

# Management of The Pregnant Trauma Patient

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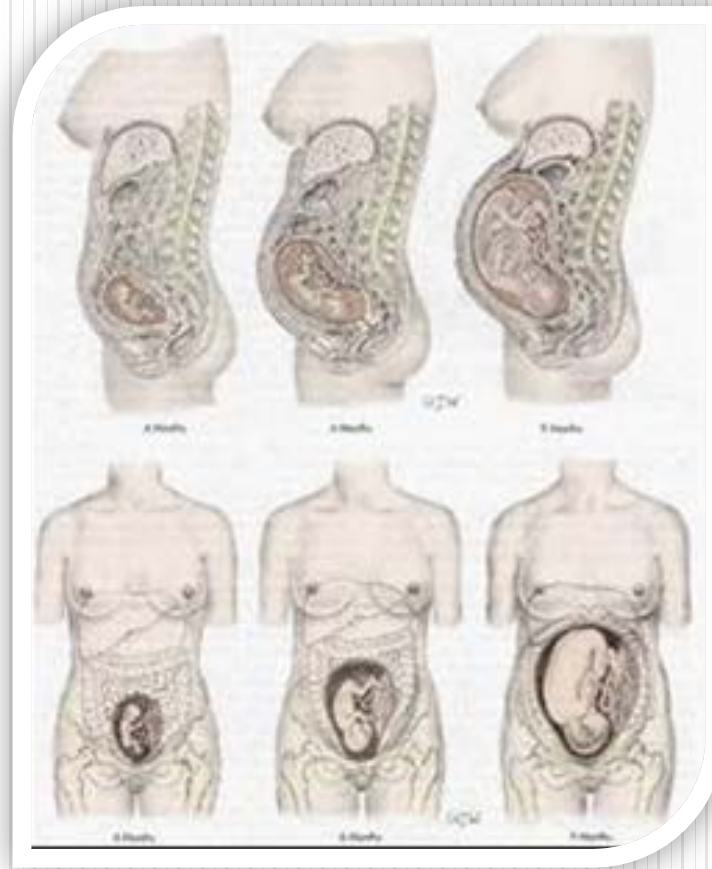
# Objectives

- Anatomic and physiologic changes
- Identifying the patient
- Establishing a multidisciplinary team
- Management considerations
- Imaging
- Outcomes and follow-up
- Injury prevention
- Difficult situations

# Epidemiology

- 7% of the pregnancies in the US are affected by trauma
- Trauma is the leading cause of non-obstetric maternal and fetal mortality
  - Falls
  - Domestic violence
  - Motor vehicle crashes

# Anatomic and Physiologic Considerations



# Anatomy

- First trimester
  - Fetus is protected by pelvis and thick walled uterus
- Fundal height
  - 12 weeks: limited to the pelvis
  - 20 weeks: at the umbilicus
  - 34 weeks: at the costal margin
- Second and third trimester:
  - Fetus more exposed
  - Thinning uterus and maternal abdominal wall

# Physiologic Changes

- Increased circulating blood volume
  - Systemic vasodilation & decreased peripheral vascular resistance
  - Uterus and placenta are vascular organs
- CO up to 45% greater than normal
- Mild tachycardia and hypotension normal in the third trimester

# Physiology

- Physiologic anemia of pregnancy: plasma volume  $>$  red cell mass
- Hypercoaguable state leaves pregnant patients predisposed to consumptive coagulopathies, e.g. DIC
- Fibrinogen is often slightly elevated at baseline in pregnancy
- Gastric emptying delayed, high aspiration risk

# Identify The Patient And Establish A Multidisciplinary Team

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- Send a Beta-HCG on every female of child bearing age

- Level 1 Trauma: Unknown age pregnant female in full arrest

# “Who you gonna call?”

- MFM attending office on call
  - (315) 464 – 4458
- Crouse L&D
  - (315) 470 – 7753
- NICU
  - (315) 470 - 7577



# Available Resources

## In the University Hospital ED

- External fetal monitor
- Emergency cesarean delivery tray

## The Available Response Team

- MFM or OB Attending
- OB residents
- OB/NICU nurses
- Infant portable bed/warmer
- NICU attending/NP/PA

# Management Of The Pregnant Trauma Patient

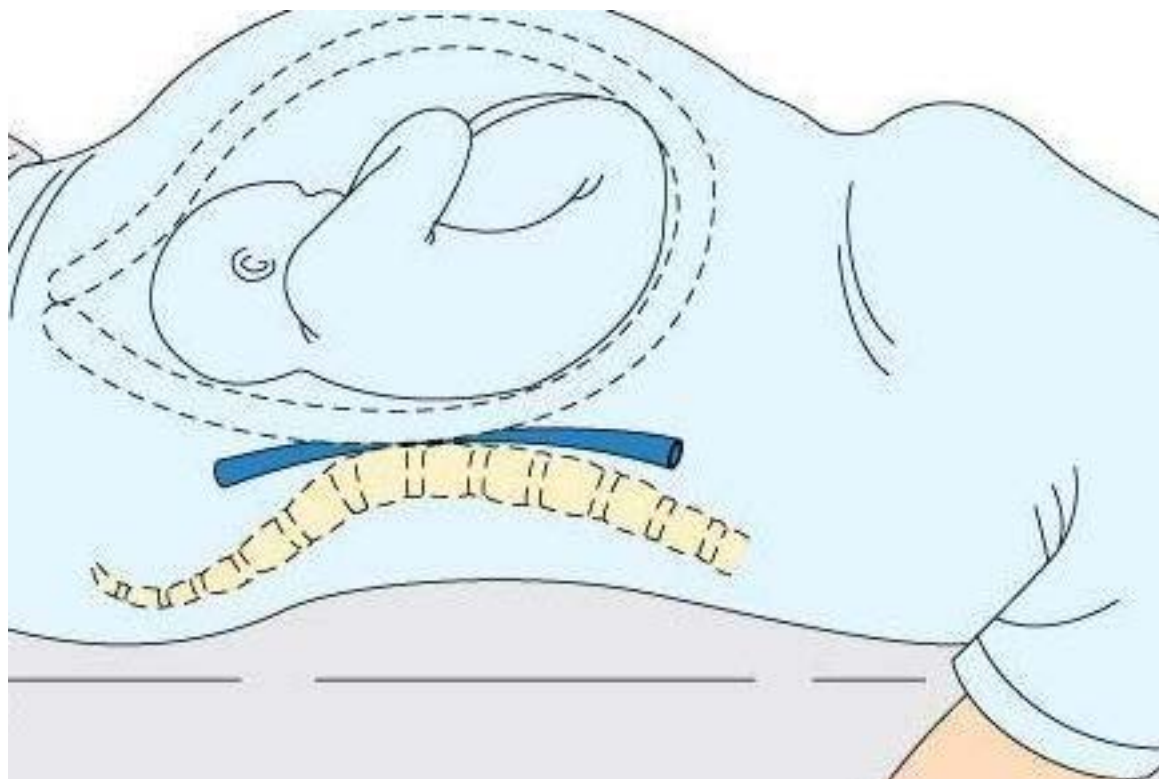
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# Management

- Do NOT deviate from standard practices
- Treat the mother first
- What is good for the mother is good for the fetus

# Trauma Evaluation Adjuncts

- Left lateral decubitus position



# Trauma Evaluation Adjuncts

- Left lateral decubitus position
- Perform a pelvic exam to identify
  - Vaginal bleeding
  - Ruptured membranes
  - Bulging perineum
- Obtain an obstetric history
- Decompress the stomach
- Adjunctive imaging including x-rays and FAST should be performed as indicated in non-pregnant patients!



J Ultrasound Med. 2005 Feb;24(2):175-81; quiz 183-184.

## **Screening sonography in pregnant patients with blunt abdominal trauma.**

Brown MA<sup>1</sup>, Sirlin CB, Farahmand N, Hoyt DB, Casola G.

- University of California San Diego
- 102 pregnant trauma patients underwent FAST
- Findings confirmed by CT, OR or clinical monitoring
- 100% specificity, 80% sensitivity
- The normal but small amount of physiologic free fluid in the pelvis during pregnancy is too small to detect
- All free fluid should be considered pathologic

# Kleihauer-Betke test

- Order in patients in second and third trimester
- Detects fetal blood in maternal circulation
- If positive, Rh negative mothers should be treated with Rho immune globulin which will suppress immune response of Rh-negative patients to Rh-positive RBC's
- RhoGAM 300 mcg IM x1

# RhoGAM



This Rh- mom has no Rh+ antibodies, and we need to keep it that way.

You're right... this Rh+ baby can send Rh+ antibodies to mom... that's bad news for future babies.

I'm RH negative

I'm RH+ just like my dad

I'm RH+ just like my dad

**RhoGAM:**  
Given IM at 28 weeks gestation and within 72 hours of birth.

Stop right there! I'm here to prevent mom from developing Rh+ antibodies that could affect future pregnancies.



# Fetal HR Monitoring

- Remains the best way to detect fetal distress
- Fetal distress is often a marker of maternal hypovolemia and early hemorrhagic shock

# Pharmacotherapy - RSI

Drug	Information
<b>Etomidate</b>	Category C. Human data is limited to women undergoing C-section. No congenital malformations were found in this study. However, the drug does cross the placenta at term (unknown early in pregnancy).
<b>Midazolam</b>	Category D. No human data in first or second trimesters, but animal data suggests low risk.
<b>Ketamine</b>	Category B. Generally thought of as safe, but does cause dose-dependent increases in maternal contractions.
<b>Rocuronium</b>	Category C. Generally thought of as safe, but does cross the placenta.
<b>Succinylcholine</b>	Category C. Generally thought of as safe and does not cross the placenta.
<b>Vecuronium</b>	Category C. Generally thought of as safe, but does cross the placenta.

# Pharmacotherapy – Pain/Sedation

Drug	Information
Fentanyl	Category C. Known risks during 3 <sup>rd</sup> trimester
Morphine	Category C. Known risks during 3 <sup>rd</sup> trimester
Ketamine	Category B. Generally thought of as safe, but does cause dose-dependent increases in maternal contractions.
Midazolam	Category D. No human data in first or second trimesters, but animal data suggests low risk.
Propofol	Category B. No reported evidence of fetal harm in animal studies. Limited data in humans suggests no harm when mothers are undergoing C-section. Does cross the placenta.
Dexmedetomidine	Category C. Animal data suggest potential fetal harm and human case reports suggest fetal bradycardia and hypotension.

# Pharmacotherapy – Other

Drug	Information
Tranexamic Acid	Category B. Generally thought of as safe. No adverse effects have been found in animals or humans.

Drug	Information
Cefazolin	Category B. No detectable teratogenic risk.
Clindamycin	Category B. No detectable teratogenic risk.

# Pregnancy Associated Pathology & Critical Care Considerations

- Preeclampsia and eclampsia
  - BP > 140/90
  - Proteinuria, elevated transaminases, thrombocytopenia
  - Poor placental perfusion
  - Seizures indicate transition to eclampsia
  - Mag sulfate & delivery of fetus



# Pregnancy Associated Pathology & Critical Care Considerations

- HELLP – Hemolysis, Elevated Liver enzymes and Low Platelets syndrome
  - Life threatening
  - Associated with preeclampsia
  - Schistocytes
  - Treated by delivery of fetus and placenta

# Pregnancy Associated Pathology & Critical Care Considerations

- Amniotic fluid embolism
  - Dyspnea, hypoxia and profound hypotension
  - Echo reveals right heart strain
  - Diagnosis of exclusion
  - Treatment is supportive care
  - 50% will develop disseminated intravascular coagulation

# Imaging

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# Radiology

- Do NOT withhold clinically indicated imaging with ionizing radiation from the pregnant trauma patient
  - Eastern Association for the Surgery of Trauma Guidelines, 2010
  - Advanced Trauma Life Support Curriculum by ACS
  - Mattox and colleagues in TRAUMA

**Radiation fear: Impact on compliance with trauma imaging guidelines in the pregnant patient.**

Shakerian R<sup>1</sup>, Thomson BN, Judson R, Skandarajah AR.

- Retrospective review from the Royal Melbourne Hospital, a level 1 adult trauma center
- 74 obstetric trauma patients, over a period of one year, 32 of which had a high-risk mechanism
- In the high-risk mechanism group the compliance rate with imaging guidelines was only 18.8%

- A single missed injury in a pregnant trauma patient can increase mortality and morbidity of the mother and the fetus

# Radiology

- Shield the fetus whenever able
- Consolidate scans and avoid repeat imaging
- Consider other non-ionizing modalities for follow up imaging

# Radiology

- There have been no reported adverse fetal outcomes with regard to less than 5 rad of exposure to the fetus and all trauma imaging falls below this threshold
  - CT head:  $<0.05$  rad
  - Chest CT:  $<0.1$  rad
  - Abdomen/Pelvis CT:  $<2.6$  rad
- $5 \text{ rad} = 50 \text{ mGy}$



# Radiology

- ACOG recommendations state that 5 rad exposure to the fetus is not associated with any increased risk of fetal loss or birth defects
- EAST guidelines on pregnant patient, diagnosis and management of injury, J Trauma, 2010

# Diagnosing Placental Injuries

J Trauma Acute Care Surg, 2013 Jan;74(1):236-41. doi: 10.1097/TA.0b013e318278937b.

**The ability of computed tomography to diagnose placental abruption in the trauma patient.**

Kopelman TR<sup>1</sup>, Berardoni NE, Manriquez M, Gridley D, Vail SJ, Pieri PG, O'Neill, Pressman MA.

- Retrospective review of 176 pregnant trauma patients at >20 weeks gestation
- CT imaging of placental abruption was apparent in all patients who required delivery for non-assuring fetal heart tones

# Percentage of Placental Enhancement

- <25% of normal placental enhancement seems to correlate with likelihood of requiring delivery
- All patients who required delivery had signs of placental abruption on CT imaging
- CT scan is much more sensitive than ultrasound

# Outcomes And Follow-Up

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Surgery. 2011 Jan;149(1):94-8. doi: 10.1016/j.surg.2010.04.019.

## **An assessment of the impact of pregnancy on trauma mortality.**

John PR<sup>1</sup>, Shiozawa A, Haut ER, Efron DT, Haider A, Cornwell EE 3rd, Chang D.

- Retrospective review of the national trauma databank
  - Pregnancy protective?
  - Compared with non-pregnant women of the same age group with similar injuries, pregnant women are found to have lower mortality rates

Surgery. 2011 Jan;149(1):94-8. doi: 10.1016/j.surg.2010.04.019.

## **An assessment of the impact of pregnancy on trauma mortality.**

John PR<sup>1</sup>, Shiozawa A, Haut ER, Efron DT, Haider A, Cornwell EE 3rd, Chang D.

- Tennessee state fetal birth and death data systems were merged with the Tennessee state hospital discharge data system
- Pregnant patients who were treated and discharged directly from the emergency room after what was defined as a **minor injury** were associated with an **increased risk for fetal demise, low birth weight, prematurity, preterm labor, placental abruption and uterine rupture**

# Follow Up

- Complications of trauma in pregnancy are often not immediate
- Communication with OB is essential for close monitoring throughout pregnancy

# Injury Prevention

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# Injury Prevention

- Identifying at risk populations
  - American college of surgeons national trauma databank
  - National violent death reporting system from the centers for disease control
  - Target and educate
  - Identified risk factors include: age < 18, alcohol & drug use, smokers, epilepsy, minorities

# Domestic Violence

- One of the most common causes of trauma in pregnancy
- Risk factors include: substance abuse, low socioeconomic status, limited education, unintended pregnancy, history of violence in previous relationships

# Seatbelt Awareness

- MVC's are among the leading causes of maternal and fetal injury and mortality in the United States
- Seatbelt use in pregnant patients is among the most extensively studied modifiable risk factors

# Seatbelt Awareness

- Adverse fetal outcomes in MVC's have been associated with
  - Higher crash severity
  - More severe maternal injury
  - **Lack of proper seatbelt use**
- However women often report that they were not counseled on the benefits of seatbelt use during pregnancy

# Difficult Situations

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# Perimortem Cesarean Section

- The American College of Obstetrics and Gynecology advocates for perimortem cesarean section for the pregnant patient in extremis for viable fetuses of at least 24 weeks gestation
- Recommended to be performed within 5 to 10 minutes of maternal cardiac arrest
- Recommendations based on expert opinions, limited data available

**Motor-vehicle injury in pregnancy and subsequent feto-maternal outcomes: of grave concern.**

Chibber R<sup>1</sup>, Al-Harmi J, Fouda M, El-Saleh E.

- Retrospective review of 728 pregnant women on motor vehicle crashes
  - 21% were wearing seatbelts
  - 44% were counseled about seatbelt use
- 91 perimortem cesarean sections
  - 81% of fetuses survived
  - 34% of women survived

# Perimortem Cesarean Section

- Infant viability in the pregnant trauma patient in extremis is determined by the presence of fetal heart tones, estimated gestational age and time that the mother is in arrest
- Survival reports seem to be limited to in hospital arrests



# Brain Dead Pregnant Trauma Patient

- Sparse literature; however the incidence of these patients is increasing as practices in critical care and resuscitation become more advanced

## **One life ends, another begins: Management of a brain-dead pregnant mother-A systematic review-**

Esmaeilzadeh M<sup>1</sup>, Dictus C, Kayvanpour E, Sedaghat-Hamedani F, Eichbaum M, Hofer S, Engelmann G, Fonouni H, Golriz M, Schmidt J, Unterberg A, Mehrabi A, Ahmadi R.

- Literature review revealed case reports of 30 patients, not limited to trauma
- Mean gestational age at time of brain death was 22 weeks
- Mean gestational age at time of delivery was 29.5 weeks
- 12 viable infants were born and all survived the neonatal period
- Limited follow up

# Take Home Points

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# Take Home Points

- Order a pregnancy test
- Treat the mother first, most of the time it is also the best way to treat the fetus
- Do not deviate from established trauma guidelines
- Image when indicated
- Left lateral decubitus position
- Kleihauer-Betke test and RhoGAM
- Buckle up, especially if you are pregnant

# Questions