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Pregnancy in Trauma

SOCIETY OF TRAUMA NURSES

Objectives

At the conclusion of this presentation the participant will be able to:

- Discuss the epidemiology, incidence and prevention of trauma in pregnancy
- Identify physiologic & anatomic changes in pregnancy pertinent to trauma care
- Discuss resuscitative management unique to the pregnant trauma patient

Epidemiology

- Leading cause non-obstetric maternal death
- 6-8% of pregnancies experience trauma
- 40-45% risk of fetal death with major trauma

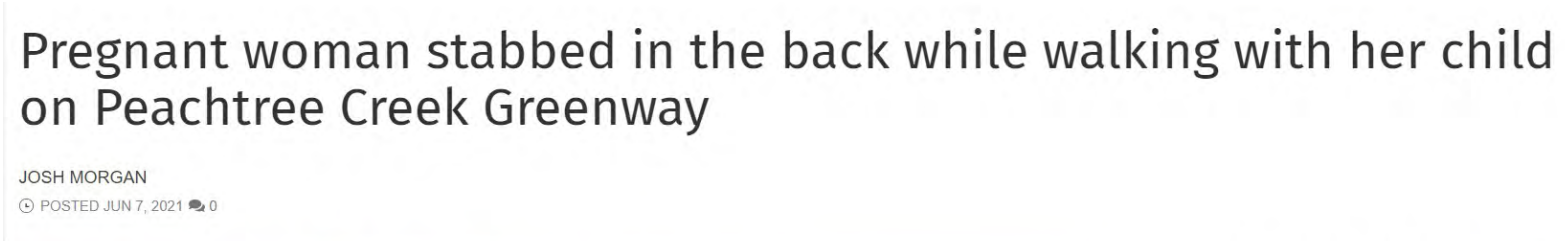
NEWS

Pregnant Tallahassee woman, 21, killed and two men injured in deadly Sunday crash, FHP says

Christopher Cann
Tallahassee Democrat

Published 10:28 a.m. ET Nov. 22, 2021

Hit-and-run driver sought after pregnant woman killed in West Palm Beach



Pregnant woman stabbed in the back while walking with her child on Peachtree Creek Greenway

JOSH MORGAN

POSTED JUN 7, 2021 0

LaRosa et al, 2020

Mechanism of Injury

- Domestic violence 8307/100,000 live births
- Motor vehicle crashes 207/100,000 live births
- Falls and slips 48.9/100,000 live births
- Penetrating trauma 3.27/100,000 live births
- Homicide 2.9/100,000 live births
- Suicide 2/100,000 live births

LaRosa et al, 2020

Who is at Increased Risk for Abuse During Pregnancy?

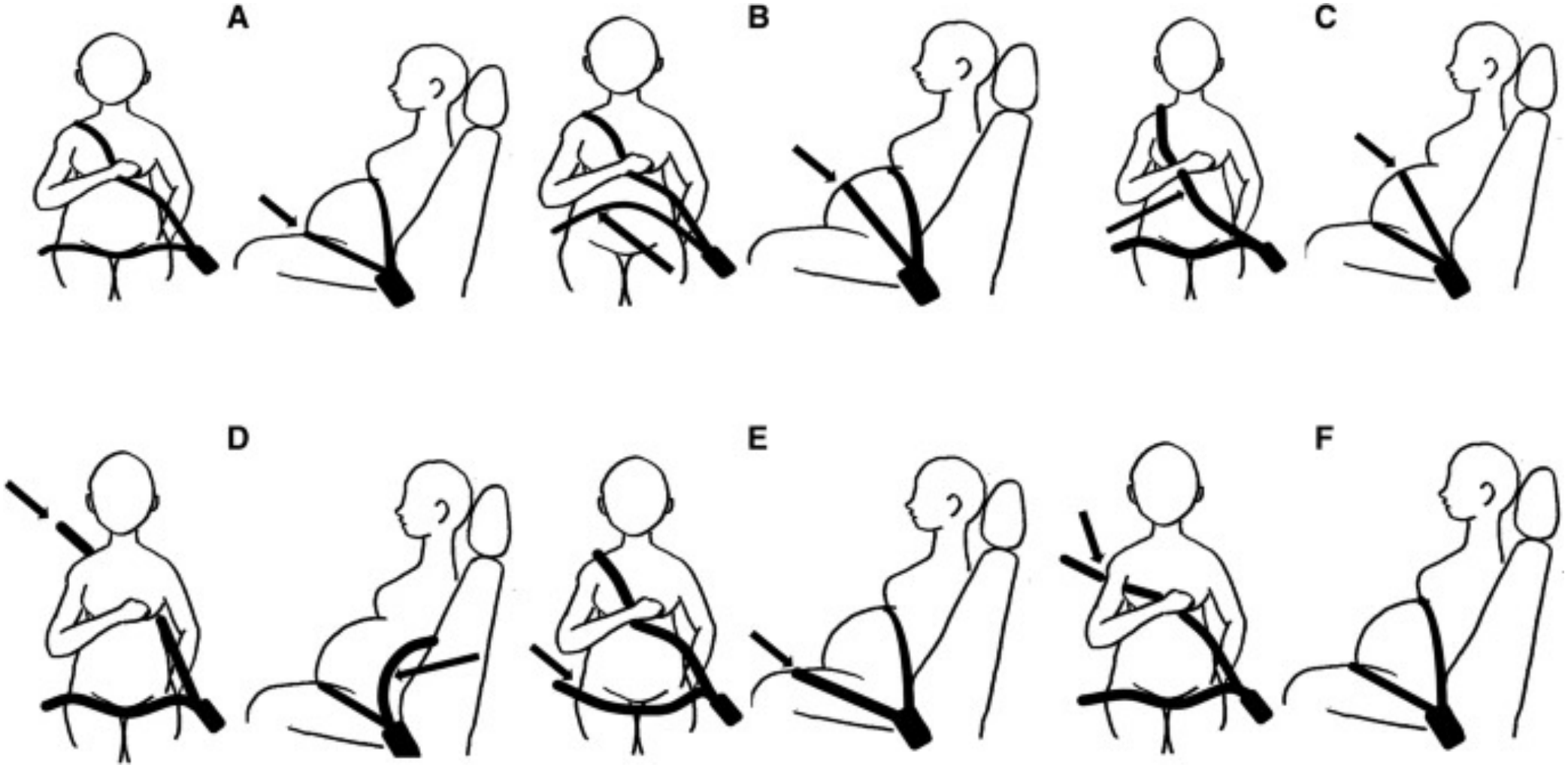
- Young
- Single relationship status
- Minority race/ethnicity
- Drug and/or alcohol abuse
- Poverty
- Pregnancy alone - independent risk factor!

Motor Vehicle Crash

- MVC is a leading cause of **maternal death**
- 97.6% of pregnant women always wore seatbelts, but 12-27% incorrectly
- In unrestrained patients, fetal death is three times more likely
- Only 50% of patients report receiving seatbelt education from prenatal care provider

Hanahara, 2020

Proper Seat Belt Positioning

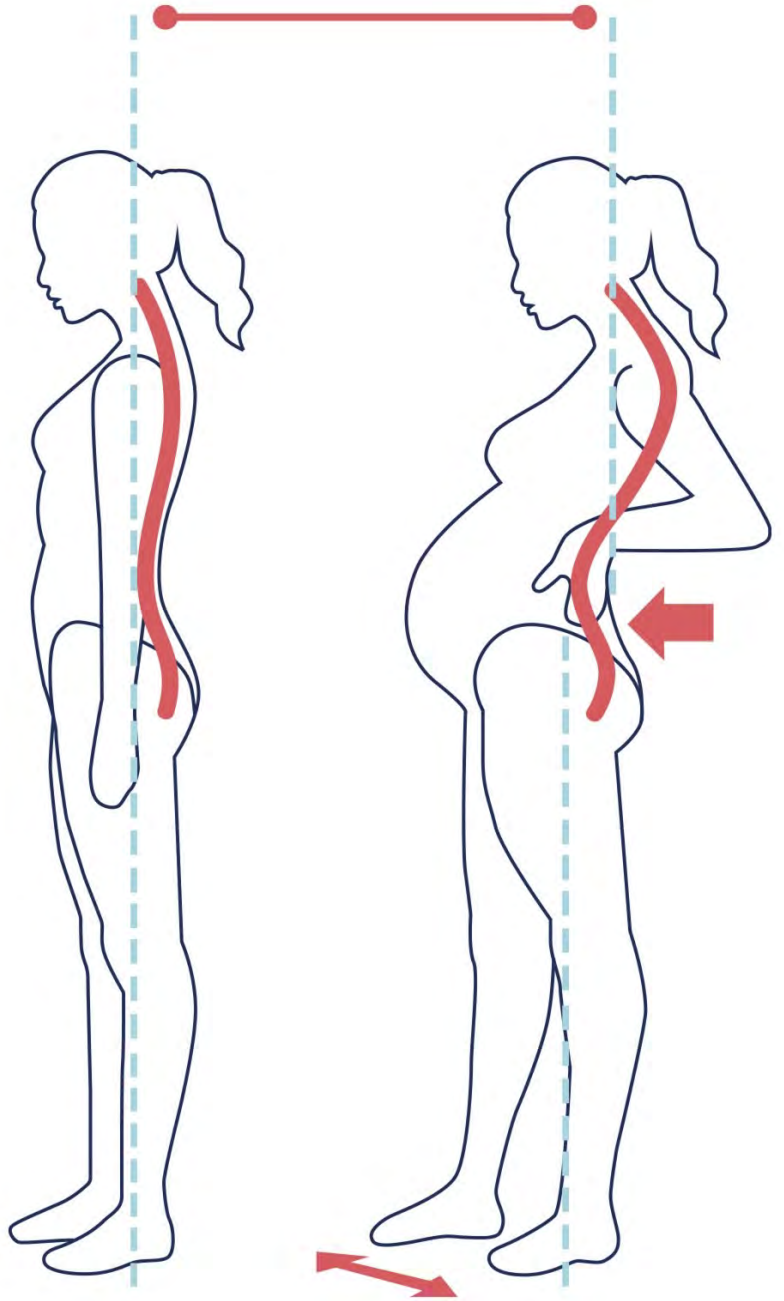


Motor Vehicle Crash

- Airbags are supplemental
  - Protective if patient restrained using three point harness
  - Positioning:
    - Sternum should be at least 10 inches from steering wheel
    - Tilt steering wheel towards sternum, not abdomen
  - More research is needed
- Distracted driving
- Use of alcohol or other intoxicant

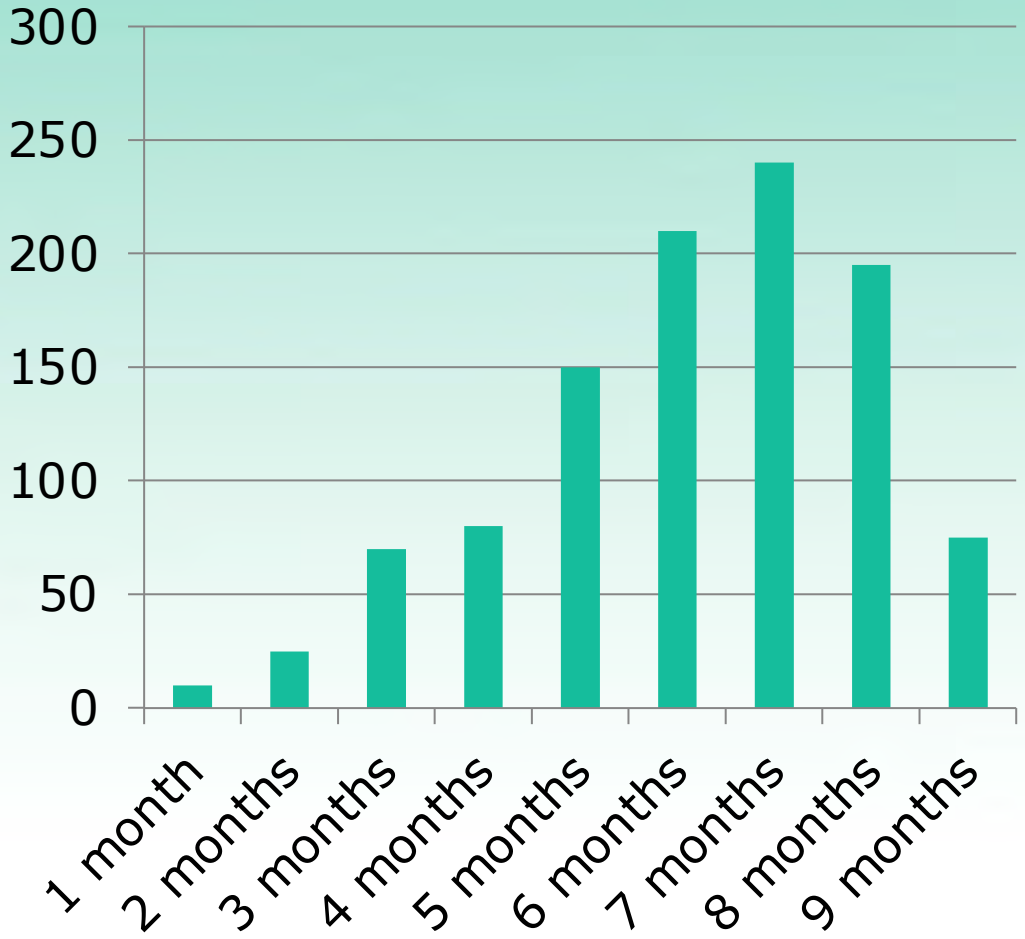
Falls

- Center of gravity shifts forward
- Hypermobility of joints
- Nerve roots stretched
- Altered sensation
- Postural sway



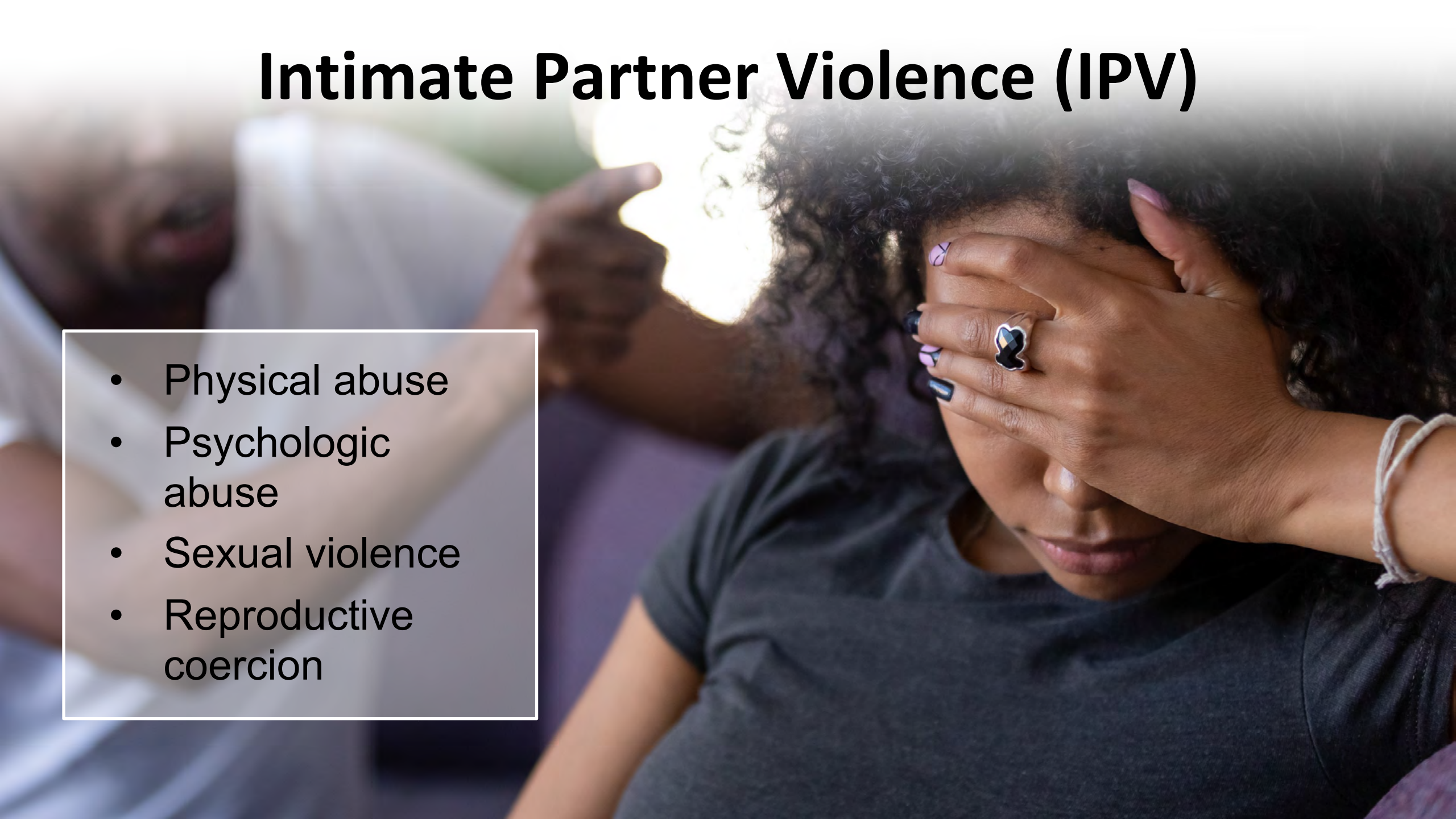
Falls

- Fall details give clues to possible injuries
- High suspicion for abuse



Dunning et al, 2010

Intimate Partner Violence (IPV)

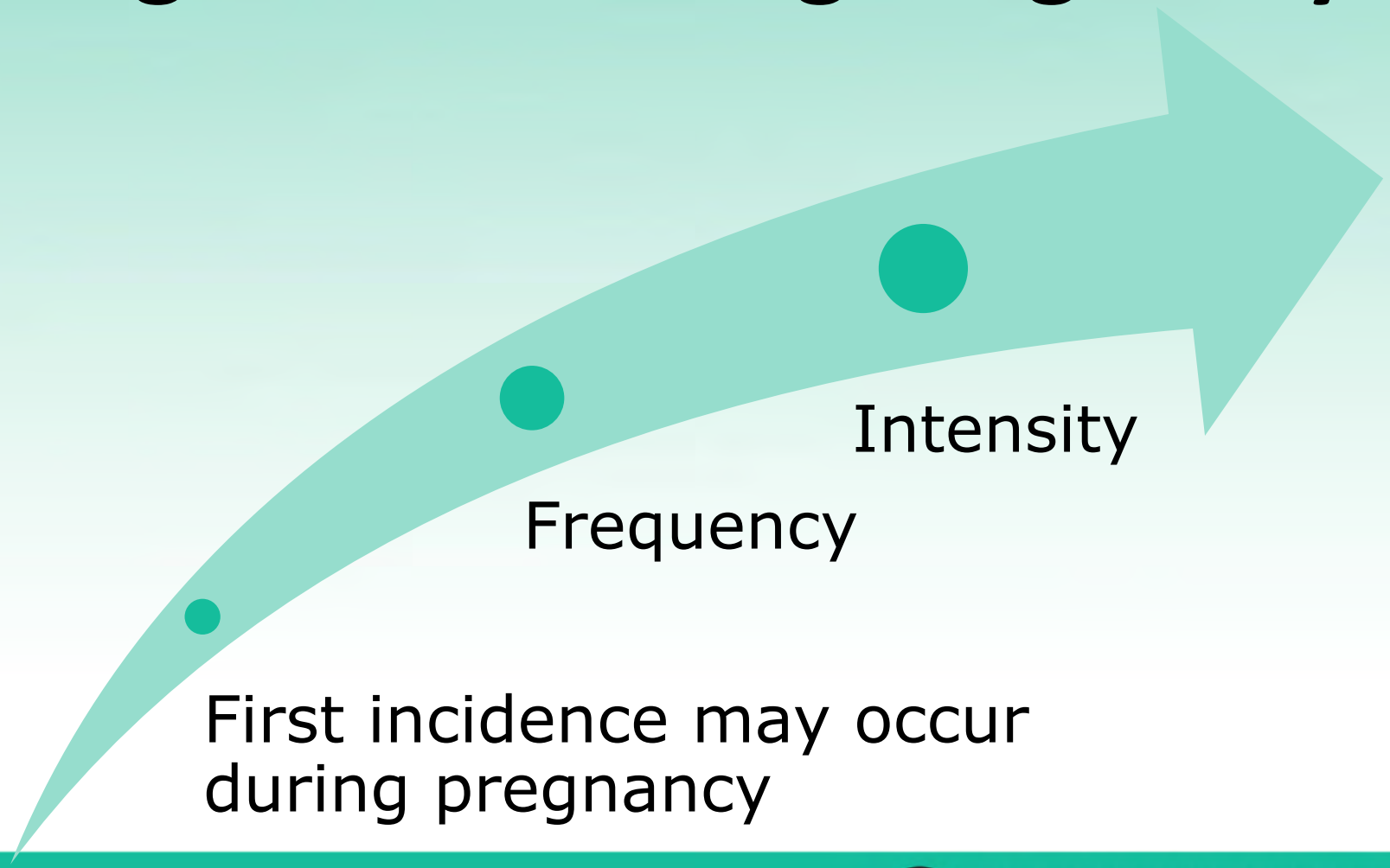


- Physical abuse
- Psychologic abuse
- Sexual violence
- Reproductive coercion

Mechanism of Injury

- Risk Factors:
  - Young
  - Single
  - Non-Caucasian
  - ↓ Socioeconomic Status
- Injuries to neck, breast, face, upper arms and legs
- National Domestic Violence Hot Line: 1-800-799-7233

Intimate Partner Violence Progression During Pregnancy



Create a Safety Plan

Interactive guide to safety planning

Introduction Basics Home School Job Technology Partner Children Emotional

SAFETY ALERT: The interactive guide to safety planning requires you to enter information into an online form. Before you begin, be sure that the computer you are using is in a safe location and is not being monitored by your partner. **Click here** to learn more about how an abusive partner can monitor your computer.

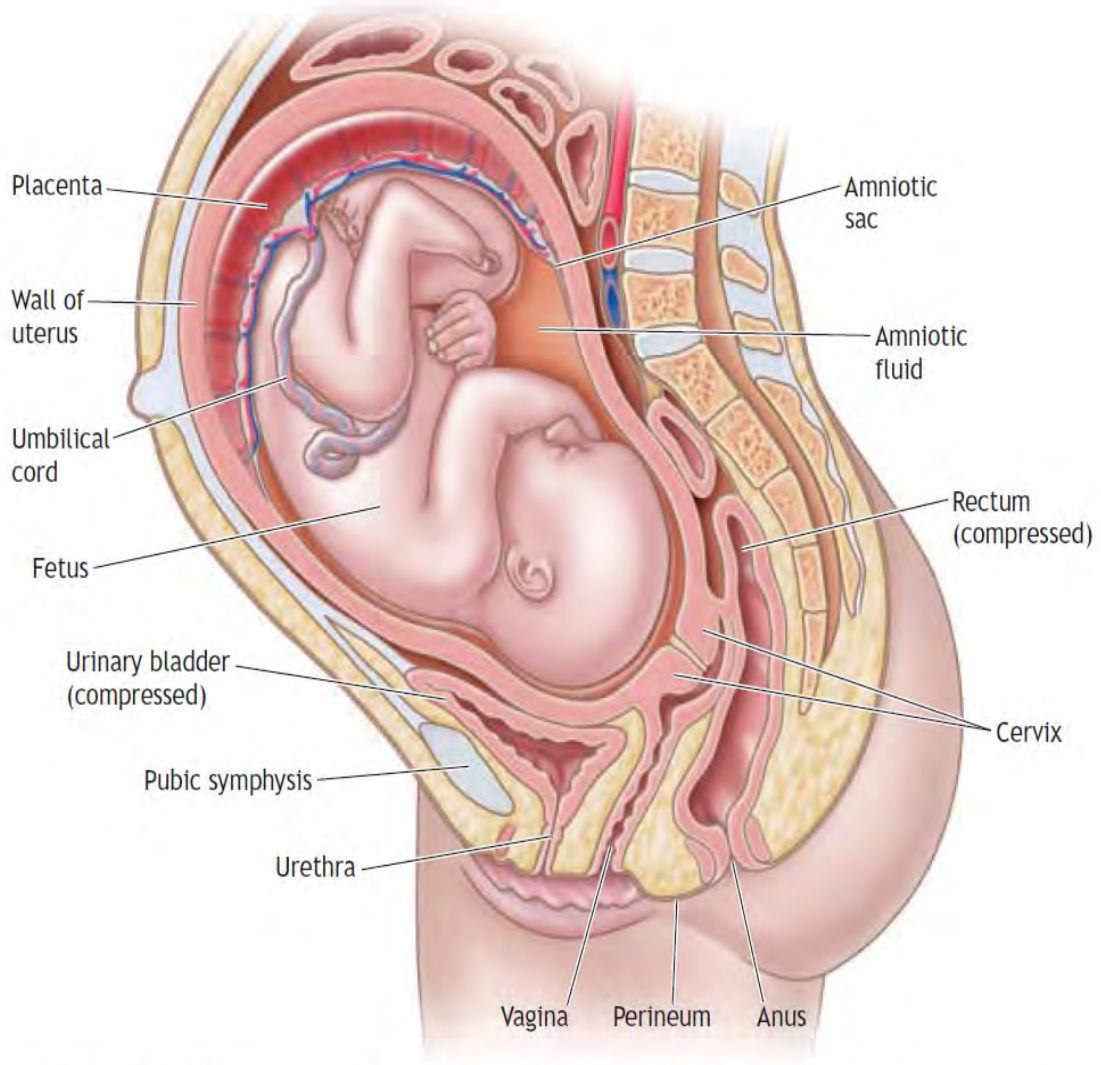
If you are using a school or work computer, remember that the information you enter may be monitored by your school or employer.

Intimate Partner Violence Sample Screening Tool

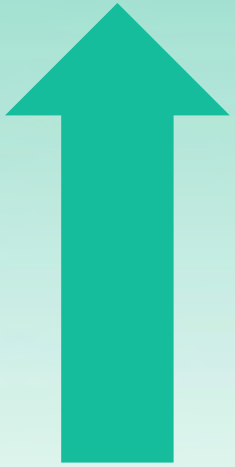
(performed in absence of patient partner)

1. Have you ever been emotionally or physically abused by your partner or someone important to you?
2. Have you been hit, slapped, kicked, or otherwise physically hurt by someone during this pregnancy?
3. Within the past year has anyone made you do something sexual that you did not want to do?
4. Are you afraid of your partner or anyone else?

Physiologic Changes in Pregnancy



Hemodynamic Changes in Pregnancy



Heart rate 15-20 bpm

Blood volume by 50%

Cardiac output by 30-50%

BP by 15-20 mmHg

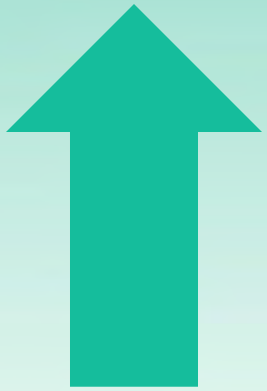
Systemic Vascular Resistance

HCT (dilutional anemia)

Net Effect May Mask Shock

LaRosa, 2020 Kilpatrick, 2021

Pulmonary Changes in Pregnancy



Engorged mucosa

Oxygen consumption 15-20%

Minute ventilation

Tidal volume

Resp Alkalosis

O2 reserve

Buffering capacity

Total lung capacity

Functional residual capacity

Intubate Early

Provide O2

High risk: Hypoxia

Pulmonary Changes in Pregnancy

Arterial Blood Gas Values		
	Pregnant	Non-Pregnant
pH	7.40 to 7.45	7.40
pCO2	27 to 32	39 to 40
pO2	100 to 108	95 to 100
Bicarbonate	18 to 21	24 to 29

Kilpatrick, 2021

Neurological Changes in Pregnancy

Normal Changes

- Dizziness, syncope
- Feeling of forgetfulness and lack of focus

Neurologic Complications

Pre-eclampsia/Eclampsia

- Hypertension
- Headaches
- Vision changes
- Hyperreflexia
- Seizures

Can mimic head injury!

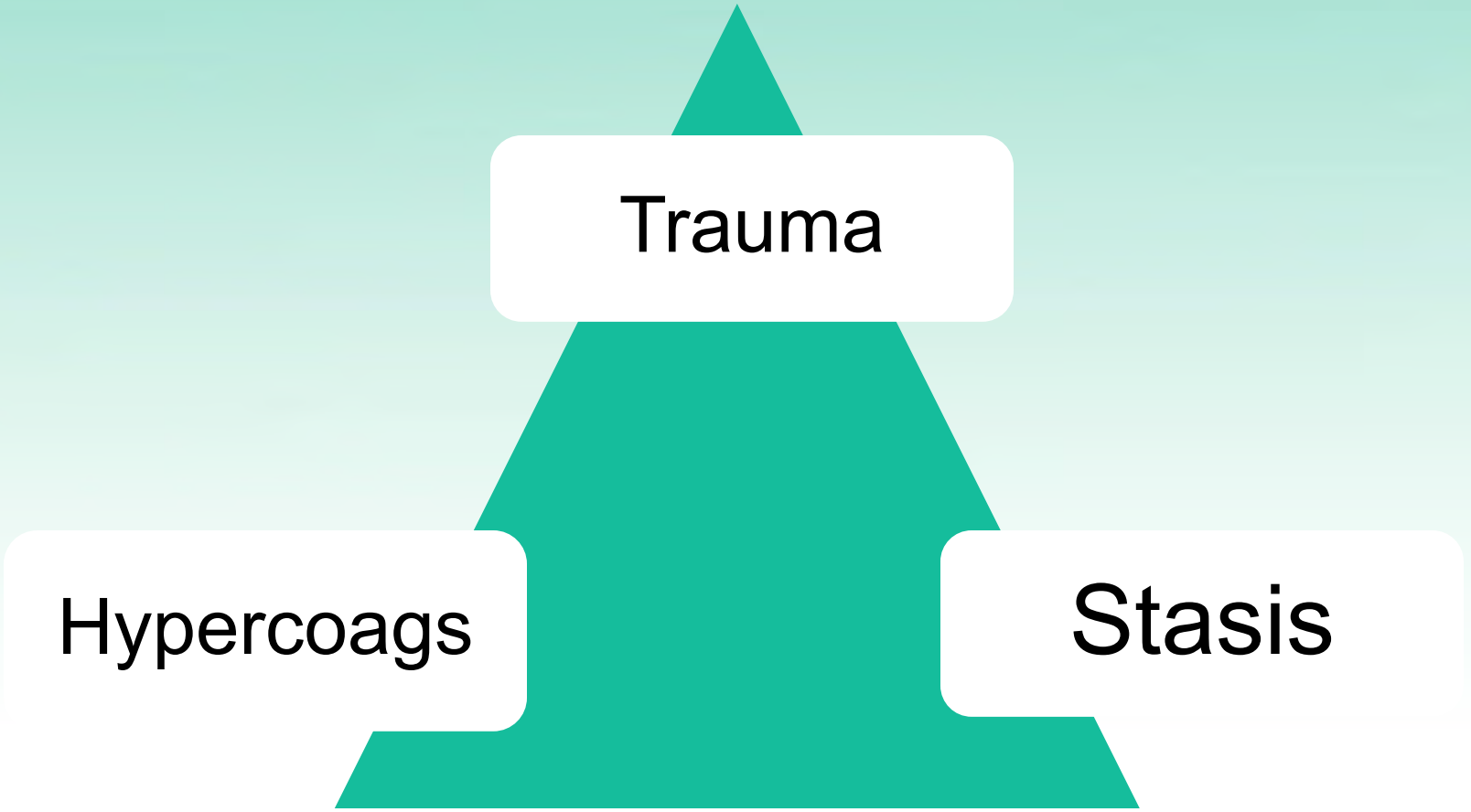
Gastrointestinal Changes in Pregnancy

- Decreased gastric motility
- Relaxed gastric and esophageal sphincters
- Bowel displaced, cephalad and anterior

Urologic Changes in Pregnancy

- Bladder
  - Displaced anterior and superior (> 12 weeks)
  - Risk for injury
- Increased glomerular filtration rate

Virchow's Triad in Pregnancy



Thrombotic Disease in Pregnancy

- Nursing assessment for signs and symptoms of VTE
- Recommended treatment:
  - Sequential compression devices
  - Low molecular weight heparin (instead of unfractionated heparin)
  - Pregnant women with acute VTE should be hospitalized or followed closely as outpatients for the first two weeks after diagnosis.

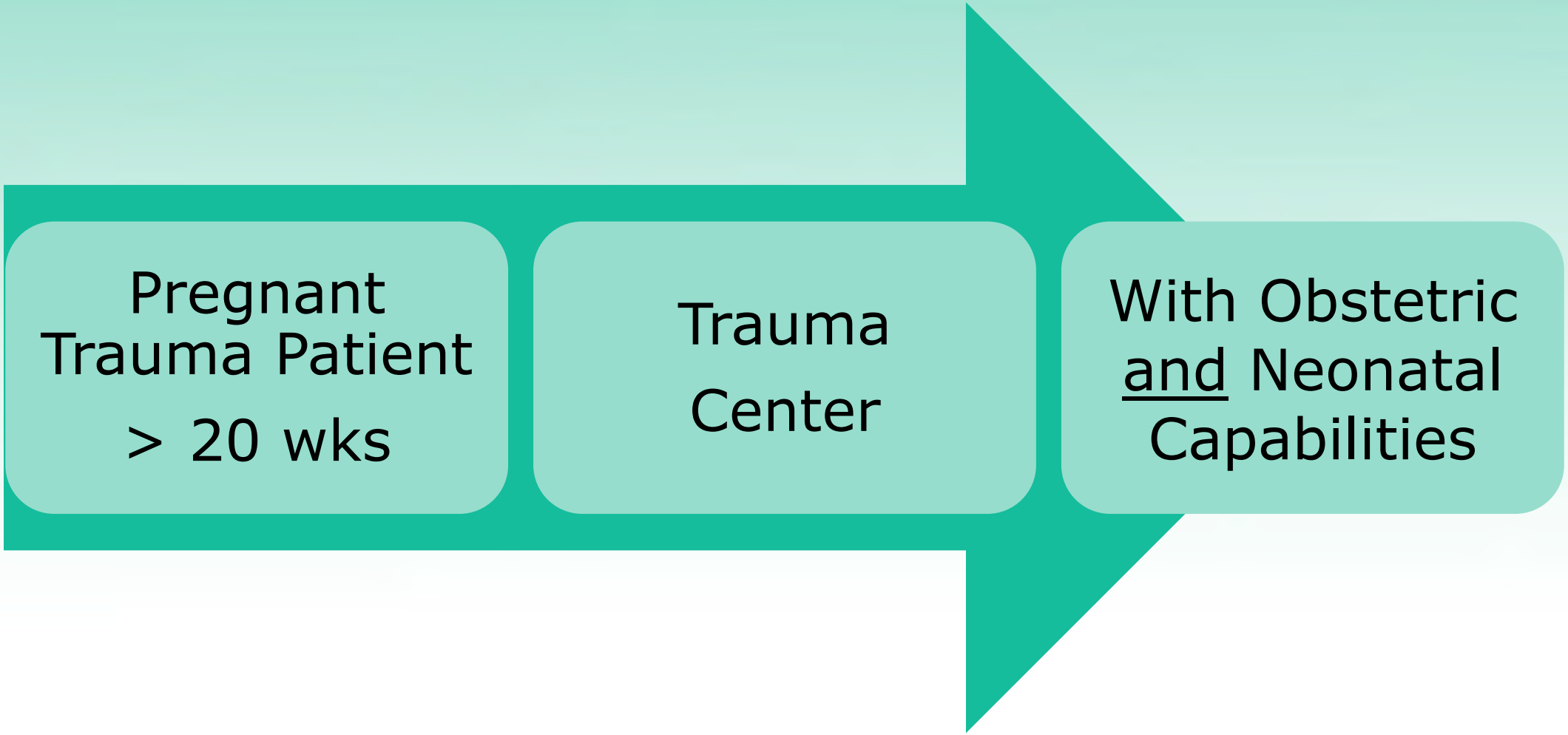
Assessment and Management of the Pregnant Patient with Trauma

Preparation and Team Work

- Trauma Team
- Obstetrician
- L&D Nurse
- Consult radiologist for radiation exposure
- Neonatologist
  - imminent delivery

https://emergencypedia.com/2014/07/24/10-ways-to-impress-in-the-ed

Pre-Hospital Triage



CDC, 2012

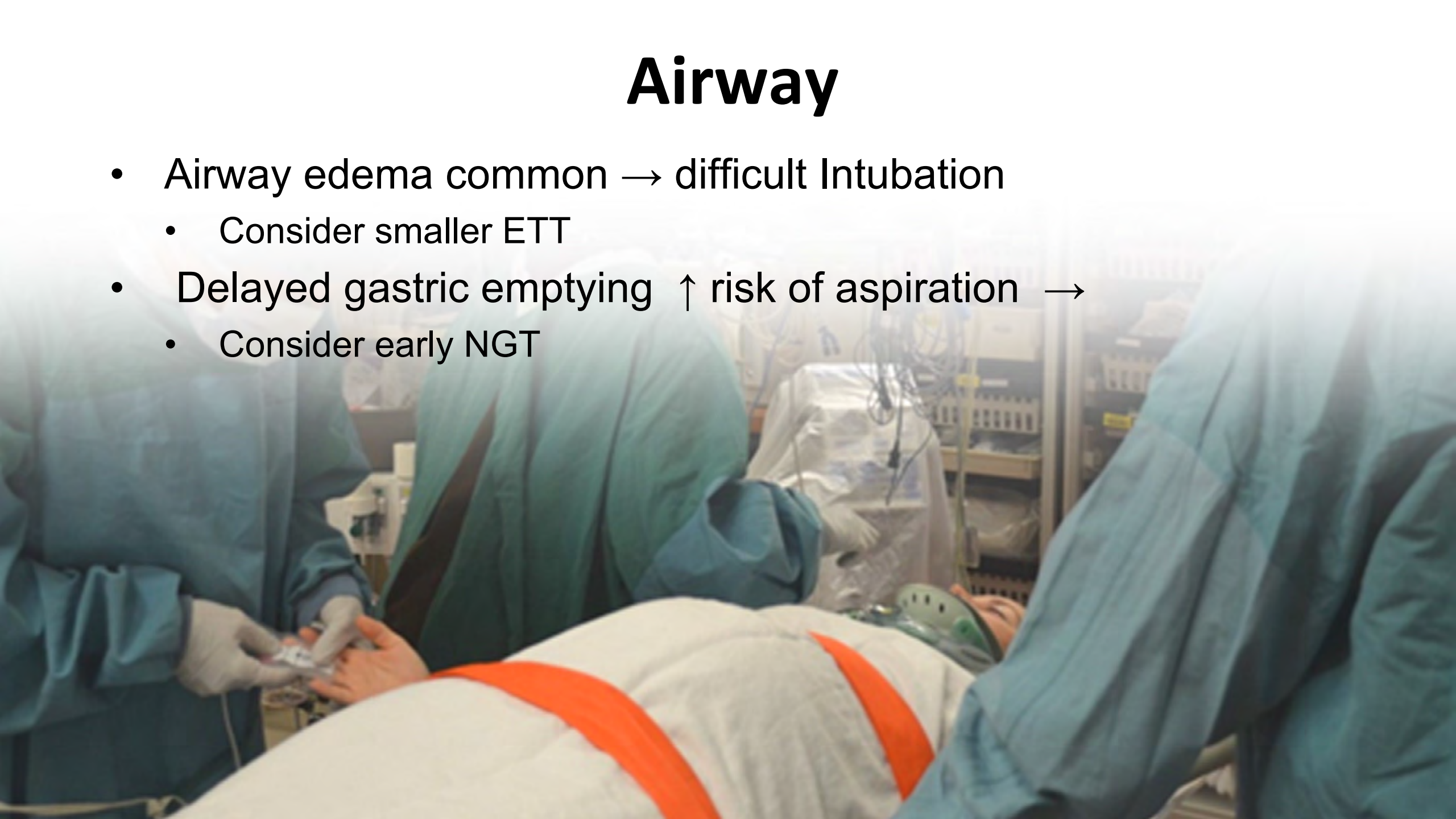
Initial Assessment

ATLS management

- Primary Assessment: Assess and stabilize mother FIRST
- Identify pregnancy/ gestational age
- Assess fetus after *primary* maternal assessment

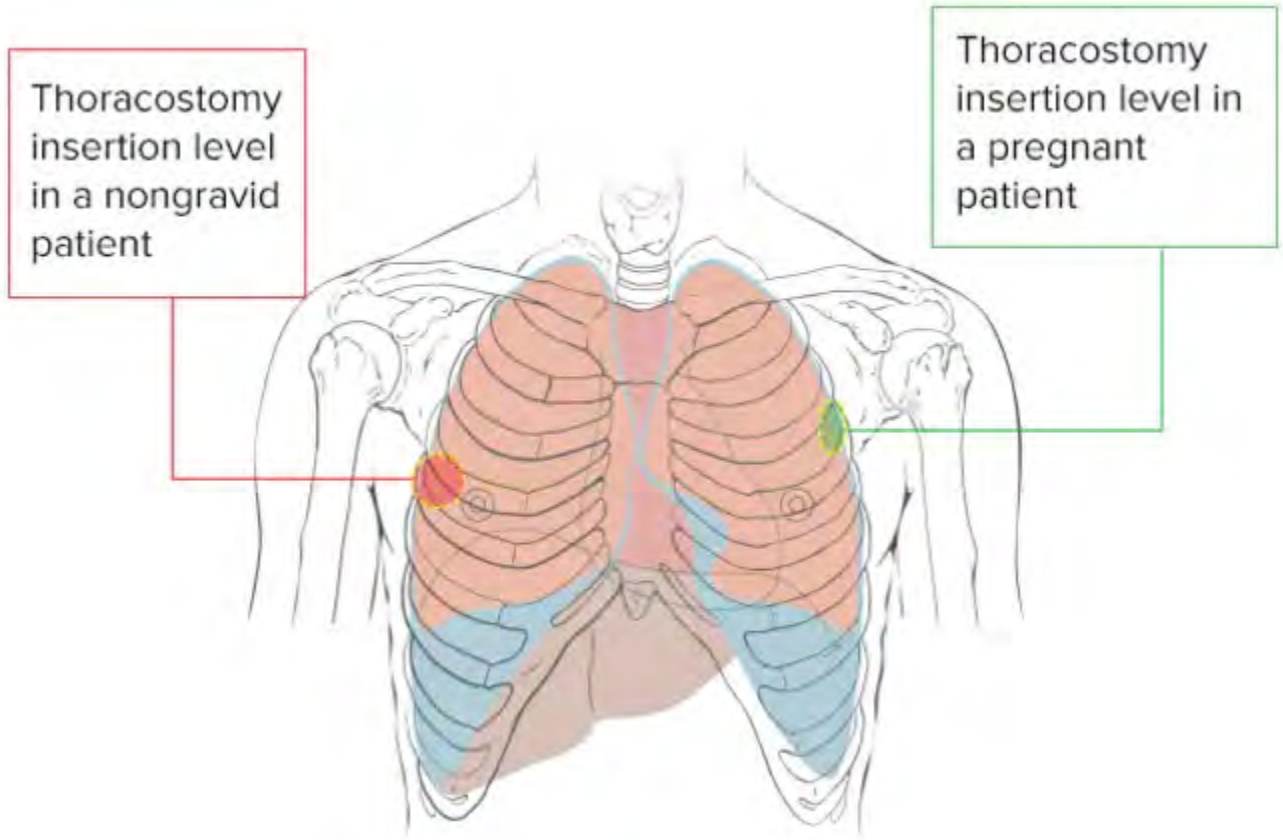
Airway

- Airway edema common → difficult Intubation
  - Consider smaller ETT
- Delayed gastric emptying ↑ risk of aspiration →
  - Consider early NGT



Breathing

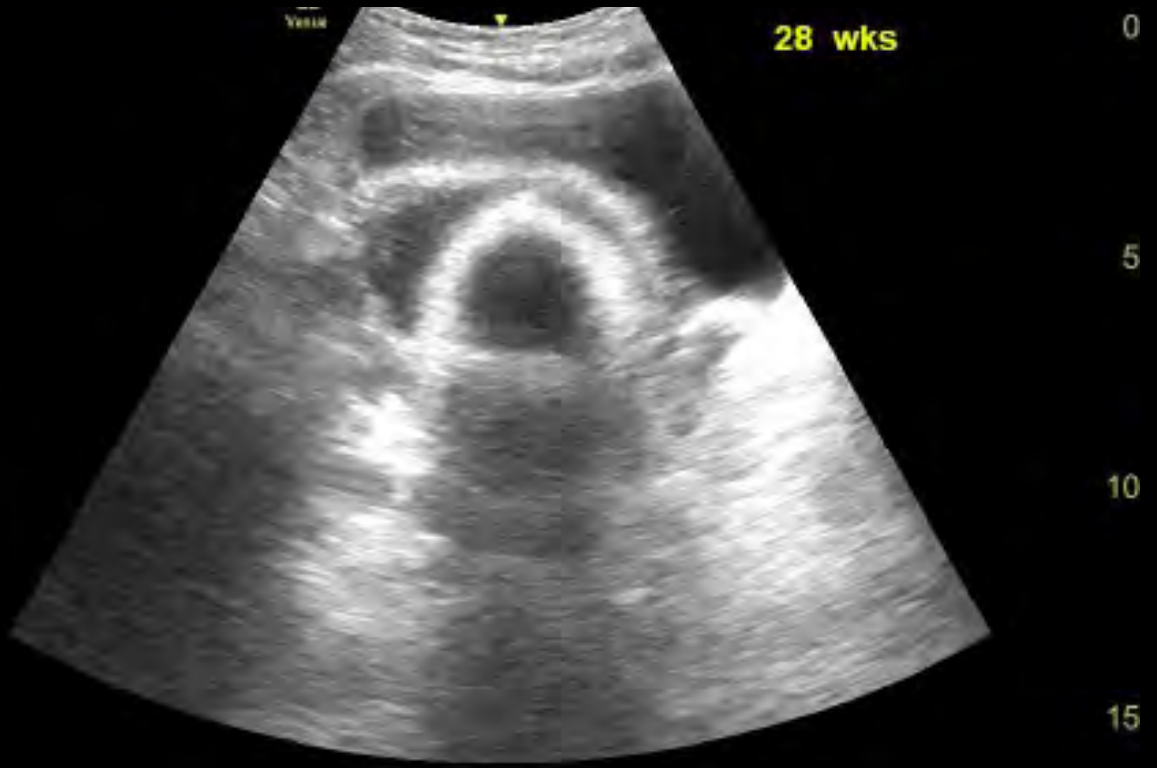
- Oxygen consumption is increased by mother
- Fetus is dependent on mother for oxygen delivery
- **Provide supplemental oxygen!**
- Elevated diaphragm
- Consider higher chest tube placement



Adapted image from Wikimedia Commons/Patrick J Lynch

Circulation

- Fetal heart rate
- FAST

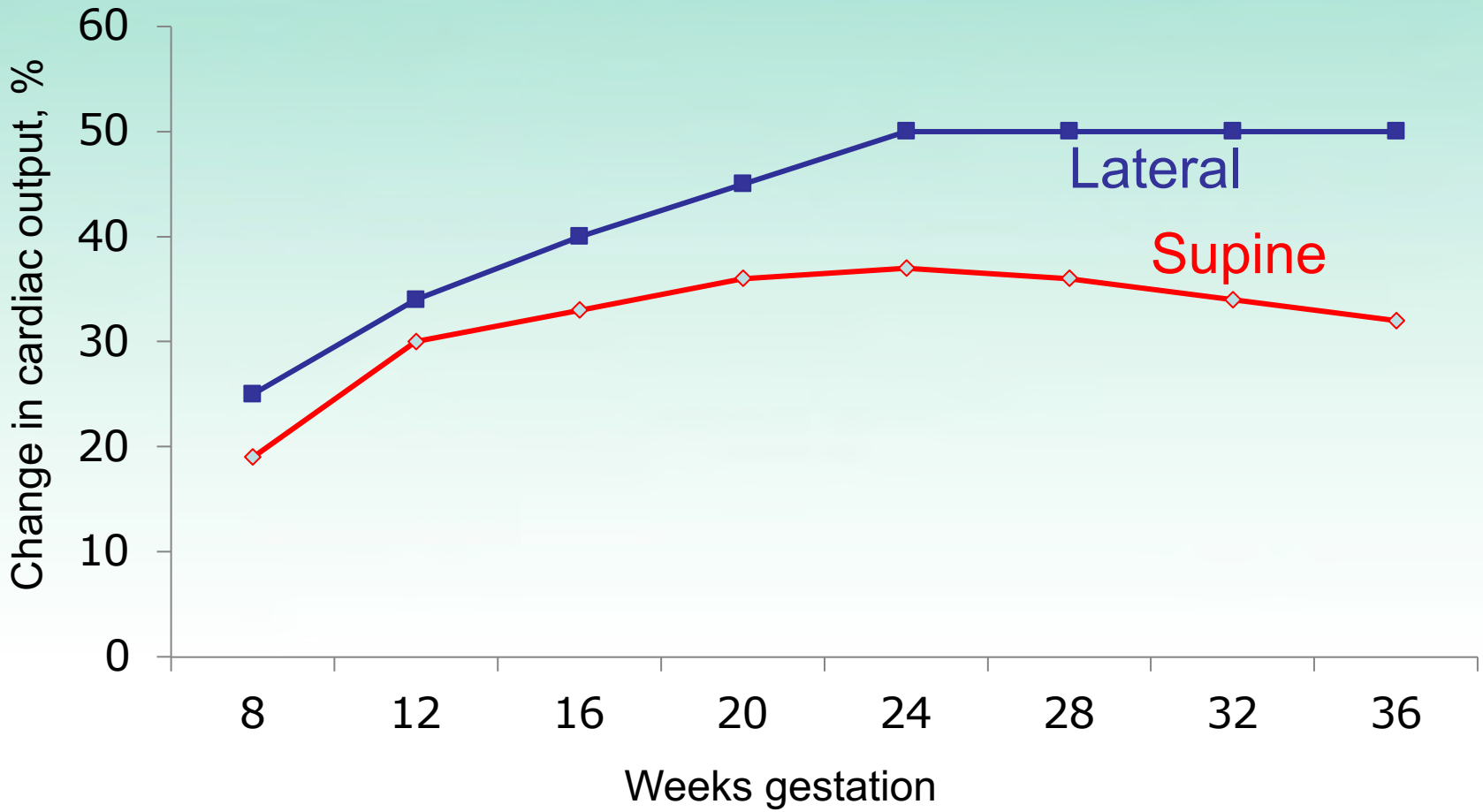


Wilson & Dixon, 2020

Circulation

- Optimize cardiac output while maintaining c-spine control.
- Prevent compression to the inferior vena cava by log rolling the patient with a 15-30 degree tilt, displacing the uterus to the left.
- Or manually displacing the uterus

Cardiac Output in Pregnancy and Effect of Left Lateral Position



Maternal Shock

Adaptations to blood loss

Mild 1200-1500ml

HR 95-105, cold pale extremities, MAP 70-75mm Hg

Moderate 1500-2000ml

HR 105-120, restlessness, tissue hypoxia, MAP 50-60mm Hg, oliguria

Severe >2000ml

HR >120 hemorrhagic shock, tissue hypoxia, MAP <50mm Hg, altered LOC, anuria, DIC

Schwaitzberg, 2021

Taking care of the pregnant patient will take care of the fetus.

The best early treatment of the fetus is the optimal resuscitation of the mother.

Circulation Interventions

- Packed red blood cells
  - Preferred over crystalloid for resuscitation
  - O negative transfusion until type specific available
- Massive Transfusion
- Avoid vasopressors
  - Decrease blood flow to uterus and placenta
  - Use with caution

Primary Survey Adjuncts

- All female trauma patients of ***childbearing age*** should be considered pregnant unless proven otherwise.
- Serum HCG
  - Human chorionic gonadotropin (β-HCG)
- Beneficial with decreased use of indwelling catheters
- Quick turnaround
- Higher sensitivity vs. urine
- May aid in determining gestational age

Labs Specific to Pregnancy

Blood & Antibody Status

- Mother Rh neg:
  give Rh immunoglobulin therapy
- Rhogam

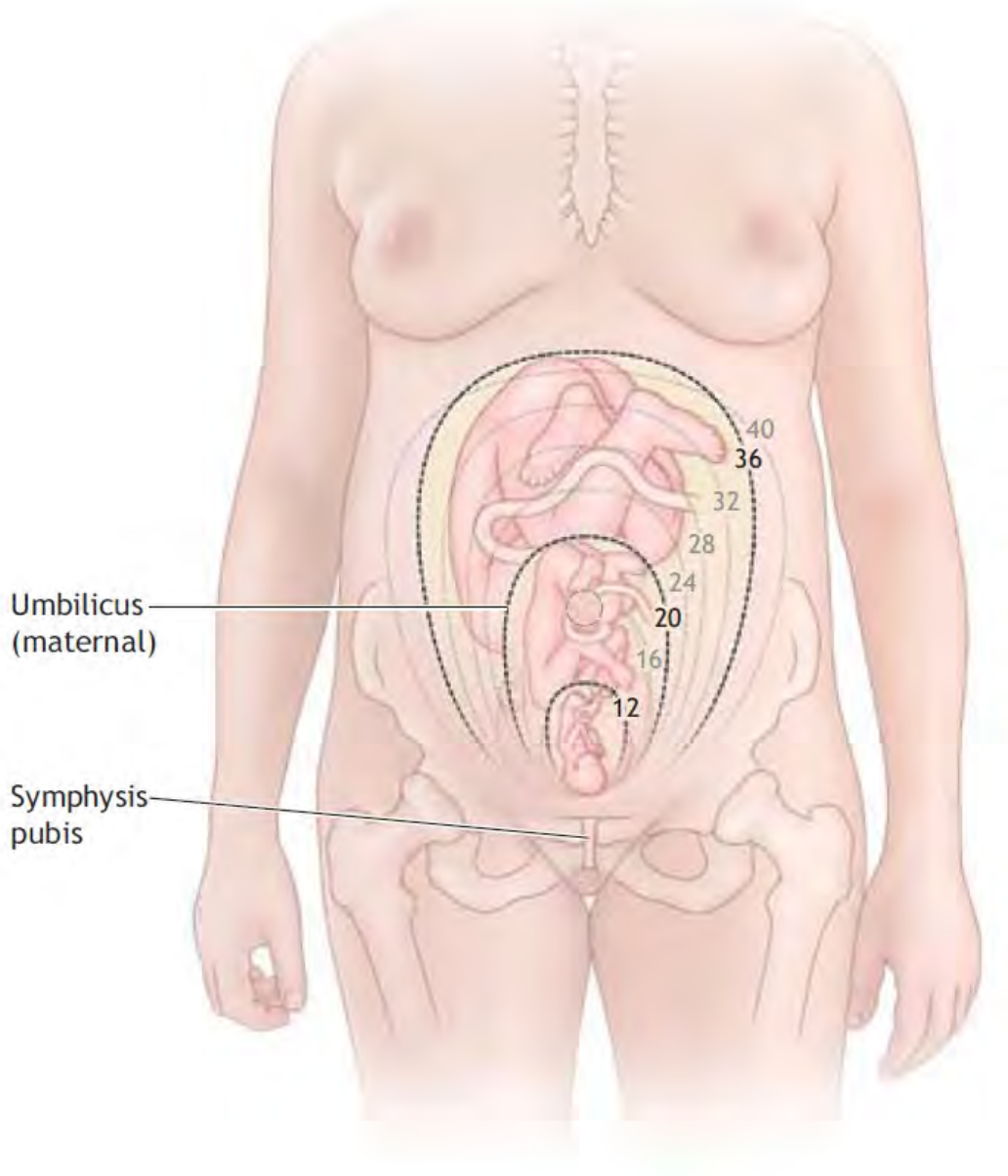
Kleihauer-Betke (KB) Test

- Detects feto-maternal hemorrhage
- Draw in all pregnant trauma patients
  > 12 weeks gestation
- Guides Rhogam *dosage* Rh- mothers
- No correlation between KB test and fetal outcomes

Abdominal Exam

Abdomen

- Skin
- Size
- Tenderness
- Rigidity
- Contractions

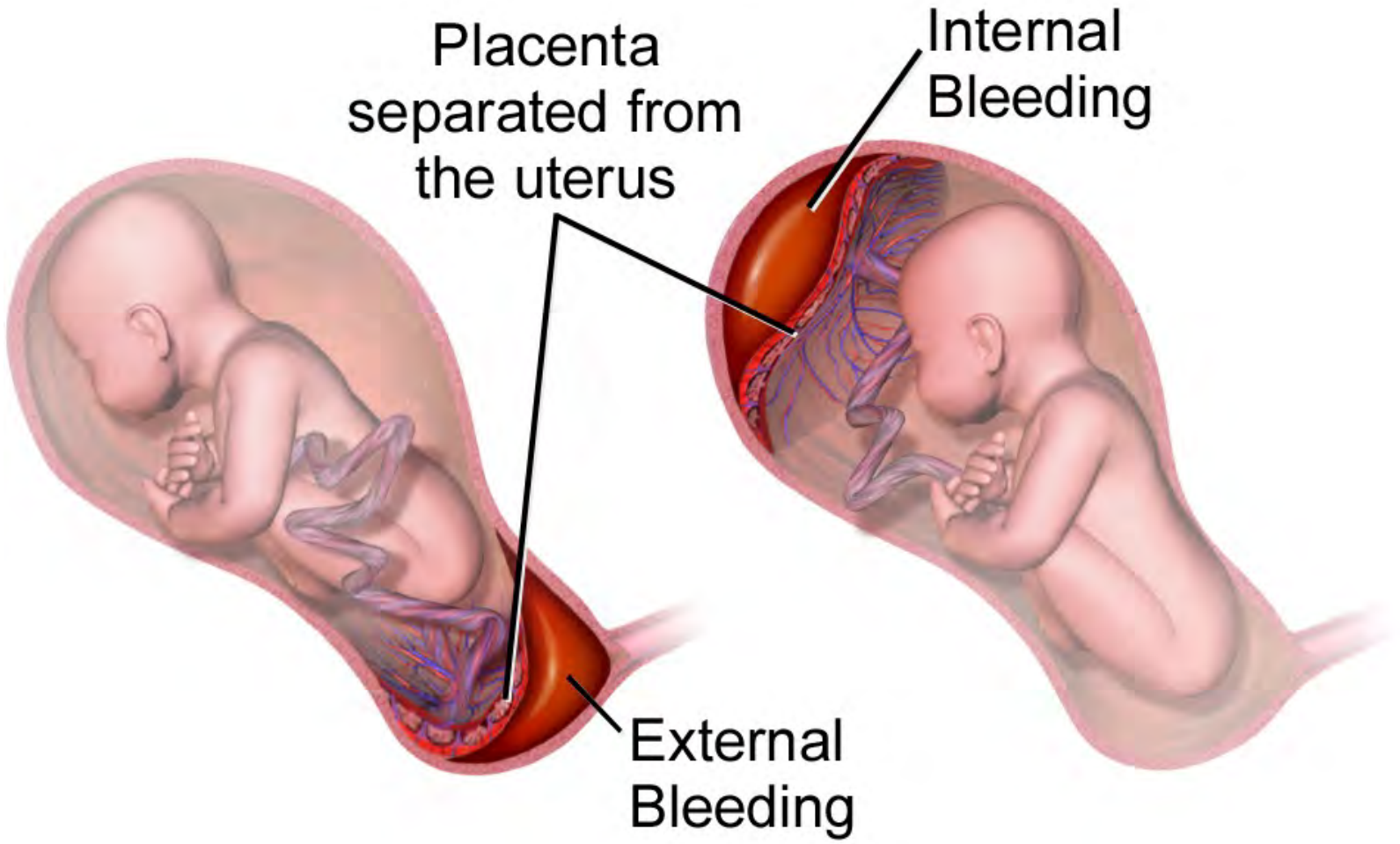


Used with permission American College of Surgeons Committee on Trauma, 2012

Vaginal Exam

Vagina

- Blood
- Amniotic Fluid
- Labor

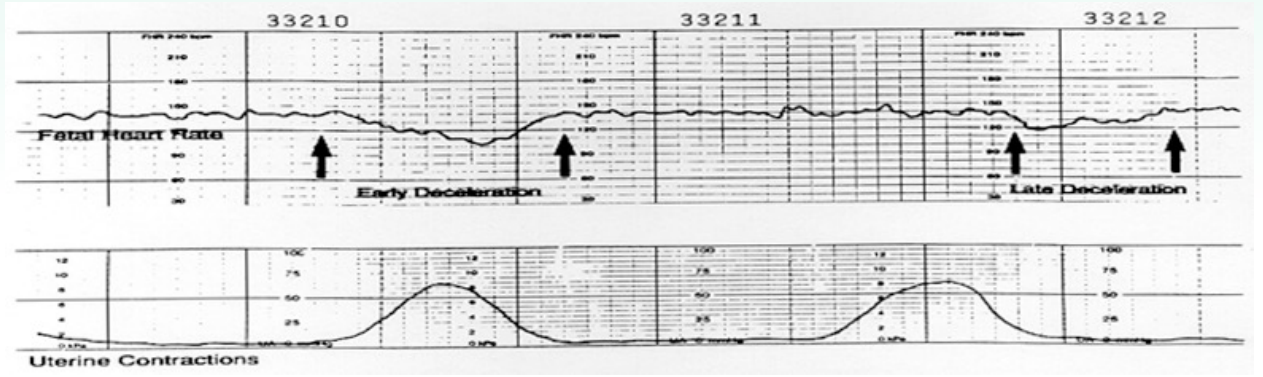


Fetal Assessment

Fetal heart tones	• 120-160 • Continuous >20wks gestation
Abdominal exam	• Gestational age • Contractions • Fetal movement
Vaginal exam	• Bleeding • Ruptured membranes

Fetal Monitoring

- All pregnant trauma > 20 weeks' gestation
- Minimum of **6 hours** continuous fetal monitoring
- Further continuous monitoring and evaluation if any of the below is present:
  - uterine contractions
  - non-reassuring fetal heart rate pattern
  - vaginal bleeding
  - significant uterine tenderness or irritability
  - serious maternal injury
  - rupture of the amniotic membranes



Barraco et al, 2010

Fetal Instability

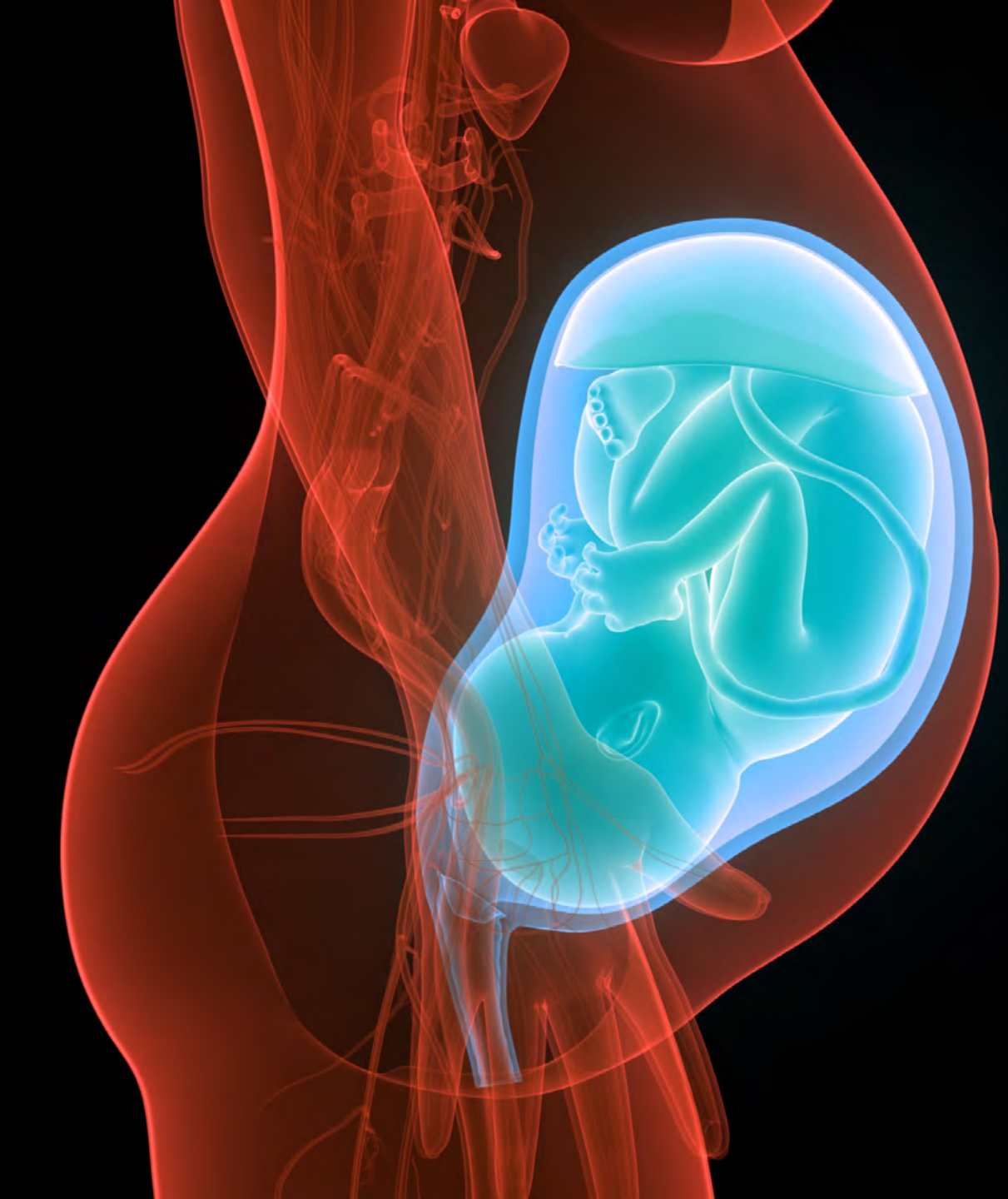
- Signs Include:
  - Bradycardia
  - Tachycardia
  - Loss of beat-to-beat variability
  - Decelerations
- Indication that the mother may be shunting blood away from the placenta to supply her vital organs
- May be the **first sign of impending maternal hemodynamic instability**

Initial Assessment

Fetal distress=Mother in distress!

https://www.emra.org/emresident/article/pregnant-trauma-patient/

- **A**irway: smaller ETT, chest tube higher
- **B**reathing: supplemental Oxygen
- **C**irculation: tilt, IV Fluids, O- blood
- **D**isability: eclampsia can mimic TBI
- **E**xposure
- **F**etal evaluation



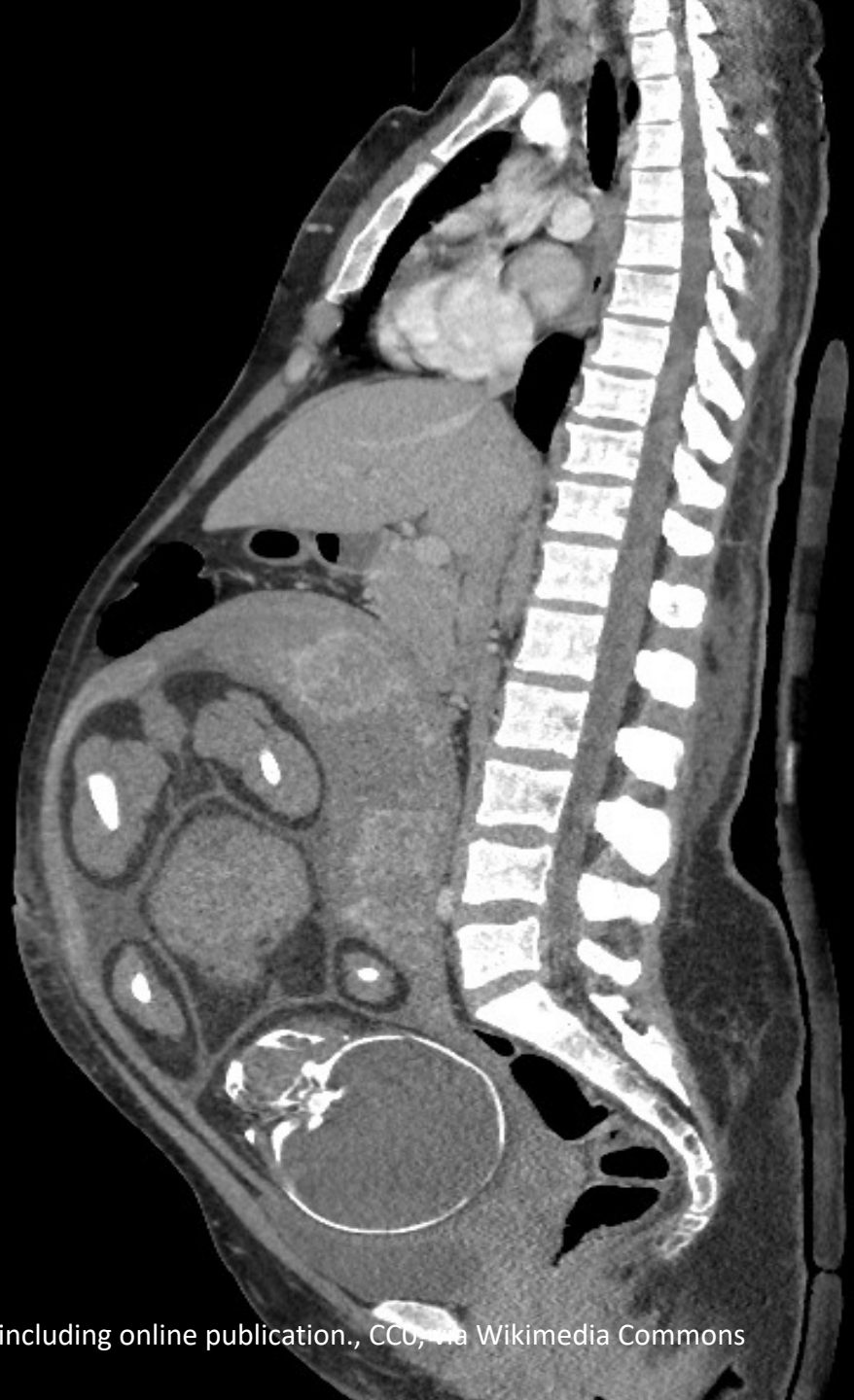
History

Obtain obstetrical history:

- Last menstrual period (LMP)
- Due date
- Number of fetuses
- Pregnancy acquired issues
- Previous pregnancies
- Delivery history

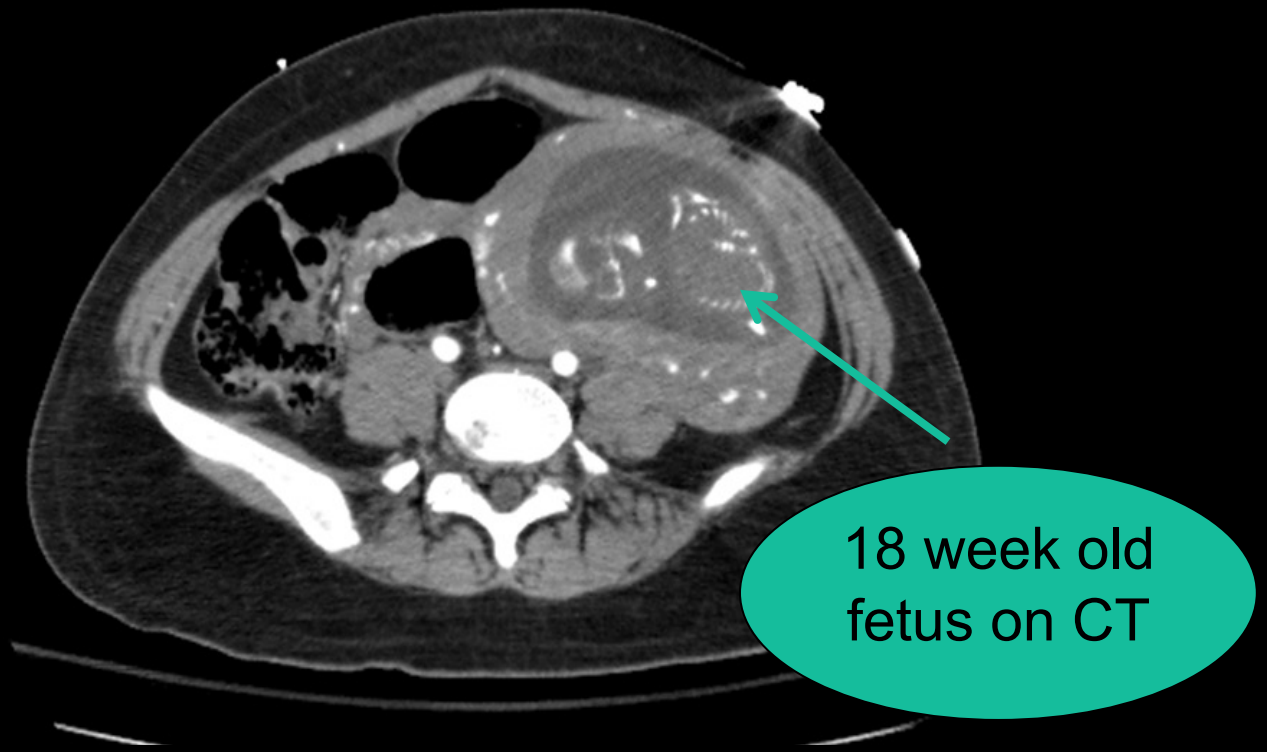
Radiology in Trauma and Pregnancy

Benefits to the mother outweigh small risks to the fetus!



Mikael Häggström, M.D. Consent note: Written informed consent was obtained from the individual, including online publication., CC0, via Wikimedia Commons

Radiologic Studies



No needed study should be deferred if the mother's life is at risk.

- Ultrasound
  - Preferred test for mom & fetus
  - Not conclusive
- Plain films
  - useful
  - exposure low
- CT
  - ↑ radiation dose

Radiologic Studies

- MRI
  - Not associated with adverse fetal effects
  - Along with ultrasounds, technique of choice for the pregnant patient
  - Only use:
    - Expected to answer relevant clinical question
    - Provides medical benefit to patient
- Nuclear medicine
  - If techniques are necessary, they should not be withheld from a pregnant patient.

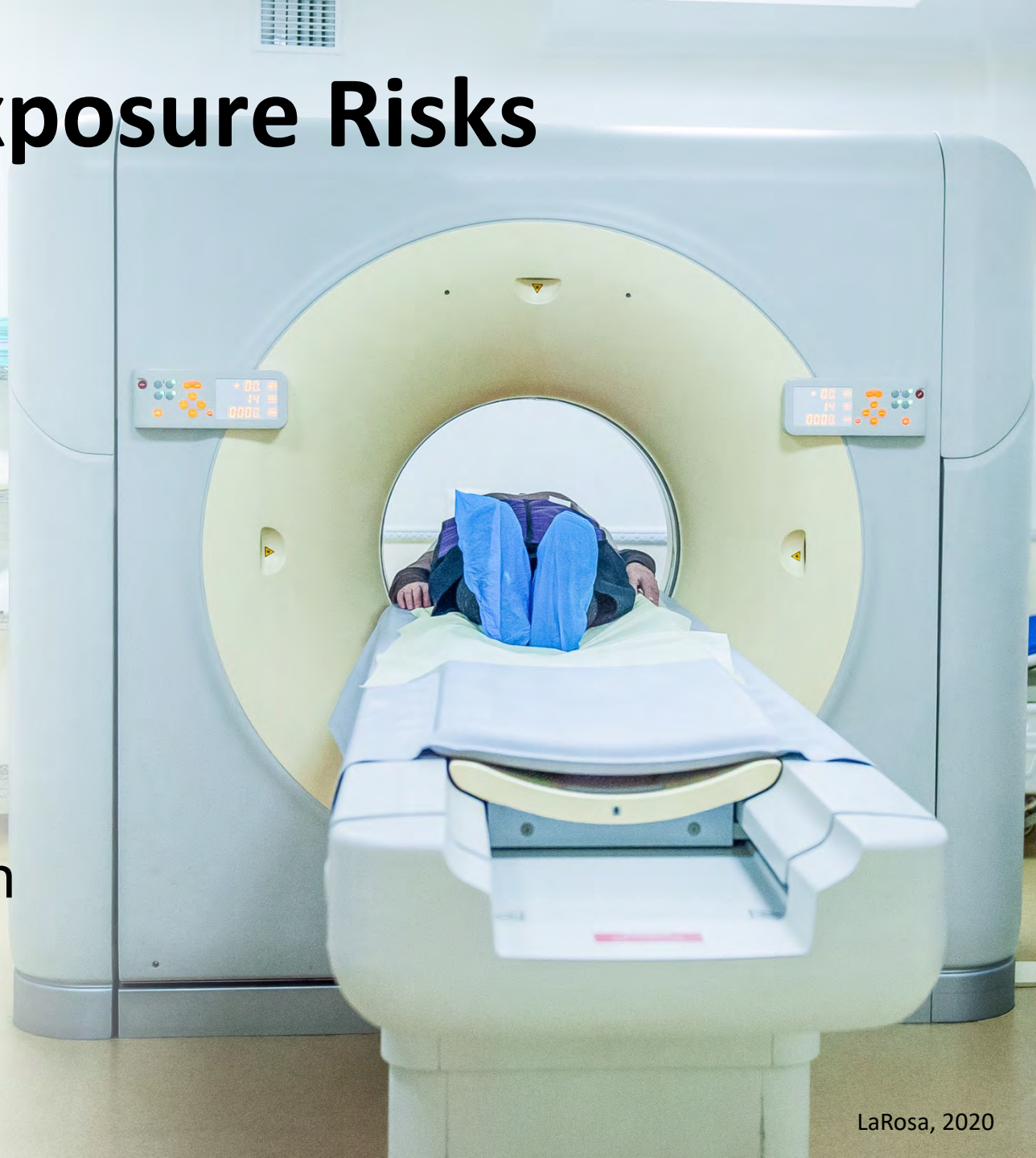
American College of Obstetricians and Gynecologists, 2017

Radiation Exposure Risks

Potential Effects on the Fetus

- Intrauterine growth retardation
- Microcephaly
- Mental retardation
- Cancer

- Most vulnerable
  - 2 and 15 weeks gestation
- Cumulative exposure of less than 5 rads has not been shown to affect the fetus
  - CT scan abd 2.6 rad (0.026 Gy)



LaRosa, 2020

Radiologic Studies

- Provide shielding when possible to the fetus.
- Try to consolidate scans.
- Consider other diagnostic techniques for follow-up imaging.
- A missed injury could be detrimental to both the mother and fetus.

Medications
Pregnancy and Lactation Labeling Rule

- Became effective June 2015
- FDA revises PLLR draft guidance July 2020
- PLLR provides a narrative risk summary during:
  - Pregnancy
  - Lactation
  - Females and males of reproductive potential

FDA 2020

Previous Medications
FDA Pregnancy Categories

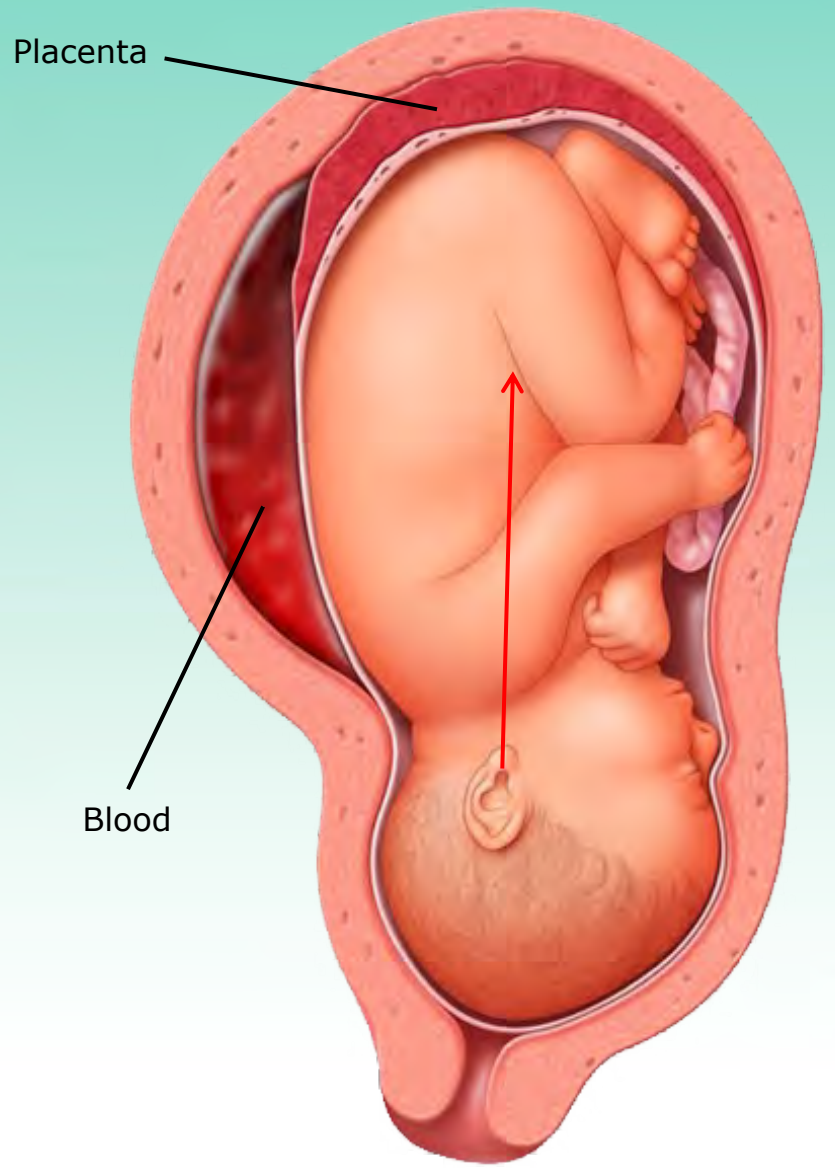
Category	Risk
A	Safety established by human studies
B	Presumed safe established by animal studies
C	Uncertain safety: animal studies show risk, weigh benefits of use
D	Unsafe: human studies show risk, weigh benefits of use
X	Highly unsafe: positive evidence of harm

Drug	Information
Etomidate	Category C-Drug does cross the placenta at term
Midazolam	Category D-Unsafe: human studies show risk, weigh benefits of use
Ketamine	Category B-Generally safe, but may cause dose-dependent increases in maternal contractions
Rocuronium/ Vecuronium	Category C-Generally safe, dose cross the placenta
Succinylcholine	Category C-Generally safe, dose NOT cross the placenta
Fentanyl/ Morphine	Category C-Drug does cross the placenta
Propofol	Category B-Drug does cross the placenta
Tranexamic Acid (TXA)	Category B-No adverse effects have been found

Injuries Specific to Pregnancy

Placental Abruption

- Placental uterine separation
- Blood Loss:
  - External: vaginal bleeding
  - Occult: accumulates behind placenta



Placental Abruption

- 3% of minor trauma
- 40% of severe trauma
- Cannot predict based on ISS
- Signs and Symptoms: rigid abdomen, abdominal tenderness, uterine contractions, fetal distress, spontaneous rupture of membranes
- ***May or may not have vaginal bleeding***
- *Fetal monitoring* → *early warning system!*

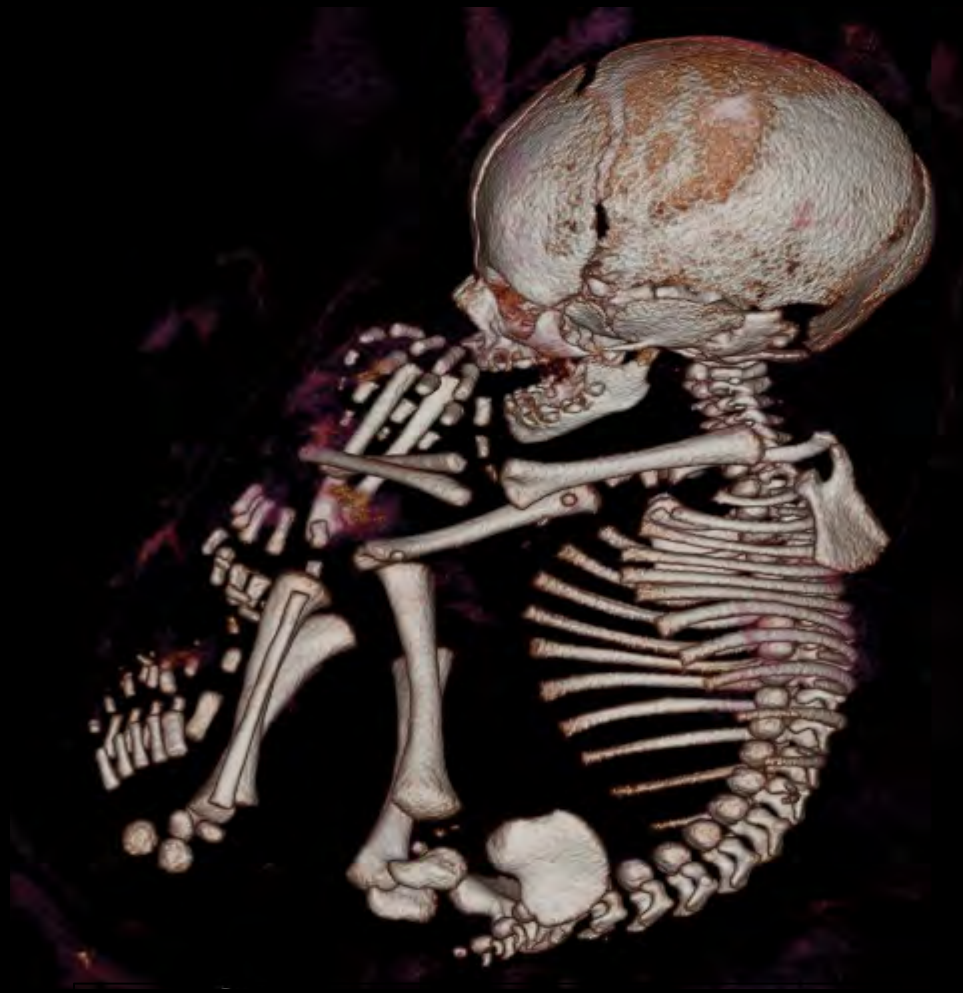
Krywko, 2021

Ruptured Uterus

- Rare but catastrophic
- Signs and symptoms:
  - Abdominal pain/ tenderness
  - Abdominal distention
  - Palpable fetal parts
  - Shock
  - Poor Fetal Heart Tones (FHT)
  - Guarding/Rigidity
- High maternal and fetal death

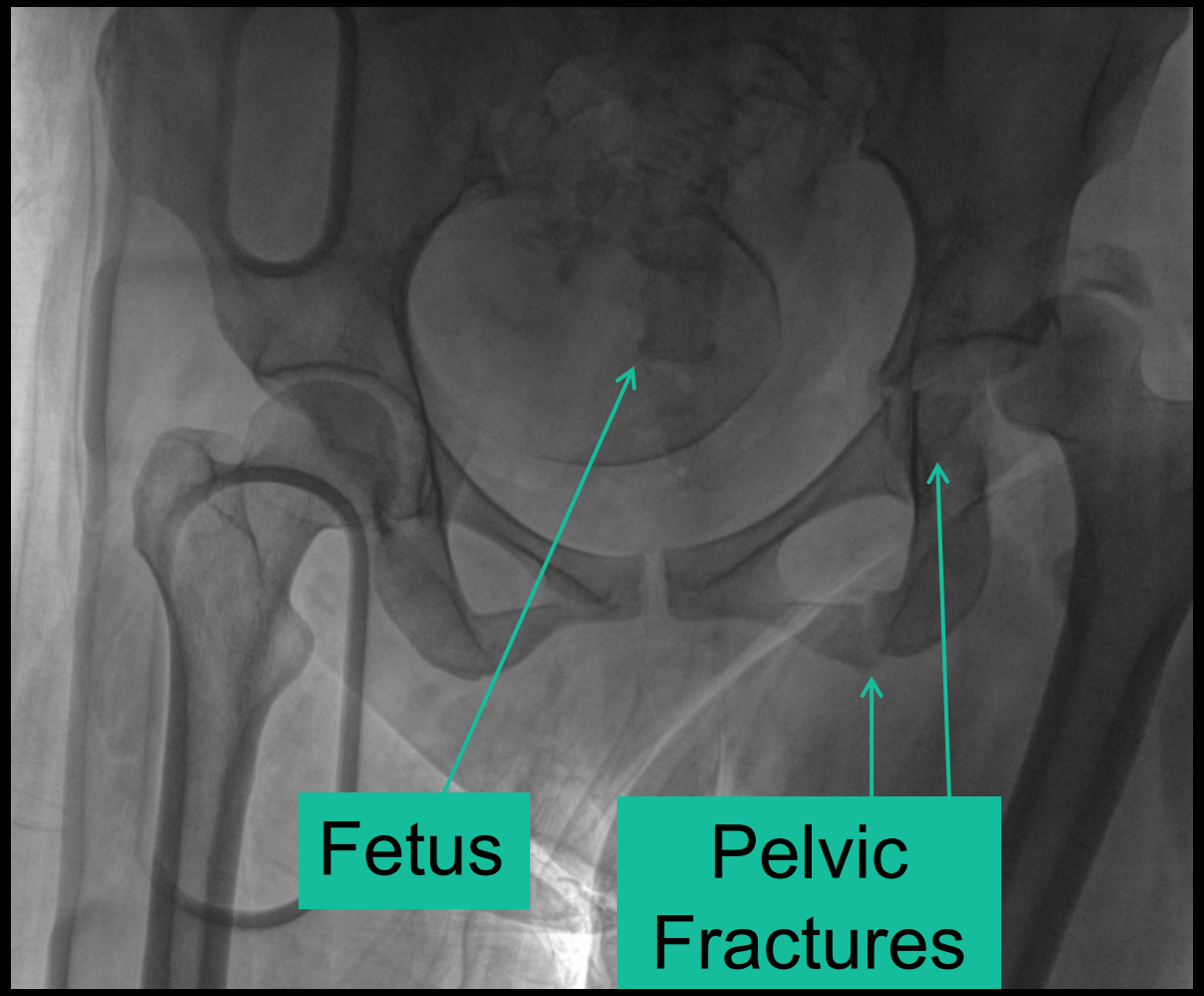
Direct Fetal Injury

- Rare - 1% of blunt trauma
- Maternal tissues protective for the fetus
- Fetal head injury
  - most common
- CT scan to assess fetus
- Prepare for cesarean section if indicated



3D reconstruction of 37 week fetus after MVC

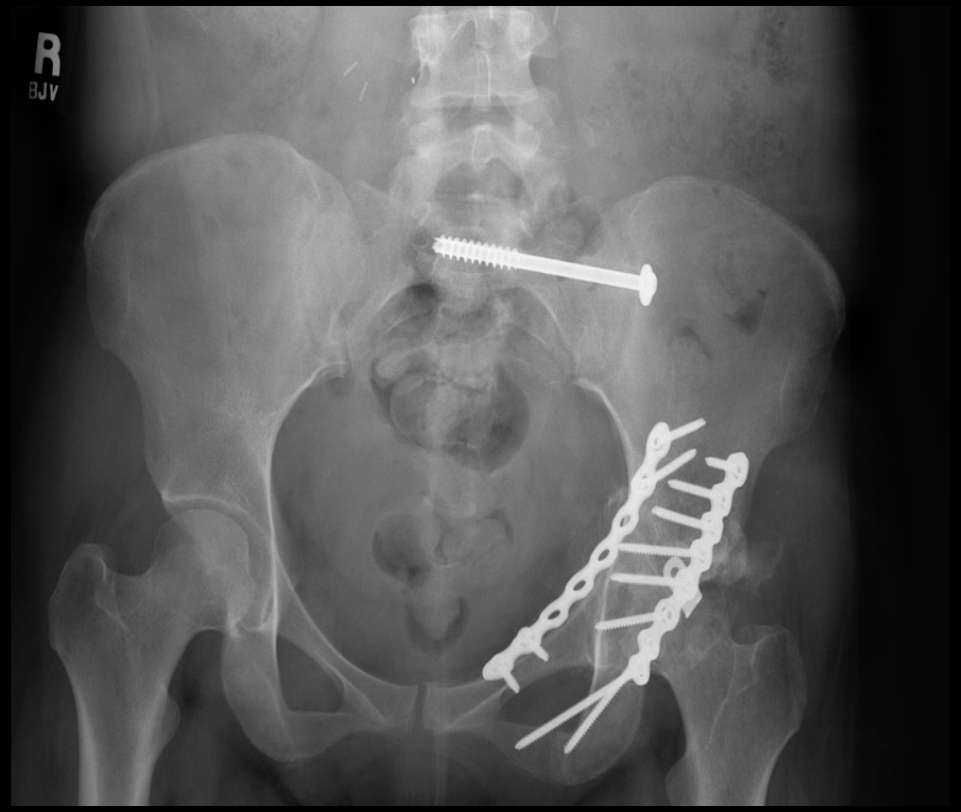
Pelvic Fractures



- Most common in MVC and falls
- Anticipate hemorrhage from engorged pelvic vessels
- Fetal mortality 35%
  Maternal mortality 9%
- Associated bladder or urethral trauma

Pelvic Fractures

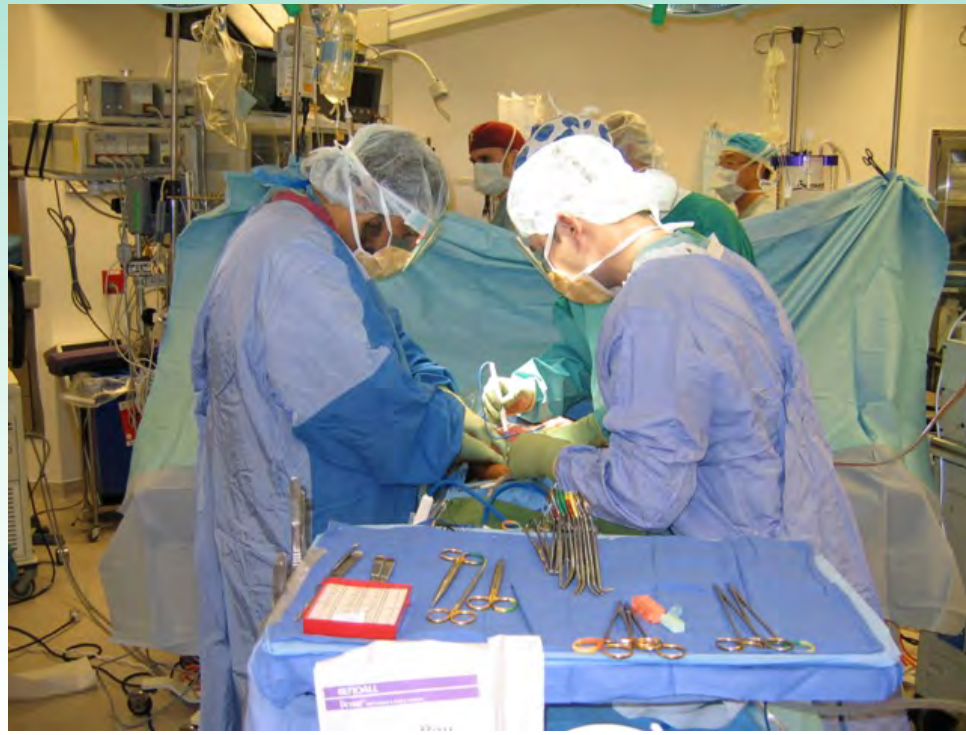
- Management:
  - internal fixation
  - non-operative approach
  - pelvic binders
- Angiography & Embolization:
  - may be used with caution
- Vaginal delivery:
  - not completely contraindicated



Repair after birth by cesarean section

Penetrating Abdominal Trauma

- Uterus is the dominant organ and likely target
- Fetal demise 40-70% due to direct fetal injury and early birth
- Risk for massive hemorrhage from uterine injury



Perimortem Cesarean Section

Cardiac arrest:

- ACLS principles should remain the same
- Defibrillation has little effect on fetus from electrical flow
- Perimortem cesarean section should be considered

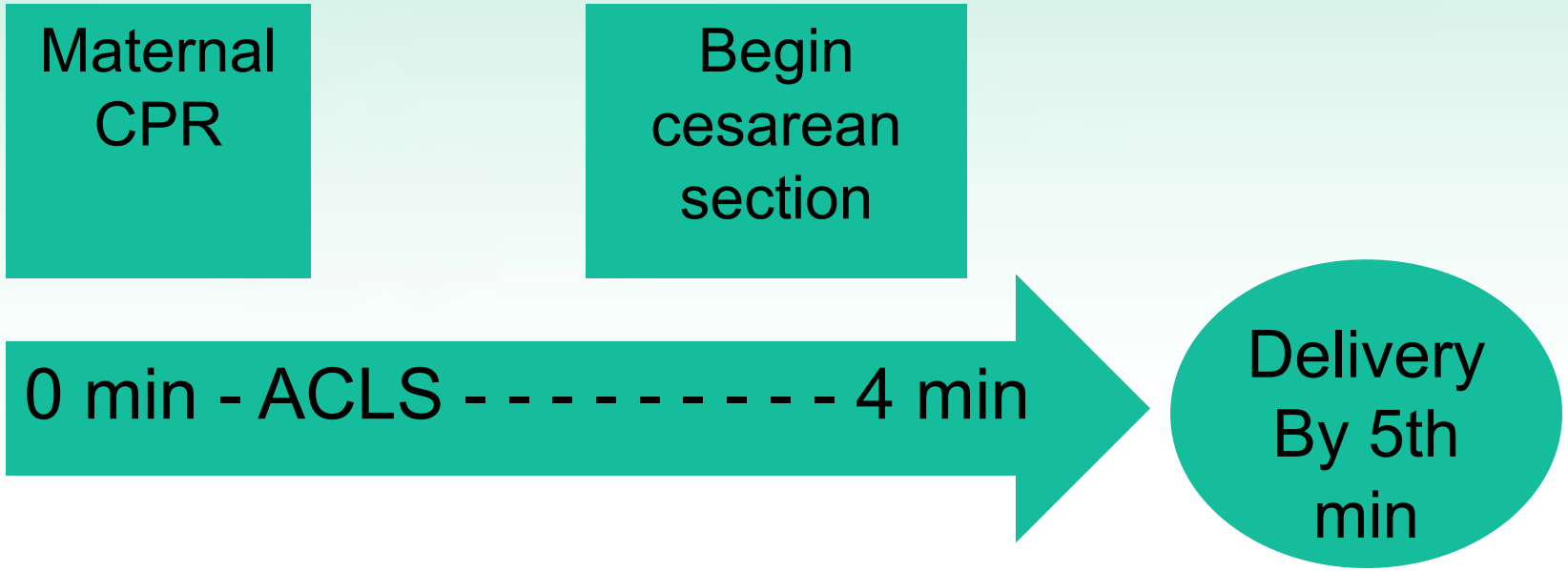
Indications:

- Fetus > 23 weeks gestation (age of viability)
- Reasonable certainty of maternal demise
- Knowledge of operative technique
- Available resources to resuscitate neonate
- Presence of fetal heart activity

Perimortem Cesarean Section

EAST 2010 Guideline

Delivery should be carried out within 4 minutes of unsuccessful maternal arrest



Patient and Family Support

This event is a stressful time for both the patient and patient's family and support system.

- Listen and honor patient and family perspectives and choices.
- Share information on findings and treatment as soon as possible.
- Allow patient and caregivers to be involved in the decision-making process.

Family Support

- Allow visitation of support system as soon as possible
- Control pain
- Support services early (social work, chaplain)

Definitive Care
Transfer to Another Facility

- Indicated if the need of the patient exceeds the resources of the current facility
- Ensure primary survey is complete and stabilized to the best of the facilities ability prior to transfer
- Transfer should be timely
- Inform patient and caregivers of need for transfer

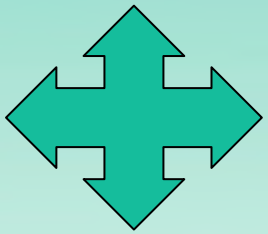
Definitive Care
Admission: Unit Placement

- Admit to the most appropriate unit
- Matched to patients' needs
- Standard of care must be maintained regardless of unit selected

Who Admits & Where?

To Trauma ICU

- Mother severely injured & viable fetus
- Admit to trauma
- Double teamed:
  - Trauma nurse
  - L & D nurse
  - At minimum remote continuous fetal monitoring



To Obstetric Unit

- Mother less injured, stable & viable fetus
- Initially admitted to trauma surgeon with OB on consult
- Care may be transferred to OB after 24-48 hrs

Definitive Care
Discharge Home

- Ensure patient has appropriate follow up and prenatal care
- Complications related to trauma in pregnancy may not manifest immediately
- Pregnant patients discharged directly from the ED after minor trauma
  - Increased risk for:
    - Fetal demise
    - Low birth weight
    - Prematurity
    - Preterm Labor
    - Placental Abruption
    - Uterine Rupture

Future Considerations

- Duration of fetal monitoring
- Domestic violence screening
- Airbag safety

Summary

- A&P changes greatly impact assessment and management of the pregnant trauma patient.
- Initial evaluation and treatment should focus on the mother's hemodynamic stability.
- If the fetus is showing signs of distress, the mother is in distress as well.
- Most common cause of fetal demise is maternal demise.
- Education regarding substance abuse, restraints, distracted driving, and domestic violence screening can save lives.

Pregnancy in Trauma

1. A 22 year-old female was involved in a motor vehicle crash (MVC). She is pregnant and states the gestational age of the fetus is 32 weeks. Her vital signs are: heart rate 89, blood pressure 127/54, respiratory rate 22, Sp02 is 100% on a non-rebreather at 15 LPM, GCS 15. After the primary assessment is completed (ABCD), the nurse expects to immediately:
    a. Transport the patient to radiology for a CT scan
    b. Place an indwelling urinary catheter
    c. Assist with fetal assessment
    d. Role the patient off the backboard and inspect the posterior surfaces

2. Pregnant women are most at risk for falls:
    a. During the 6th, 7th, and 8th months of pregnancy
    b. During the 9th month of pregnancy
    c. During the 4th and 5th months of pregnancy
    d. The risk is equal throughout pregnancy

3. Which of the following is NOT true about blunt trauma in the pregnant patient?
    a. The placenta is not able to contract and expand with the uterus
    b. The first sign of maternal hemorrhage may be non-reassuring fetal heart tones
    c. Increased vascularity puts the mother at greater risk for hemorrhage
    d. The severity of injuries is a good predictor for placental abruption

4. Hemorrhagic shock in a pregnant trauma patient may lead to:
    a. Placenta previa
    b. Fetal demise
    c. Fetal low birth weight
    d. Abruptio placenta

5. The Kleihauer-Betke test is used to test for:
    a. Fetal maturity
    b. Transplacental hemorrhage
    c. Mothers Rh status (negative or positive)
    d. The presence of disseminated intravascular coagulopathy (DIC)

6. Which woman is more at risk for intimate partner violence, based on current statistics:
    a. African American, 25 year-old woman, bachelor degree, 1st pregnancy, married
    b. 19 year-old Mexican woman, 8th grade education, 2nd pregnancy, unmarried with a live in boyfriend
    c. 17 year-old Caucasian woman, currently in high school, 1st pregnancy, lives at home with her parents
    d. Asian, 43 year-old woman, high school education, 1st pregnancy, unmarried

7. The cardiovascular changes associated with a normal pregnancy are:

a. Increased heart rate, decreased systemic vascular resistance (SVR) and an increase in blood volume
b. Increased blood pressure, decreased hematocrit, and increased heart rate
c. Decrease in cardiac output, decrease in blood pressure and decrease in systemic vascular resistance (SVR)
d. Increase in blood volume, increase in hematocrit and an increase in cardiac output

8. Normal pregnancy has two of the three factors of Virchow's Triad. In the pregnant trauma patient, endovascular trauma comprises the last of the three factors, making the patient at risk for:

a. Low hematocrit
b. Acidosis
c. Alloimmunization
d. Deep vein thrombosis (DVT)

9. When screening for intimate partner violence in the pregnant patient, the best method is:

a. A pen and paper questionnaire
b. Call social worker because they are familiar with this role
c. After asking the partner to step out, ask a single direct question, such as "Within the past year -- or since you have been pregnant -- have you been hit, slapped, kicked or otherwise physically hurt by someone?"
d. Ask the patient if she has something she wants to talk about

10. When resuscitating the pregnant trauma patient, which step should be completed first?

a. Begin infusing normal saline at a wide- open rate
b. While maintaining spinal precautions, place the patient in a left tilt at 15 degrees or 4-6 inches
c. Assess fetal heart tones
d. Place two large bore IV's

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5th Edition

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