Acute Surgery in Pregnancy

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Gynecologist & Obstetrician
Structure of presentation

- Burden of problem
- Main Challenges/differences with non pregnant
- Imaging studies: concerns/alternatives
- Appendicitis:
  - Current surgical approach
- Cholecystitis:
  - Current surgical approach
- Obstetrical input perioperative
Case presentation

• 30 yo, nil PMH
• Primigravida 35 wk uneventful
  – since 12 hrs c/o: nausea and vomiting
  – Right sided pain
  – Normal bowel motions
• P/Ex HR:130 BP 120/60 T: 37.5
• No guarding, maximum pain 6 cm BRCM
• PR: (-) PV(-)
Magnitude of the problem

- Abdominal surgery: up to 1% of pregnancies (USA)\(^1\)
- Acute abdomen: 1/500-635 preg \(^2\)

Appendicitis

Acute cholecystitis

Bowel obstruction

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Main challenges

• Differential diagnosis:
  – w/ob -gyn source
  – Anatomic/physiologic changes

• Workup
  – Potential risks of imaging

• Timing

• Surgical approach
  – Lpc/open

• Obstetrical input
Differential Diagnosis challenges

Causes:
1. INCIDENTAL
2. ASSOCIATED
3. DUE TO PREGNANCY

Non-specific S&S
Anatomic /physiologic alterations
RUQ Differential

- GORD
- PUD
- Acute pancreatitis
- Acute cholecystitis/biliary cholic
- Hepatitis
- Pylonephritis
- Pneumonia
- Acute appendicitis
RUQ Differential

- GORD
- PUD
- Acute pancreatitis
- Acute cholecystitis/biliary cholic
- Hepatitis
- Pylonephritis
- Pneumonia
- Acute appendicitis
- Acute fatty liver of pregnancy
- HELLP
- Ectopic
- Round ligament sd
- Abruptio plac
- Uterine rup
- Ov vein thromboflebitis
Physiologic Changes

Increased:
- Minute ventilation
- Heart rate and cardiac output
- Blood volume
- Glomerular filtration rate
- Gastric emptying time

Decreased:
- $pCO_2$
- Haematocrit
- Acid production
Lab results

- WBC: 12000
- Bili: 1  Alc Phos: 50
- BUN 40 creat:1.4
- UA: (-)

- Now what???
Imaging
Imaging

- Ultrasound
- MRI
- Xrays:
  - Plain films
  - CT

Concerns??
RISKS OF RADIATION EXPOSURE

• Potential biological effects of in utero radiation exposure of developing fetus include:
  – prenatal death
  – intrauterine growth restriction
  – small head size
  – mental retardation
  – organ malformation
  – childhood cancer

• Belief that any radiation exposure to the fetus is harmful → anxiety about imaging
FETAL RADIATION RISKS

• Occur throughout pregnancy
• Related to stage of pregnancy, absorbed dose
• Greatest during organogenesis and early fetal period, less in 2nd trimester and least in 3rd
# MEASURES OF IONISING RADIATION

<table>
<thead>
<tr>
<th>Measure</th>
<th>Definition</th>
<th>Unit</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure</td>
<td>No. of ions produced/kg of air</td>
<td>Roentgen (R)</td>
<td>R</td>
</tr>
<tr>
<td>Dose</td>
<td>Energy/kg of tissue</td>
<td>Rad (rad)</td>
<td>Gray (Gy) = 100rad</td>
</tr>
<tr>
<td>Relative effective dose</td>
<td>Energy deposited/kg of tissue normalised for biological effectiveness</td>
<td>Roentgen equivalents man (rem)</td>
<td>Sievert (Sv)</td>
</tr>
</tbody>
</table>
# Fetal Effects from Low-Level Radiation Exposure

<table>
<thead>
<tr>
<th>Effect</th>
<th>Most Sensitive Period after Conception (d)</th>
<th>Threshold Dose at Which an Effect Was Observed (mGy)</th>
<th>Absolute Incidence</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prenatal death</td>
<td>0–8</td>
<td>ND</td>
<td>ND</td>
<td>If the conceptus survives, it is thought to develop fully, with no radiation damage.</td>
</tr>
<tr>
<td>Preimplantation</td>
<td></td>
<td>50–100</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>Postimplantation</td>
<td></td>
<td>250</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>Growth retardation</td>
<td>8–56</td>
<td>10</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Organ malformation†</td>
<td>14–56</td>
<td>250</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>Small head size</td>
<td>14–105</td>
<td>100</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>Severe mental retardation</td>
<td>56–105</td>
<td>ND</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Reduction of IQ</td>
<td>56–105</td>
<td>ND</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Childhood cancer</td>
<td>0–77 (first trimester)</td>
<td>No threshold observed</td>
<td>No threshold observed</td>
<td>0.017%†</td>
</tr>
</tbody>
</table>

Atomic bomb survivors who received >200 mGy were 2–3 cm shorter and 3 kg lighter than controls and had a head circumference 1 cm smaller. About 25% of children with small head size were mentally retarded. No increase in absolute incidence was observed for exposure in the first 7 weeks or after the 25th week. Effects from a dose of 100 mGy or less were statistically unrecognizable. At 100 mGy or more, the IQ reduction was 0.025 points per milligray.
TERATOGENESIS

• Threshold radiation dose below which no teratogenic effects occur is unknown
  – estimated range 0.05–0.15Gy (5 to 15 rad)
CARCINOGENESIS

- Baseline risk of fatal childhood cancer
  - 1 in 1,000
- Relative risk after 0.05Gy (5 Rad )= 2
- Pelvic CT \(\rightarrow\) 0.02 – 0.05Gy
- Odds of dying from childhood cancer \(\rightarrow\)
  2 in 1,000
### Fetal Radiation Doses from Standard Xrays

#### Table 3

<table>
<thead>
<tr>
<th>Examination</th>
<th>Typical Conceptus Dose (mGy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical spine (AP, lat)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Extremities</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Chest (PA, lat)</td>
<td>0.002</td>
</tr>
<tr>
<td>Thoracic spine (AP, lat)</td>
<td>0.003</td>
</tr>
<tr>
<td>Abdomen (AP)</td>
<td></td>
</tr>
<tr>
<td>21-cm patient thickness</td>
<td>1</td>
</tr>
<tr>
<td>33-cm patient thickness</td>
<td>3</td>
</tr>
<tr>
<td>Lumbar spine (AP, lat)</td>
<td>1</td>
</tr>
<tr>
<td>Limited IVP*</td>
<td>6</td>
</tr>
<tr>
<td>Small-bowel study†</td>
<td>7</td>
</tr>
<tr>
<td>Double-contrast barium enema study‡</td>
<td>7</td>
</tr>
<tr>
<td>Examination</td>
<td>Dose Level</td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Extra-abdominal</td>
<td></td>
</tr>
<tr>
<td>Head CT</td>
<td>Standard</td>
</tr>
<tr>
<td>Chest CT</td>
<td></td>
</tr>
<tr>
<td>Routine</td>
<td>Standard</td>
</tr>
<tr>
<td>Pulmonary embolus</td>
<td>Standard</td>
</tr>
<tr>
<td>CT angiography of coronary arteries</td>
<td>Standard</td>
</tr>
<tr>
<td>Abdominal</td>
<td></td>
</tr>
<tr>
<td>Abdomen, routine</td>
<td>Standard</td>
</tr>
<tr>
<td>Abdomen/pelvis, routine</td>
<td>Standard</td>
</tr>
<tr>
<td>CT angiography of aorta (chest through pelvis)</td>
<td>Standard</td>
</tr>
<tr>
<td>Abdomen/pelvis, stone protocol*</td>
<td>Reduced</td>
</tr>
</tbody>
</table>

*Anatomic coverage is the same as for routine abdominopelvic CT, but the tube current is decreased and the pitch is increased because standard image quality is not necessary for detection of high-contrast stones.
Conventional Radiographs

Average plain films: 0.43 mGy (0.043 rad)
Fetus in beam: 3.24 mGy
Fetus NOT in beam: 0.01 mGy

CT scan

- Multiple studies highly sensitive for appendicitis (lower in obstetric population)
Ultrasound

- Good for RUQ evaluation in 1\textsuperscript{st} T, very limited for 2\textsuperscript{nd} and 3\textsuperscript{rd} T
- For appendix depends on trimester
- S: 67-100% $\rightarrow$ (-) test do not exclude it
MRI

• Appendicitis: Se: 100% Sp: 93%
• Concerns about Gd (ACR guidelines)
MRI IN PREGNANCY

• Children who were exposed to MRI in utero at 1.5 Tesla do not demonstrate exposure-related negative outcomes at 9 months and up to 9 years

• A small number of animal studies raised the possibility of teratogenic effects of MRI exposure in early pregnancy
MRI IN PREGNANCY

• Possible mechanisms:
  – heating effect of magnetic resonance gradient changes
  – direct nonthermal interaction of the EM field with biological structures.
  – tissue heating is greatest at maternal body surface negligible levels near body centre

• Unlikely that thermal damage to the fetus is a serious risk.
MRI IN PREGNANCY

• Potential risk of acoustic damage
“It is good practice to avoid MRI during pregnancy, particularly for elective studies or during the first trimester, but MRI remains preferable to any studies using ionizing radiation.”

Obstet Gynecol 2008;112:333
Other studies

Nuclear studies
• Radio pharmaceutical
• <0.5 rad to foetus

Cholangiogram
• 0.2-0.5 rad (IOC/ ERCP)
• Fluoroscopy up to 20 rad/min
• Use selectively
• Use shield
• No adverse effect reported
Acute Appendicitis

- 1/600-1400 deliveries (Prevalence similar gravid and non gravid population but higher risks of presentation with perforation)
- More in 2\textsuperscript{nd} T
- Most common surgery

- Clinical presentation: Similar to non pregnant
  - Pain
  - Vomit
  - Guarding

- Position of appendix at end of pregnancy
- LAB: leucocitosis, BR (perforation), microhematuria
Ruptured appendix

• 20-35% foetal mortality (older studies)
• 8% (recent studies)
• less frequent in 1\textsuperscript{st} T
Complications appendicitis

- PT labor/delivery
  - 22% after 23 weeks (in the 1\textsuperscript{st} week ONLY) study with >800 patients.
- Wound infection
- Sepsis
Timing

- Prompt diagnosis and treatment reduce morbidity and mortality (materno foetal)
- Reduce complications
Potential risks of...

- Operating
- Non Operating
LPC /open appendicetomy

• LPC accepted procedure for abdominal exploration
• Open over the point of maximum tenderness

• ATB?
• Tocholitics?
Acute cholecystitis

- 10-15% of population has GS
- 1-4% pregnant has GS in routine US
- 30% has sludge
- Acute cholecystitis Does NOT occur more freq in preg
- Decreased emptying
- GB volume x2 in 2-3T
- men v/s women
  - Estrogen:> cholesterol secretion
  - Progesterone:< soluble bile acid secretion
Complications

• Gangrenous Cholecystitis
• Cholangitis/pancreatitis (choledocolithiatis is uncommon)

• 45% Biliary Cholic
• 34% Cholecystitis
• 6% pancreatitis

Study with 122 patients 2009 (similar 72pat 94)
Treatment

• Early surgical management
• High relapse rate with NOM
  – 1T  92%
  – 2T  64%
  – 3T  44%
• Overall recurrence symptoms>50%
• 23 % develop acute cholecystitis/pancreatitis
Delay in surgical management

- Repeated ed visits
- Hospitalisation
- Abortion
- PT delivery
- CS

- Foetal mortality 7% NOM
- Foetal mortality 2.2% Op
ERCP

- Limited data
- 67 patients ERCP 16% pancreatitis, higher than general population
LPC

- Preferred approach to symptomatic GB disease
- Safe in any trim
- Benefits: same as non gravid
- No reports of foetal demise in any trim
- Less abortion and PT labor compared to open
Figure 1:
Laparoscopic Trocar Sites During Different Stages of Pregnancy

Trocar Sites: 2\textsuperscript{nd}/3\textsuperscript{rd} Trim.  Trocar Sites: 1\textsuperscript{st} Trim.  Trocar Sites: Late IUP/Chole

Trocar Sites can be on opposite side for Ovarian or Other Gynecologic Pathology
Single port?

Single-port laparoscopic appendectomy during pregnancy. Koh et al
OB involvement

• Consultation before or after surgery
• No routine tocolysis consider periop if signs of PT labor
RECOMMENDATIONS

• Be involved from the beginning
• Prompt surgical decision
• Discuss risks benefits with patient
• Involve OB
• LPC safe approach
Acute surgery in Pregnancy

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