Trauma and Pregnancy

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Trauma and Pregnancy

• ATLS Protocol the same
• Physiologic and Anatomic changes of pregnancy change the pattern of injury and the physiologic response to injury
• Two patients requiring treatment!!!
Anatomic Changes

16 weeks

- Tomato Size
- Growing still
- a medium tomato
- but not quite ready for
- sculpting with play dough

Week #16
- Approx. 4 1/2 oz.
- 6 inches long
- Baby completely formed
- Placenta is starting to work

24 weeks

- Eggplant Size
- Baby’s moving
- more and more,
- like a living eggplant
- pounding at the door

Week #24
- Approx. 1 1/4 lbs.
- 13 inches long
- Baby is still very thin
- but growing longer
- Baby can suck its
- thumb and hiccup

32 weeks

- Honeydew Size
- The sweetest melon
- anywhere. Is it ripe yet?
- Are we there?

Week #32
- Approx. 3 1/2 lbs.
- 16 inches long
- Baby is perfectly formed
- Lungs have developed
- Placenta has reached
- maturity

http://www.bellaonline.com/articles/art7113.asp
Changes in Blood Volume and Composition

- 40% increase in blood volume
- 25% increase in red cell mass
- Relative anemia (Hct 31-35)
- The mother may lose up to 1500 cc of blood without hemodynamic instability BUT the fetus may be in SHOCK!!!!
Changes in Blood Volume and Composition

- White Blood Count elevated in pregnancy (15,000)
- Fibrinogen and clotting factors increased
- Albumin level 2.2-2.8
Hemodynamic Changes in Pregnancy

• Cardiac Output is increased by 1.0-1.5 liters/minute after the 10\textsuperscript{th} week of pregnancy

• Hypotension may be due to vena caval compression by the uterus—Place patient left side down!!
Hemodynamic Changes in Pregnancy

- Heart rate increases 10-15 beats/minute—consider “tachycardia of pregnancy” when evaluating Heart Rate during Stage “C” of the Primary Survey.
Blood Pressure

- Should be relatively normal.
- If patient is hypotensive, turn patient to the left thereby releasing uterine pressure from the vena cava decreasing venous return to the heart.
- Treat hypotension with aggressive fluid resuscitation if blood pressure does not improve rapidly.
Venous Pressure

- CVP variable
- Venous hypertension in lower extremities
Respiratory Changes

- Increased $O_2$ Consumption
- Elevated diaphragm
- 30-40% increase in tidal volume and minute ventilation
- $PaCO_2 = 30-35$ mm Hg
- Intubation may be challenging b/o airway edema
- Relaxed LES + Delayed Gastric Emptying = Increased Risk of Aspiration
Renal Function

- Glomerular Filtration Rate increased in pregnancy
- BUN and Creatinine decrease in pregnancy
- Glycosuria common
- Mild hydronephrosis a physiologic response to uterine compression of the ureters
Musculoskeletal

• Symphysis pubis widens by the 7\textsuperscript{th} month. Sacroiliac joint spaces increase – may create confusion in interpretation of Pelvic X-rays
Eclampsia

• Seizures
• Hypertension, hyperreflexia, proteinuria, peripheral edema
• May mimic Head Injury in the Trauma Patient!!
Thrombotic Disease and Pregnancy

- Pregnancy may induce a hypercoagulable state
  - Increased activity of Clotting Factors
  - Decreased Fibrinolysis
- Venous Hypertension due to Uterine Pressure on the Inferior Vena Cava
- Incidence of DVT of 0.1-0.2%
- Lower Extremity Sequential Compression Compression Devices recommended
- Heparin and Low Molecular Heparin ok in pregnancy
- Coumadelin CONTRAINDICATED because of severe fetal malformations
Anesthetic Considerations

- Teratogenicity of Anesthetic Agents
- Anesthetic Drugs and Maternal Physiology
Scoring System for Medication Teratogenicity

- **A** Safety established by human studies
- **B** Presumed safety established by animal studies
- **C** Uncertain safety: no human or animal studies show teratogenicity
- **D** Unsafe: evidence of risk which may be justified in certain clinical circumstances
- **X** Highly Unsafe
Teratogenicity and Anesthetics

- Almost all anesthetic drugs are Category C drugs. No anesthetic drugs have been listed as definitely teratogenic
Anesthetic Drugs and Maternal Physiology

- Paralytic drugs do NOT cross the placenta
- Drugs used in Anesthesia are (with reasonable certainty) safe in pregnancy
  - Inhalation anesthetics
  - Local anesthetics
  - Muscle relaxants
  - Narcotics
  - Benzodiazepines

Radiology, Trauma and Pregnancy

Benefits to the Mother outweigh small risks to the fetus
Radiation Risk to Fetus

- Teratogenicity
- Birth Defects (not proven)
- Increased Lifetime risk of malignancy
Radiation Exposure

• Measurement
  – Rad (radiation absorbed dose)
  – Grey (1 rad = 1 centiGy; 100 rads = 1 Gy)

• Greatest effects of radiation exposure occur between conception and week 25
  – Radiation injury during weeks 1-3 results in death of the implant or embryo
  – Radiation during weeks 8-25 affect CNS
    ➢ 10 rads may result in decreased IQ
    ➢ 100 rads may result in severe mental retardation

Radiation Exposure

- After 25 weeks, greatest risk is childhood hematologic malignancy
  - Background incidence is 0.2-0.3%
  - Risk increases to 0.3-0.4% if exposure > 1 Gy
  - Risk increases by 0.06% per 1 Gy of fetal exposure
- Risk negligible < 5 rads exposure
- Risk increases > 15 rads exposure
- Most diagnostic procedures have no measurable risk
- Therapeutic Procedures have greatest risk

## Approximate Fetal Radiation Dose

<table>
<thead>
<tr>
<th>Study</th>
<th>Dose (rads)</th>
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<tbody>
<tr>
<td>Chest X-ray</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Pelvis</td>
<td>0.04</td>
</tr>
<tr>
<td>CT Head</td>
<td>&lt;0.05</td>
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<tr>
<td>CT Chest</td>
<td>0.01-0.2</td>
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<tr>
<td>CT Abdomen</td>
<td>0.8-3.0</td>
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<tr>
<td>CT Pelvis</td>
<td>2.5-7.9</td>
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<tr>
<td>Spine series</td>
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<tr>
<td>9 month background dose</td>
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</table>
Primary Survey

Airway: as per all patients
Breathing: High diaphragms in late stages of pregnancy
Circulation: If low risk of spinal injury, nurse left side down

REMEMBER: THE PREGNANT PATIENT CAN LOSE A LOT OF BLOOD BEFORE ABNORMAL BP AND PULSE!!!
Additional Monitors

- Fetal Heart Monitoring
- Fetal Ultrasound
- Maximum fetal radiation dose = 5 rads
Fetomaternal Hemorrhage???

- Kleihauer-Betke Test: used to detect fetal cells in the mother’s serum
- If mother is Rh negative and possible fetomaternal hemorrhage: give Rh immunoglobulin even if Kleihauer-Betke Test negative.
Primary Concerns with Blunt Abdominal Trauma

- **Abruptio Placenta**
  - Leading cause of fetal death in injured mother
  - DIC may occur

- **Ruptured Uterus**
  - 0.6% of blunt abdominal trauma in pregnancy
Goals of Treatment of the Severely Injured Pregnant Patient

• Goal 1
  – SAVE THE MOTHER

• Goal 2
  – Save the Fetus if possible
Emergency Cesarean Section

• Limited Role

• Primarily in unstable mother who is not responding to Fluid Management given in the Primary Survey

• Little role for perimortem cesarean section if mother has been in shock—the fetus has already been severely hypoperfused for a long period of time!!!!
Summary

- Primary Survey
- Stage of Resuscitation
- Secondary Survey
- SAVE THE MOTHER FIRST!!!
- Limit fetal radiation to 5 rads
- Limited role for emergency cesarean section