ISUOG Basic Training
Examining the Abdomen & Anterior Abdominal Wall
Learning objectives

At the end of the lecture you will be able to:

• Describe how to obtain the two planes required to assess the fetal abdomen & anterior abdominal wall correctly

• Recognise the differences between the normal & most common abnormal ultrasound appearances of the abdomen & anterior abdominal wall
1. What are the key ultrasound features of plane 11?
2. What are the key ultrasound features of plane 12?
3. What probe movements are required to move from plane 11 to plane 12?
4. Which abnormalities should be excluded after correct assessment of planes 11 & 12?
## The 20 + 2 planes

<table>
<thead>
<tr>
<th>Anatomical area</th>
<th>Plane</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overview 1</td>
<td>Sweep 1</td>
<td>Longitudinal head &amp; body for initial orientation</td>
</tr>
<tr>
<td>Spine</td>
<td>1</td>
<td>Sagittal complete spine with skin covering</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Coronal complete spine</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Coronal section of body</td>
</tr>
<tr>
<td>Head</td>
<td>4</td>
<td>Transventricular plane*</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Transthalamic plane*</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Transcerebellar plane*</td>
</tr>
<tr>
<td>Thorax</td>
<td>7</td>
<td>Lungs, 4 chamber view of heart</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Left ventricular outflow tract (LVOT)</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Right ventricular outflow tract (RVOT) &amp; crossover of LVOT</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>3 vessel trachea (3VT) view of heart</td>
</tr>
</tbody>
</table>

* measurement required
## The 20 + 2 planes

<table>
<thead>
<tr>
<th>Anatomical area</th>
<th>Plane</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdomen</td>
<td>11</td>
<td>Transverse section of abdomen with stomach &amp; umbilical vein*</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>Transverse section of abdomen at cord insertion</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Transverse section(s) of left kidney &amp; pelvis, right kidney &amp; pelvis</td>
</tr>
<tr>
<td>Pelvis</td>
<td>14</td>
<td>Transverse section of pelvis, bladder, both umbilical arteries</td>
</tr>
<tr>
<td>Limbs</td>
<td>15</td>
<td>Femur diaphysis length*</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>3 bones of both legs, both feet &amp; normal relationships to both legs</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>3 bones of both arms, both hands &amp; normal relationships to both arms</td>
</tr>
<tr>
<td>Face</td>
<td>18</td>
<td>Coronal view of upper lip, nose &amp; nostrils</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>Both orbits, both lenses</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>Median facial profile</td>
</tr>
<tr>
<td>Overview 2</td>
<td>Sweep 2</td>
<td>Transverse sweep of body from neck to sacrum, one vertebra at a time</td>
</tr>
</tbody>
</table>

* measurement required
# Moving through the 20 planes

<table>
<thead>
<tr>
<th>Plane</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>3 vessel trachea (3VT) view of heart</td>
</tr>
<tr>
<td>11</td>
<td>Transverse section of abdomen with stomach &amp; Umbilical vein*</td>
</tr>
<tr>
<td>12</td>
<td>Transverse section of abdomen at cord insertion</td>
</tr>
<tr>
<td>13</td>
<td>Transverse section(s) of left kidney &amp; pelvis, Right kidney &amp; pelvis</td>
</tr>
<tr>
<td>14</td>
<td>Transverse section of pelvis, bladder, Both umbilical arteries</td>
</tr>
</tbody>
</table>

* measurement required

From plane 10 to 11 - slide
From plane 11 to 12 – slide
## Requirements from each plane

<table>
<thead>
<tr>
<th>Plane</th>
<th>Description</th>
<th>Structures to be evaluated(^{2,3,4})</th>
<th>Measurement(^{1,2}) &amp; criteria for referral</th>
<th>Abnormalities that can be excluded from the normal appearances of the section</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Transverse section of abdomen with stomach &amp; umbilical vein</td>
<td>Abdominal situs Abdominal circumference (AC) section</td>
<td>AC, Refer if AC outside normal range of size chart</td>
<td>Abnormal abdominal situs Small/absent stomach (oesophageal atresia without fistula) Duodenal atresia Ascites Skin oedema</td>
</tr>
<tr>
<td>12</td>
<td>Transverse section of abdomen at cord insertion</td>
<td>Cord insertion</td>
<td></td>
<td>Omphalocele Gastrochisis</td>
</tr>
</tbody>
</table>

ISUOG Education Committee recommendations for basic training in obstetric & gynecological ultrasound, UOG, 2014, 43: 113-116
Practice guidelines for performance of the routine mid trimester scan, UOG, 2010, 37: 116-126
Sonographic examination of the fetal central nervous system, UOG, 2007, 29(1): 109-116
ISUOG Practice Guideline (updated): sonographic screening examination of the fetal heart, UOG, 2013, 41(3): 348-359
Recommended minimum requirements of basic mid-trimester fetal anatomical survey of the abdomen

- Stomach in normal position
- Bowel not dilated
- Both kidneys present
- Cord insertion site
  - Intact anterior abdominal wall
### Fetal abdominal planes

<table>
<thead>
<tr>
<th>Plane</th>
<th>Transverse view - axial plane</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Just below diaphragm; stomach and intrahepatic umbilical vein, (area for abdominal circumference)</td>
</tr>
<tr>
<td>12</td>
<td>Cord insertion (anterior abdominal wall)</td>
</tr>
</tbody>
</table>
Plane 11
Upper abdomen - stomach

Ultrasound features
• Transverse section of abdomen
• Umbilical vein at the level of the portal sinus (in the liver)
• Stomach bubble visualised on the left (situs)
• Kidneys should not be visible
Moving from planes 11 to 12
(stomach to cord insertion)

- Slide inferiorly from AC to sacrum
- Maintain cross sectional approach
- Cord inserts superior to bladder
Plane 11(stomach) - Upper abdomen

- stomach
- spine
- aorta
- inferior vena cava
- single rib
- umbilical vein (intra-hepatic)
- liver
Plane 11(stomach) - Upper abdomen

1. As circular as possible (rotate or angle)
2. Short length of umbilical vein / at level of portal sinus (usually rotate)
3. Stomach ‘bubble’ visualised (slide)
4. Kidneys should not be visible (slide)

This is the plane required for abdominal circumference (AC) measurement

http://www.brooksidepress.org/Products/OBGYN_101/MyDocuments4/Ultrasound/2nd_and_3rd_Trimester_Ultrasound_Scanning.htm
Calculation of abdominal circumference

- Outer surface of skin line
- Ellipse calipers
- Linear measurements
  - Anteroposterior diameter (APAD)
  - Transverse abdominal diameter (TAD)
  - Diameters 90° to each other, outer to outer

\[ AC = (APAD + TAD) \times 1.57 \]

ISUOG Practice Guidelines, UOG, 2011, 37:116-126
Plane 12 (cord insertion) - Ultrasound features

- Transverse view
- Spine
- Cord insertion at abdominal wall
- Above the urinary bladder
- Intact abdominal wall
Plane 12 (cord insertion) - Umbilical cord insertion

Colour Doppler showing cord insertion
Fetal abdomen organ situs

- Left & right axes
- Important for cardiac & abdominal abnormalities

[Image showing ultrasound scan with annotations: hrt left, st left, Spine, ceph]
Fetal abdomen organ *situs*

- Left & right axes
- Important for cardiac & abdominal abnormalities
### Sonographic definition of the fetal situs

**Right-hand rule of thumb for TA scanning**

<table>
<thead>
<tr>
<th>Hand</th>
<th>Fetus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dorsum</td>
<td>Back</td>
</tr>
<tr>
<td>Palm</td>
<td>Abdomen</td>
</tr>
<tr>
<td>Fist</td>
<td>Head</td>
</tr>
<tr>
<td>Thumb</td>
<td>Left</td>
</tr>
</tbody>
</table>

---


---

Physical features for situs inversus:

1. **Breech**
   - Thumb: Left
   - Fist: Left
   - Abdomen: Right

2. **Vertex**
   - Thumb: Right
   - Fist: Right
   - Abdomen: Left
Ultrasound assessment of fetal abdomen - stomach not seen

Normal amniotic fluid volume:
- Most likely transient emptying
- Not clinically significant
- Wait 30-60 minutes

While you wait, look around - the stomach may appear or be found elsewhere
Abnormal fluid collections

- Amniotic fluid volume

- Intra-abdominal:
  - Enlarged stomach
  - Dilated bowel loops
  - Cysts
  - Ascites
Polyhydramnios
Gastrointestinal obstruction

• Diaphragmatic hernia
• Esophageal atresia
  – Absent or persistently small
• Small bowel obstruction
  – Pyloric stenosis
  – Duodenal atresia
  – Jejunal atresia
Esophageal atresia

- 1:3,500 live births
- Low prenatal detection rate
- Polyhydramnios
- Absent or small stomach
  - Partial obstruction
  - Tracheoesophageal fistula
Abnormal stomach – double bubble

Duodenal atresia

• Most common perinatal intestinal obstruction
• 1:10,000 live births
• Trisomy 21 - 20-40%
• Increased perinatal morbidity & mortality

30 weeks

Stomach

Duodenum
Dilatation of small and large bowel

<table>
<thead>
<tr>
<th>Bowel</th>
<th>Upper limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>6 mm</td>
</tr>
<tr>
<td>Colon</td>
<td>20 mm</td>
</tr>
</tbody>
</table>
Hyperechoic bowel loops

- Idiopathic - normal variant
- Trisomy 21
- Infection
  - Cytomegalovirus
  - Parvovirus
  - Toxoplasmosis
- Meconium peritonitis
  - Cystic fibrosis

Clinically significant hyperechoic = *bright as bone*
Fetal abdominal cyst

Key to diagnosis - origin of cyst
- Reproductive ? Gender
- Bowel
- Mesentery
- Renal
- Biliary
- Other organ

Any cystic structure should prompt referral

Choledochal cyst
Abdominal wall defects- omphalocele

- Abnormal cord insertion
  - Cord inserts into apex of defect
  - Contains liver +/- bowel etc
  - Membrane covered
- Prenatal detection rate ~ 80%
- Abnormal karyotype ~ 50%
  - Trisomy 18
Physiological herniation
< week 12
Abdominal wall defect - omphalocele
Abdominal wall defect - gastroschisis
Abdominal wall defect - gastroschisis

- 1-6:10,000 live births
  - Young mothers
  - Normal karyotype
  - Majority isolated
  - Oligohydramnios
  - 10-15% late IUFD

- Normal cord insertion
  - Defect below & to right of cord insertion
  - Contains bowel only
  - Free floating

“Cluster of grapes”
Key points

1. Sliding from the chest to through the abdomen to the pelvis in a transverse view, document location of:
   - Fetal stomach
   - Absence of abnormal fluid collection in the abdomen
   - Both kidneys
   - Umbilical cord insertion into an intact abdominal wall

2. If the stomach is not seen, or found to be “small”, with normal amniotic fluid volume, most likely to be normal emptying - but wait 30-60 minutes & look again
Key points

3. An accurate measurement requires that the AC be imaged in the correct transverse plane, with correct caliper placement.

4. Prompt referral for detailed ultrasound should be initiated if:
   - Herniation of bowel after 12 weeks of gestation
   - Abnormal fluid collection(s), such as dilated bowel loops or enteric cyst, are seen
ISUOG Basic Training by ISUOG is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.

Based on a work at https://www.isuog.org/education/basic-training.html.

Permissions beyond the scope of this license may be available at https://www.isuog.org/