Baby on Board!
The Pregnant Trauma Patient
Gillian Schmitz, MD, FACEP
Disclosures

• No financial disclosures
• These views do not represent the views of the US Army, USUHS, or Department of Defense
• Focus on patient care and not politics
OBJECTIVES

1. Maternal-fetal anatomy & physiology
2. Impact of pregnancy on labs and imaging
3. Uterine pathology / fetal monitoring
4. Complications of pregnancy and abortion
5. Peri-mortem cesarean delivery (PMCD)
6. Evidence based approach for resuscitation
Trauma in Pregnancy:

• Most common cause of traumatic maternal deaths are due to *hemorrhage shock*
Anatomic Changes
Anatomic Changes
Changes to the Circulatory System

- HR increases 10-20 bpm
- BP decreases by 10-15 mmHG

- Can lose 30-35% circulating blood volume before manifesting clinical signs of shock!
Blood volume
Supine Hypotension Syndrome
Venous Thromboembolism

- The risk is increased five fold during pregnancy

- (DVT) and (PE) may occur in all three trimesters and the postpartum period

- The majority of DVTs in pregnancy are ileofemoral and are thus more likely to embolize

- Either IV unfractionated heparin or adjusted-dose subcutaneous low- molecular weight heparin (LMWH) are the treatment of choice because heparin does not cross the placenta
Changes to the Pulmonary System

Increased minute ventilation
Relative hypocapnea

Faster desaturation
Adaptation of the Respiratory System

- Oxygen consumption increases 35%.
- Progesterone -> respiratory stimulation → 30% increase in Vt.
- Minute ventilation is increased above the level needed to eliminate CO2 and PCO2 falls to 27 to 32 mm Hg.
- Renal compensation results in a maternal pH 7.40 to 7.45, with serum bicarbonate decreasing to 18 to 21 mEq/L.

Decreased FRC and increased oxygen consumption makes pregnant woman and fetus more vulnerable to hypoxia in the event of hypoventilation or apnea.
Gastrointestinal Changes

GASTROPARESIS

Healthy

Gastroparesis

Sphincter

Vagus nerve is damaged

Healthy

Gastroparesis

Esophagus

Nausea and bloating

Pyloric sphincter
YEAH, SO IF THIS BABY WOULD JUST GO AHEAD AND BE BORN

THAT'D BE GREAT
<table>
<thead>
<tr>
<th>1st baby:</th>
<th>2nd:</th>
<th>3rd:</th>
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<tbody>
<tr>
<td>crib</td>
<td>diapers</td>
<td>coffee</td>
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<tr>
<td>car seat</td>
<td>wipes</td>
<td>diapers</td>
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<td>stroller</td>
<td>diaper bag</td>
<td>extra car seat</td>
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<tr>
<td>swing</td>
<td>diaper genie</td>
<td>frozen meals</td>
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<td>bouncy chair</td>
<td>baby books</td>
<td>wine</td>
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<tr>
<td>teething toys</td>
<td>tummy time mat</td>
<td>90 day kid &amp; spouse-free trip to Tahiti</td>
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<td>pacifier</td>
<td>playmat</td>
<td>vasectomy appointment</td>
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<td>wipes warmer</td>
<td>bathing apparatus</td>
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<tr>
<td>breast pump</td>
<td>mobile</td>
<td>therapist</td>
</tr>
<tr>
<td>rocking chair</td>
<td>butt cream</td>
<td></td>
</tr>
<tr>
<td>baby food maker</td>
<td>monogrammed onesies</td>
<td></td>
</tr>
</tbody>
</table>
Labs

\[ WBC \xrightarrow{Hgb} HCT \xrightarrow{PLT} \]

\[ \text{Na}^+ | \text{Cl}^- | \text{BUN} \xrightarrow{glucose} \]
\[ \text{K}^+ | \text{HCO}_3^- | \text{creatinine} \]
Approach to Resuscitation:

ADEQUATE RESUSCITATION OF MOTHER
The WOMAN Trial: Early TXA in Post-Partum Hemorrhage
Vital Signs in Pregnancy

- Normal is NOT necessarily normal
- Up to 30% (2 L) loss of blood volume before vital signs change
- Maternal shock = fetal survival 20%
Airway: early RSI

- ↑ risk difficult intubation
- Failed intubation 8x ↑
  - ↑ Weight gain (aspirate)
  - ↑ Respiratory tract mucosal edema
    - • Smaller tube
  - ↓ FRC
  - ↑ Airway resistance
  - ↓ Respiratory system compliance
  - ↑ Oxygen requirements
Breathing and Circulation
Mechanical Ventilation

- The initial ventilator settings should be aimed at achieving \( \text{Pco}_2 \) of 28 to 35 mm Hg.

- Further Respiratory alkalosis reduces fetal oxygenation and decrease uteroplacental flow.

- ARDS net; The safety of this permissive hypercapnia in pregnancy remains to be determined.

- Continuous fetal monitoring should be conducted after each ventilator setting change.
Approach to Resuscitation: Secondary Survey

- Head to toe exam
- Abdominal exam / fetal viability
- GU exam
- Fetal monitoring / early OB consultation
- Early NG tube placement / IVF / blood

• ADEQUATE RESUSCITATION OF MOTHER
Imaging in Pregnancy
Placental Abruption
Uterine Rupture
Penetrating Trauma
Trauma and Pregnancy

- **Intimate partner violence**
  - Homicides (57-63%)
  - Accidents (12-34%)
    - MVC, falls
  - Suicides (9-13%) *

Intimate Partner Violence

- Focus is on the fetus
  - Abdomen (60%)
- \( \uparrow \) Preterm delivery
- \( \uparrow \) Fetal demise
Domestic Violence

- Think about it
- Ask when patient is alone
- Social services evaluation or referral
Injury Prevention
Complications of Unsafe and Self-Managed Abortion

Lisa H. Harris, M.D., Ph.D., and Daniel Grossman, M.D.

When abortion is legally restricted or otherwise inaccessible, girls, women, and those who care about them look outside formal medical care to end pregnancies. Worldwide, people increasingly choose misoprostol or a combination of mifepristone and misoprostol to end pregnancies on their own (referred to as self-managed abortion). These medications are safer and more effective than older, invasive techniques of self-managed abortion, and patients who have used these medications may be clinically indistinguishable from those who have had uncomplicated spontaneous pregnancy loss. Similarly, patients with complications of self-managed medication-induced abortion and those with complications of miscarriage may have identical clinical presentations.
| **PRESENTATION**       | Fever  
|                       | Abdominal pain  
|                       | Vaginal discharge  
|                       | Vaginal bleeding  
|                       | History of recent pregnancy |
| **ETIOLOGY**          | Retained products of conception (POCs) due to incomplete spontaneous or therapeutic abortion and secondary infection |
| **WORKUP**            | Beta- HCG  
|                       | CBC  
|                       | Blood type and Rh  
|                       | Urinalysis  
|                       | Ultrasound for retained POCs |
| **TREATMENT**         | Fluid resuscitation  
|                       | Obstetric Consultation ASAP (Need evacuation of uterus)  
|                       | Ampicillin-Sulbactam 3 g IV OR Clindamycin 600 mg IV  
|                       | +  
|                       | GENTAMICIN 1-2 mg/kg IV |
Pre-eclampsia

- complicates 5 to 10% of all pregnancies
- 10 to 15% of maternal deaths
- occurs most often in nulliparous women after the 20th week of gestation, typically near term
- may occur postpartum
- hypertension, proteinuria, and generalized edema, and hyperuricemia
- may progress without warning to a convulsive and potentially lethal phase, *eclampsia*. 
Maternal complications

- seizures (eclampsia)
- cerebral hemorrhage or edema
- renal dysfunction
- pulmonary edema
- placental abruption with DIC
- HELLP syndrome
- and hepatic infarction, failure, sub capsular hemorrhage, or rupture
Management of preeclampsia

- Immediate delivery if >34 wks
- Magnesium sulfate
- BP control is best controlled with IV labetalol
# Magnesium Dosing in Severe Preeclampsia/Eclampsia

<table>
<thead>
<tr>
<th>Variables</th>
<th>Normal Renal Function</th>
<th>Renal Insufficiency, Creatinine &gt; 1.0 mL/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>6 g IV over 15–20 min</td>
<td>4–6 g IV over 15–20 min</td>
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<tr>
<td>Maintenance</td>
<td>2 g/h infusion</td>
<td>1 g/h infusion</td>
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<tr>
<td>Serum levels</td>
<td>4.8 to 8.4 mg/dL</td>
<td>Monitor every 6 h</td>
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<tr>
<td>Monitor</td>
<td>Patellar reflex present</td>
<td>Patellar reflex present</td>
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<tr>
<td></td>
<td>Respiratory rate &gt;12 breaths/min</td>
<td>Respiratory rate &gt;12 breaths/min</td>
</tr>
<tr>
<td></td>
<td>Urine output &gt;100 mL/4 h</td>
<td>Urine output &gt;100 mL/4 h</td>
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<tr>
<td>Adverse effects</td>
<td>Hypotension/asystole</td>
<td>Hypotension/asystole</td>
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<td>Respiratory depression</td>
<td>Respiratory depression</td>
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<tr>
<td>Drug interactions</td>
<td>Calcium-channel blockers may enhance adverse/toxic effects</td>
<td>Calcium-channel blockers may enhance adverse/toxic effects</td>
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</tbody>
</table>
When people point at my pregnant belly and ask if I know what it's going to be, I like to say, "We're hoping it's a baby."
Resuscitative Hysterotomy
How to perform CPR Pregnancy
What do I need?
Challenging the 4- to 5-minute rule: from perimortem cesarean to resuscitative hysterotomy

Carl H. Rose, MD; Arij Faksh, DO; Kyle D. Traynor, MD; Daniel Cabrera, MD; Katherine W. Arendt, MD; Brian C. Brost, MD

Few obstetrical providers are confronted with an acute MCPA during clinical practice. The complex medical, cognitive, operational, and emotional circumstances surrounding MCPA creates a substantial challenge, particularly while trying to expediently balance competing maternal and fetal priorities. This monograph will review the historical evidence for current practices and suggest modifications based primarily on maternal status.

Introduction
Antepartum maternal cardiac arrest is a fortuitously rare event, with an incidence of approximately 1/12,500 deliveries.1

THE PROBLEM: Scenario no. 1: emergency medical services transports a young woman to the emergency department following high-speed frontal-impact motor vehicle accident requiring prolonged vehicular extraction. Primary survey reveals multifocal cranial and extremity trauma, and she appears to be approximately 7 months’ gestation. While lucid at the scene, she becomes unresponsive and requires airway management with endotracheal intubation. At time of arrival fetal heart tones are unable to be auscultated (suggestive of intrauterine fetal demise), and soon thereafter maternal cardiopulmonary arrest (MCPA) occurs. Scenario no. 2: in the labor and delivery suite, a 25-year-old primigravida at 39 weeks’ gestation in active labor at 9-cm dilation suddenly notes onset of dyspnea followed by loss of consciousness. No pulse is palpable. Fetal heart rate tracing previously was category 1 but now demonstrates a prolonged deceleration for 4 minutes.

A SOLUTION: As the on-call obstetrician, how do you manage these cases? Is
MATERNAL ARREST

Uterus palpable/visible above umbilicus OR Known gestational age ≥20-24 weeks?

YES

Initiate preparation for Resuscitative Hysterotomy

NO

RESUSCITATION PER STANDARD GUIDELINES

SHOCKABLE?

NO

Resuscitative Hysterotomy NOW

RESUSCITATION PER STANDARD GUIDELINES

YES

STANDARD ACLS (2 ROUNDS CPR)

ROSC?

NO

Resuscitative Hysterotomy NOW

YES

STANDARD POST ARREST MANAGEMENT

RESUSCITATION PER STANDARD GUIDELINES
Treatment Algorithm > 20 weeks

- Unstable
- Stable

Resuscitate
Transfer to OR
Perimortem
C section
Treatment Algorithm > 20 weeks

Unstable

Stable

FAST Exam/Ultrasound

Serial exams

Surgical and OB consultation

CT vs OR

Fetal Monitoring

ADMIT

Consider CT

Fetal Monitoring

OB consultation
Treatment Algorithm > 20 weeks

- Stable
- CT neg
- Tocodynamamometer Monitoring
• Monitoring for 4 hours is sufficient to rule out major trauma-related complications in low risk patients
Hospitalization and intermittent fetal heart rate and uterine activity monitoring by EFM for 24 hours for patients with:

- uterine tenderness, vaginal bleeding
- contractions during a monitoring period of 4 hours
- rupture of the membranes
- atypical or abnormal fetal heart rate
- high risk mechanism of injury (motorcycle, pedestrian, high speed crash)
- serum fibrinogen < 200 mg/dL
Fetomaternal Hemorrhage

- Apt test
- Kleihauer-Betke (KB) test
- Rhogam
- Tetanus
Take Home Points

• Focus resuscitation on mom
• Not all minor trauma is minor!
• Vital signs not reliable indicators
• Imaging in pregnancy
• PMCS now Resuscitative Hysterotomy
Questions?

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