



## Chapter 37 – Trauma in Pregnancy

### Episode Overview:

- 1) What is the threshold for fetal viability? How can this be estimated clinically?
- 2) List the expected physiologic changes during pregnancy
- 3) List 8 unique considerations in the management of the pregnant trauma patient
- 4) How is fetal distress detected?
- 5) Discuss placental abruption including the pathophysiology, clinical findings, diagnostic modalities, management, and complications.
- 6) List 2 potential uterine injuries
- 7) What is a safe radiation dose in pregnancy? What diagnostic tests have the potential to exceed this dose?
- 8) Describe alterations to the primary and secondary survey in the pregnant trauma patient. What additional lab work is needed? What specific therapies are employed in the primary survey?
- 9) Describe early, variable, and late decelerations. What is the implication of each? What is one other indicator of fetal distress related to the FHR?
- 10) How is fetomaternal hemorrhage diagnosed and managed?
- 11) Describe specific management in the following conditions:
  - a. Stable mother with stable fetus
  - b. Stable mother with unstable fetus
  - c. Unstable mother with unstable fetus
- 12) What are indications for peri-mortem c-sections. Describe the procedure.

### Wisecracks:

- 1) What is the concern with fetal-maternal hemorrhage? How is it managed?
- 2) Outline a basic approach to the pregnant trauma patient in the ED
- 3) What are indications for continuing fetal monitoring beyond 4 hrs?

### Rosen's in Perspective:

What are the top three causes of trauma during pregnancy?

- MVC's , interpersonal violence, falls
- many women may not know they are pregnant

Clinical features of trauma in pregnancy:

- increased likelihood of spleen, liver, bowel injury
- increased preterm labour
- fetal death
  - risk factors
    - ejections, motorcycle collisions, pedestrian collisions, no restraints
- restraint should be properly placed:



- lap belt UNDER gravid abd – it should be resting on the hip bones
- shoulder harness off to the side of the uterus, with the strap between the breasts

Interpersonal violence:

- important to ask about interpersonal violence
- victims of interpersonal violence are more likely to develop HTN, kidney infections, deliver preterm, have underweight infants, require NICU care

Falls:

- may trigger premature contractions, but RARELY result in immediate labour and delivery

Penetrating trauma:

- likely ~100% risk of harm to bowels, liver, spleen when the wound is in the upper abdomen
- fetus at risk for any uterine injury

Which is worse – penetrating or blunt trauma? PENETRATING

Fetal Injury:

- with maternal hypotension, hypoxia, acidosis, and FHR <110
- 40% chance of fetal demise when mother sustains life threatening injuries
  - e.g. maternal DIC
- outcome is NOT predicted by maternal vital signs:
  - outcome depends on 4 hrs of fetal monitoring
- in blunt trauma most injuries are
  - ICH, skull fractures
  - higher incidence with maternal pelvic or acetabular fractures

**1) What is the threshold for fetal viability? How can this be estimated clinically?**

- fetal viability
  - >24 weeks
  - >500 grams
- Estimated by uterine fundus being ABOVE the umbilicus

\*\*\*do what is best for the mother first\*\*\*

**2) List the expected physiologic changes during pregnancy**

Cardiovascular changes:

- Increasing heart rate
- Increased cardiac output
- 40% increase in blood volume



- Lower MAP in 1st and 2nd

Respiratory changes:

- 40% increase in minute ventilation
- decreased vital capacity

Gastrointestinal:

- decreased gastric emptying
- Weak LES tone

Anatomic:

- Elevated diaphragm (need to do thoracostomies 1-2 spaces higher)
- Diastasis recti
- Abdominal contents relatively elevated

**Table 37-1 Hemodynamic Changes of Pregnancy (Mean Values)**

PARAMETER	NONPREGNANT	TRIMESTER 1	TRIMESTER 2	TRIMESTER 3
Heart rate (beats/min)	70	78	82	85
Systolic blood pressure (mm Hg)	115	112	112	114
Diastolic blood pressure (mm Hg)	70	60	63	70
Cardiac output (L/min)	4.5	4.5	6	6
Central venous pressure (mm Hg)	9.0	7.5	4.0	3.8
Blood volume (mL)	4000	4200	5000	5600
Hematocrit without iron (%)	40	36	33	34
Hematocrit with iron (%)	40	36	34	36
White blood cells (cells/mm <sup>3</sup> )	7200	9100	9700	9800

Anatomic changes continued:

- intrapelvic until 12 weeks
  - umbilicus at 20 weeks
  - costal margins at 34 weeks
- rising diaphragm
  - more rapid tension pneumothorax
    - PEARL: \*\*\*place thoracostomies 1-2 rib spaces higher than the 5th interspace\*\*
- upwardly pushed abdominal viscera
  - increased risk of bowel injury in penetrating trauma
  - expected guarding and rebound are blunted
    - significant intra-abdominal bleeding with no pain on palpation
  - bladder more prone to injury because of displacement
- baseline pubic diastasis and hydro-nephrosis is common

Lab value changes:



- physiologic anemia
  - due to a 50% increase in blood plasma and only 18% increase in RBC's
  - therefore a LOWER hematocrit
- placental progesterone stimulates resp. centre to breath for a PaCO<sub>2</sub> of 30
  - compensatory lowering of bicarbonate
- changes to a PaCO<sub>2</sub> of 40 at the end of pregnancy = leading to mild resp. acidosis
- left axis shift of 15 degrees on ECG
- flat T waves or Q waves in lead III

### 3) List 8 unique considerations in the management of the pregnant trauma patient

#### Cardiovascular:

- *alterations in BP and HR can mimic shock*
- greater fall in diastolic BP in 1st and 2nd trimester
- <10 bpm rise in HR

#### What is gravid uterus syndrome and how is it managed?

- supine hypotensive syndrome (aka. aortocaval compression syndrome aka. Gravid uterus syndrome
  - after 20 weeks the uterus has risen to compress the IVC when the mother is supine
    - decreases CO by up to 30% (decreases systolic BP by 30 mmHg)
  - tilt mother to LEFT side by 15-30 degrees
    - also elevate mothers feet

#### Physiologic alterations may mask hypovolemic shock

- blood volume increases up to 45% above normal (peak at 32-34 weeks)
  - increase with multigravidas (twins, etc)
- increased circulatory reserve may delay signs of hemorrhage

#### Physiologic alterations can exacerbate traumatic bleeding

- increased cardiac output by 40%
  - mother's entire blood volume flows through uterus every 8-11 mins
  - **\*\*major source of blood loss\*\***
  - marked venous congestion in the pelvis and lower extremities
- gravid uterus increases peripheral venous pressure = more loss of blood from leg wounds

#### Pulmonary considerations:

- reduced oxygen reserve (FRC)
- increased O<sub>2</sub> consumption
  - increased oxygen demand during apnea by 30%
- increase minute ventilation leads to hypocapnia (so a paCO<sub>2</sub> of 35 is abnormal...!)



- need RAPID RSI, BVM is super tough

Gastrointestinal considerations:

- reduced sphincter response and GI motility
  - = increased aspiration risk
- increased acid production
  - consider early gastric decompression

So, in summary:

1. Pregnancy alterations in BP and HR can mimic shock
2. The gravid uterus syndrome
3. Blood volume increases can mask hypovolemic shock
4. Pregnancy can exacerbate traumatic bleeding
5. Reduced FRC - tube quickly
6. Increased O<sub>2</sub> consumption needs
7. reduced sphincter response and GI motility
  - a. = increased aspiration risk
8. increased acid production
  - a. consider early gastric decompression

#### 4) How is fetal distress detected?

- Fetal distress is detected with:
  - Non-stress testing
    - Abnormal baseline HR (</> 120-160)
    - Late decelerations
  - Fetal movement assessment

Fetal evaluation

- (1) fetal heart rate
- (2) fetal movement
- Signs of fetal distress (3)
  - abnormal baseline HR
    - normal 120-160
  - decreased variability
    - normal beat-beat variability and long term variability
  - Late decelerations
    - indicate fetal hypoxia

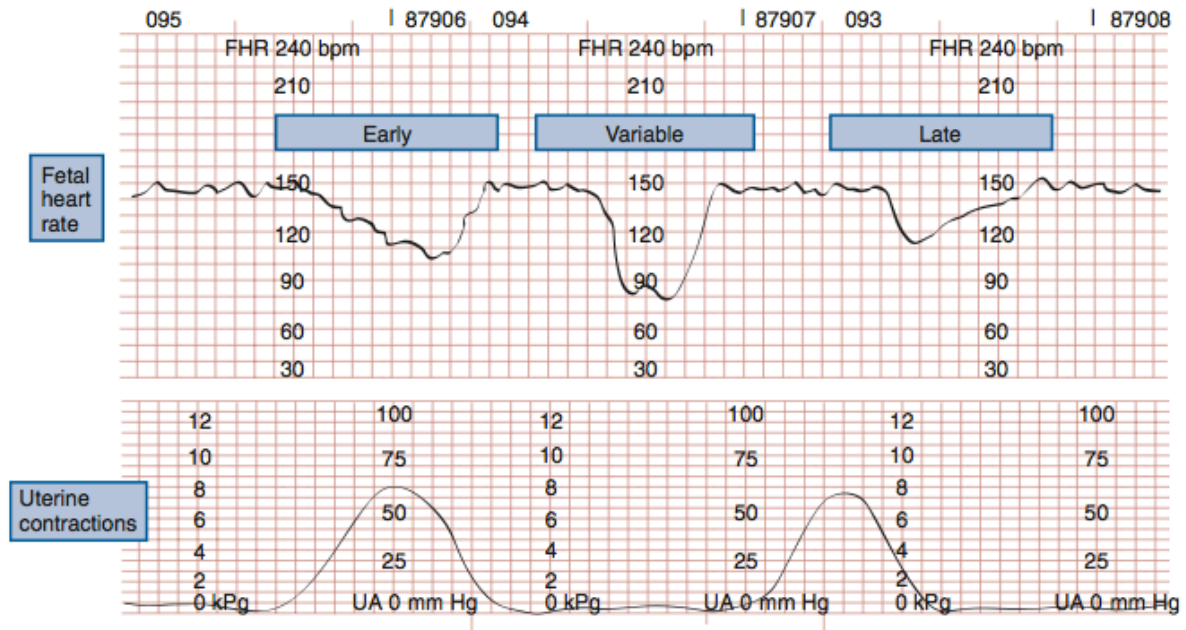


Figure 37-4. Types of fetal heart rate decelerations. bpm, beats per minute; FHR, fetal heart rate; UA, uterine activity.

## 5) Discuss placental abruption including the pathophysiology, clinical findings, diagnostic modalities, management, and complications.

### Placental injury

- blunt trauma leading to abruption results in 60% of fetal losses
- placental (inelastic) separation/shearing (abruption) from the uterus (elastic uterus)
  - think of it like your lungs being sheared off
  - can occur with NO visible abdominal trauma
- can lead to uterine contractions which further inhibit blood flow

### Clinical findings:

- classic symptoms:
  - painful, vaginal bleeding
  - abd. cramps
  - uterine tenderness
  - Frequent uterine contractions
  - Maternal shock
  - change in fetal HR
  - \*\*\*\*fetal distress\*\*\* (most sensitive indicator of abruption)
  - A CLINICAL DIAGNOSIS!

### Diagnosis:



- requires the kleihauer-betke test
- U/S (50% sens)
- Fetal stress testing

#### Management:

- Expectantly
  - If mother and fetus are stable:
    - Usually closely monitored in hospital
- After 32 weeks - OB may elect to do deliver early

#### Complications:

- Premature labour
- Stillbirth
- there is an exponential rise in fetal mortality with increasing amounts of abruption
- abruption can lead to maternal coagulopathy (resulting in DIC)

### **6) List 2 potential uterine injuries**

- 1) Pre-mature labour / contractions
- 2) Uterine rupture

- most common problem is uterine contractions after trauma
  - myometrial and decidual cells release prostaglandins --> contractions
  - use of tocolytics is not recommended because contractions usually herald a pathologic condition (such as abruption) -- where tocolysis is relatively contraindicated
- uterine rupture is very rare
  - often due to severe MVCs with pelvic fractures
    - penetrating trauma is rarely a cause
  - Diagnosis is difficult and may be confused with liver/spleen injury
    - fetal parts palpable, massive hemoperitoneum and shock --> high mortality

### **7) What is a safe radiation dose in pregnancy? What diagnostic tests have the potential to exceed this dose?**

#### Plain radiographs:

- fetal damage is rare with < 5-10 Rads (equivalent to ~two CT abdomens)
- fetus more sensitive in the first trimester
- for example the spontaneous developmental risks are much higher than 1 rad dose
- e.g. a chest and pelvis x-ray are <5 and 200-2000 milli-rads

#### CT / MRI

- CT head <50 milirads, an abdomen is about 3 or LESS rads



- With shielding of the mother's abdomen, a CT head and chest can be kept below 1 rad
- \*\*\*a PELVIC CT can produce a 3-9 rad dose\*\*\*
- MRI scanners are the better option if available

#### DPL

- recommended by Rosen's for the crashing pt. with an indeterminate U/S
- very high risk and low yield (missing retroperitoneal, intrauterine pathology)

What is the primary screening investigation for major intrabdominal injury? How sensitive is it?

#### Ultrasound

- **BEST test for maternal and fetal assessment**
- >85% sens. and >98% spec.
- 97% accurate for detecting intra-abdominal injuries in blunt trauma

In the pregnant patient:

- 80% sensitive and 100% specific for detecting MAJOR abdominal injury in the pregnant patient

### **8) Describe alterations to the primary and secondary survey in the pregnant trauma patient. What additional lab work is needed? What specific therapies are employed in the primary survey?**

#### Management

- From the start: mother is always the first priority
- Key decision points/questions:
  - (1) Is the uterus/fetal size >24 weeks?
    - if no ignore fetus and resus mother.
    - If yes
      - (a) Resus mother
      - (b) Get fetal heart tones
  - (2) Is the mother in arrest? If yes:
    - If fetal heart tones present and > 24 weeks = PERIMORTEM C SECTION
    - If fetal heart tones absent and mother in arrest STOP resuscitation

#### Maternal resus:

"ABCT + UFO"

#### Primary survey

- focus on mother
  - A+B
    - give O2 early
    - get a secure airway: do RSI





- goal PaCO<sub>2</sub> is 30 mmHg
- C
  - HR and BP are not consistent predictors of well being
    - uterine blood flow may be reduced with no external signs of bleeding or trauma
  - **avoid vasopressors**
- T "not D"
  - Tilt the mother!
- U + Fetal tones
  - U-uterus: if uterus above umbilicus: likely >24 weeks
  - FO- Fetal Tones: Modify primary survey to assess uterine size and presence of fetal tones

### Secondary survey

- Get maternal detailed info
  - ? Weeks pregnant, number of babies, GTPAL Hx.
  - ? uterine tenderness
  - ? contractions
  - ? vaginal bleeding
- Pelvic exam:
  - ? signs of ferning on uterine fluid? (ruptured membranes)
  - ? cervical dilatation
  - Swabs for G+C
  - ? GBS status
  - Bimanual exam for pelvic bone protrusion

### Fetal evaluation

- (1) fetal heart rate
- (2) fetal movement
- Signs of fetal distress (3)
  - abnormal baseline HR
    - normal 120-160
  - decreased variability
    - normal beat-beat variability and long term variability
  - Late decelerations
    - indicate fetal hypoxia

### What additional lab work is needed?

- regular trauma panel
- include blood type and Rh status and serum BHCG
- ABG's helpful to assess hypoxia and acidosis
- tests for DIC! (PTT, INR, Fibrinogen)
- Kleihauer-betke test:
  - for transplacental bleeding
  - 8-30% incidence after trauma
- **\*\*all Rh-Neg. mothers with any abd. trauma should receive RhIG within 72 hrs of the incident at a 300 mcg dose (protects against 30 ml of blood)\*\***

**9) Describe early, variable, and late decelerations. What is the implication of each? What is one other indicator of fetal distress related to the FHR?**

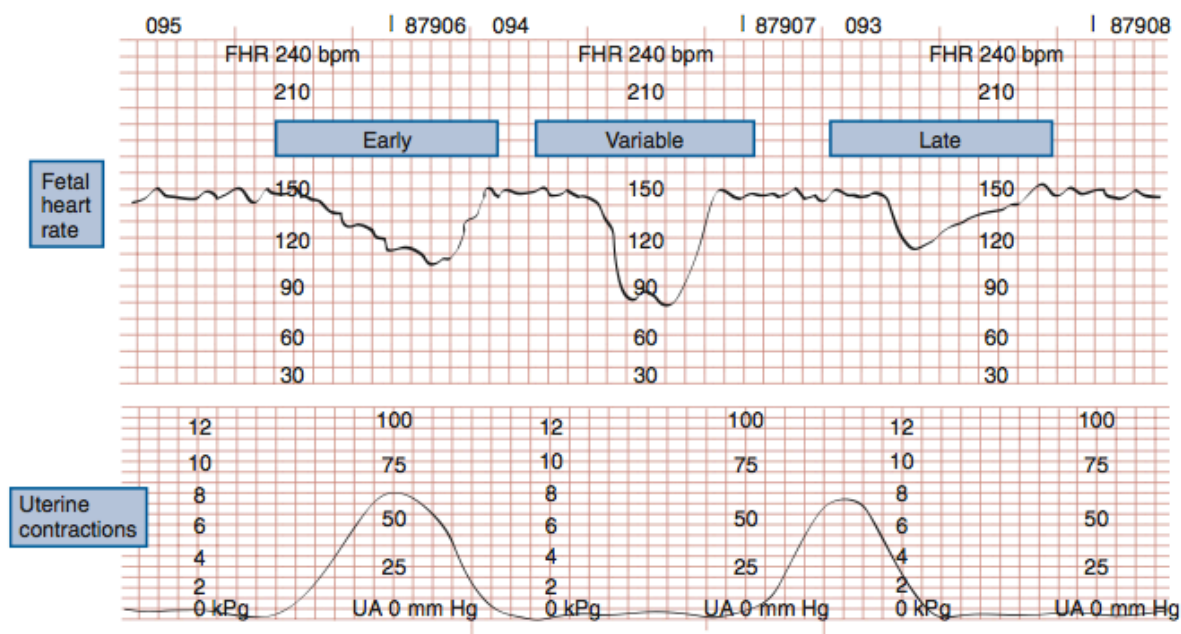


Figure 37-4. Types of fetal heart rate decelerations. bpm, beats per minute; FHR, fetal heart rate; UA, uterine activity.

Lack of variability at baseline is another indicator of fetal distress!

**Wisecracks:**

**1) How is feto-maternal hemorrhage diagnosed and managed?**

Most concern when greater than 12 weeks into pregnancy.

- Kleihauer-betke test:
  - for transplacental bleeding
    - Quantifies the amount of fetal-maternal hemorrhage (>5 mL)
  - 8-30% incidence after trauma
- **\*\*all Rh-Neg. mothers with any abd. trauma should receive RhIG within 72 hrs of the incident at a 300 mcg dose (protects against 30 ml of blood)\*\***
  - Regardless of a negative KHB test!
    - A 50 mcg dose is sufficient in the 1st trimester (only 4.2 mL of fetal blood then)
    - But in 2-3rd trimester you need to give 300 mcg to cover up to 30 mL
      - you may need more than one dose based on the KHB test

Bottom line: give Rhesus immuno globulin regardless of the KHB test!!



## 2) Describe specific management in the following conditions:

- a. **Stable mother with stable fetus**
- b. **Stable mother with unstable fetus**
- c. **Unstable mother with unstable fetus**

Mother stable: fetus stable

- minimal maternal trauma doesn't mean minimal fetal trauma
- at LEAST 4 hrs of fetal monitoring is recommended
- mother should record fetal movements on discharge (4 per hour)
- f/u should be arranged

Mother stable: fetus unstable

- fetal death rates are 3-9x higher than maternal death rates
- if fetus still unstable despite resus --> c-section
- ZERO fetal survival with no fetal heart tones!!

Mother unstable: fetus unstable.

- Repair/treat/resus mother's wounds:
  - If mother can't survive to C-section then the fetus definitely won't!
- uterine wounds need exploration

## 3) What are indications for peri-mortem c-sections. Describe the procedure.

Indications: **Must start within 4 mins of maternal cardiac arrest**

- **Present Fetal heart tones**
- **Greater than 24 weeks gestation**
  
- If no response to Tilting, resus with fluids and basic ACLS doesn't work, with fetal heart tones present:
  - Need to remove the babe within 4 minutes of maternal arrest
    - beyond 20 mins. there is no outcome for either pt.
- Procedure: (call for help, get equipment and suction ready, have warmer on hand, etc.)
  - Ensure high quality CPR is underway!!
  - chlorhex splash
  - midline vertical incision from epigastrium to symphysis pubis
  - vertical incision of the uterus
  - deliver fetus
  - clamp and cut cord

Can you give a pregnant mother Tetanus, TIG, and electricity

Crack Cast Show Notes – Trauma in Pregnancy – August 2016  
[www.crackcast.org](http://www.crackcast.org)



Misc. points:

- Tetanus and TiG have no negative effect on the fetus
  - the tetanus antibody CAN cross the placenta
- Maternal cardioversion is safe for cardiac dysrhythmias in ALL trimesters
  - up to 300J has been used without inducing labour or affecting fetus
  - fetal monitoring still recommended.