Fetal Echogenicities
US and MRI

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Financial Disclosures

• No relevant financial relationships with any commercial interests.
• Goals and Objectives:
  – Review 3 most important group of “echogenicities” and their meaning
  – Identify abnormal echogenicities and their association with other disease processes
  – Illustrate how fetal MRI aids in the proper localization and diagnosis of echogenicities seen by US
1. Abdominal:
   - Bowel
   - Hepatic (Ca)
   - Peritoneal (Ca)

2. Cardiac:
   - Echogenic heart focus

3. Intracranial:
   - Calcifications (TORCH, teratomas)
   - Echogenicity
Echogenic bowel (EB)

- Subjective impression/ echo ≥ bone
- Second trimester
- 0.5% Pregnancies
- Pathology:
  - Abnormal meconium decreased water and or increased protein content
  - Swallowed blood due to intraamniotic hemorrhage
  - Bowel wall edema (Thalassemia)
  - Ischemia
### Causes of EB

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<th>Most common</th>
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| 2nd most common |

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Nyberg. Diagnostic imaging of fetal anomalies. 2003
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Meconium peritonitis is the most common cause of fetal intra-abdominal calcifications.

Nyberg. Diagnostic imaging of fetal anomalies. 2003
No shadowing / Mass-like
Nyberg’s grading system for echogenic bowel:

1. Grade 1: Mildly echogenic and typically diffuse
2. Grade 2: Moderately echogenic and focal
3. Grade 3: Very echogenic, similar to bone

- Grades 2 and 3 have increased risk of CF and aneuploidy
- EB + increased maternal AFP: IUGR, IUFD
- EB + abnormal Doppler: IUGR and IUFD

Echogenic bowel (EB) grading

- Grade 0: < Liver (normal)
- Grade 1: > Liver, < bone (normal)
- Grade 2: = Bone (potentially abnormal)
- Grade 3: > Bone (potentially abnormal)

- Focal EB more likely pathologic than diffuse EB

- High frequency probe may cause false EB
Mildly echogenic
Mass like
Echogenic = bone
• Impaction of thick and sticky meconium in the distal ileum
• Nearly all babies with MI have CF BUT only 10-15% of CF pt have meconium ileus. Varies with studies
• 8% fetuses with meconium peritonitis have CF
• CF- 1:2000-1:5000. European
• Carrier: 1/25
EB- Meconium ileus-CF

- US findings: EB 2 trimester, worsen dilatation towards 3 trimester
- Ddx: ileal atresia, T 21, Infection, bowel ischemia, swallowed blood
- **What to do?**
  - Look for associated anomalies (T21, CMV)
  - Mutation screen parents
  - Amniocentesis
  - Genetic counseling

Meconium Peritonitis

- Chemical peritonitis due to bowel perforation
- 1:35000
- *Peritoneal Ca* 85%: liver capsule (ddx with hep Ca)
- Ascites
- Meconium pseudocyst: irregular thick walls
- Dilated bowel → obstruction
- No dilatation when perforation is due to ischemia
Meconium Peritonitis

• Calcifications seen in 1-2 weeks of bowel perforation
• Pathology: ischemia or bowel anomalies leading to perforation (atresias, MI, volvulus)
• If dilated bowel → primary intestinal problem
• Look for infection → vasc compromise → perforation
Meconium Peritonitis

- Type I (large meconium ascites)
- Type II (large pseudocyst), or
- Type III (intra-abdominal calcifications and/or resolving ascites or shrinking pseudocyst)

Tseng et al., 2003
Meconium Peritonitis

• **TO LOOK FOR IN US:**
  – Ascites: 1st sign
  – Calcifications: liver capsule, scrotum, bowel surface
  – Dilated bowel: not seen if due to ischemia
  – Meconium pseudocyst: calcify. Other cysts don’t
  – May resolve in follow up studies
  – May worsen with increasing bowel dilatation
• Prognosis:
  – Spontaneous resolution
  – Late preg detection: significant bowel pathology
  – Neonatal diagnosis: worse prognosis, mortality morbidity CF

• Fetal tto: fetal paracentesis, drainage of pseudocyst. Injection urinary trypsin inhibitor
Enteroliths

- Calcified intraluminal meconium
- Move within bowel lumen: “marbles”
- Seen with vesicoenteric fistula- anal atresia
32w6d fetus with L-CDH and calcified intracolonic meconium
L-CDH, dilated colon with high T2 signal and internal debris, lower than expected T1 signal and abrupt termination above perineum
No anal sphincter
Hepatic Calcifications

- 1:1700
- 1/3 isolated – 2/3 associated with anomalies
- Main distinction with hepatic capsular surface
- Ddx: infection, tumors, vascular ca and fetal aneuploidy
- US: usually don’t shadow
- Infection: CMV, Toxo, parvo, varicella
- Look for associated bowel abnormalities-gallstones
Echogenic Intracardiac Focus (EIF)

- Focal structure in the ventricles with similar echogenicity as that of bone
- In 0.5-20% pregnancies
- Microcalcification within papillary muscle
- Prenatal resolution (~59%)
- Trivial abnormalities seen at postnatal ECHO: MV prolapse; mild PV regurgitation; mild TV regurgitation

EIF

- Small (< 3 mm)
- 78% left, 18% right, 4% bilateral
- Multiple large and bilateral ECF have ↑ risk for aneuploidy compared to single ECF
- Ddx: echogenic masses in heart; Atrioventricular (AV) septal defect. Valve remnants can mimic ECF
- *If isolated, no genetic testing usually warranted*
Decrease persistence of EIF with age

Most regress by 5 yo

Studies have shown no association with significant heart disease or other extra cardiac anomalies.

Yes, there is mild association with T21 in high risk pregnancies but not in low risk pregnancies.

High risk: maternal age > 35 yr, increased trisomy 18 or 21 risk by maternal serum screening.

Intracranial Calcifications

• Causes:
  – TORCH: Toxo, CMV, Syphillis, Varicella, Parvovirus, HSV II, Rubella
  – Hemorrhage
  – Teratoma

• May be subtle/ non-shadowing

• Infectious Ca: associated with intra-hepatic Ca and other abnormalities
Intracranial Calcifications

- **CMV** + Common cong infection worldwide (2.2%)
- **CNS:**
  - Periventricular Calcifications
  - Ventriculomegaly
  - Microcephaly
  - Intraparenchymal cysts
  - Cortical dysplasia
  - Posterior fossa abnormalities
- Additional extra-cranial findings: EB, Heart, Hydrops, IUGR
- Absent of fetal US findings: neurologic sequela in up to 30%
Intracranial Calcifications

- **Toxo**: Ca may be PV or random in location + ventriculomegaly
  - IUGR
  - EB
  - 1\textsuperscript{st} T infection: abortion or severe infection
  - 2\textsuperscript{nd} T: high rate of infection but less severe
  - Sequela of congenital infection: blind, epilepsy, mental retardation
Intracranial Calcifications

• **Varicella**: Transplacental infection of fetus following maternal chickenpox infection
  – Intrahepatic + Intracranial Ca
  – Polyhydramnios: swallowing impaired
  – Limb contractures/hypoplasia
  – Skin lesions following dermatome at birth

• **Teratoma**:
  – Most common brain fetal tumor
  – Large, destructive
  – Could be extension of facial/neck teratoma
  – Calcifications not always present like in other teratomas
33 week male fetus with congenital CMV
Postnatal imaging at 2 days of life
Intracranial Echogenicities
Donor
1. **Abdominal:**
   - **Bowel:** LOOK FOR OTHER SIGNS OF underlying infectious/inflammatory/Ischemic/CF/Hemorrhagic process
   - **Hepatic:** Idiopathic/underlying infection. LOOK EVERYWHERE

2. **Cardiac:** Unless signs of Trisomy ➔ not very concerning

3. **Intracranial:** Search everywhere else. Do fetal MRI to rule out more serious process
THANK YOU

Some images are courtesy of Drs. Meholling-Ray, Chapman, Kline-Fath, and Cassady