal. Collect two sets of blood cultures. Collect other cultures as required (this must not delay antibiotics).
     - Administer IV crystalloid- aim SBP >90 mmHg. If BP inadequate after 2L fluid → notify ICU/Rapid Response Team. Monitor for overload.
   - **Blood tests**

   - **Fluid administered**
Guidelines for the investigation and management of sepsis in pregnancy
SOMANZ, 2017

Respond

Administer antibiotics within 60 min
Do not delay for investigations

Consider also administration of antipyretics if woman is febrile after antibiotics administered. If already on antibiotics seek advice from microbiologist/ infectious disease specialist. If non-bacterial or non-infectious causes considered – administer antibiotics until other cause is verified.
Guidelines for the investigation and management of sepsis in pregnancy
SOMANZ, 2017

- Re-assess woman
- Assess fetus
- Signs of sepsis deterioration?
  - SBP < 90 mmHg
  - Increased respiratory rate
  - Renal dysfunction
  - Altered level of consciousness

Yes → ICU or rapid Response review
No → Targeted assessment and continue monitoring woman and fetus/newborn

Assessment of fetus may involve ultrasound and/or electronic fetal monitoring depending on gestation and availability.
Targeted history and physical examination to illicit source of sepsis.

Renal dysfunction may present as increased serum creatinine > 90 umol/L or urine output < 80 mls over 4 hours
Altered level of consciousness include response to voice, response to pain or unresponsive.

Rationalise antibiotics if source and microorganism isolated.
Notify newborn’s care team of condition and outcome.
Consider treatment and sepsis impact on breast feeding.
National Partnership Strategy to Enhance Maternal Safety

BUNDLE SCIENCE

A "bundle" is a group of interventions related to a disease process that, when executed together, result in better outcomes than when implemented individually.
## CA-PAMR: Chance to Alter Outcome
### Grouped Cause of Death; 2002-2004 (N=145)

<table>
<thead>
<tr>
<th>Grouped Cause of Death</th>
<th>Strong / Good (%)</th>
<th>Some (%)</th>
<th>None (%)</th>
<th>Total N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obstetric hemorrhage</td>
<td>69</td>
<td>25</td>
<td>6</td>
<td>16 (11)</td>
</tr>
<tr>
<td>Deep vein thrombosis/pulmonary embolism</td>
<td>53</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sepsis/infection</strong></td>
<td><strong>50</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preeclampsia/eclampsia</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiomyopathy and other cardiovascular causes</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cerebral vascular accident</td>
<td>22</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amniotic fluid embolism</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All other causes of death</td>
<td>46</td>
<td>46</td>
<td>8</td>
<td>26 (18)</td>
</tr>
<tr>
<td><strong>Total (%)</strong></td>
<td><strong>40</strong></td>
<td><strong>48</strong></td>
<td><strong>12</strong></td>
<td><strong>145</strong></td>
</tr>
</tbody>
</table>
Let’s review some physiology…

Photo from creative commons/pixabay
Normal physiologic changes

- Cardiovascular
- Hematologic
- Pulmonary
- Renal
Cardiovascular

Normal Cardiac Adaptation during Pregnancy

Cardiac Changes

**Stroke Volume**

↑ 30-50%

**Heart Rate**

↑ 20% (~10-20 beats)

**Anatomic Changes**

↑ Uterus

**Vascular Resistance**

↓ SVR  ↓ PVR

Cardiac Output

Weeks of gestation

pregnant

postpartum
Hematologic

Normal Hematologic Events Associated with Pregnancy

Blood Volume Changes

Total Volume
↑ 35% (~2,000ml)

Plasma Volume
↑ 50% (~1,600ml)

RBC Mass
↑ 17% (~350mL)
## Hematologic continued:
### Clotting Factors During Pregnancy

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fibrin</td>
<td>Increases 40% at term</td>
</tr>
<tr>
<td>Plasma fibrinogen</td>
<td>Increases 50% (300 – 600) mg/dl</td>
</tr>
<tr>
<td>Coagulation factors I, VII, VIII, X, XII</td>
<td>Increases markedly</td>
</tr>
<tr>
<td>Von Willebrand factor antigen</td>
<td>Increases markedly</td>
</tr>
<tr>
<td><strong>Coagulation factor XI</strong></td>
<td>Decreases 60% - 70%</td>
</tr>
<tr>
<td><strong>Coagulation factor XIII</strong></td>
<td>Decreases slightly</td>
</tr>
<tr>
<td>Coagulation factors II, V</td>
<td>Increases slightly or unchanged</td>
</tr>
<tr>
<td><strong>Protein S (anticoagulant) activity</strong></td>
<td>Decreased</td>
</tr>
<tr>
<td>Clotting and bleeding time</td>
<td>Unchanged</td>
</tr>
<tr>
<td>Prothrombin time</td>
<td>Increases slightly or unchanged</td>
</tr>
<tr>
<td>Partial plasma thromboplastin time</td>
<td>Increases slightly or unchanged</td>
</tr>
<tr>
<td>Fibrin degradation products</td>
<td>Increased (D–Dimer increased)</td>
</tr>
<tr>
<td>Platelets</td>
<td>Unchanged (150 K – 500K)</td>
</tr>
</tbody>
</table>
Hematologic

↑ Factors V, VII, VIII, IX, X, XII

↓ Fibrinolysis

↑ Fibrinogen

↑ Prothrombin
### Pulmonary

- **Diaphragm** 4-7 cm – ribs flare
- **Functional Residual Capacity** 25%
- **Respiratory Rate** unchanged 16-20
- **Tidal volume** from 500 – 700 ml
- **Compensatory Alkalemia**

<table>
<thead>
<tr>
<th><strong>Not Pregnant</strong></th>
<th><strong>Pregnant</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>pH 7.35 – 7.45</td>
<td>pH 7.40 – 7.45</td>
</tr>
<tr>
<td>pO2 90 -100</td>
<td>pO2 104 -108</td>
</tr>
<tr>
<td>pCO2 35 – 45</td>
<td>pCO2 27 – 32</td>
</tr>
<tr>
<td>HCO3 22 - 26</td>
<td>HCO3 18 - 22</td>
</tr>
</tbody>
</table>
Renal Adaptation

Pregnancy is a high flow state

Kidneys have structural and functional changes

- 50% Increase renal blood flow
- 50% Increase glomerular filtration rate
- Physiologic hydronephorsis (right sided)
- Altered lab values
  - Creatinine
  - Proteinuria
  - Glycosuria

3 Ways Microbes cause damage

1. Tissue Damage
   - Adhere to or invade cells
   - Produce toxins

2. Blood Clots
   - Toxins may cause coagulation
   - Small clots block blood flow
   - Oxygen deprivation

3. Fluid leakage from vessel
   - Toxins damage vessel wall
   - Fluid leaks out through holes
   - Hypotension from fluid loss

Pathogenesis of multiorgan system failure

Figure: Pathogenesis of multiorgan system failure in sepsis. Reprinted with permission from Alex Yartsev.¹⁰
Invasive Organism Injury

Vasodilatation occurs. Inflammatory cascade is activated.
Cytokines and complement system are activated.
Blood coagulation system is activated.

Deactivators produced + healthy anti-inflammatory response system =
inhibition of immune system reaction from occurring throughout the body.

Invasive Organism Injury

- Vasodilation occurs/inflammatory cascade activated
- Cytokines and complement system activated
- Blood coagulation system activated

- Overproduction of inflammatory cytokines
- Further vasodilation
- Destruction of vessel walls/ fluid leak into extravascular spaces
- Decreased intravascular volume/hypotension
- Low level of activated protein C

Adult Respiratory Distress Syndrome

Hemorrhagic Shock →

Damage to endothelial cells in pulmonary vasculature →
Fluid leaks from vascular space into alveoli →
Respiratory failure
Pathophysiology of Cell Death

- Tissue hypoperfusion $\rightarrow$ metabolic acidosis $\rightarrow$ inflammatory mediators $\rightarrow$ tissue and vascular injury $\rightarrow$ multiple organ failure
Secondary (Late) Causes

1. **Infection/sepsis**
   - ↓ myometrial cell contractility
   - Disrupts blood vessel endothelial lining
   - Fever → vasodilatation

2. Retained products of conception

3. Placental site sub involution

4. Coagulopathy
## OB Hemorrhage Checklist

### Draft 1.2

#### Prenatal Assessment & Planning

- Identify and prepare for patients with special considerations: Placenta Previa/Accreta, Bleeding Disorder, or those who Decline Blood Products
- Screen and aggressively treat severe anemia: if oral iron fails, initiate IV Iron Sucrose Protocol to reach desired Hgb/Hct, especially for at risk mothers.

#### Admission Assessment & Planning

<table>
<thead>
<tr>
<th>Admission Hemorrhage Risk Factor Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low (Clot only)</strong></td>
</tr>
<tr>
<td>No previous uterine incision</td>
</tr>
<tr>
<td>Singleton pregnancy</td>
</tr>
<tr>
<td>≤4 previous vaginal births</td>
</tr>
<tr>
<td>No known bleeding disorder</td>
</tr>
<tr>
<td>No history of PPH</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

#### Ongoing Risk Assessment

- Evaluate for development of additional risk factors in labor:
  - Prolonged 2nd Stage labor
  - Prolonged oxytocin use
  - Active bleeding
  - Chorioamnionitis
  - Magnesium sulfate treatment
- Increase Risk level (see below) and convert to Type & Screen or Type & Crossmatch
- Treat multiple risk factors as High Risk

#### STAGE 0: All Births: Prevention & Recognition of OB Hemorrhage

- **Active Management of Third Stage**
  - Oxytocin infusion: 10-20 units oxytocin/1000ml solution titrate infusion rate to uterine tone; or 10 units IM; do not give oxytocin as IV push
  - Vigorous fundal massage for at least 15 seconds
- **Ongoing Quantitative Evaluation of Blood Loss**
  - Using formal methods, such as graduated containers, visual comparisons and weight of blood soaked materials (1gm = 1ml)
- **Ongoing Evaluation of Vital Signs**
  - If: Cumulative Blood Loss >500ml vaginal birth or >1000ml C/S - OR - Vital signs >15% change or HR ≥110, BP ≤85/45, O2 sat <95% - OR - Increased bleeding during recovery or postpartum, proceed to STAGE 1
STAGE 1: OB Hemorrhage

**Cumulative Blood Loss >500ml vaginal birth or >1000ml C/S -OR- Vital signs >15% change or HR ≥110, BP ≤85/45, O2 sat <95% -OR- Increased bleeding during recovery or postpartum**

**MOBILIZE**
- Primary nurse, Physician or Midwife to:
  - Activate OB Hemorrhage Protocol and Checklist
- Primary nurse to:
  - Notify obstetrician (in-house and attending)
  - Notify charge nurse
  - Notify anesthesiologist

**ACT**
- Primary nurse:
  - Establish IV access if not present, at least 18 gauge
  - Increase IV Oxytocin rate, 500 mL/hour of 10-40 units/1000mL solution;
    Titrate infusion rate to uterine tone
  - Continue vigorous fundal massage
  - Administer Methergine 0.2 mg IM per protocol (if not hypertensive); give once, if no response, move to alternate agent; if good response, may give additional doses q 2 hr
  - Vital Signs, including O2 sat & level of consciousness (LOC) q 5 minutes
  - Weigh materials, calculate and record cumulative blood loss q 5-15 minutes
  - Administer oxygen to maintain O2 sats at >95%
  - Empty bladder: straight cath or place Foley with urimeter
  - Type and Crossmatch for 2 units Red Blood Cells STAT (if not already done)
  - Keep patient warm
- Physician or midwife:
  - Rule out retained Products of Conception, laceration, hematoma
- Surgeon (if cesarean birth and still open):
  - Inspect for uncontrolled bleeding at all levels, esp. broad ligament, posterior uterus, and retained placenta

**THINK**
- Consider potential etiologies:
  - Uterine atony
  - Trauma/Laceration
  - Retained placenta
  - Amniotic Fluid Embolism
  - Uterine Inversion
  - Coagulopathy
  - Placenta Accreta

If: Continued bleeding or Continued Vital Sign instability, and <1500 mL cumulative blood loss proceed to STAGE 2

**UTEROTONIC AGENTS for POSTPARTUM HEMORRHAGE**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Route</th>
<th>Frequency</th>
<th>Side Effects</th>
<th>Contraindications</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pitocin® (Oxytocin) 10 units/ml</td>
<td>10-40 units per 1000 mL, rate titrated to uterine tone</td>
<td>IV infusion</td>
<td>Continuous</td>
<td>Usually none; nausea, vomiting, hypotension ('water intoxication') with prolonged IV administration; ↑ BP and 1 HR with high doses, esp IV push</td>
<td>Hypersensitivity to drug</td>
<td>Room temp</td>
</tr>
</tbody>
</table>
| Methergine® (Methylergonivine) 0.2mg/ml | 0.2 mg | IM | Q 2-4 hours; if no response after first dose, it is unlikely that additional doses will be of benefit | Nausea, vomiting, Severe hypertension, esp. with rapid administration or in patients with HTN or PIH | Hypertension, PIH, Heart disease
Hypersensitivity to drug
Caution if multiple doses of ephedrine have been used, may exaggerate hypertensive response w/possible cerebral hemorrhage | Refrigerate
Protect from light |
| Hemabate® (15-methyl PG F2a) 250mcg/ml | 250 mcg | IM or intra-myometrial | Q 15-90 min; Not to exceed 6 doses/24 hrs; if no response after several doses, it is unlikely that additional doses will be of benefit | Nausea, vomiting, Diarrhea, Fever (transient), Headache, Chills, shivering, Hypertension, Bronchospasm | Caution in women with hepatic disease, asthma, hypertension, active cardiac or pulmonary disease
Hypersensitivity to drug | Refrigerate |
| Cytotec® (Misoprostol) 100 or 200mcg tablets | 800-1000mcg | Per rectum (PR) | One time | Nausea, vomiting, diarrhea, Shivering, Fever (transient), Headache | Rare
Known allergy to prostaglandin
Hypersensitivity to drug | Room temp |

California Maternal Quality Care Collaborative (CMOCC): Hemorrhage Taskforce (2009) visit: www.CMOCC.org
## STAGE 2: OB Hemorrhage
Continued bleeding or Vital Sign instability, and <1500 mL cumulative blood loss

<table>
<thead>
<tr>
<th>MOBILIZE</th>
<th>ACT</th>
<th>THINK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary nurse (or charge nurse):</strong></td>
<td><strong>Team leader (OB physician):</strong></td>
<td><strong>Sequentially advance through procedures and other interventions based on pathology:</strong></td>
</tr>
<tr>
<td>- Call obstetrician to bedside</td>
<td>- Additional uterotonic medication: Hemabate 250 mcg IM [if not contraindicated] OR Misoprostol 800-1000 mg PR</td>
<td><strong>Vaginal birth</strong></td>
</tr>
<tr>
<td>- Call Anesthesiologist</td>
<td>- Can repeat Hemabate up to 3 times every 20 min; (note-75% respond to first dose)</td>
<td>- If trauma (vaginal, cervical or uterine):</td>
</tr>
<tr>
<td>- Activate Response Team: PHONE #:</td>
<td><strong>Do not delay other interventions (see right column) while waiting for response to medications</strong></td>
<td>- Visualize and repair</td>
</tr>
<tr>
<td>- Notify Blood bank of hemorrhage; order products as directed</td>
<td>- Bimanual uterine massage</td>
<td>- If retained placenta:</td>
</tr>
<tr>
<td><strong>Charge nurse:</strong></td>
<td>- Move to OR (if on postpartum unit, move to L&amp;D or OR)</td>
<td>- D&amp;C</td>
</tr>
<tr>
<td>- Notify Perinatologist or 2nd OB</td>
<td>- Order 2 units PRBCs and bring to the bedside</td>
<td>- If uterine atony or lower uterine segment bleeding:</td>
</tr>
<tr>
<td>- Initiate OB Hemorrhage Record</td>
<td>- Order labs STAT (CBC/Plts, Chem 12 panel, Coag Panel II, ABG)</td>
<td>- Intrauterine Balloon</td>
</tr>
<tr>
<td>- If selective embolization, call Interventional Radiology Team and second anesthesiologist</td>
<td><strong>Transfuse PRBCs based on clinical signs and response, do not wait for lab results</strong></td>
<td>If above measures unproductive:</td>
</tr>
<tr>
<td>- Notify nursing supervisor</td>
<td></td>
<td>- Selective embolization (Interventional Radiology if available &amp; adequate experience)</td>
</tr>
<tr>
<td>- Assign single person to communicate with blood bank</td>
<td><strong>Primary nurse:</strong></td>
<td><strong>C-section:</strong></td>
</tr>
<tr>
<td>- Call medical social worker or assign other family support person</td>
<td>- Establish 2nd large bore IV, at least 18 gauge</td>
<td>- B-Lynch Suture</td>
</tr>
<tr>
<td></td>
<td>- Assess and announce Vital Signs and cumulative blood loss q 5-10 minutes</td>
<td>- Intrauterine Balloon</td>
</tr>
<tr>
<td></td>
<td>- Set up blood administration set and blood warmer for transfusion</td>
<td><strong>If Uterine Inversion:</strong></td>
</tr>
<tr>
<td></td>
<td>- Administer meds, blood products and draw labs, as ordered</td>
<td>- Anesthesia and uterine relaxation drugs for manual reduction</td>
</tr>
<tr>
<td></td>
<td>- Keep patient warm</td>
<td><strong>If Amniotic Fluid Embolism:</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Second nurse (or charge nurse):</strong></td>
<td>- Maximally aggressive respiratory, vasopressor and blood product support</td>
</tr>
<tr>
<td></td>
<td>- Place Foley with urimeter (if not already done)</td>
<td><strong>If vital signs are worse than estimated or measured blood loss:</strong> possible uterine rupture or broad ligament tear with internal bleeding, <strong>move to laparotomy</strong></td>
</tr>
<tr>
<td></td>
<td>- Obtain portable light and OB procedure tray or Hemorrhage cart</td>
<td><strong>Once stabilized:</strong> Modified Postpartum management with increased surveillance</td>
</tr>
<tr>
<td></td>
<td>- Obtain blood products from the Blood Bank</td>
<td><strong>Re-Evaluate Bleeding and Vital Signs:</strong></td>
</tr>
<tr>
<td></td>
<td>- Assist with move to OR (if indicated)</td>
<td>If cumulative blood loss &gt;1500mL, &gt;2 units PRBCs given, VS unstable or suspicion for DIC, proceed to STAGE 3</td>
</tr>
</tbody>
</table>
# STAGE 2: OB Hemorrhage

Continued bleeding or Vital Sign instability, and <1500 mL cumulative blood loss

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<td><strong>Primary nurse (or charge nurse):</strong></td>
<td><strong>Team leader (OB physician):</strong></td>
<td><strong>Sequentially advance through procedures and other interventions based on etiology:</strong></td>
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</table>
| - Call obstetrician to bedside | - Additional uterotonic medication: Hemabate 250 mcg IM [if not contraindicated] **OR** Misoprostol 800-1000 mg PR  
  - Can repeat Hemabate up to 3 times every 20 min;  
  (note-75% respond to first dose) |  |
| - Call Anesthesiologist | - Do not delay other interventions (see right column) while waiting for response to medications |
| - Activate Response Team: | - Bimanual uterine massage |
| **PHONE #:** | - Move to OR (if on postpartum unit, move to L&D or OR) |
| - Notify Blood bank of hemorrhage; order products as directed | - Order 2 units PRBCs and bring to the bedside |
| **Charge nurse:** | - Order labs STAT (CBC/plt, Chem 12 panel, Coag Panel II, ABG) |
| - Notify Perinatologist or 2nd OB | - Transfuse PRBCs based on clinical signs and response, do not wait for lab results |
| - Initiate OB Hemorrhage Record | **Primary nurse:** |
| - If selective embolization, call Interventional Radiology Team and second anesthesiologist | - Establish 2nd large bore IV, at least 18 gauge |
| - Notify nursing supervisor | - Assess and announce Vital Signs and cumulative blood loss q 5-10 minutes |
| - Assign single person to communicate with blood bank | - Set up blood administration set and blood warmer for transfusion |
| - Call medical social worker or assign other family support person | - Administer meds, blood products and draw labs, as ordered |
| | - Keep patient warm |
| **Second nurse (or charge nurse):** | **Blood Bank:** |
| - Place Foley with urimeter (if not already done) | - Determine availability of thawed plasma, fresh frozen plasma, and platelets; initiate delivery of platelets if not present on-site |
| - Obtain portable light and OB procedure tray or Hemorrhage cart | - Consider thawing 2 FFP (takes 30 min), use if transfusing >2 units PRBCs |
| - Obtain blood products from the Blood Bank | - Prepare for possibility of massive hemorrhage |
| - Assist with move to OR (if indicated) | **Re-Evaluate Bleeding and Vital Signs** |
| | If cumulative blood loss >1500mL, >2 units PRBCs given, VS unstable or suspicion for DIC, proceed to STAGE 3 |

If above measures unproductive:  
- Selective embolization (Interventional Radiology if available & adequate experience)  
- B-Lynch Suture  
- Intrauterine Balloon  
- Anesthesia and uterine relaxation drugs for manual reduction  
- Maximally aggressive respiratory, vasopressor and blood product support  
- Possible uterine rupture or broad ligament tear with internal bleeding, move to laparotomy  
- Modified Postpartum management with increased surveillance
Tranexamic acid (TXA)

- For women with established PPH
  - Not responsive to medications or treatments
  - Considered an adjunct treatment
  - Most effective if used within first 30 minutes (3 hours from onset)
  - Dose: TXA 1 gram IV over 10 minutes
  - may repeat 2nd dose in 30 minutes if bleeding persists or if stopped and restarted

Exposure of Fetal Tissue to Maternal Circulation

Maternal specific risk factors

Activation of Inflammation

DIC

ARDS

NEUROLOGIC INJURY

HYPOXEMIA

RIGHT HEART FAILURE

LEFT HEART FAILURE

BLEEDING

HYPOTENSION

Neligan PJ 2011
What is DIC?

- Underlying disorder
- Activates coagulation cascade
  - Blood clot formation
  - Coagulation factors become depleted
  - Results in uncontrolled bleeding
    - Death
Disseminated Intravascular Coagulation

Society on Thrombosis and Hemostasis defines “DIC as:

An acquired syndrome characterized by the intravascular activation of coagulation with loss of localization arising from different causes. It can originate from and cause damage to the microvasculature which if sufficiently severe can produce organ dysfunction.

- Accompany certain obstetrical conditions
- Varied clinical presentation and prognostic course
- An “effect“ of other disease processes
- Treatment will be focused on removal of the causative agent
Etiology of DIC

- Infection
- Cancer
- OB/Gyn Complications
Pathophysiology of DIC

1. **Disseminated Fibrin Thrombi**
   - Obstructed blood flow
   - End organ ischemia / necrosis

2. **Activation of kinin system**
   - Vascular permeability
   - Hypotension
   - Shock
Pathophysiology of DIC

3. Activation of the complement system
   - Red cell and platelet lysis
   - ↑ vascular permeability
   - Shock

4. Release of cytokines (IL 1 & 6) and TNF

5. Plasma-induced lysis of fibrin
   - FDP’s
   - Depletion of Coag factors
   - Hemorrhage and shock
Underlying OB conditions associated with DIC

- Intrauterine Fetal Demise: 25%
- Placental abruption: 37%
- PPH / Hypovolemia / MBT: 29%
- Severe Pre E / HELLP: 14%
- Acute Fatty Liver: 8%
- Amniotic Fluid Embolism: 6%
- Sepsis: 6%
**Mechanism**

- Release of TNF $\alpha$
  - Endothelial injury
  - Releases Tissue Factor
    - Produces Thrombin
    - Protein C is activated
    - Fibrinolysis

**Management**

- Evacuation of uterus
- Antibiotics

**Diagnosis**

- Clinical evidence of infection
- Lab studies
Clinical Presentation

- Peripheral cyanosis
- Renal impairment
- Drowsiness
- Confusion
- Coma
- Cardiorespiratory failure
- Large and small vessel thrombosis
- Ischemia
- End organ damage
Bleeding from unrelated sites

- Venipuncture sites
- Epistaxis
- Ecchymosis
- Purpura
- Petechiae
- Hematomas
Diagnosis of DIC

- Obvious with massive hemorrhage
- Lab tests
  - CBC, Plts
  - Fibrinogen, FDP’s
  - PT, aPTT
  - D Dimer
- Rotem
Fluid and Blood Resuscitation

- Non-pregnant guidelines pose risk of fluid overload/pulmonary edema
  - Reduced colloid/oncotic pressure
- OB patients 20mL/kg verses 30mL/kg
  - 200 lb patient = 90 kg (90x20= 1,800 mL Normal Saline)
  - Consider CVP placement
- Transfuse Blood products specific to deficits
  - PRBS to maintain Hgb 7.0-9.0 g/dL
  - Platelets if <5,000/mm or if surgery is warranted >35,000/mm
  - MTP for Stage 3 Hemorrhage/DIC
Antibiotic Administration: Delayed administration = higher mortality

- Empiric Therapy with broad spectrum antibiotic ASAP
  - (1 hr target)
  1. Ampicillin & Gentamicin
  2. Influenza Clindamycin & Vancomycin

- Treat for suspected influenza
  - Anti-viral therapy

De-escalate antibiotic once source has been identified
Pressor Support

- If mean arterial pressure MAP remains <65 after fluid bolus

- Norepinepherine
  - Appears to be safe during pregnancy in low doses

- Dobutamine – rarely used
  - Positive Inotrope
    - Improve left ventricular contractility
    - Normalize preload and improve cardiac output
    - May restrict uterine blood flow (pregnant ewes)

- Epinephrine – safe to use after volume and Norepinepherine
  - 2nd Line agent

- Vasopressin and May stimulate uterine contractions
  - → preterm birth
Timing/Mode of Delivery

- Decision regarding delivery is complex
- Consider the following:
  - Source of infection (Chorioamnionitis – no!)
  - Maternal Status
  - Fetal assessment – gestational age
    - May prolong pregnancy per maternal tolerance (not chorio)
    - Steroids for fetal lung maturity
    - Fetal status often will improve if maternal condition stabilizes
Respiratory Support

- ICU Transfer: tachypnea, worsening hypoxia, ↑ O₂ requirement
- Monitor O₂ saturation
  - Position: Left tilt to minimize aorta/venal cava compression
- Airway – delayed gastric empty
  - Intubation
    - Pre-oxygenation
    - ↓ Functional residual capacity
    - Ventilation/ perfusion (VQ) mismatch
    - Customize ventilator settings for gravid patient
## Risk Factors for DVT

<table>
<thead>
<tr>
<th>Maternal</th>
<th>Pregnancy</th>
<th>Labor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obesity</td>
<td>Multiparity</td>
<td>Cesarean Birth</td>
</tr>
<tr>
<td>Smoking</td>
<td>Preeclampsia</td>
<td>PPH Blood</td>
</tr>
<tr>
<td>Hx of VTE</td>
<td>Physiologic changes of Pregnancy</td>
<td>Infection</td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td>Immobilization</td>
</tr>
<tr>
<td>Age &gt; 35 years</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Heparin Compounds

- Unfractionated heparin or Low molecular weight heparin (LMWH)
- Do not cross the placenta
- Safe during pregnancy
  - Higher dosing required during pregnancy
    - ↑ total blood volume
    - ↑ glomerular filtration thus ↑ in renal excretion of heparin
    - ↑ protein binding of heparin
    - ↓ peak plasma volume and shorter half life

Side effects
  - Hemorrhage, hypotension
  - Protamine sulfate 1mg neutralizes 100 units of heparin
  - Should not exceed 50 mg in single dose

Follow aPTT levels 4 hours after initiation and after dose changes
Post Birth Warning signs

Venous Thromboembolism
- Essential Teaching for Women

What is VTE
- VTE is when you develop a blood clot usually in your leg (calf area)

Signs of VTE
- Leg pain, tender to touch, burning or redness, particularly in calf area

Obtaining Immediate Care
- Call healthcare provider immediately for above signs of VTE if no response call 911 or go to nearest hospital emergency department
Call for Help Early

- Detect abnormal VS and clinical changes
- Alert the Team
- Mobilize a response
- Optimal patient outcome

I wonder why we were called?

Gee...she looks pretty good to me...
Escalation

- An abnormal parameter requires:
  - Prompt reporting to a physician or other qualified clinician
  - Prompt bedside evaluation by a physician or other qualified clinical provider with the ability to activate resources in order to initiate emergency diagnostic and therapeutic interventions as needed
Chain of Command / Authority

- Hospital Administer
- House Supervisor
- Nurse Manager
- Medical Director
- Physician

Adapted from Lyndon et al., AWHONN Fetal Heart Monitoring; Chapter 8, 2009
Simulated Multidisciplinary Drills

Conduct team training in perinatal areas to teach staff to work together and communicate more effectively.
OB Triage Case

- A G3, P1, 38-yo woman @ 29+2 weeks arrives to OB Triage
  - Hx of dry cough X’s 3 days – fever/aches past 24 hrs.
  - VS: T 40.3°C (104.5°F); BP, 119/60 mm Hg; pulse 125, RR 36
  - (SaO2), 95%.
- FHR 175 bpm with minimal variability.
- The patient had no uterine cramping or contractions
- Patient reported diffuse body aches and rated her pain 10/10
How Errors Occur

Failures

Defenses

Culture
Policies
Resources
Training
Communication

Safeguards
Stop the line
Standard work
Flexible staffing
Self-checks

Harm

UCSF Benioff Children's Hospitals
Based on the AWHONN MFTI what is the priority?

a) Priority 1
b) Priority 2
c) Priority 3
d) Priority 4
e) Priority 5
Maternal Fetal Triage Index (MFTI)

Is the woman presenting for a scheduled procedure and has no complaint?

YES

Does the woman or fetus have STAT/PRIORITY 1 vital signs?

OR

Does the woman or fetus require immediate lifesaving intervention?

OR

Is birth imminent?

YES

STAT/PRIORITY 1

Abnormal Vital Signs

- Maternal HR >160 or <60, SpO2 <93%, SBP <90 or DBP <60, or EDR >120 or <60 seconds; the PVR is elevated by dopamine

- Eclampsia (previously intrapartum fetal distress), FHR >160 bpm for >30 seconds

Immediate lifesaving intervention required, such as:

- Cardiac compromise
- DSCL, respiratory distress
- Hemorrhaging

- Active maternal-bearing-down efforts

_NO_

Does the woman or fetus have URGENT/PRIORITY 2 vital signs?

OR

Is the woman in severe pain without complaint of contractions?

OR

Is this a high risk situation?

OR

Will the woman and/or newborn require a higher level of care than institution provides?

YES

URGENT/ PRIORITY 2

Abnormal Vital Signs

Maternal HR 120-140 or >160

Temperature >100°F, RBS >200, WBC >12, SpO2 <93%, SBP >140 or DBP >90, or symptoms of a preeclampsia or toxemia, or septic shock

Severe Pain (unresisted <5 cm) on a 0-10 pain scale

Examples of High-Risk Situations

- Unstable, high-risk medical conditions
- Difficulty breathing
- Alcohol withdrawal
- Seizure or eclampsia
- W/S x<1/2, or detectable, uterine contractions

- Active maternal bearing-down efforts

- Cesarean section

Transfer of Care Needed

- Clinical needs of woman and/or newborn indicate transfer of care, per hospital policy

NO

Does the woman or fetus have PROMPT/PRIORITY 3 vital signs?

OR

Does the woman require prompt attention?

YES

PROMPT/ PRIORITY 3

Abnormal Vital Signs

Maternal HR 120-140 or >160

Temperature >100°F, RBS >200, WBC >12, SpO2 <93%, SBP >140 or DBP >90, or symptoms of a preeclampsia or toxemia, or septic shock

Severe Pain (unresisted <5 cm) on a 0-10 pain scale

Examples of High-Risk Situations

- Unstable, high-risk medical conditions
- Difficulty breathing
- Alcohol withdrawal
- Seizure or eclampsia
- W/S x<1/2, or detectable, uterine contractions

Prompt Attention, such as:

- Signs of active labor >4 weeks
- E/e early labor signs and/or SROM/loosing 5-7 weeks
- >4 weeks with irregular contractions and MIV
- >4 weeks multiple gestation pregnancy with irregular contractions
- Woman is not coping with labor per the Coping With Labor Algorithm Y2

NO

Does the woman have a complaint that is non-urgent?

YES

NON-URGENT/ PRIORITY 4

Non-urgent Attention, such as:

- >37 weeks early labor signs and/or SROM/loosing
- Non-urgent symptoms may include: common discomforts of pregnancy, vaginal discharge, constipation, flatulence, pain, nausea, anxiety

NO

Is the woman requesting a service and she has no complaint?

YES

SCHEDULED OR REQUESTING PRIORITY 5

Scheduling Procedure

Any event or procedure scheduled formally or informally with the unit before the patient’s arrival, when the patient has no complaint.

��

What needs to happen

a) Begin Early Goal Directed Therapy (EGDT)
b) Begin The 1 Hour Bundle it replaces the 3 Hour Bundle
c) Bolus with 1,000 mL NS follow with 500mL/hr until BP is >90/50
d) The optimal fluid replacement for pregnant patients is unknown
e) Administer antibiotics once blood cultures have been obtained
f) b & d
Sepsis

- Systemic inflammatory response syndrome and pregnancy
- Severe sepsis and septic shock

Screening

Treatment
- i. Cultures
- ii. Antibiotics
- iii. Fluid resuscitation
- iv. Source control
- v. Vasopressors
# SIRS Criteria Comparison

SIRS: Systemic Inflammatory Response Syndrome

<table>
<thead>
<tr>
<th>Adult Screening Criteria</th>
<th>Perinatal Screening Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Temp &gt; 38°C (100.4°F) or &lt; 36°C (96.8°F)</td>
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</tr>
<tr>
<td>• HR &gt; 90 bpm</td>
<td>• HR &gt; 110 bpm</td>
</tr>
<tr>
<td>• Resp Rate &gt; 20 breaths/minute</td>
<td>• Resp Rate &gt; 24 breaths/minute</td>
</tr>
<tr>
<td>• WBC &gt; 12,000, &lt; 4,000 or &gt; 10% immature neutrophils</td>
<td>• WBC &gt; 15,000 or &lt; 4,000 or &gt; 10% immature neutrophils</td>
</tr>
<tr>
<td>• Blood glucose &gt; 140 mg/dl in the absence of diabetes</td>
<td>• Blood glucose &gt; 140 mg/dl in the absence of diabetes</td>
</tr>
<tr>
<td>• <em>New mental status change</em></td>
<td>• <em>Mental status change</em></td>
</tr>
</tbody>
</table>

- 93% Sensitivity
- 63% Specificity
Maternal Sepsis Pathway: Screening

Screen in triage, upon admission, every shift (within first 2 hours of shift) and PRN suspected infection *(Document in EMR Flowsheet).*

**SIRS CRITERIA EVALUATION:** Evaluate for SIRS Criteria/Altered Mental Status

- Altered mental status *(if positive and pt has suspected source of infection, immediately move forward with interventions).*
- Temp $> 100.4^\circ F (38^\circ C)$ OR Temp $< 96.8^\circ F (36^\circ C)$
- HR $> 110$
- RR $> 24$
- WBC $> 15,000$
- WBC $< 4,000$ OR $> 10\%$ bands (found in CBC diff)

SIRS: Systemic Inflammatory Response Syndrome

2 or more positive SIRS criteria OR
ALTERED MENTAL STATUS AND suspected source of infection*

= + Sepsis Screen

Begin Time Zero

Lori Olvera DNP, RNC-OB, EFM
Maternal Sepsis Pathway: Screening

Screen in triage, upon admission, every shift (within first 2 hours of shift) and PRN suspected infection (Document in EMR Flowsheet).

**SIRS CRITERIA EVALUATION:** Evaluate for SIRS Criteria/ Altered Mental Status

**SEPSIS INTERVENTIONS for 1st HOUR**

- Call Sepsis Alert - NOTIFY RRT, Lab tech, and OB Provider
- OB Provider places OB Severe Sepsis Order Set
- Draw STAT Lactate, CBC, - close loop communication with lab
- Blood Cultures (2 sets prior to antibiotics)
  - Draw even if patient has been treated for GBS+
- Consider other labs- Chem 7, PT, PTT, (Consult with RRT)
- Administer broad spectrum Antibiotic**
- Obtain U/A (consider source of infection)
- Chest XRAY (if suspected lung infection)
- Document TIME ZERO
- Vital Signs Q30 X2, Q1HX2, Q2 X2, then Q4H

_Time Zero_

Must complete sepsis interventions within 60 minutes!

Lori Olvera DNP, RNC-OB, EFM-
Maternal Sepsis Pathway: Increased Surveillance

Screen in triage, upon admission, every shift (within first 2 hours of shift) and PRN suspected infection (Document in EMR Flowsheet).

ACUTE ORGAN DYSFUNCTION EVALUATION
Evaluate for 1 or more ACUTE ORGAN DYSFUNCTION - Criteria due to infection

- Lactate ≥ 2 mmol/L – 3.9 mmol/L
- SBP < 90 mmHG◊ or MAP < 65
  (NOTE: ◊ Sys BP of 90 must be at least 5mm Hg lower than baseline to meet this criteria)
- SBP decrease < 40mmHG from baseline
- Bilirubin > 2mg/dL
- Urine output < or equal to 30 ml/hr for 2 hours
- Creatinine ≥ 1.5 mg/dL
- Platelet count < 100,000
- Coagulopathy (INR > 1.5 or PTT > 60 sec)

SEPSIS + 1 or more positive acute organ dysfunction = diagnosis of SEPSIS
Screen in triage, upon admission, every shift (within first 2 hours of shift) and PRN suspected infection (*Document in EMR Flow Sheet*).

**ACUTE ORGAN DYSFUNCTION EVALUATION**
Evaluate for 1 or more ACUTE ORGAN DYSFUNCTION Criteria due to infection

**SEVERE SEPSIS INTERVENTIONS**

☐ Consider IV Fluids N/S or LR 30 mL/kg; Administer each liter over 60 min (Lactate 2-3.9)
☐ Repeat lactate every 3 hours until lactate < 2 mmol/L
☐ SpO2 per protocol, titrate oxygen to ≥ 92%
☐ Consult with RRT to maximize oxygenation
☐ Notify OB, MFM, Hospitalist
☐ Vital signs Q30 X2, Q1H X2, Q2x2, then Q4h
Maternal Sepsis Pathway: Escalate Care

Screen in triage, upon admission, every shift (within first 2 hours of shift) and PRN suspected infection (*Document in EMR Flow Sheet*).

**SEPTIC SHOCK CRITERIA**

**Evaluate for SEPTIC SHOCK Criteria**

- LACTATE > 3.9 MMOL/L (initial lactate)
- BP Systolic < 90, MAP < 65 despite fluid resuscitation
- Clinical features are the same as severe sepsis

**SEPTIC SHOCK INTERVENTIONS**

- Notify OB MD - come to bedside
- RN - CALL RAPID RESPONSE TEAM
- RRT will initiate CODE SEPSIS OVERHEAD PAGE
- Broad spectrum antibiotics
- RRT will determine if ICU admission required
- IV Fluids Normal Saline or LR bolus 30ml/kg NOW for lactate > 3.9 mmol or hypotensive (if not previously done)
- Vital signs q 30 min

Lori Olvera DNP, RNC-OB, EFM-
Maternal Sepsis Pathway: Escalate Care

*Consider source of infection
- Chorioamnionitis
- Endometritis
- Pneumonia
- Intrauterine Fetal Demise
- Pyelonephritis
- UTI
- Other

*NOTES FOR OB PROVIDER USE:
• Add “Sepsis” to Problem List.
• For Lactate above 3.9—PMA comes to bedside, consults with OB Doc & documents plan of care-
Maternal Sepsis Pathway-2019

Screen in triage, upon admission, every shift (within first 2 hours of shift) and PRN suspected infection

Document in OB Sepsis Summary Flowsheet.

**SIRS CRITERIA EVALUATION**
Evaluate for SIRS Criteria / Altered Mental Status
- Altered mental status (if + and has suspected source of infection, immediately move forward with interventions).
- Temp >100.4°F (38°C) OR Temp <96.8°F (36°C)
- HR >110
- RR >24
- WBC >15,000
- WBC <4,000 OR >10% bands (found in CBC differential)

SIRS: Systemic Inflammatory Response Syndrome

**SEVERE SEPSIS CRITERIA EVALUATION**
Evaluate for 1 or more acute organ dysfunction criteria due to infection
- Lactate ≥ 2 mmol/L - 3.9 mmol/L
- SBP < 90 mmHg or MAP ≤ 65 (NOTE: SBP of 90 must be at least 5 mmHg lower than baseline to meet this criterion)
- SBP decrease >40mmHg from baseline
- Bilirubin >2mg/dL
- Urine output < or equal to 30 mL/hr for 2 hours
- Creatinine ≥ 1.5 mg/dL
- Platelet count < 100,000
- Coagulopathy (INR > 1.5 or PTT > 60 sec)

**ACUTE ORGAN DYSFUNCTION EVALUATION**
Evaluate for 1 or more acute organ dysfunction criteria due to infection
- Lactate ≥ 2 mmol/L - 3.9 mmol/L
- SBP < 90mmHg or MAP ≤ 65
- Urine output < or equal to 30 mL/hr for 2 hours
- Creatinine ≥ 1.5 mg/dL
- Platelet count < 100,000
- Coagulopathy (INR > 1.5 or PTT > 60 sec)

**SEPSIS INTERVENTIONS for 1st HOUR**
- Notify RRT and OB Provider
- OB Provider places OB Severe Sepsis Order Set
- Draw lactate, CBC, - call lab, request "STAT sepsis labs"
- Blood Cultures (2 sets prior to antibiotics - ok to draw if patient treated for GBS+)
- Give broad spectrum Antibiotic
- Consider other labs: Chem 7, PT, PTT, (Consult with RRT)
- Obtain U/A (considering source of infection)
- Chest XRAY (if suspected lung infection)
- Document TIME ZERO
- Vital Signs Q30 X2, Q1H X2, Q2 x2, then Q4h

**SEPTIC SHOCK INTERVENTIONS**
- Notify OB MD-come to bedside
- RN - CALL RAPID RESPONSE TEAM
- RRT will initiate CODE SEPSIS OVER HEAD PAGE
- Broad spectrum antibiotics
- RRT will determine if ICU admission required
- IV Fluids Normal Saline or LR bolus 30 mL/kg NOW for lactate > 3.9 mmol/L or hypotensive (if not previously done)
- Vital signs q 30 min

**SEVERE SEPSIS INTERVENTIONS**
- Consider IV fluids N/S or LR 30 mL/kg each liter over 60 min (Lactate 2-3.9)
- Repeat lactate every 3 hours until lactate < 2 mmol/L
- SpO2 per protocol, titrate oxygen to ≥ 92%
- Consult with RRT
- Notify OB MD
- Vital signs Q30 X2, Q1H X2, Q2 x2, then Q4h

**SEPTIC SHOCK INTERVENTIONS**
- Notify OB MD-come to bedside
- RN - CALL RAPID RESPONSE TEAM
- RRT will initiate CODE SEPSIS OVER HEAD PAGE
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- RRT will determine if ICU admission required
- IV Fluids Normal Saline or LR bolus 30 mL/kg NOW for lactate > 3.9 mmol/L or hypotensive (if not previously done)
- Vital signs q 30 min

**OB Provider Use**
- Add "Sepsis" to Problem List.
- For Lactate above 3.9—PMA comes to bedside, consults with OB Doc & documents plan of care.

**SEPTIC SHOCK CRITERIA**
Evaluate for Severe shock criteria
- LACTATE > 3.9 mmol/L (initial lactate)
- BP Systolic < 90, MAP < 65 despite fluid resuscitation
- Clinical features are the same as severe sepsis

**INCREASED SURVEILLANCE**

**SCREENING**

**TIME ZERO**

**ESCAPE CARE**
NICOM

- Noninvasive cardiac output monitor
Unplanned ICU Admission: Postoperative Course

- Transfer to ICU
- Weak but stable
- Separation from baby
- Delayed breastmilk

- Hbg Hct
  - Iron—IV (sucrose)
  - Rh-Erythropoietin
  - Heparin

- Discharge home WITH support
Surviving Sepsis: where do we go from here

- Immediate post-sepsis treatment plan
  - Treat anemia
  - Care of newborn
    - Breastfeeding
    - Antibiotics/side effects

- Long term patient follow-up
  - Negative impact on patient
    - Near death experience
Traumatic Childbirth

“process that involves actual or threatened serious injury or death to the mother or her infant. The birthing woman experiences intense fear, helplessness, loss of control and horror”.

- Dehumanizing experience
  - High level of medical interventions, extreme pain
  - Stripped of their dignity
  - Powerless
  - Lack of caring and support from perinatal staff
  - Fear of dying

Thematic Analysis of Women’s Perspectives on the Meaning of Safety During Hospital-Based Birth

Audrey Lyndon, Jennifer Malana, Laura C. Hedli, Jules Sherman, and Henry C. Lee

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ABSTRACT
Objective: To explore women’s birth experiences to develop an understanding of their perspectives on patient safety during hospital-based birth.

- Clinicians should be mindful of birth environment and how their behaviors influence the patient perspective of safety during birth.
- At least one team member should focus on emotional support during emergency birth to mitigate the potential for negative experiences that lead to emotional harm.
Learning from Review
Severe Maternal Morbidity

Adverse Outcome Review

• Why do it?
  – Finger point, blame, punish
  – Learn, improve future outcomes

• ACOG, AWHONN, SMFA –
• Recommend all severe morbidity whether sentinel or not:
  – Undergo review process:
    • thorough, credible, multidisciplinary, comprehensive
Summary

- Consider normal physiologic changes of pregnancy when screening pregnant or postpartum women.
- Lack of recognition and delays in treatment can result in septic shock and end organ dysfunction.
- Nurses play an essential role to screen, recognize, and promptly respond to women who screen positive for sepsis.
- The ability to mobilize a multidisciplinary team for early intervention, MFM, and ICU referral will promote intact survival of maternal sepsis.
- Multidisciplinary review of adverse outcomes promotes learning and provides opportunity for quality improvement.
Maternal Mortality Rate, California and United States; 1999-2013

HP 2020 Objective – 11.4 Deaths per 100,000 Live Births

Nurses are a valuable source of information and support for women and their families.

Thank You!

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