Trauma in the Pregnant Female

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FRAGILE
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Introduction

"Save the mother, save the fetus…"

The Scenario

- The situation: It's Friday night, and as the EMS provider on call, you receive a call.
- You go to the scene and find a 25 year old female, restrained passenger in an MVA, with open left tib/fib fracture.
- The victim tells you she is 26 weeks pregnant and asks if the baby is OK.


AMBULANCE

Second Scenario

- Another Friday night call:
- You arrive at a residence to find a 30 year old female complaining of abdominal pain and vaginal bleeding.
- The police suspect her boyfriend physically assaulted her.
- She tells you she is pregnant but does not know how far along she is.

Incidence

- These two hypothetical cases are actually very common.
- Trauma is the leading cause of death in pregnancy
- Occurs in 8-10% of all pregnancies
- Frequent cause of injury in pregnancy
- Accounts for 20% of maternal mortality

Incidence

- Increases as pregnancy increases
- 8% first trimester
- 40% in second trimester
- 52% in third trimester

Types of Trauma

- MVA >50%
- Falls
- Blunt Head Injury
- Gunshot Wounds
- Stab Wounds
- Burns
- Drowning

Motor Vehicle Accidents

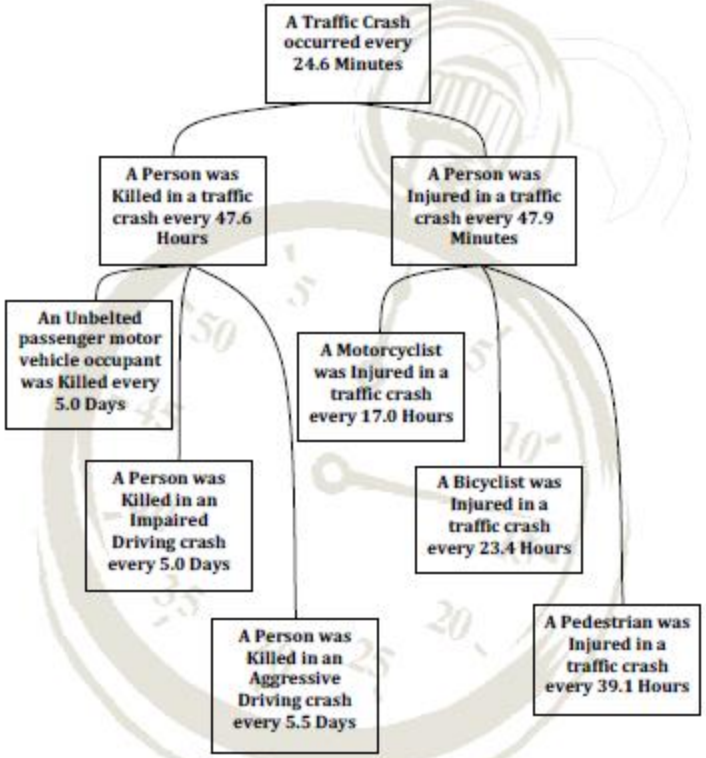
- Most common cause of major trauma in pregnancy

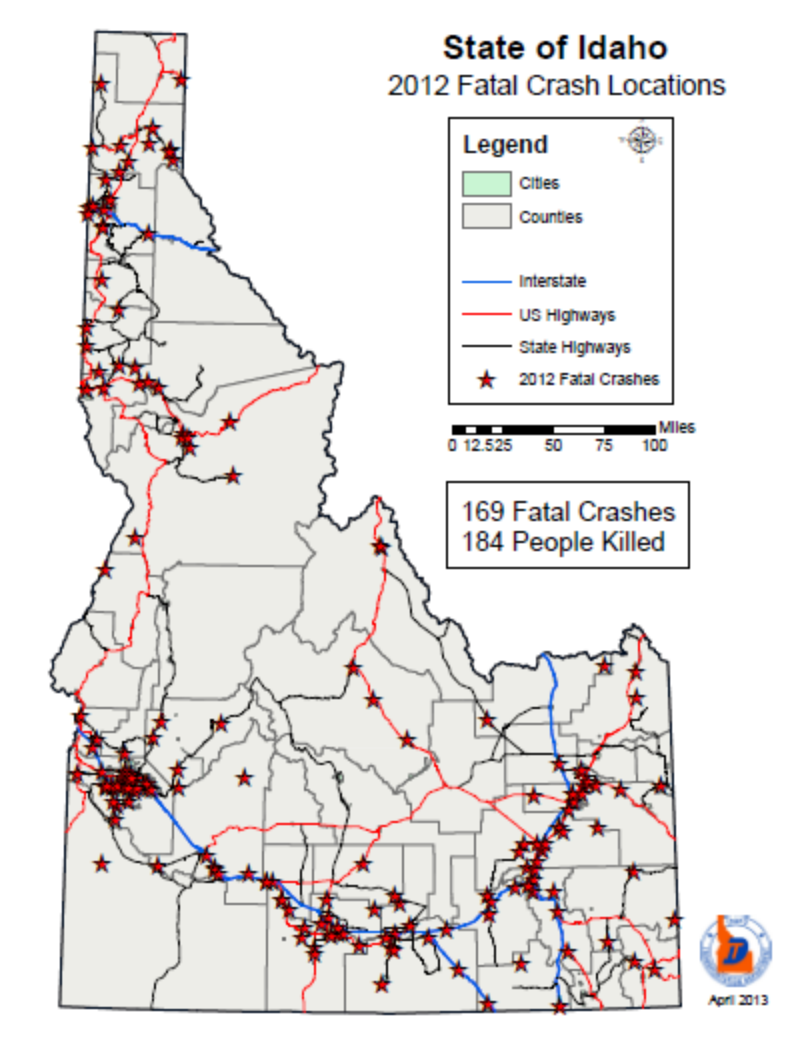
Idaho Traffic Crashes

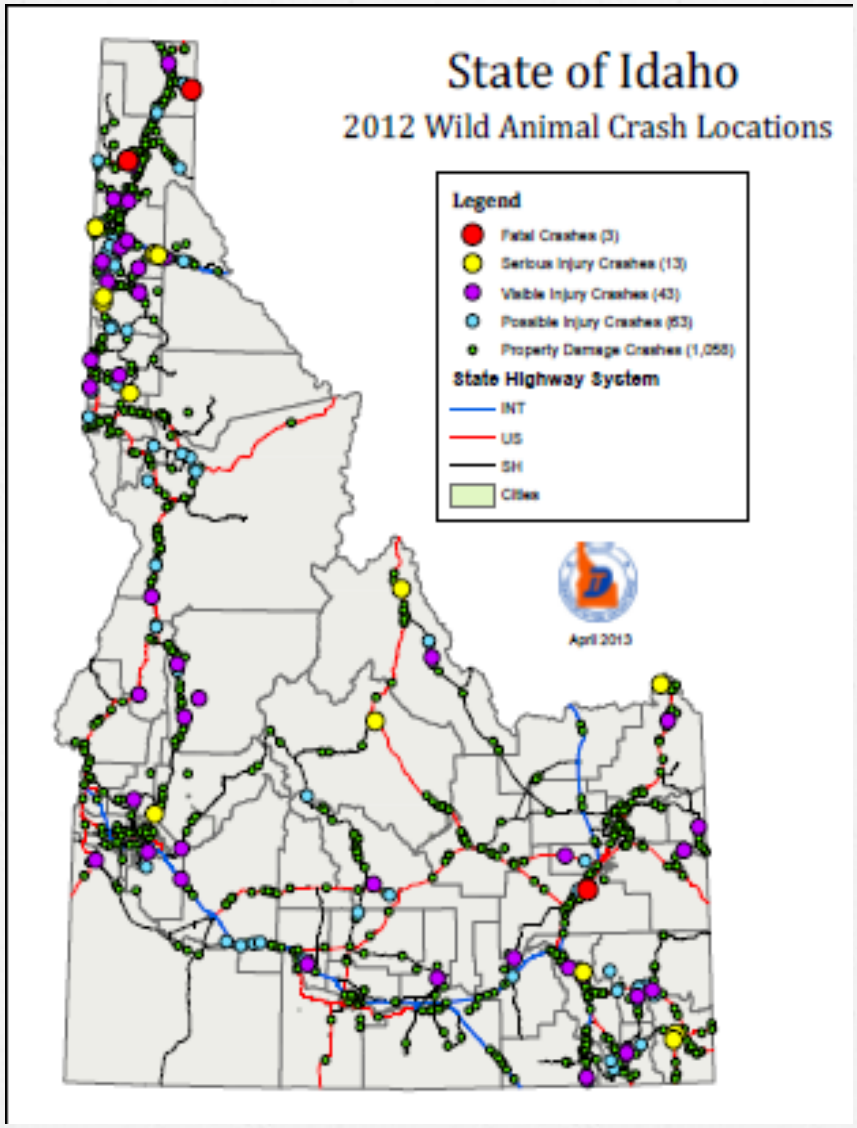
2012

Idaho Transportation Department
Office of Highway Safety

Idaho's Traffic Crash Clock: 2012




State of Idaho
2012 Fatal Crash Locations
Legend
Cities
Counties
Interstate
US Highways
State Highways
2012 Fatal Crashes
Miles
0 12.525 50 75 100
169 Fatal Crashes
184 People Killed
April 2013


State of Idaho
2012 Wild Animal Crash Locations
Legend
Fatal Crashes (3)
Serious Injury Crashes (13)
Visible Injury Crashes (43)
Possible Injury Crashes (63)
Property Damage Crashes (1,058)
State Highway System
INT
US
SH
Cities
April 2013

Minor vs Major Trauma

- 2-8% of those with trauma will have life threatening injuries
- Minor- usually from fall, low speed MVA, minor burns, etc.
- Major- MVA, blunt, penetrating trauma ,etc.
- CAVEAT: Severity of maternal injury may not correlate with risk of adverse pregnancy outcome.

Minor vs Major Trauma

- Minor- miscarriage in first trimester, placental abruption, fetomaternal hemorrhage
- Major- miscarriage in first tri, significant fetal morbidity or fetal/neonatal death

Trauma Concepts

- Maternal mortality is similar to non-pregnant females in similar situation
- Prompt and effective resuscitation is best way to prevent fetal injury and mortality

Potential Complications

- Maternal death
- Fetal or Neonatal death
- Maternal Injury
- Fetal Injury
- Hospitalization

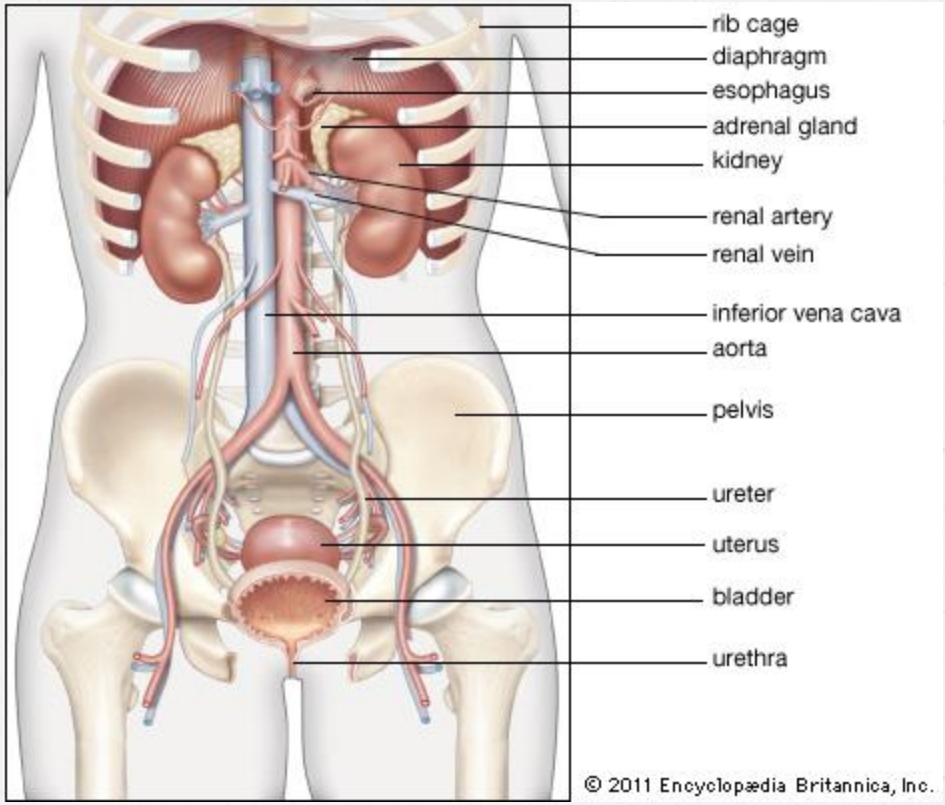
Pregnancy Considerations

- Gestational age of fetus- viable or not
- Anatomic changes
- Physiologic changes
- Two patients

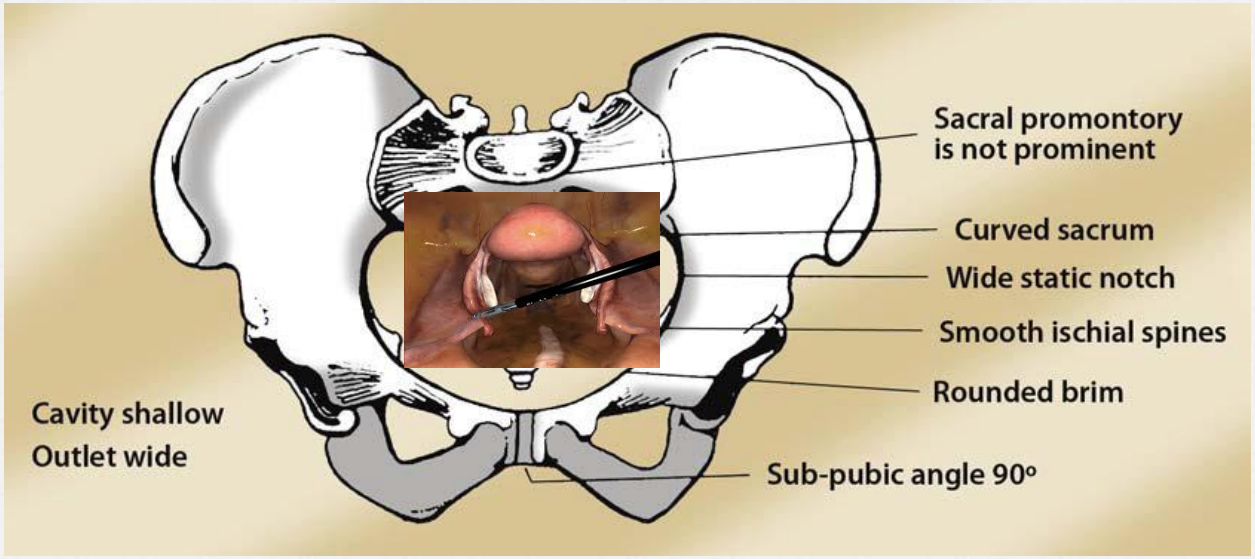
Stratification

- Prior to viability: less than 23 – 24 weeks.
- Viable gestation: 23 weeks and beyond.
- In active labor
- Critically ill, perimortem state

Anatomy of a Female


rib cage
diaphragm
esophagus
adrenal gland
kidney
renal artery
renal vein
inferior vena cava
aorta
pelvis
ureter
uterus
bladder
urethra
© 2011 Encyclopædia Britannica, Inc.

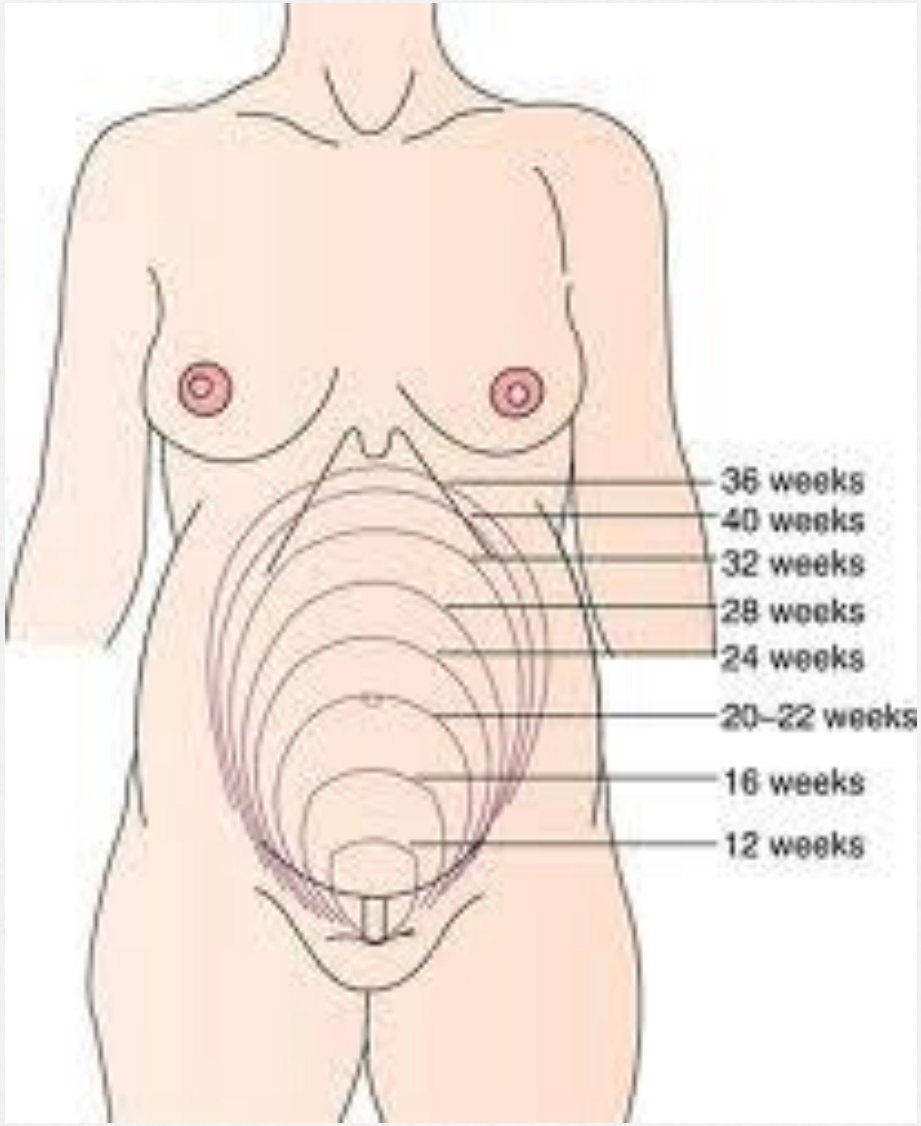
Female Pelvis



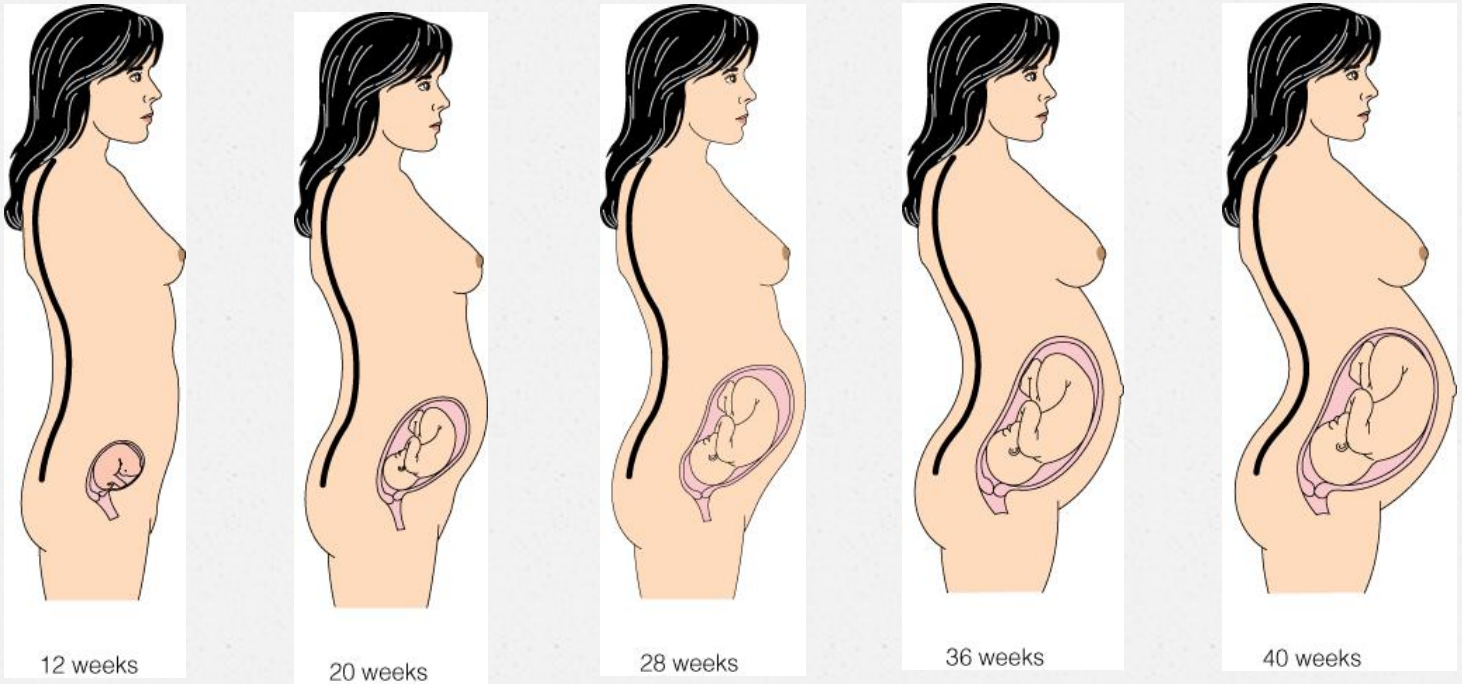
Anatomic changes in Pregnancy

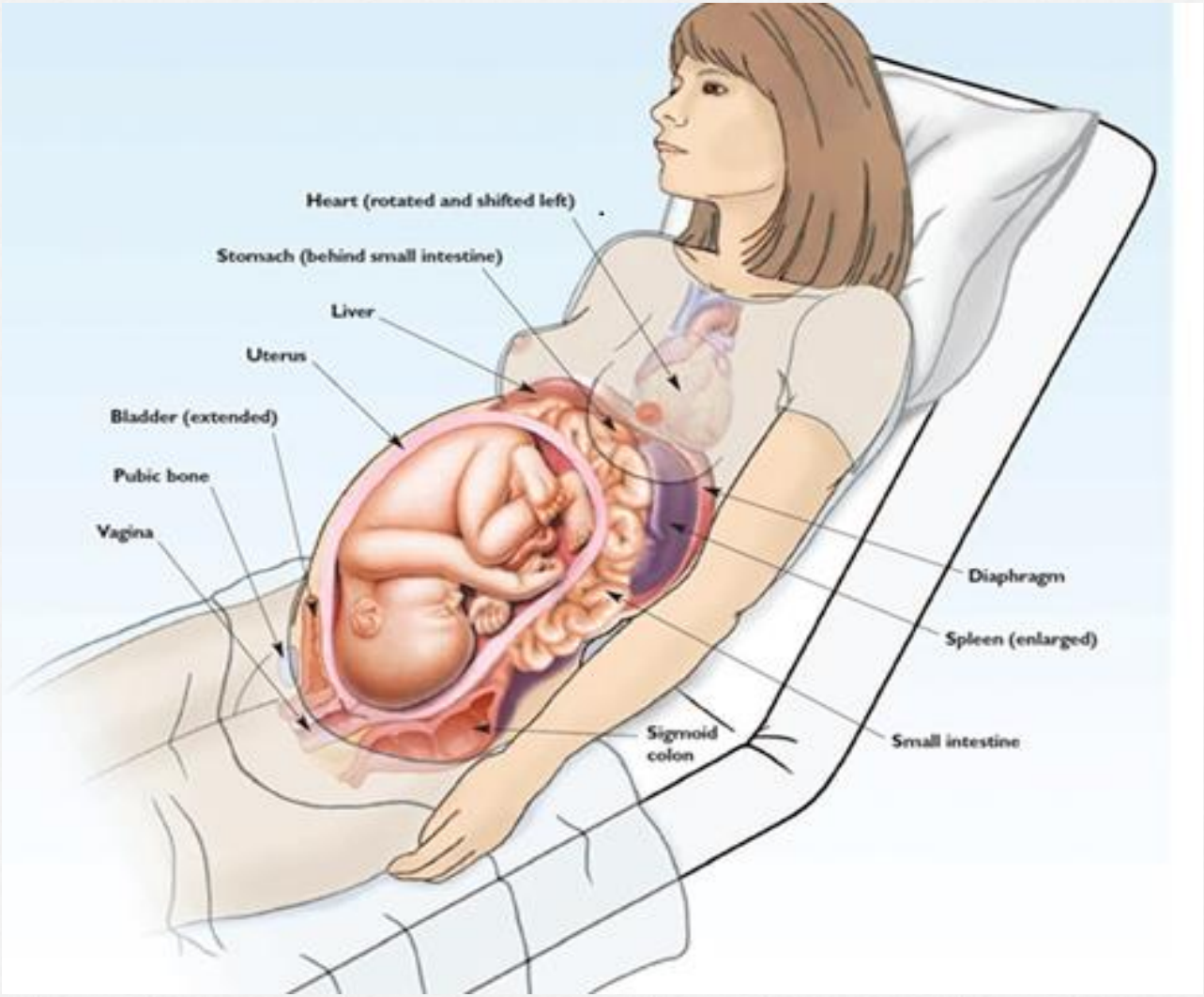
Reproductive System

- Enlargement of uterus
- Intra-abdominal organ at 12 weeks
- At umbilicus at 20 weeks
- Costal margin at 36 weeks
- Descends/drops due to fetal engagement around 38 weeks


36 weeks
40 weeks
32 weeks
28 weeks
24 weeks
20–22 weeks
16 weeks
12 weeks

Pregnancy

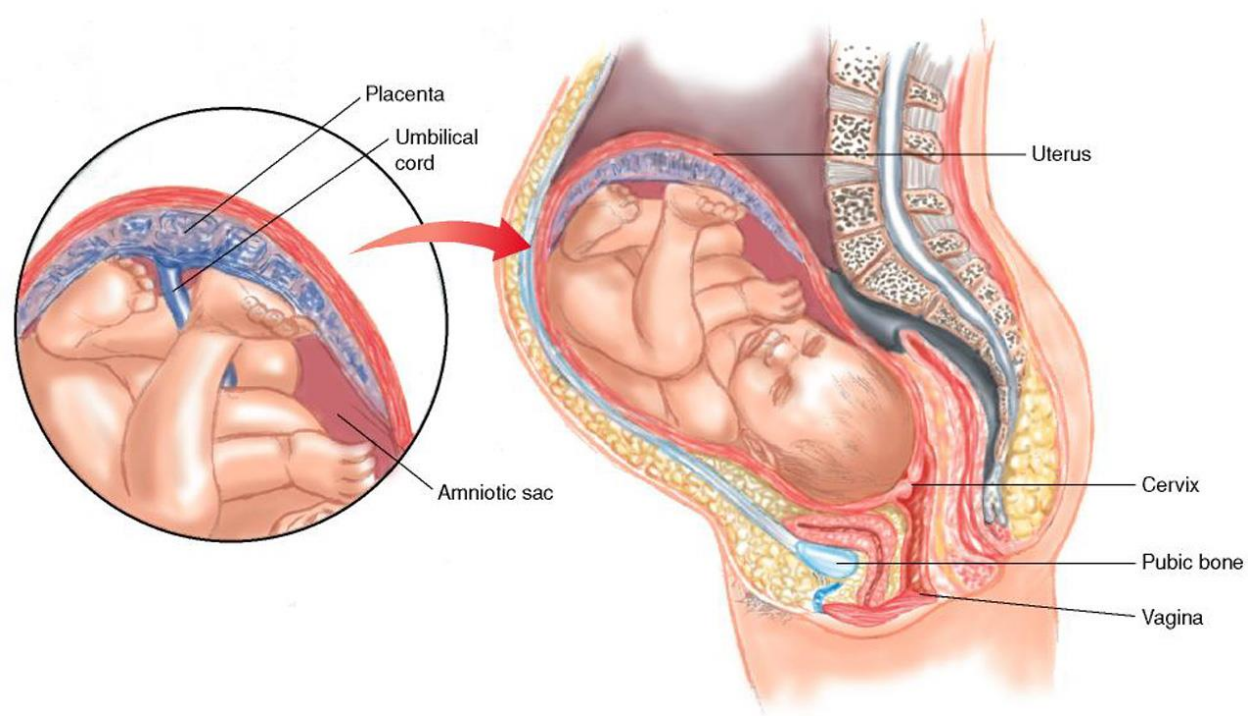



Heart (rotated and shifted left)
Stomach (behind small intestine)
Liver
Uterus
Bladder (extended)
Pubic bone
Vagina
Diaphragm
Spleen (enlarged)
Small intestine
Sigmoid colon

Reproductive System

- Uterus becomes thin-walled. More prone to injury.
- Placenta- inelastic. Prone to separation (abruption).

Pregnant Female



Physiologic changes

- Cardiovascular
- Hemodynamic
- Respiratory
- Renal
- Gastrointestinal
- Hematologic
- Musculoskeletal

Cardiovascular

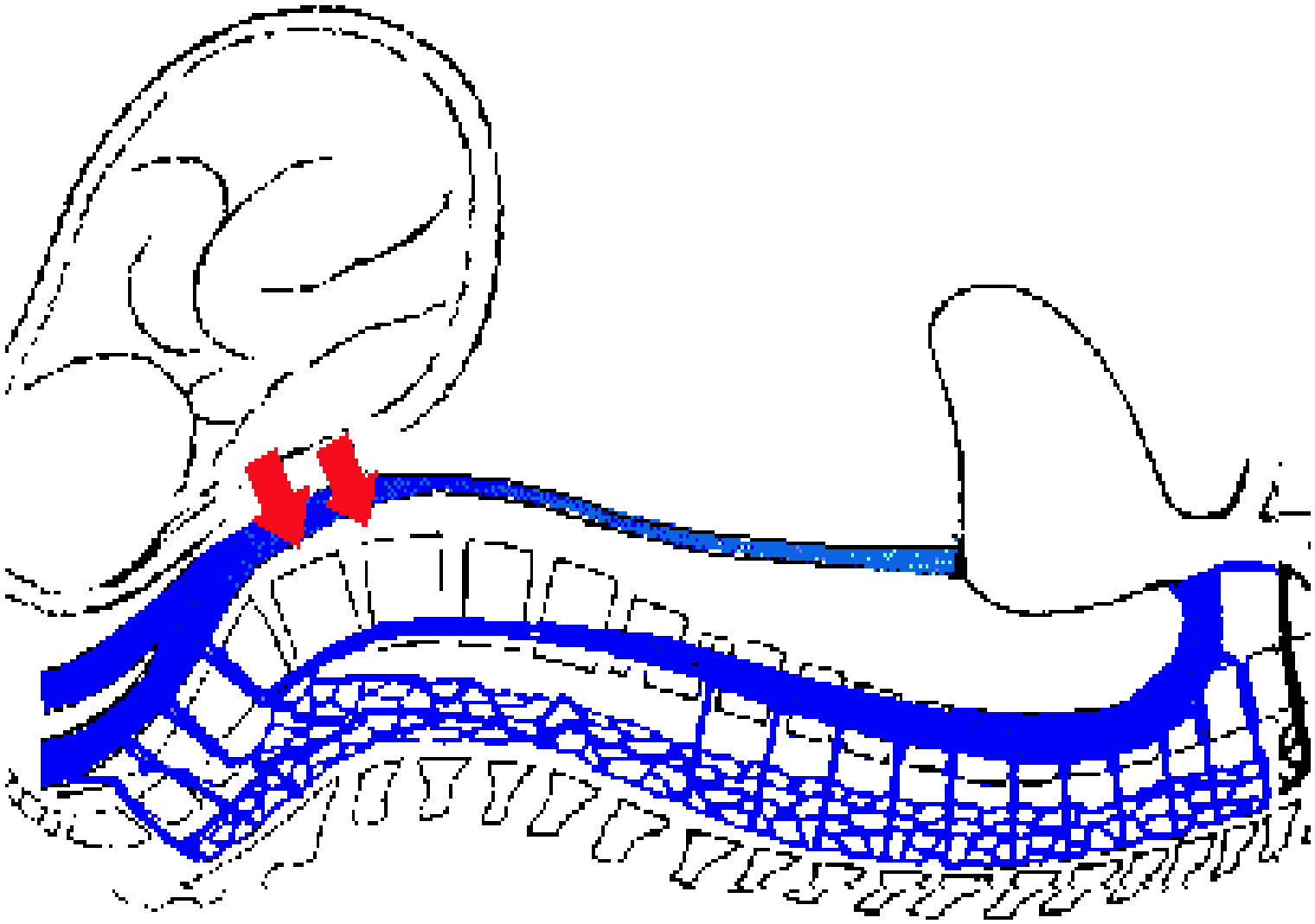
- Cardiac output -up to 50% increase
- Heart rate increases by 10-15 beats/minute
- Pregnant pt can lose 30% (2L) of blood volume before vital signs change

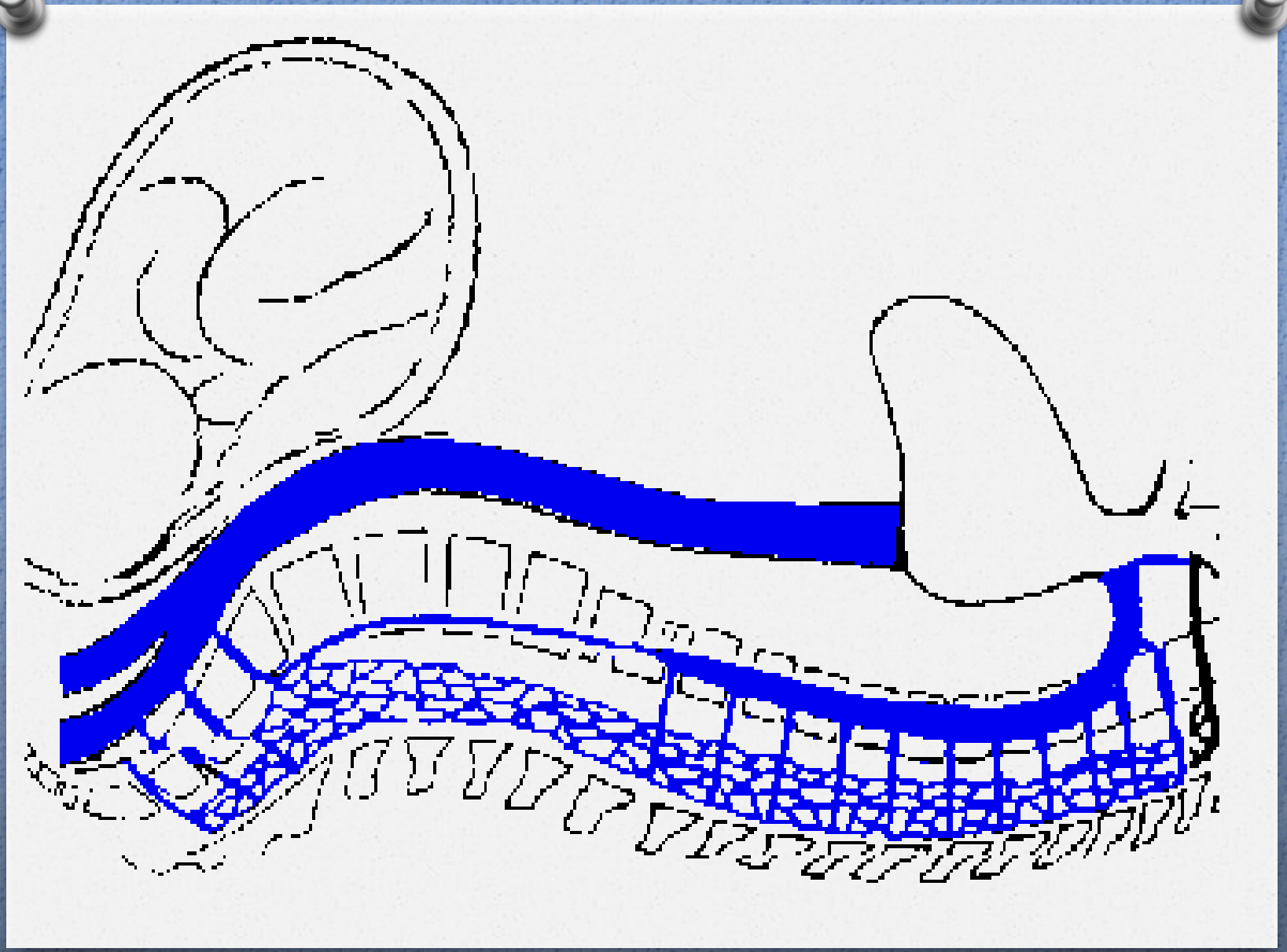
Hemodynamic

- Uterine compression of vena cava:
- Causes decreased venous return
- Can cause 30% drop in cardiac output
- Called “Supine Hypotension Syndrome”

Supine Hypotension Syndrome

- Avoid by displacing the uterus
- Place in left lateral decubitus position
- Manually tilt uterus to side
- Towel roll under right hip
- Tilt spine immobilization board

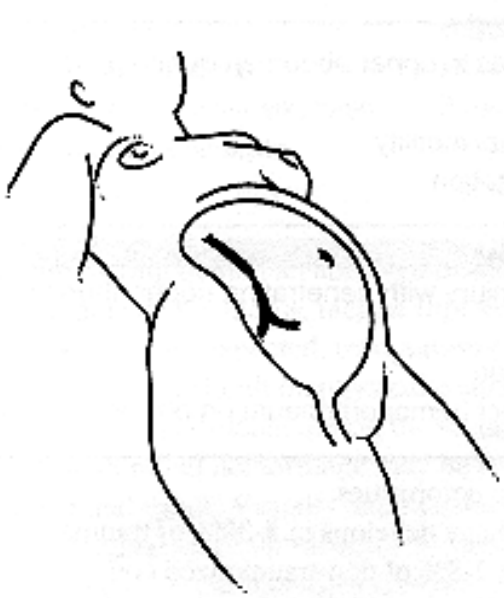




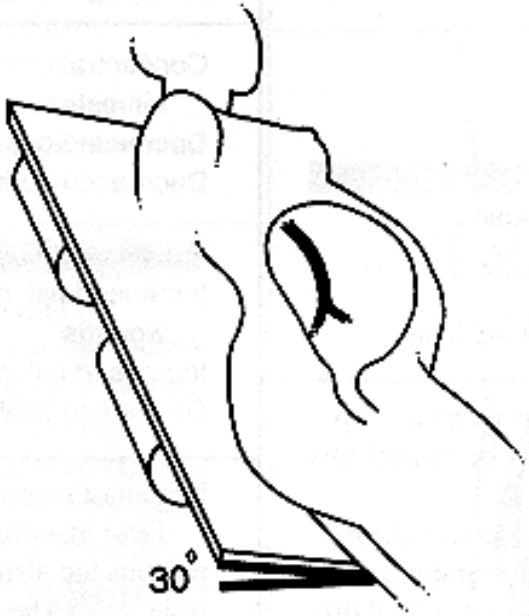
http://www.manbit.com/OA/f28-1.htm

Manbit Images

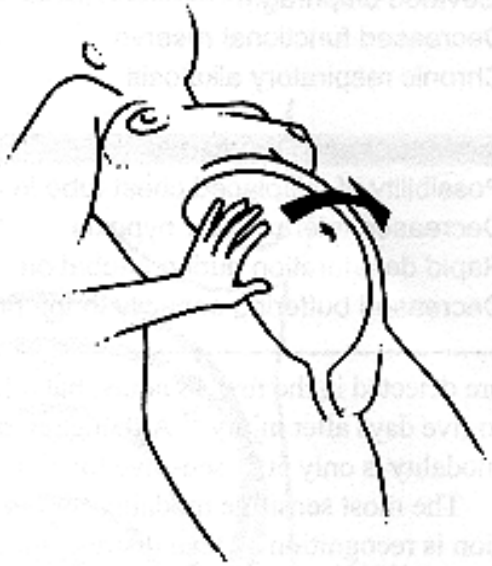
Figure 1: Supine Hypotensive Syndrome



Supine hypotensive syndrome: The gravid uterus compresses the vena cava in supine position

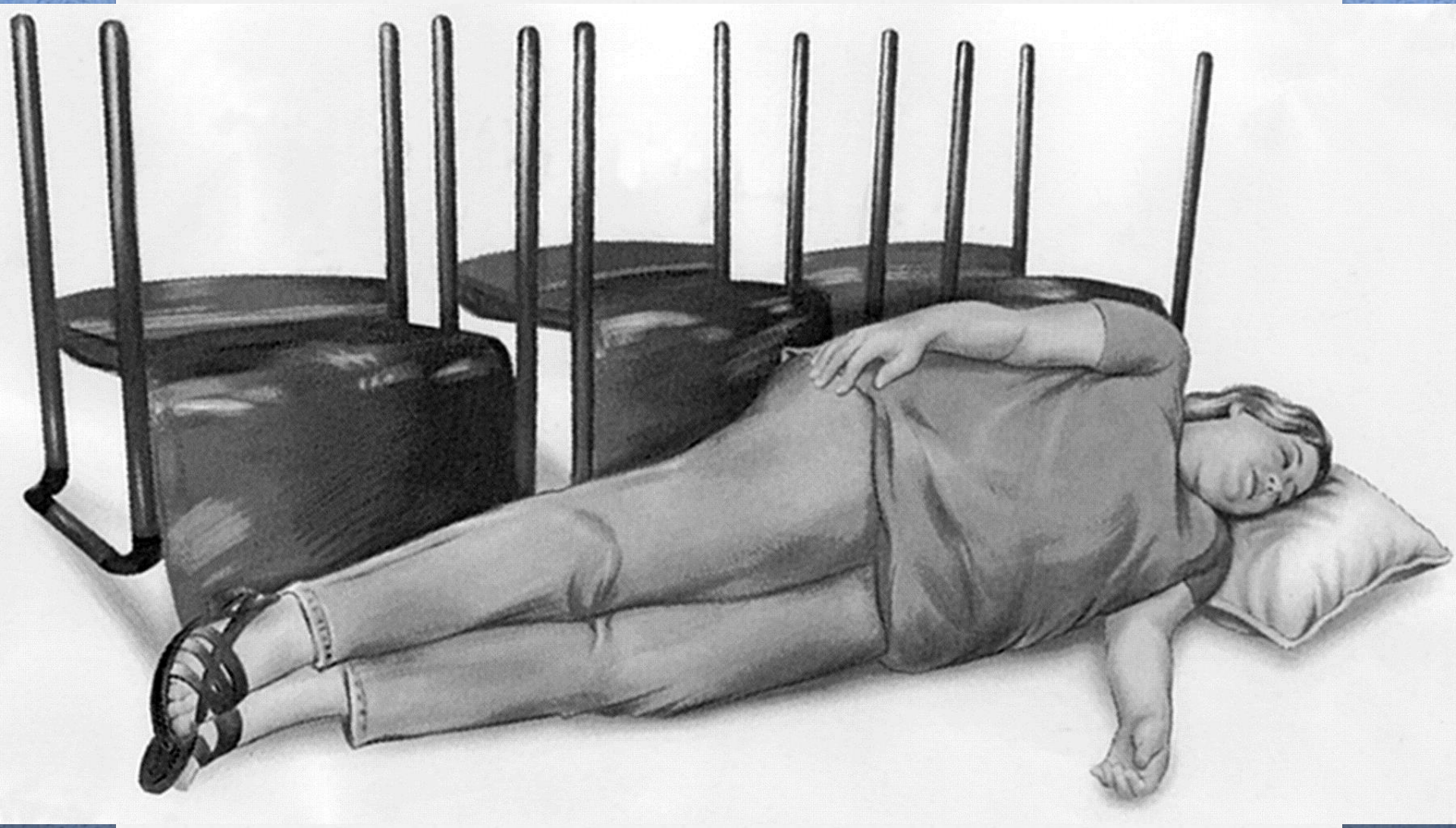


Treatment of supine hypotensive syndrome: 30° left lateral decubitus unloads vena cava



Treatment of supine hypotensive syndrome: Alternate method: manual shift of uterus

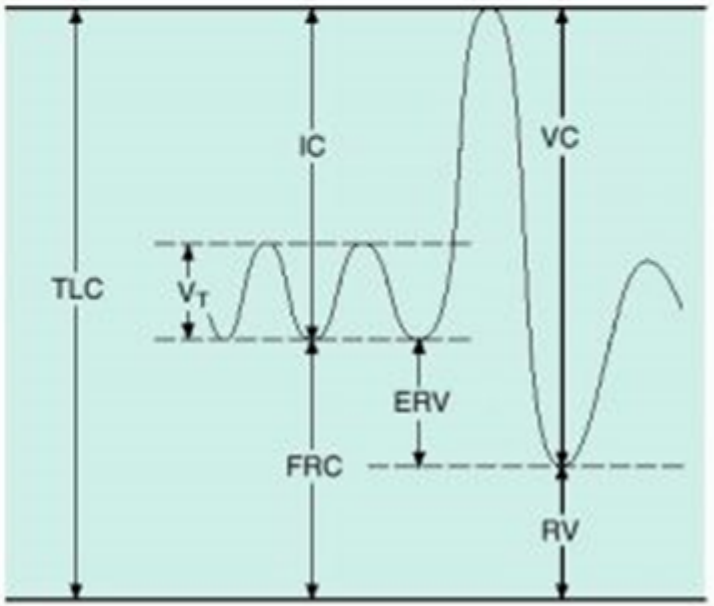
Milson I, Forssman L: Factors influencing aortocaval compressionin late pregnancy, Am J Obtst Gynecol 148: 764-771, 1984



Respiratory

- Increased O2 consumption
- Elevated diaphragm
- Tidal volume increased by 30-40%
- Minute ventilation increased by 30-40%
- Intubation challenging due to airway edema
- Increased risk of aspiration

- Normal Pulmonary Physiology in Pregnancy
  - Tidal volume is increased
  - Functional residual capacity is decreased
- Normal ABG = compensated respiratory alkalosis
- Respiratory distress may progress more rapidly due to pregnancy



Respiratory

- Maternal-fetal O2 consumption increases 40-50% over non-pregnant state.
- Cardiac output increases by 50%.
- Functional residual capacity (apneic reserve of O2) decreases by 20%

Pregnant patient has diminished capacity to tolerate apnea!

Functional residual capacity (FRC) is our “air tank” for apnea.

www.picture-newsletter.com/scuba-diving/scuba... from Google images

Pregnant Mom has a smaller “air tank”

Non-pregnant woman

www.pyramydair.com/blog/images/scuba-web.jpg

Mom

4 ml O2 / kg / min

Feto-placental unit

12 ml O2 / kg / min

Mother is consuming and delivering oxygen for two!

Respiratory Considerations

- At term, respiratory alkalosis with metabolic compensation. Less HCO_3^- to buffer
- At term, lower Hgb concentration to buffer acid load
- Less tolerant to both apnea and acidosis

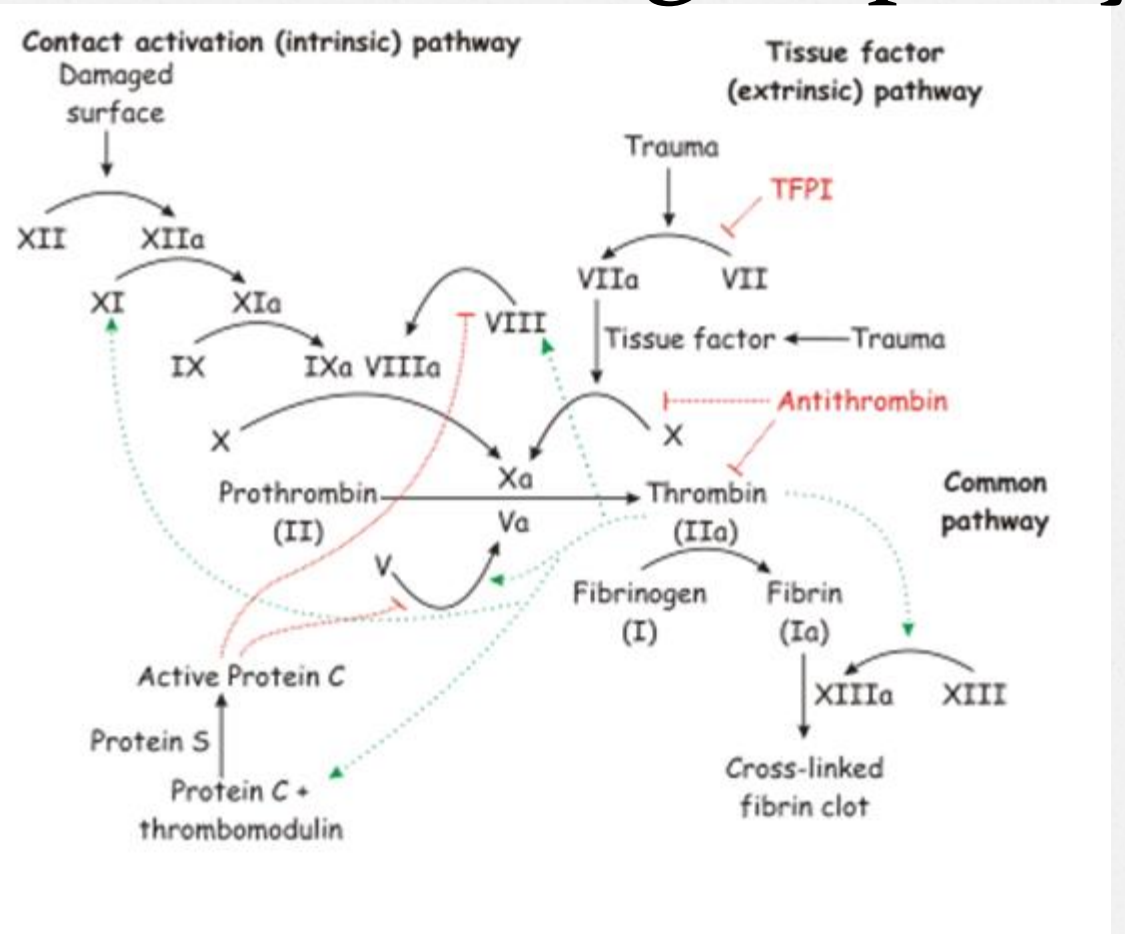
Hematologic

- 40% increase in blood volume
- 25% increase in red cell mass
- Results in relative anemia HCT 31-35
- Mother can lose up to 1500ccs of blood without signs of instability. Fetus cannot tolerate however and will be in shock.

Hematologic

- WBC increased
- Fibrinogen and clotting factors increased
- Albumin low

Increased coagulopathy



Renal

- Glomerular filtration rate increased
- BUN & Creatinine decrease
- Glycosuria common

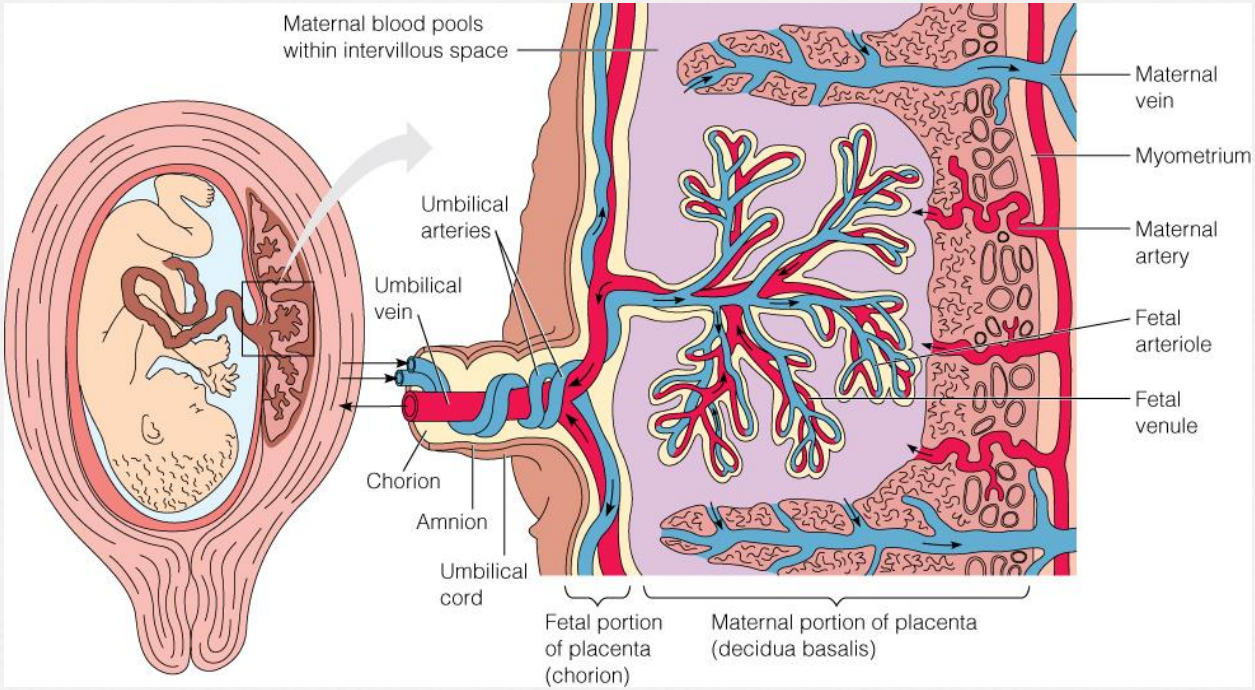
Gastrointestinal

- Delayed gastric emptying
- Relaxed lower esophageal sphincter
- Increases risk for aspiration

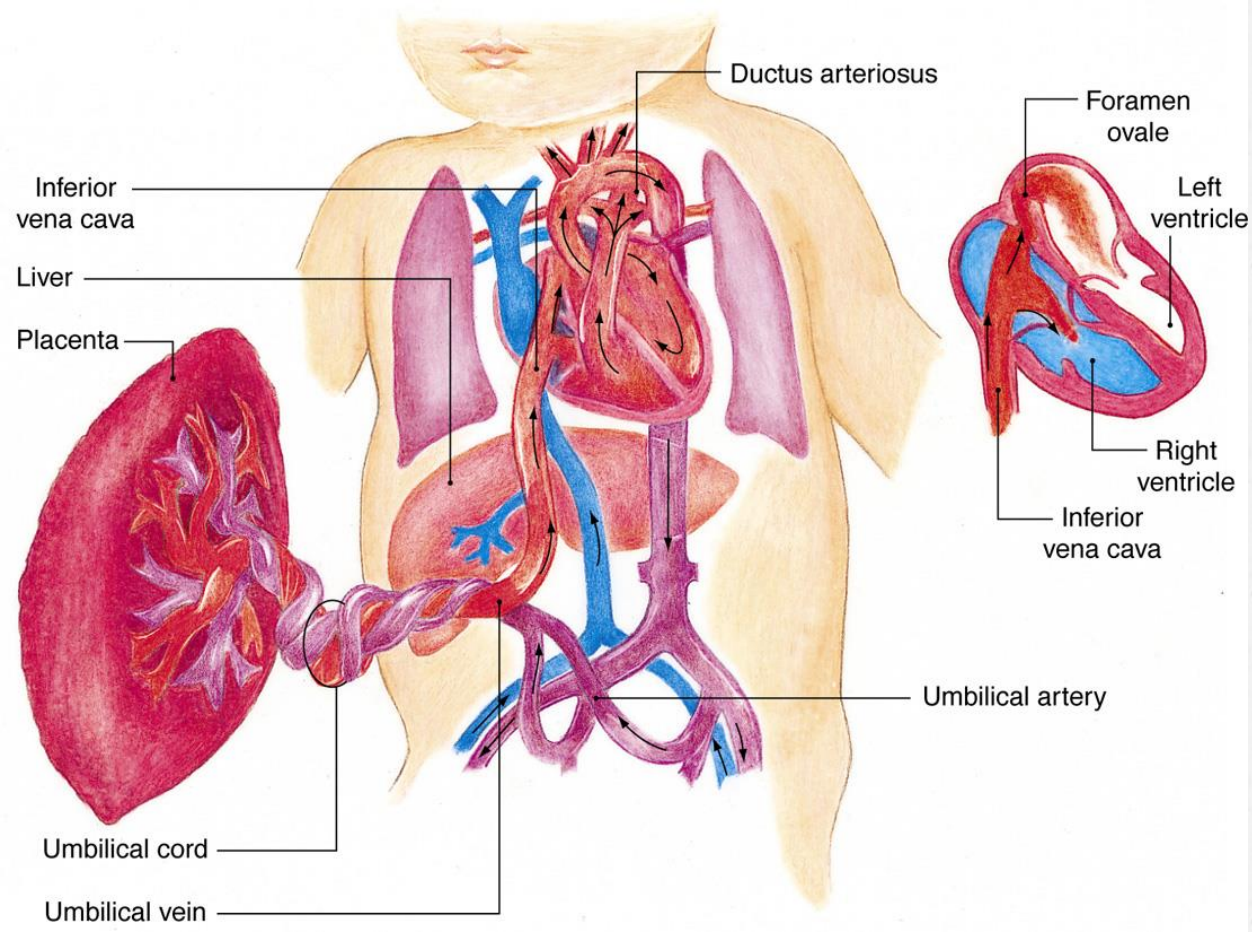
Musculoskeletal

- Joint laxity
- Symphysis pubis widens by 7th month
- Sacroiliac joint spaces may increase

Fetal Blood Supply



Fetal Circulation



Assessment in the Field

- Differences in pregnant females are important, however:
- Pregnant patient is still a trauma victim
- Should assess the pregnant trauma patient following usual protocols.

Special considerations

- May need to modify evaluation:
- Fully evaluate mother
- Treat mother
- Then assess fetus
- Treat fetus

Management Protocols

- What is best for the mother is best for the fetus!!!!!

Initial Management

- AIRWAY: as per all patients
- BREATHING: as per all patients
- CIRCULATION: If able, place on left side or left hip tilt

Airway Considerations

- Assess airway: Can have increased edema which can obscure vocal cords
- Mother and fetus both have increased oxygen demands.

Breathing Considerations

- Decreased FRC
- Increased O2 consumption
- Mother and baby need O2
- Give supplemental O2 via nasal cannula if possible
- Consider intubation early

Circulation Considerations

- PREGNANT PATIENT CAN LOSE A LOT OF BLOOD BEFORE ABNORMAL BP AND PULSE!!

Circulation Considerations

- Avoid vasopressors
- Avoid supine hypotension
- Left lateral decubitus


Emergency

General Assessment

- Initial Assessment
  - Routine protocol
- History
  - Due date
  - Pre-existing disease
  - Pain
  - Vaginal Bleeding

General Assessment

- Physical Exam
  - Routine protocol
  - Assess uterus and obtain fundal height
  - Do not perform vaginal exam
  - Assess fetal heart rate if possible

General Assessment

- CAVEATS:
  - Two patients
  - ABC
  - Monitor for shock

Trauma Management

- Follow usual protocols
- High flow, high concentration O2
- Large bore IVs
- Left lateral tilt
- Reassess patient
- Monitor fetus

Fetal Assessment

- Obtain heart rate
- Normal heart rate 110-160

Fetal Outcome

- Fetal loss occurs in 40% of critically injured pregnant pts
- Fetal loss directly related to severity of trauma injury
- Overall fetal loss rate 4-5%

Fetal Loss Rate

- Maternal shock- 80%
- Abruption- 30-70%
- Penetrating Abdominal Injury- 70%

- CAVEAT: Homicides and MVAs most common cause of fetal death

Risk Factors for Fetal Loss

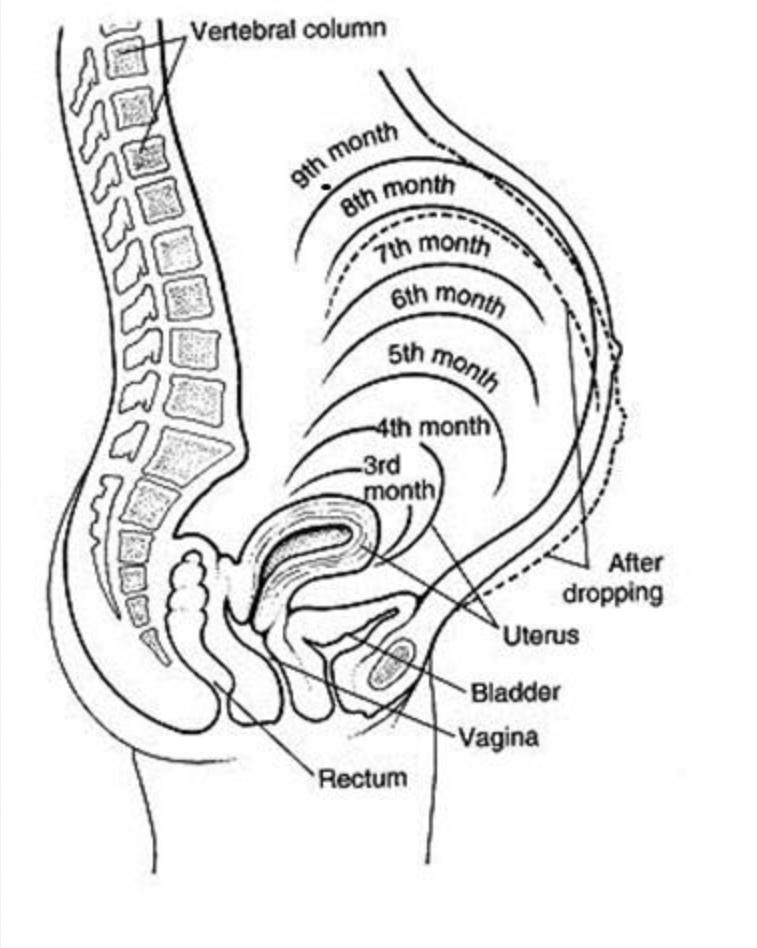
- Maternal hypotension
- High maternal injury severity score
- Ejection from MV
- Maternal pelvic fracture
- Maternal ETOH use
- Motorcycle crash
- Uterine rupture

Blunt Trauma Concerns

- Placental Abruption
  - Leading cause of fetal death
  - DIC may occur
- Fetal Anemia
  - Feto-Maternal hemorrhage
- Ruptured Uterus
  - 0.6% of blunt trauma

Pattern of Injury
Blunt Trauma

- First trimester
  - Uterus in pelvis
  - Bladder in pelvis
  - Pattern of injury is similar to non-pregnant
  - Uterus is protected
  - Pattern of abd injury unchanged

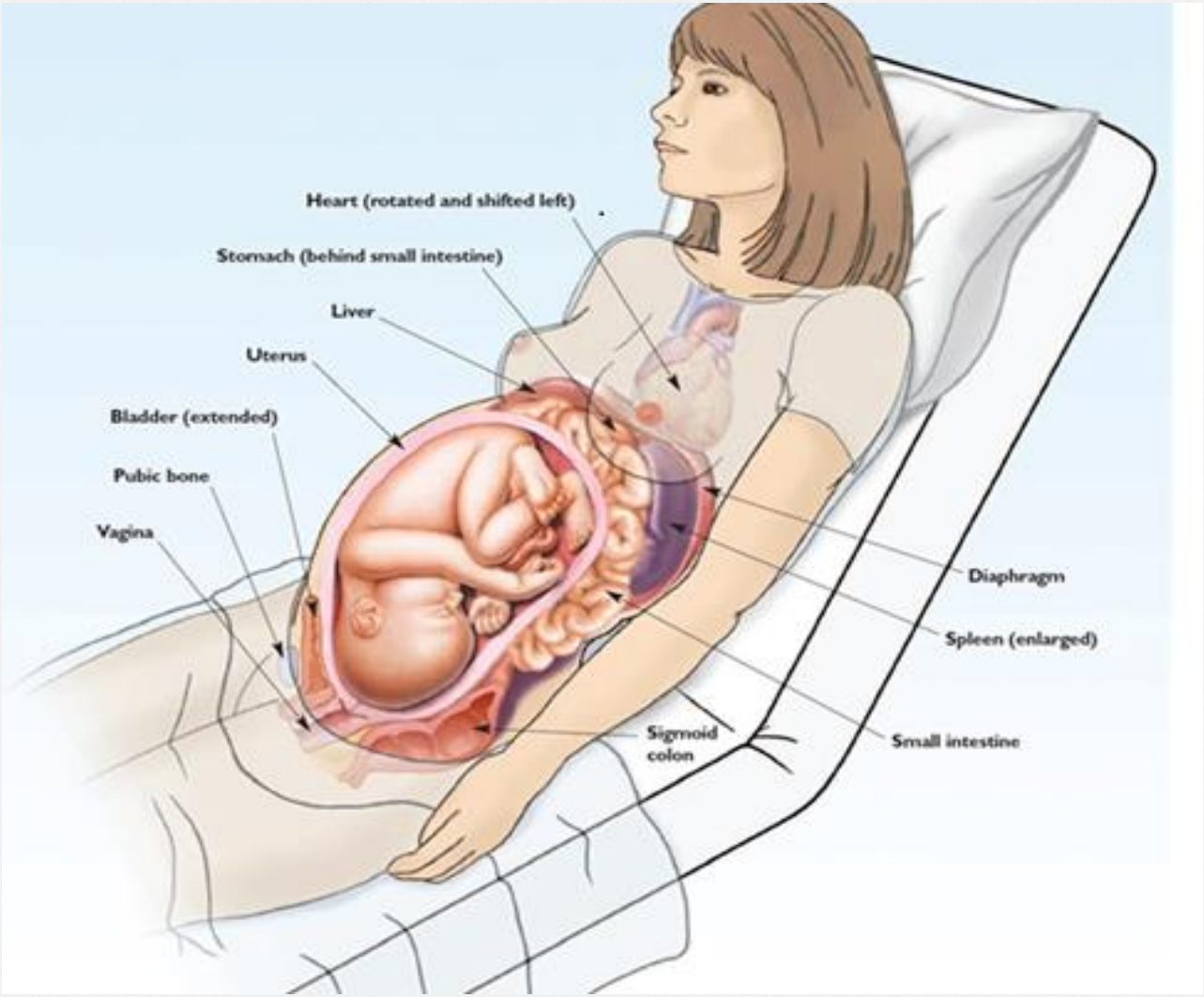

Vertebral column
9th month
8th month
7th month
6th month
5th month
4th month
3rd month
After dropping
Uterus
Bladder
Vagina
Rectum

Pattern of Injury
Blunt Trauma

- Second and Third Trimesters
  - Uterus extrapelvic
  - Bladder extrapelvic
  - Stomach, spleen displaced
  - Increased uteropelvic blood flow
  - Pattern of injury altered

Late Pregnancy Blunt Trauma

- **Pattern of Injury Altered:**
  - Bladder injuries more common
  - Small bowel injuries less common
  - Greater risk of pelvic fractures
  - Increased uterine rupture
  - Increased placental abruption


Heart (rotated and shifted left)
Stomach (behind small intestine)
Liver
Uterus
Bladder (extended)
Pubic bone
Vagina
Diaphragm
Spleen (enlarged)
Small intestine
Sigmoid colon

Placental Abruption

- Second most common cause of fetal death in trauma
- Incidence ranges from 6-60% in literature
- Can result from very minor trauma- ie fall

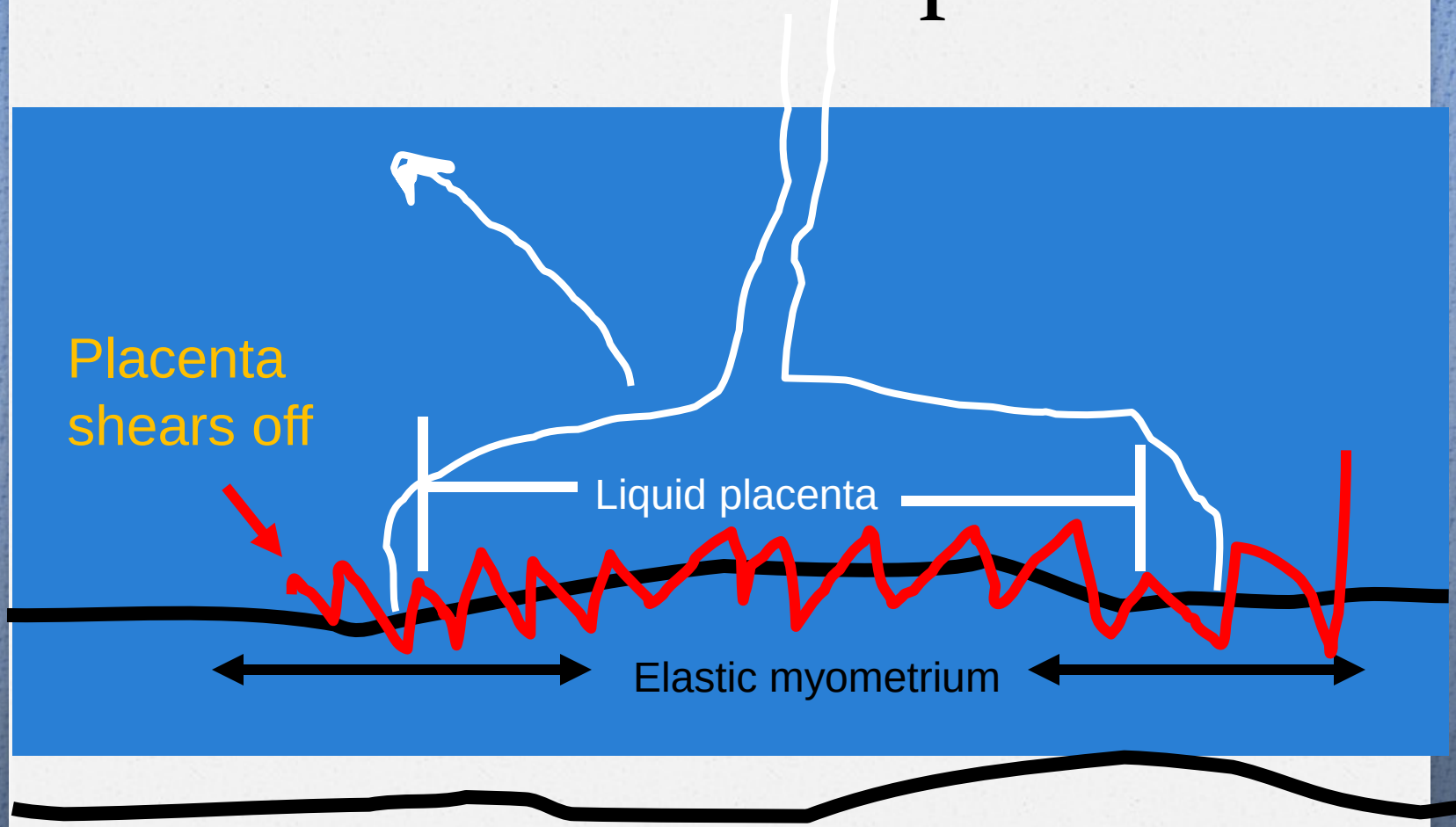
Placental Abruption

- Occurs in 5% of pts with minor injuries
- Occurs in 50% of pts with major injuries
- Usually occurs within first 24 hrs after injury

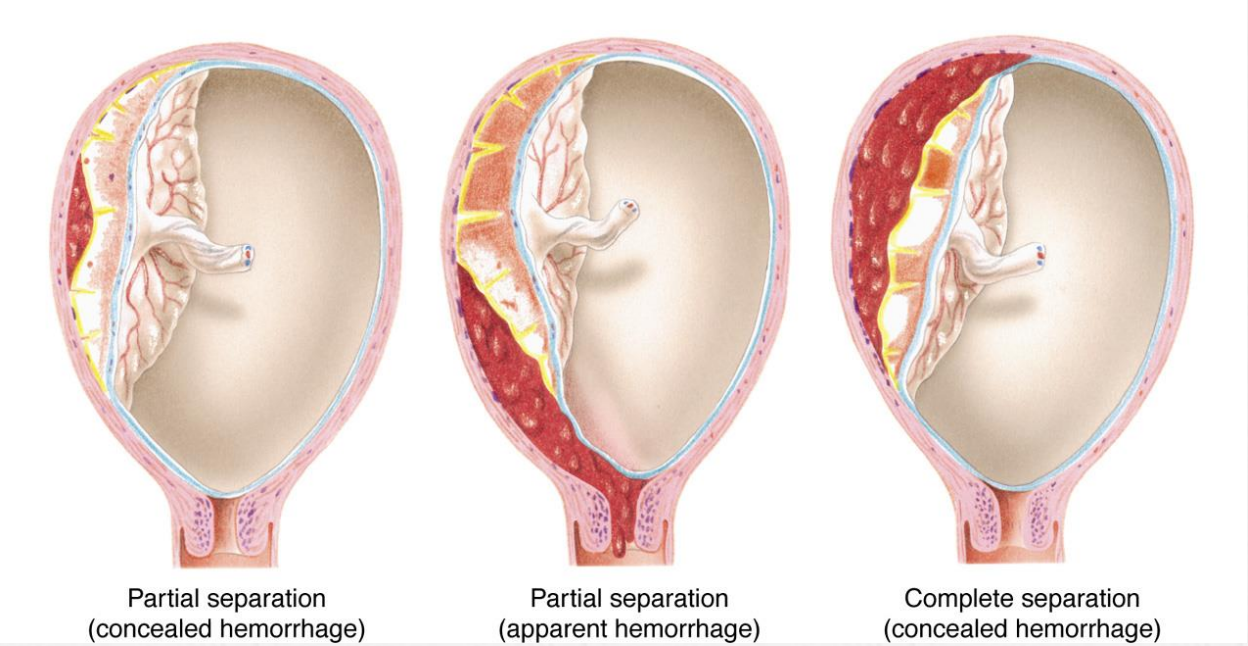
Etiology of Abruption in Trauma

- Uterus has many elastic fibers
- Placenta has few elastic fibers
- Causes inelastic connection
- Susceptible to shearing force

Placental abruption



Placental Abruption



Bledsoe et al., *Essentials of Paramedic Care: Division 1V*

Placental Abruption

- Abdominal pain
- Vaginal Bleeding
- Uterine tenderness
- Contractions
- Hard, stiff uterus
- Fetal bradycardia

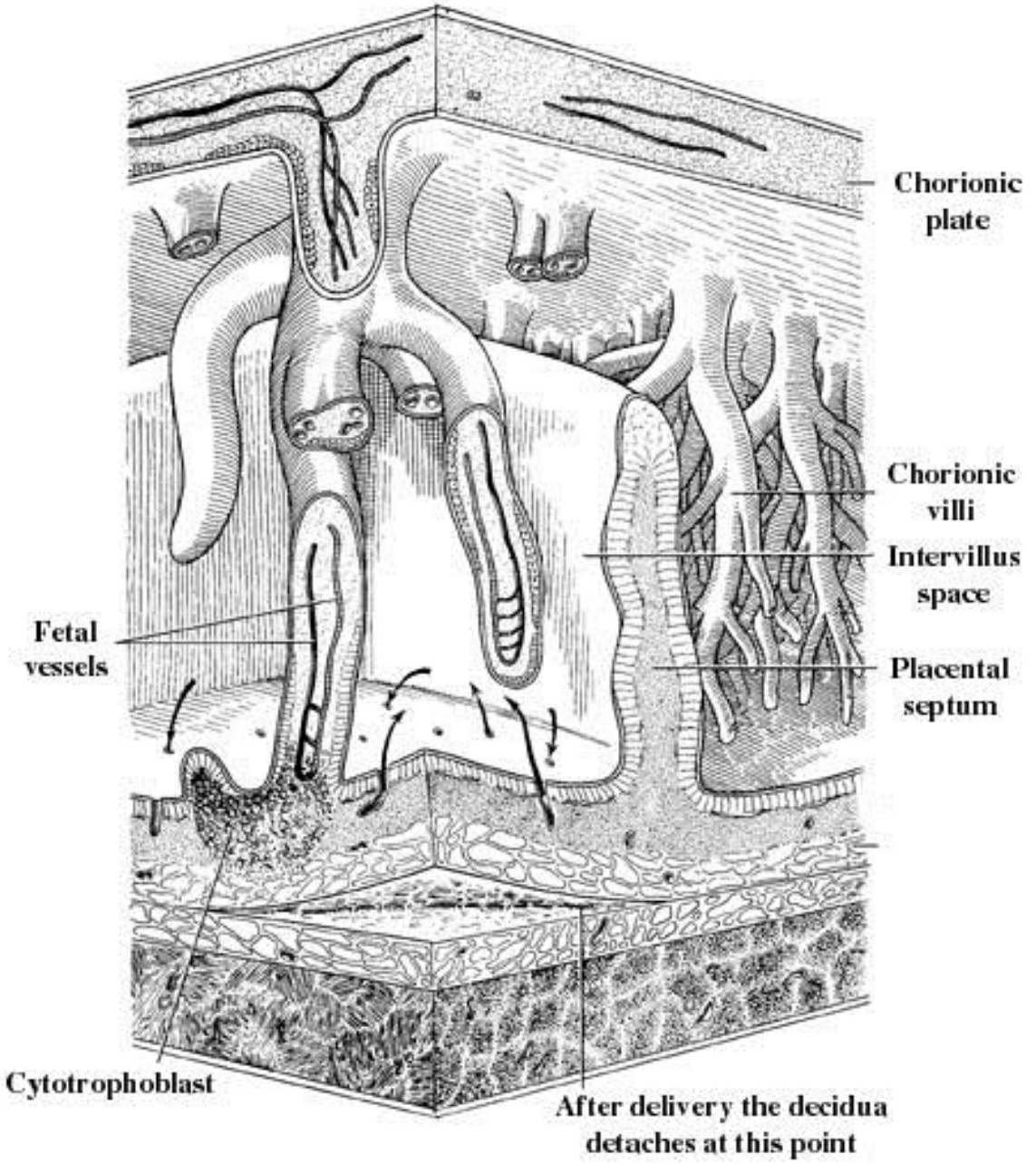
What happens if fetus doesn't get enough oxygen?

(What is the mammalian diving response?)

www.doc.govt.nz/.../images/diving-whale-tail.jpg

The mammalian diving reflex shuts down blood flow to all organs except the heart and brain, in order to conserve oxygen.

The fetus responds to hypoxia in this manner


Chorionic plate
Chorionic villi
Intervillus space
Placental septum
Fetal vessels
Cytotrophoblast
After delivery the decidua detaches at this point

Fetal Hypoxia Response

- Fetal O2 uptake is proportional to placental blood flow.
- Decrease in FHR due to hypoxia

Prevention

- Use of seatbelts improves maternal/fetal outcomes in MVA
- Incorrect positioning can lead to injuries
- If too high- direct injury to uterus and fetus


8 out of 10 Idahoans
buckle up.
Do you?

Seatbelts

- 20% never or rarely use seatbelts
- 20% incorrectly use seatbelts
- ACOG: “..substantial evidence seat belt use in pregnancy protects both the mother and the fetus.”

Prevention

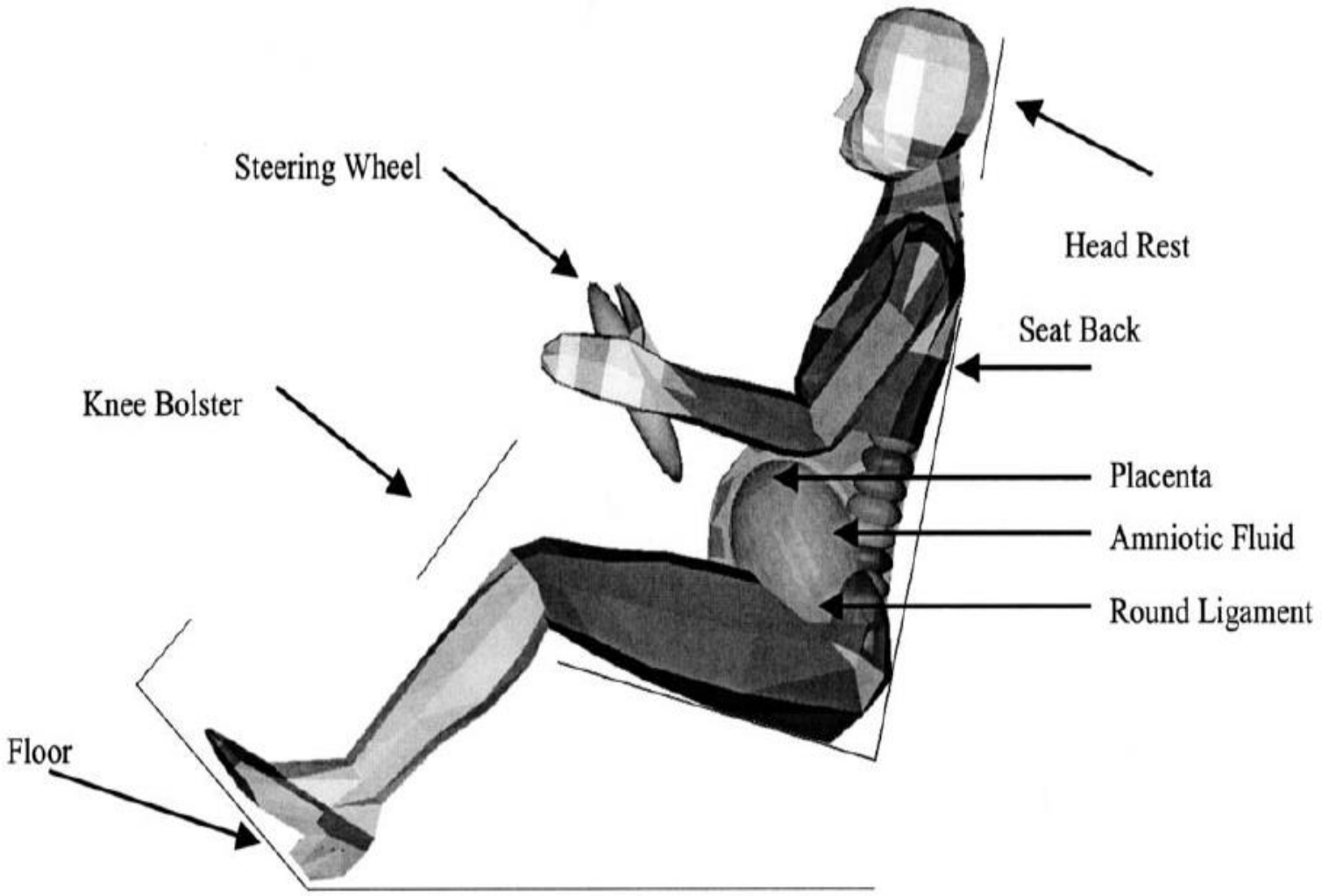
- If only lap belt- increases placental abruption and uterine rupture
- Shoulder harnesses decrease likelihood of serious injury in mother, resulting improved fetal outcomes
- Airbag deployment not shown to cause harm based on limited data

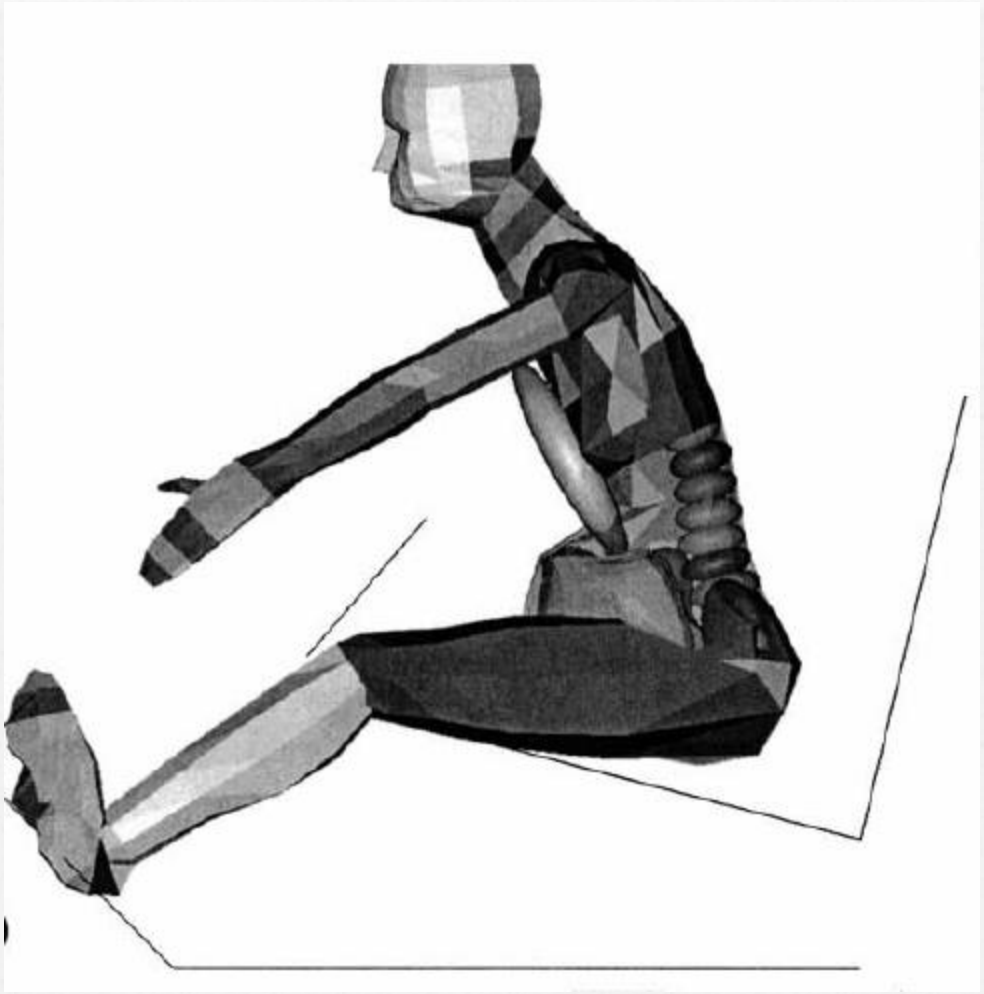
Proper Use of Seatbelts

- As low as possible on pregnancy bulge and across pubic symphysis
- Placement on uterus causes 3-4X increase in force transmitted to uterus

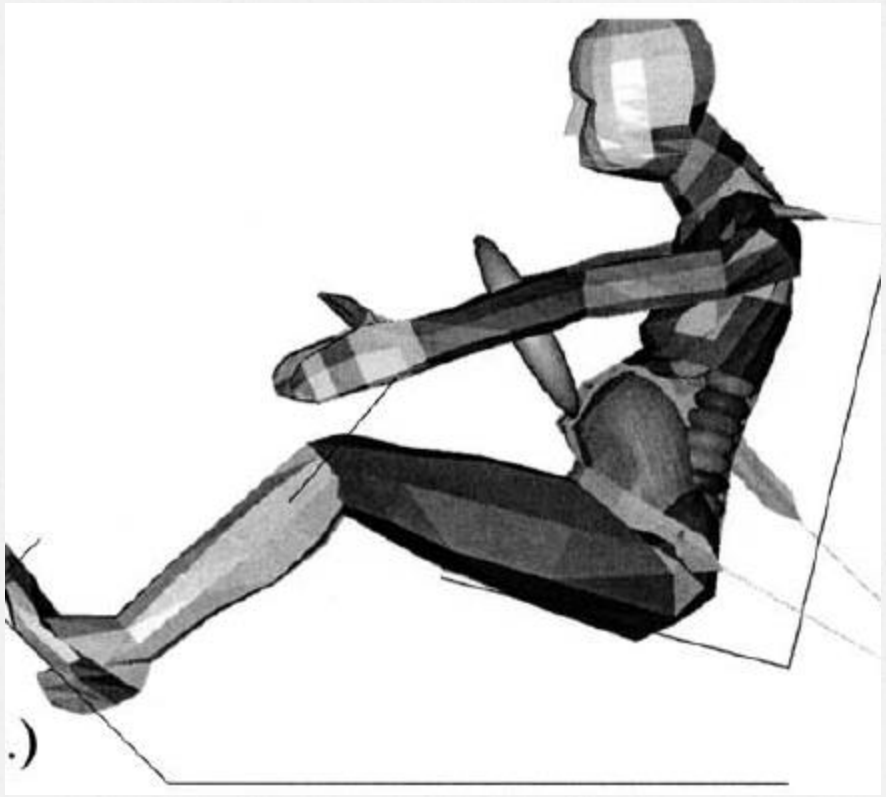
Proper seatbelt position

- If too high- direct injury to uterus and fetus
- Shoulder harness should be placed between breasts

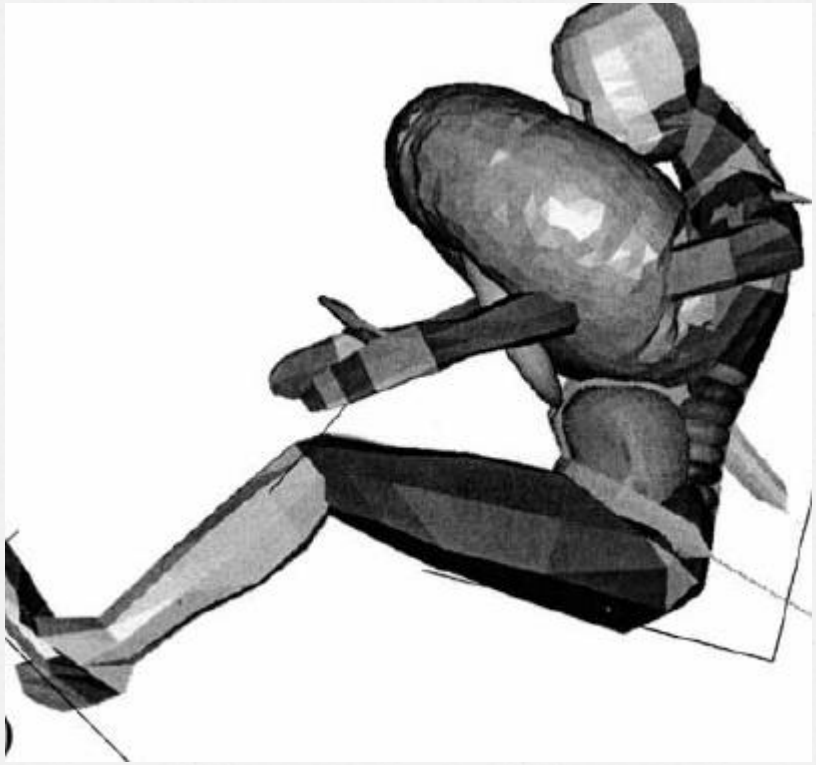

Steering Wheel
Head Rest
Seat Back
Knee Bolster
Placenta
Amniotic Fluid
Round Ligament
Floor



Worst Fetal Outcome



Proper 3 point harness



Best Fetal Outcome


"What's the right way to wear my seat belt?"
NEVER place the lap belt above or on your belly.
Never place the shoulder belt behind your back or under your arm
Place the shoulder belt across your chest (between your breast) and away from you neck
Adjust the lap belt across your hips / pelvis, and below your belly.
IMAGE SOURCE: VIRGINIA DEPARTMENT OF HEALTH

Domestic Violence

- Physical abuse can occur
- Possibly 10% of pregnant women
- Blunt abdominal trauma is common
- Need a low index of suspicion

Uterine Rupture

- Rare in trauma pts - 0.6-1.0%
- Can be associated with pelvic fractures
- Usually occurs in pts with previous cesarean sections

Uterine Rupture

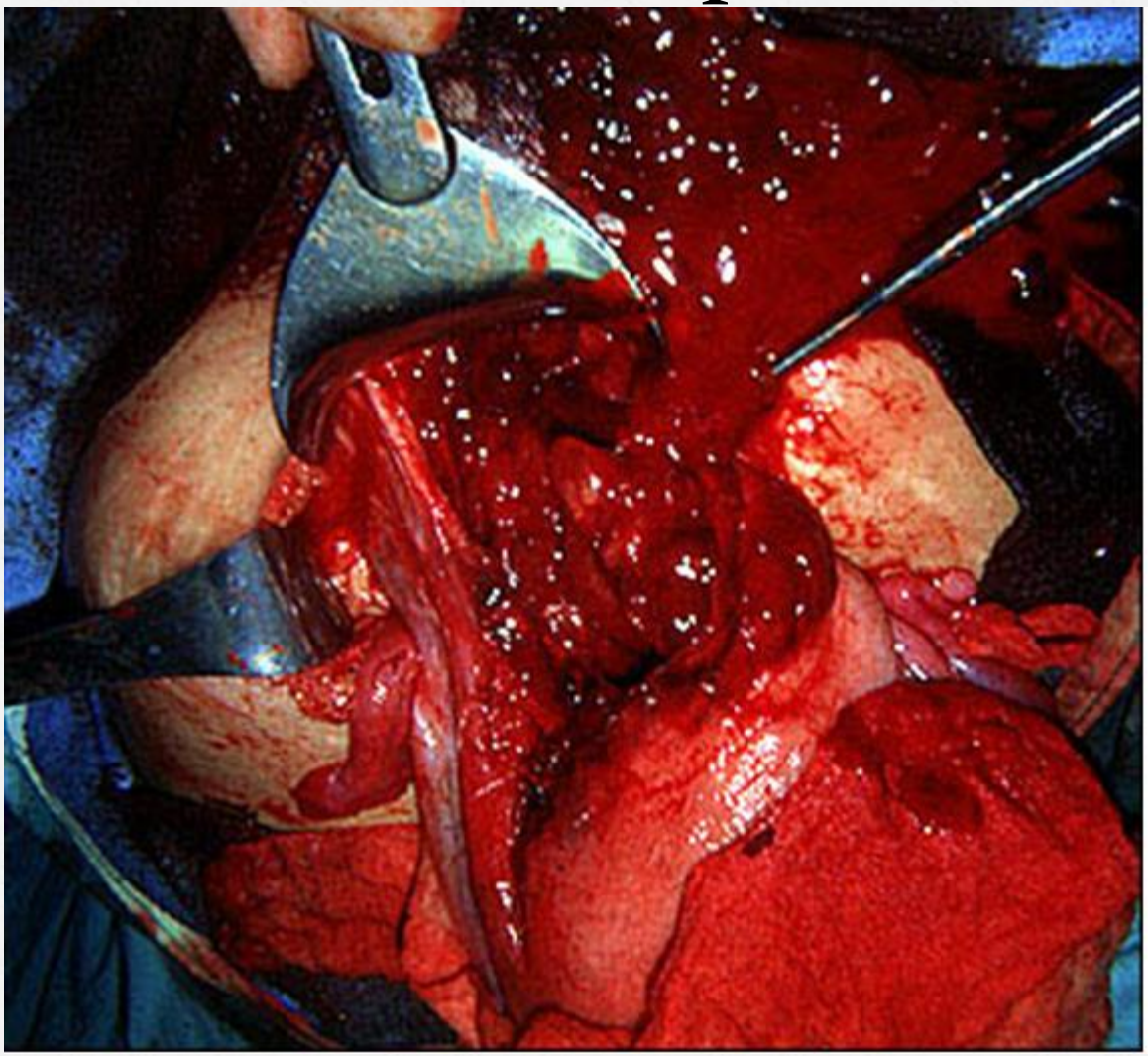
- Results from direct abdominal trauma
- Maternal mortality 10%
- Fetal mortality- almost 100% unless immediately delivered

Uterine Rupture

- Various degrees- complete with fetus in abdomen to small window in lower uterine segment
- 75% of cases involve fundus
- With previous C-section, usually occurs in ant LUS

Intact Uterus

Uterine Rupture



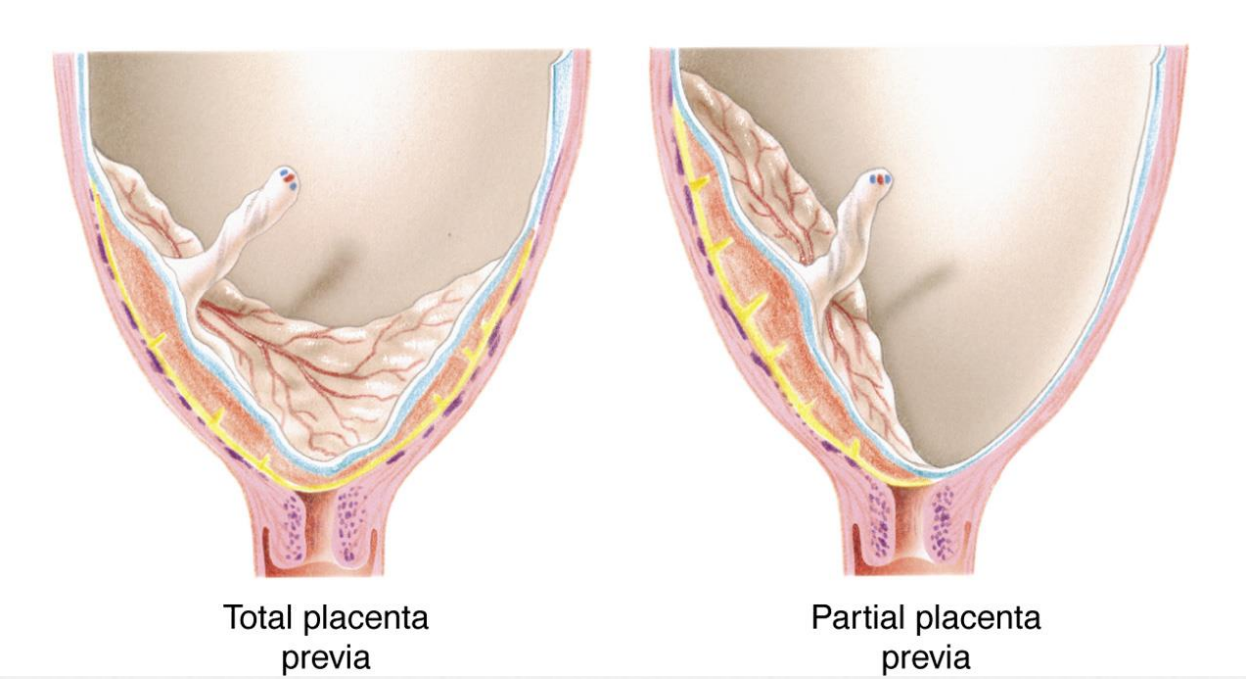
Uterine Rupture

- **Common Findings:**
  - Abdominal tenderness
  - Uterine irregular shape
  - Palpable fetal parts

OB Complications

- Rupture of membranes
- Preterm labor
- Preterm delivery
- Placenta previa
- Fetal injury- ICH, etc.

Placenta Previa



Bledsoe et al., *Essentials of Paramedic Care: Division 1V*

Cardiac Arrest

- ABC's
- CPR- no difference
- Left displacement of uterus
- Defibrillator use is OK
- If code, delivery by C-section within 5 minutes

Perimortem Cesarean Section

- No clear guidelines
- Best fetal outcomes with delivery within 5 minutes of absent maternal circulation
- May result in maternal survival due to increased venous return and elimination of uterine- placental blood flow

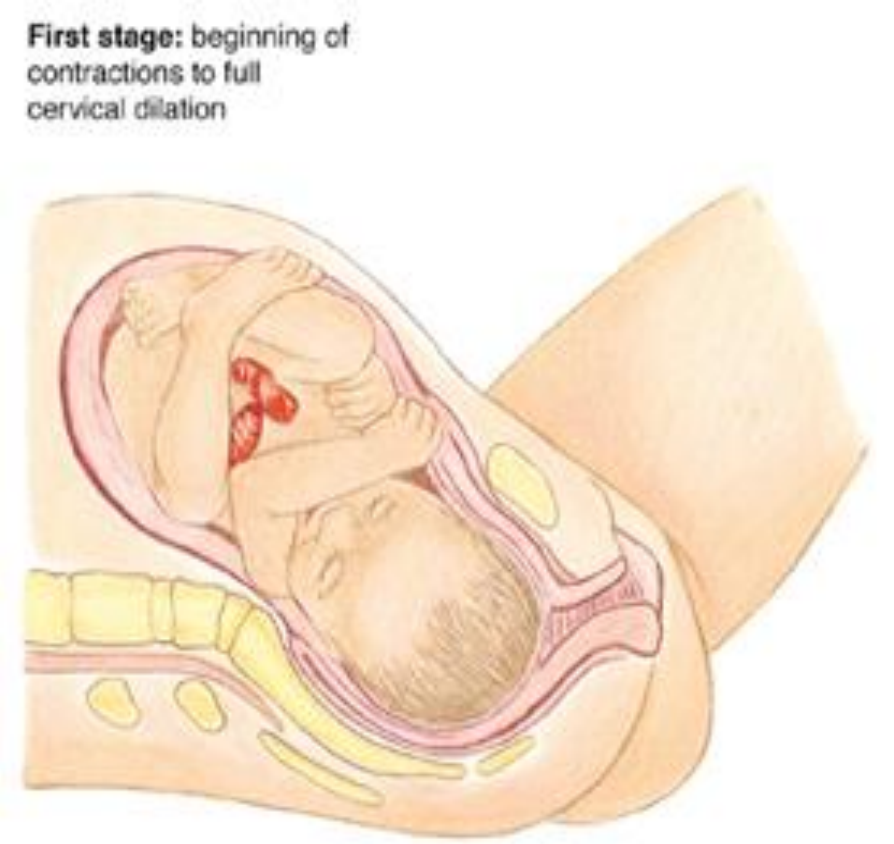
Delivery

- Avoid delivery in the field if possible
- Try to control the delivery so that the head does not “pop” out
- Double clamp the cord and cut

Delivery

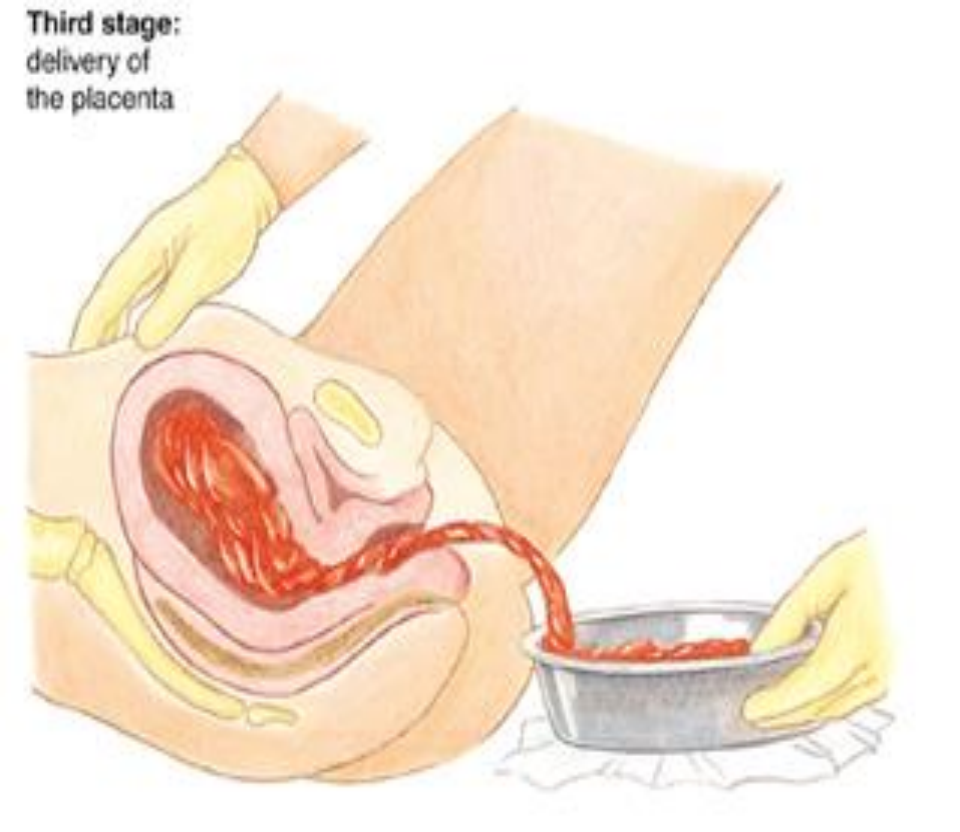
- Placenta usually detaches and delivers shortly after the baby or up to 30 minutes
- Do not pull on cord! Will break!!
- Wrap up baby and place on mother's chest if feasible

Vertex Delivery



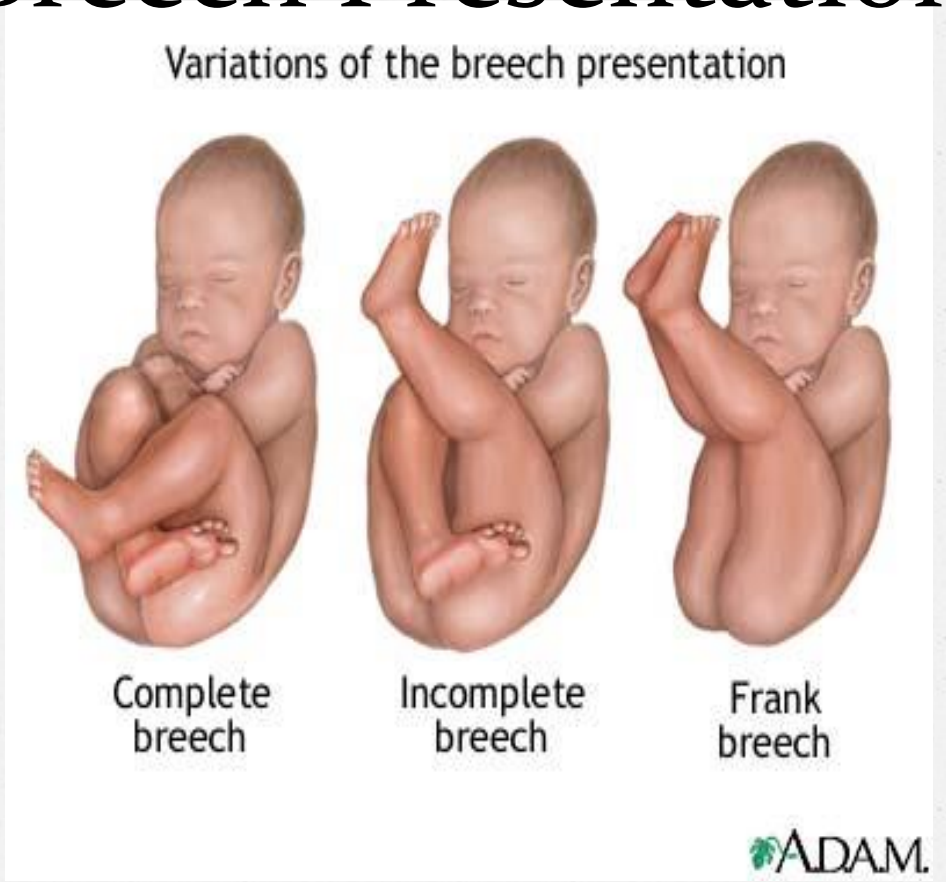
Vertex Delivery

Vertex Delivery

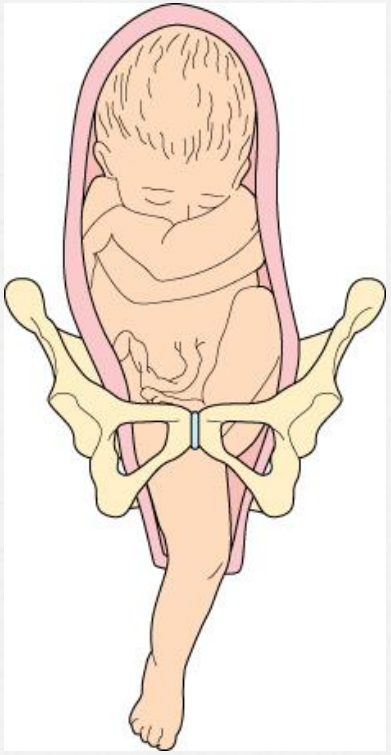


Non-vertex Delivery

Breech Presentation



Breech Presentation



Footling breech

Breech Delivery

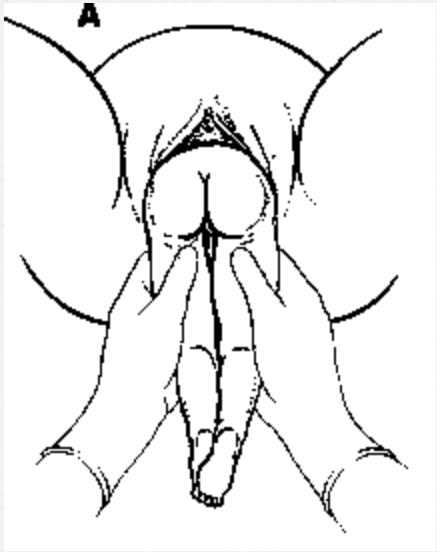
- If at all possible, delay delivery in field
- Best outcome is hospital delivery by experienced OB, not ER provider
- If unable to delay, obtain maternal assistance if she is able
- Place patient on raised surface with pelvis at end of stretcher if possible

Wait until presenting part is beyond introitus and gently guide

Deliver both legs

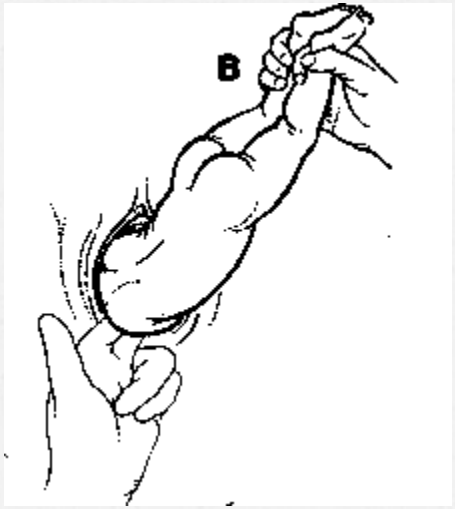
May need to reach into vagina and grasp leg and pull out

Breech Delivery



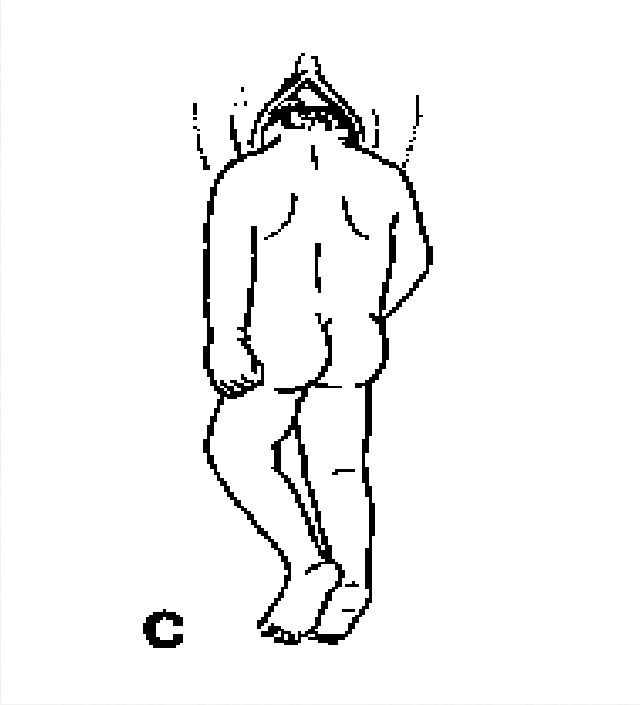
Support body while delivering arms

Breech Delivery



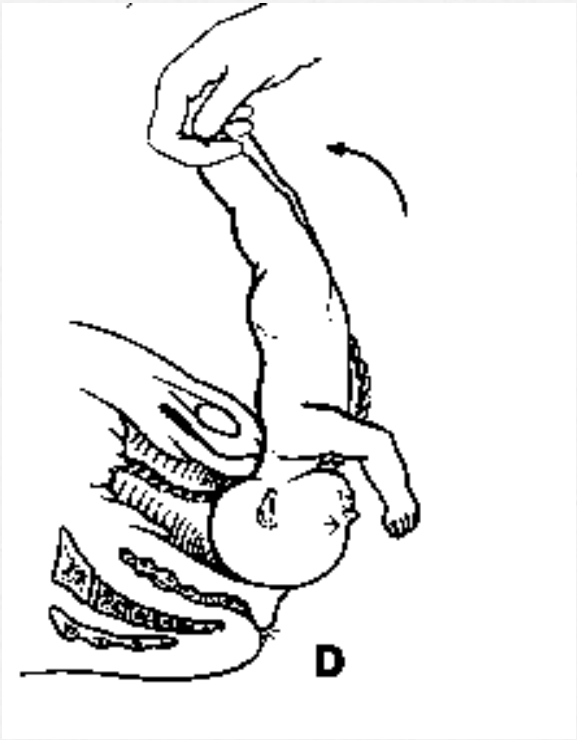
Support body until head/neck is showing

Breech Delivery



While supporting baby, let the baby drop downward to deliver the back of the head

Breech Delivery



Then grasp both legs and pull the body upward to deliver the rest of the head

Postpartum Hemorrhage

- Don’t forget that all women who have just delivered are at risk of postpartum hemorrhage

Conclusion

- Trauma is leading cause of non-obstetric maternal mortality
- Follow basic guidelines of trauma evaluation and resuscitation
- Be mindful of special considerations in the pregnant trauma victim
- Remember that you have TWO victims

Goals

- Save the mother!!
- Save the fetus if possible!