The Pregnant Trauma Patient

Vildana Omerovic, MD
Acute Care Surgery, Trauma Surgery and Surgical Critical Care
Marshfield Medical Center, MCHS

1

First things first…

- No disclosures to report
- By the end of this presentation, the audience should be able to:
  - Understand main similarities and differences between pregnant and non-pregnant trauma patient
  - Be able to describe the initial approach to the evaluation and treatment of pregnant trauma patient
  - Be cognizant of tests and interventions unique to the management of trauma during pregnancy
  - Describe unique traumatic injuries seen in pregnancy, as well as trauma burden to the fetus

2

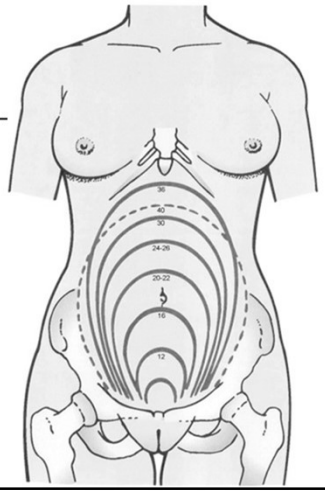
Epidemiology of Trauma

- 6 – 8% of all pregnant women
  - 0.4% require hospital admission, 0.1% ISS>15
- 50% of all non-obstetric maternal mortality
- (blunt trauma – MVC, domestic violence)
- 50% fetal mortality following major trauma
- Placental abruption in 50% of major trauma, 5% in minor
- 3-7 fetal deaths per 100,000 live births
- Further health risks to the fetus –preterm delivery, low birth weight

3

Patient stratification by category.

Category	Considerations
Potentially pregnant	History alone is unreliable in excluding pregnancy Perform a pregnancy test on all women of childbearing age who sustained trauma Where pregnancy is confirmed after a trauma event, provide counseling on the implications (ie, radiographic studies)
Previable gestation (< 24 wk)	Dates and estimations of gestational age may be inaccurate or unreliable Where in doubt, presume viability Document presence or absence of fetal heart rate
Viable gestation	Gestation greater than 24 wk Start cardiotocograph monitoring
Perimortem	Evaluate to perform cesarean delivery



4

Airway management

- Smaller-size ETT during intubation, early intubation
  - Laryngeal/nasopharyngeal and oropharyngeal edema
  - Gastric aspiration
- Use second-generation supraglottic device as the rescue of choice
  - Increased incidence of failed intubation, 1 in 225
  - Increasing age, higher BMI, higher Mallampati score
- Longitudinal incision over midline to access cricothyroid membrane
  - Increased soft tissue edema / obesity
  - Do not use needle cricothyroidotomy

5

Breathing

- Provide supplemental high-flow oxygen 10-15 L/min, via NRM, maintain oxygen sat 94-98%
  - Significantly increased oxygen consumption
  - Avoid hyperoxemia – O2 supplementation during elective C-sections – increased requirements for neonatal resuscitation
- Thoracostomy sites / placement of chest tubes in 3rd or 4th intercostal space, anterior to the mid-axillary line
  - Gravid uterus may displace the diaphragm up by 4 cm

6

Circulation

- Limited reliance on BP as marker of hypovolemia
  - HR increases by 8-16 beats/min
  - Expansion of blood volume by 1500 mL (2/3, 1/3)
  - Circulating volume 100 mL/kg
  - BP stable due to decreased SVR
  - Uterine blood flow 50 mL/min pre-pregnancy to 500 mL/min in the 40th week
  - Directly dependent on maternal MAP
  - Increased cardiac output up to 25%
  - Loss of 35% of circulating blood volume before signs/symptoms of hypovolemic shock

7

Circulation

- Establish circulatory access above the diaphragm
  - IV over IO, use humeral heads (R/L), sternum; tibia if no other choice
- Early administration of blood products in the aggressive volume resuscitation
  - Avoid large volume crystalloid or colloid infusions - worsens physiologic anemia of pregnancy
  - Activate MTP early!

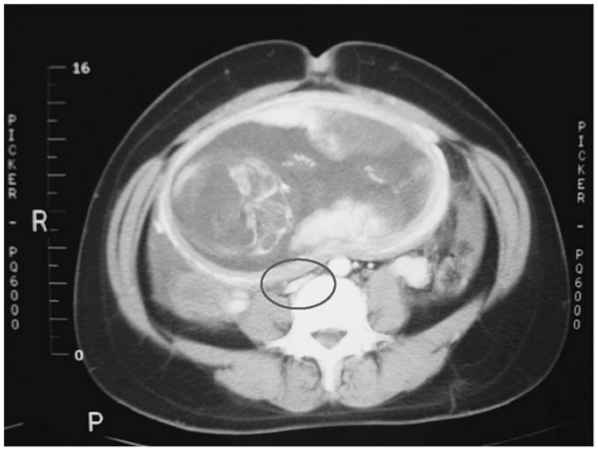
8

Circulation

- Manual uterine displacement or left tilt positioning
  - IVC compression, decreases CO and can cause SHS
  - Placental blood flow can be compromised despite the absence of maternal symptoms/signs
  - At least 15 degree left tilt (right side down) to offload the IVC, may not be enough
  - Can use lateral rotation, may not be feasible due to injuries
  - Manual uterine displacement – "up, off and over", may be required, but needs special instruction to achieve safely and properly

9

IVC Compression



10

Circulation

- Examination of the uterus and external genitalia required to complete abdominal eval for hemorrhage
  - Traumatic APH – placental abruption and uterine rupture
  - Concealed (20-35%) or revealed APH
- Use pelvic binders if indicated , as per local guidelines
- Can use TXA if needed, as per local guidelines
  - TXA effective in obstetric hemorrhage, clinical safety remains to be proven
- CPR to be performed in supine position with manual uterine displacement

11

Main Differences

Table 1
Changes in maternal physiology during pregnancy.

Change	Consequence
Cardiac output and blood volume increase	Shock after more than 40% of blood loss
Expansion of plasma volume	Physiological anemia
Decline in arterial and venous pressure	Vital signs are not reflective of hemodynamic status
Increase of resting pulse	
Chest enlargement	Change in anatomical landmarks
Diaphragm rise	Caution during thoracic procedures (eg, thoracostomy)
Substernal angle increase	
Decrease in functional residual capacity	Rapid decline in PO_2 during apnea or airway obstruction
Increase in oxygen consumption	
Airway closure when supine	
Increase in tidal volume and minute ventilation	Reduction in PCO_2 and bicarbonate levels
Decrease in anesthetic requirements	Need for adjustment of sedative doses
Decreased gastric motility	Risk of aspiration
Relaxation of gastroesophageal sphincter	

12

Conditions suggesting potential harm to pregnancy

1. Abdominal pain / tenderness on abdominal palpation
2. Vaginal bleeding (premature cervical dilation, early labor, placental abruption or placenta previa)
3. Ruptured membranes (prolapse of the umbilical cord)
4. Bulging perineum (pressure from extra-uterine located fetal parts)

13

Conditions suggesting potential harm to pregnancy

5. Presence and pattern of contractions, rigidity of the uterus
6. Abnormal fetal heart rate and rhythm
7. Kleihauer – Betke test (fetomaternal hemorrhage)

14

Feto-maternal Hemorrhage

- FHM possible by 4th week of gestation, 10-30% after trauma, KB should be performed on all >12 weeks
- 1 fetal cell per 1000 = FMH of 5 mL (estimated 5L volume)
- Rh sensitization of the mother (as little as 1 mL of Rh +ve blood can sensitize 70% of Rh -ve mothers)
- Fetal anemia, paroxysmal atrial tachycardia, hypoxia, neurological damage, intrauterine death from exsanguination
-
- All Rh -ve pregnant women should receive 1 prophylactic dose of 300 μg of Rho(D) immune globulin (RHOgam), additional doses for every 30 mL of fetal blood

15

Placental Abruption

- Most common injury to the gravid uterus
- 50% incidence in major trauma, 5% in minor trauma
- Acceleration – deceleration forces cause shearing between the rigid placenta and elastic uterine wall - retroplacental hemorrhage
- 50% abruption – 50% fetal loss
- Add to FAST? US insensitive, only 24% sensitivity
- CT can be falsely negative due to isoechoic placental clot
- External fetal monitoring – increased uterine tone and contractility and abnormal fetal heart tones (variable late decelerations and sustained fetal bradycardia)

16

Indications for Cesarean

Table 6
Indications for cesarean delivery during trauma.[49]

Maternal shock
Threat to life from exsanguination from any cause
Mechanical limitation for maternal repair
Irreparable uterine injury
Fetal distress in viable fetus
Unstable thoracolumbar spine injury
Instability in a potentially viable fetus
Maternal death

- Peri-mortem Cesarean delivery – vertical midline incision through all the layers into the uterus
- Between 26-32 weeks, if CPR not effective – anterior thoracotomy with OCM, no cross clamping
- After 32 weeks, ECM not useful, perform C-section immediately, to improve both patients' survival

17

"Level 1 Trauma: 20 yo pregnant F, MVC, intubated, vitals stable, ETA 15 min"

18

Critical Decision/Step #1: What do you need? Who do you need? What is your plan?

19

Level 1 Trauma Activation

- 20 y/o F; “heavily” pregnant
- High – speed MVC; restrained driver ‘T-boned’ by a bus on the driver’s side at 60 mph
- + airbag deployment; unknown if she was wearing her seatbelt
- +LOC; intubated at the scene for airway protection
- BP 167/77 HR 92 RR 14 O2 Sat 99% on 100% FiO2

20

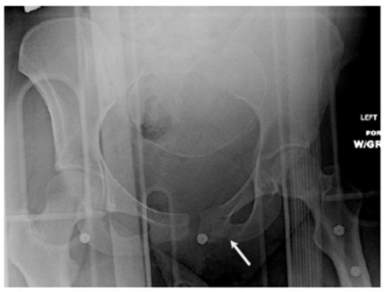
Primary and Secondary Survey

- Airway secured with ETT
- Equal breath sounds bilaterally
- Vitals as noted
- Facial lacerations noted on physical exam
- CXR normal
- FAST negative for free fluid
- Fetal heart tones evaluated with US – 150 bpm
- Hgb 10.5 Hct 33% pH 7.3 HCO_3 17 AG 9 LA 1.8

21

Primary and Secondary Survey

- Pelvic XR – Left pubic bone fracture
- Ossified fetal cranium low in the pelvis with a cephalic presentation



22

Critical Decision/Step #2: What is your next step?

- Ortho consult?
- OB/GYN consult?
- CT scan?
- Something else entirely?

23

In the CT scanner

- CT head/C-spine, chest, abdomen/pelvis ordered
- After CT head – patient developed evidence of preterm labor…
- Concern for placental abruption with fetal distress
- Cervical effacement over the course of last 50 min
- External fetal monitoring – increased uterine tone and increased frequency of uterine contractions, now up to every minute
- Fetal baseline heart rate 90 – 110 bpm

24

In the CT scanner

- Patient reposition into more of left side down tilt in an attempt to normalize the heart rate
- Fetal HR back to 120 bpm

25

Critical Decision/Step #3: What do you do now?

- Complete the CT scans?
- Straight to the OR for emergency C-section?
- Go to the SICU for tocolytics?
- Something else entirely?

26

CT Findings

- Placental abruption and near complete devascularization of the placenta

27

Critical Decision/Step #4: What now?

- Await the rest of the CT results?
- OR right away?

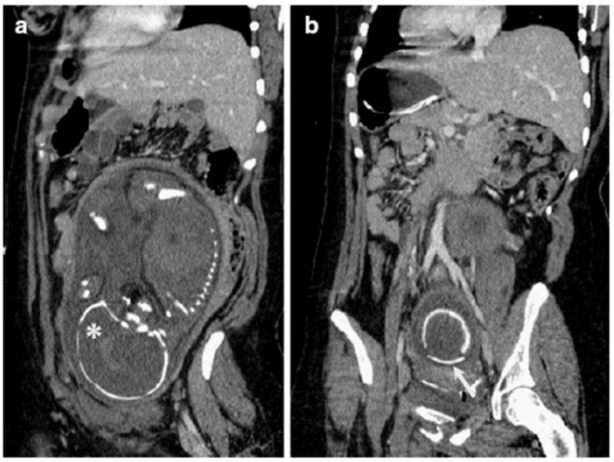
28

OR Events

- In the OR: fetal heart rate 117 bmp immediately prior
- Live male infant delivered within 1 min of skin incision with Apgar 1, 1, 1 and 1
- Amniotic fluid appeared bloody with substantial retroplacental clot
- After 34 min of resuscitation with maximum ephinephrine, transfusions and CPR, infant is pronounced dead
- Autopsy findings consistent with CT scan finding as follows

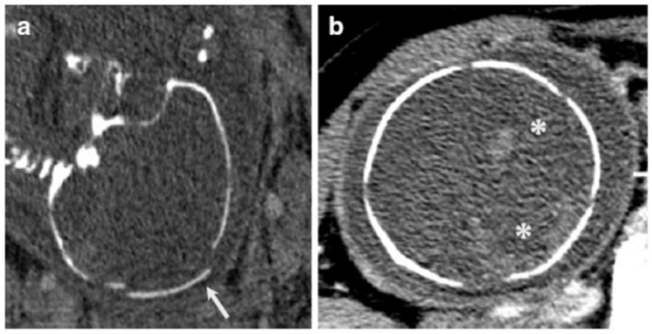
29

Additional CT scan findings



30

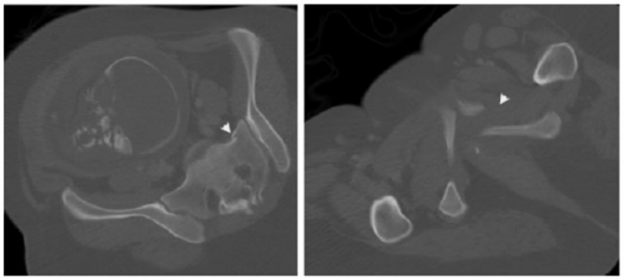
Additional findings (fetal)



- Displaced fracture right parietal bone
- Large amount of blood in the fetal ventricles, over the right cerebral hemisphere and right brain parenchyma

31

Additional findings (maternal)



- Acute intraparenchymal hemorrhage in right temporal lobe
- Right 1st rib fracture and trace pneumothorax
- Mandibular fracture
- Zone 2 fracture left sacrum, widening of left SI joint, fracture left pubic bone near symphysis pubis

32

Questions?

For references, please email me at
omerovic.vildana@marshfieldclinic.org

33