

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

Key questions

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

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

* measurement required

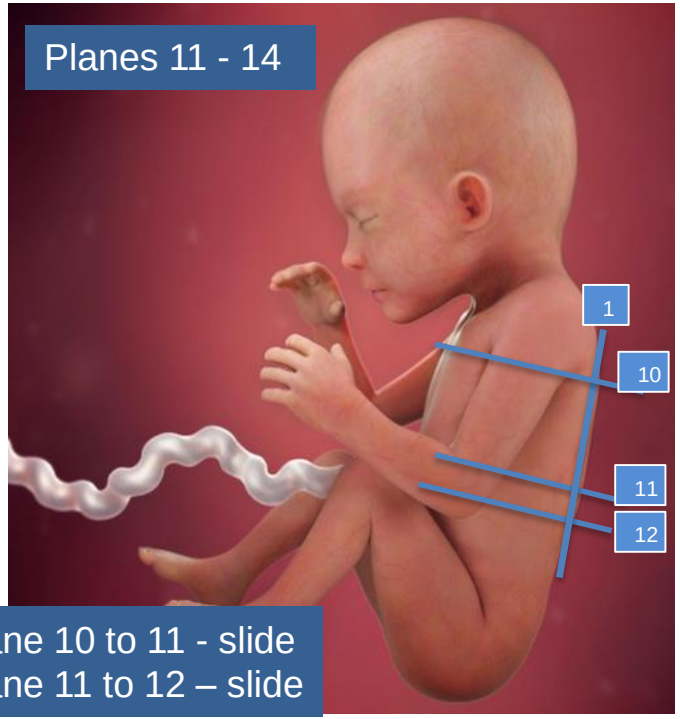
The 20 + 2 planes

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

* measurement required

Moving through the 20 planes

Plane	Description
10	3 vessel trachea (3VT) view of heart
11	Transverse section of abdomen with stomach & Umbilical vein*
12	Transverse section of abdomen at cord insertion
13	Transverse section(s) of left kidney & pelvis, Right kidney & pelvis
14	Transverse section of pelvis, bladder, Both umbilical arteries



From plane 10 to 11 - slide
From plane 11 to 12 – slide

* measurement required

Requirements from each plane

Plane	Description	Structures to be evaluated[2,3,4]	Measurement[1,2] & criteria for referral	Abnormalities that can be excluded from the normal appearances of the section
11	Transverse section of abdomen with stomach & umbilical vein	Abdominal situs Abdominal circumference (AC) section	AC, Refer if AC outside normal range of size chart	Abnormal abdominal situs Small/absent stomach (oesophageal atresia without fistula) Duodenal atresia Ascites Skin oedema
12	Transverse section of abdomen at cord insertion	Cord insertion		Omphalocoele Gastroschisis

1. ISUOG Education Committee recommendations for basic training in obstetric & gynecological ultrasound (UOG 2014; **43:** 113-116)
2. Practice guidelines for performance of the routine midtrimester scan (UOG 2010)
3. Sonographic examination of the fetal central nervous system (UOG 20007)
4. ISUOG Practice Guideline (updated): sonographic screening examination of the fetal heart (UOG 2013)

Recommended minimum requirements of basic mid-trimester fetal anatomical survey of the abdomen*

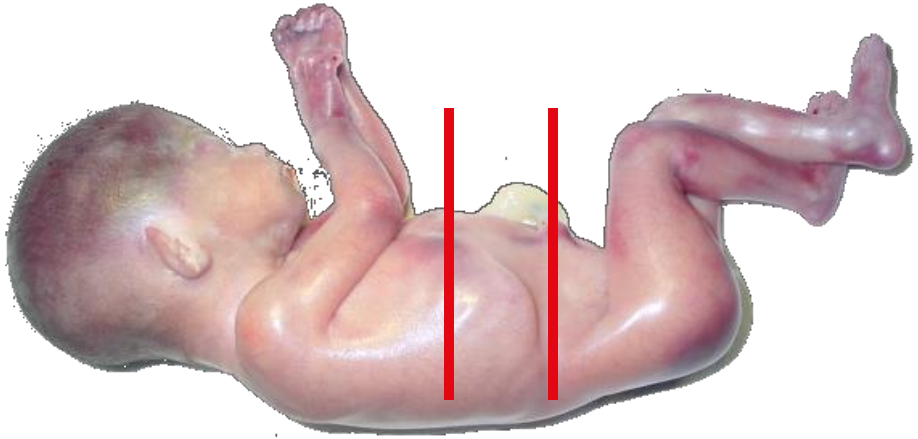
- Stomach in normal position
- Bowel not dilated
- Both kidneys present
- Cord insertion site
  - Intact anterior abdominal wall



Transverse sweep “pelvis to diaphragm”

*ISUOG Practice Guidelines. UOG 2011;37:116-126

Fetal abdominal planes



Plane	Transverse view - axial plane
11	Just below diaphragm; stomach and intrahepatic umbilical vein, (area for abdominal circumference)
12	Cord insertion (anterior abdominal wall)

Plane 11
Upper abdomen - stomach

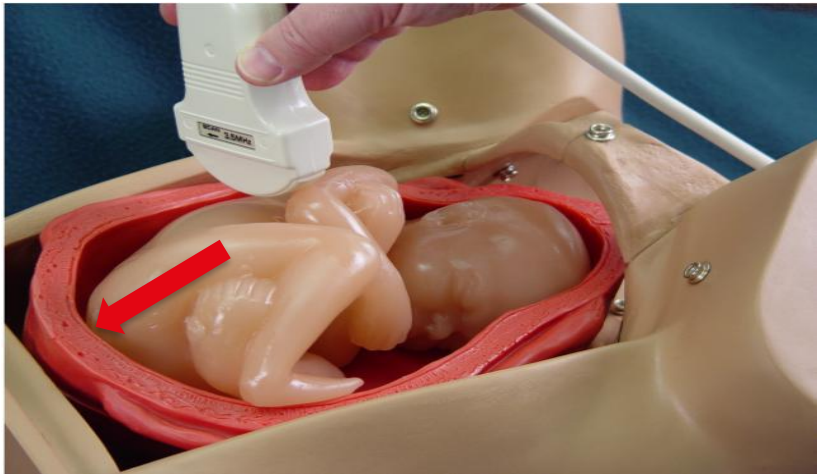
Ultrasound features

- 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



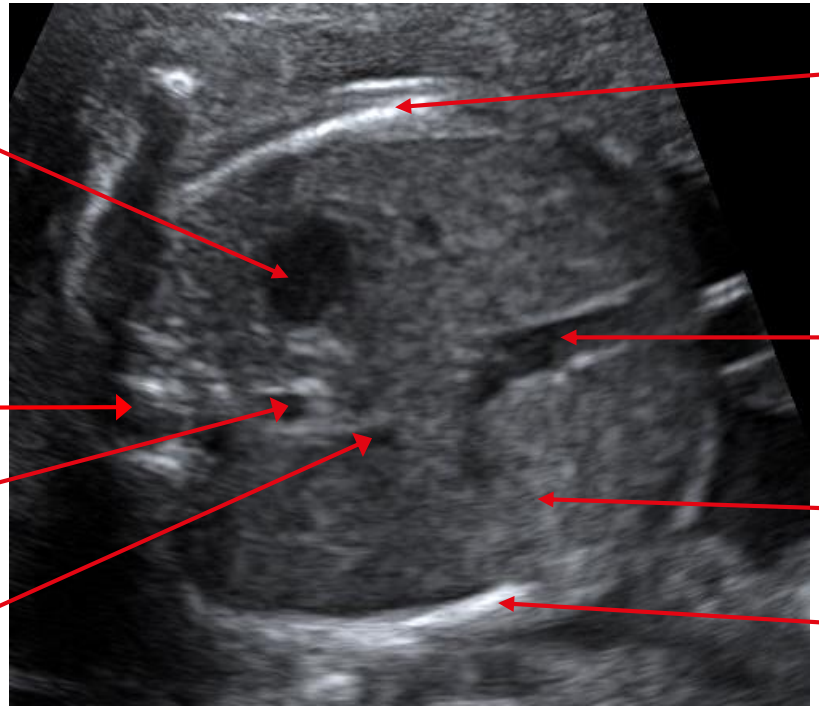
Moving from planes 11 to 12 (stomach to cord insertion)

- Slide inferiorly from AC to sacrum
- Maintain cross sectional approach
- Cord inserts superior to bladder

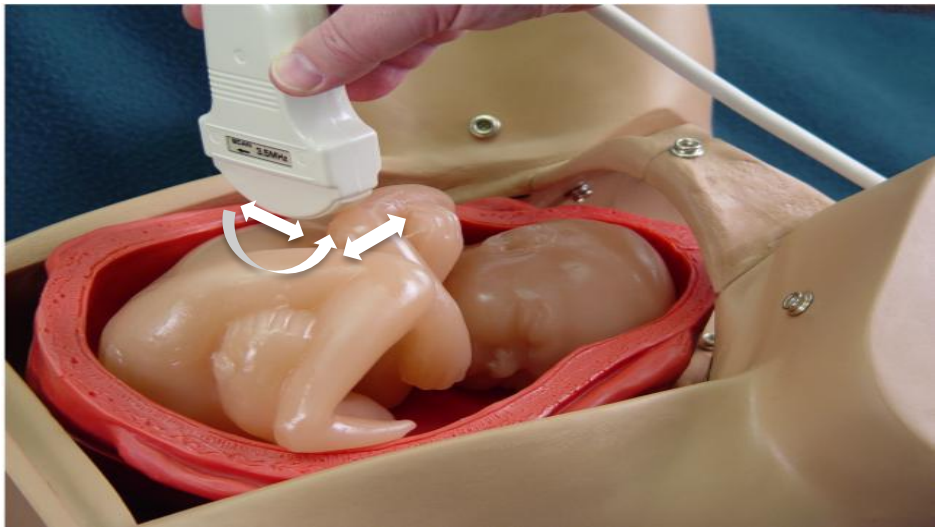




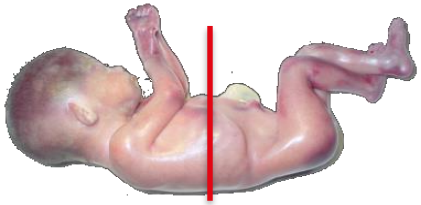
Plane 11
Upper abdomen - stomach



Plane 11 upper abdomen - stomach



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)*

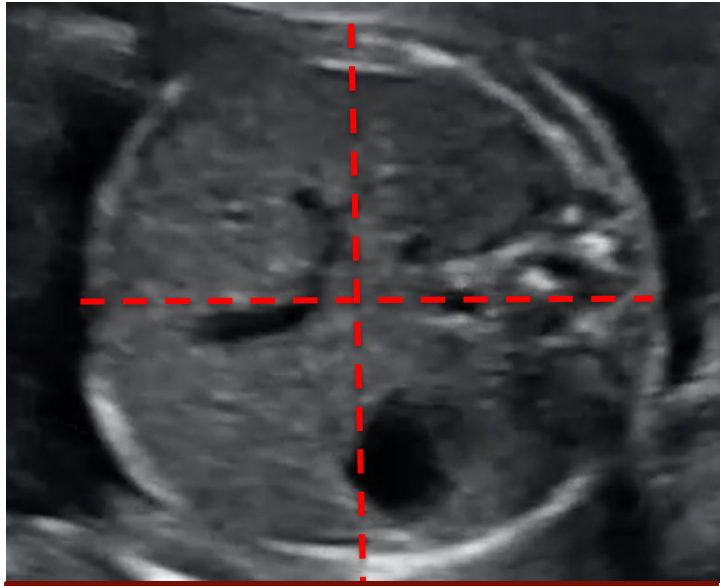


This is the plane required for abdominal circumference (AC) measurement

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 90^0 to each other, outer to outer

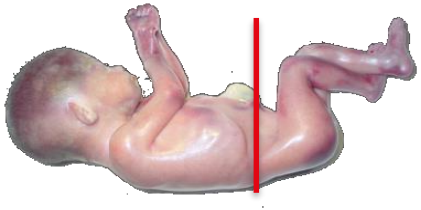


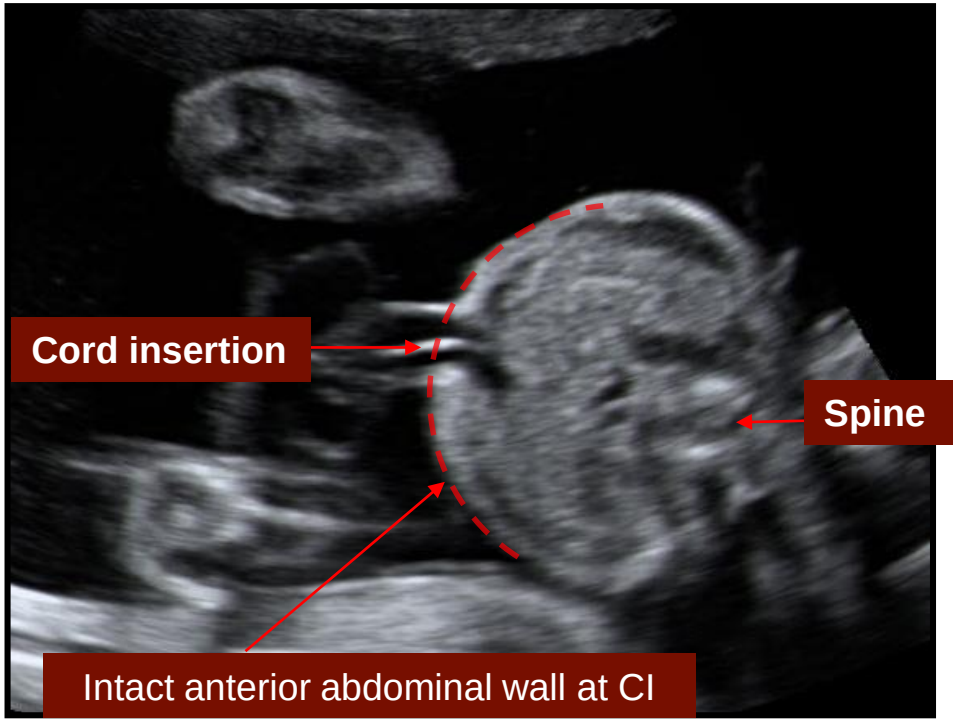
AC = (APAD + TAD) x 1.57

ISUOG Practice Guidelines. UOG 2011;37:116-126

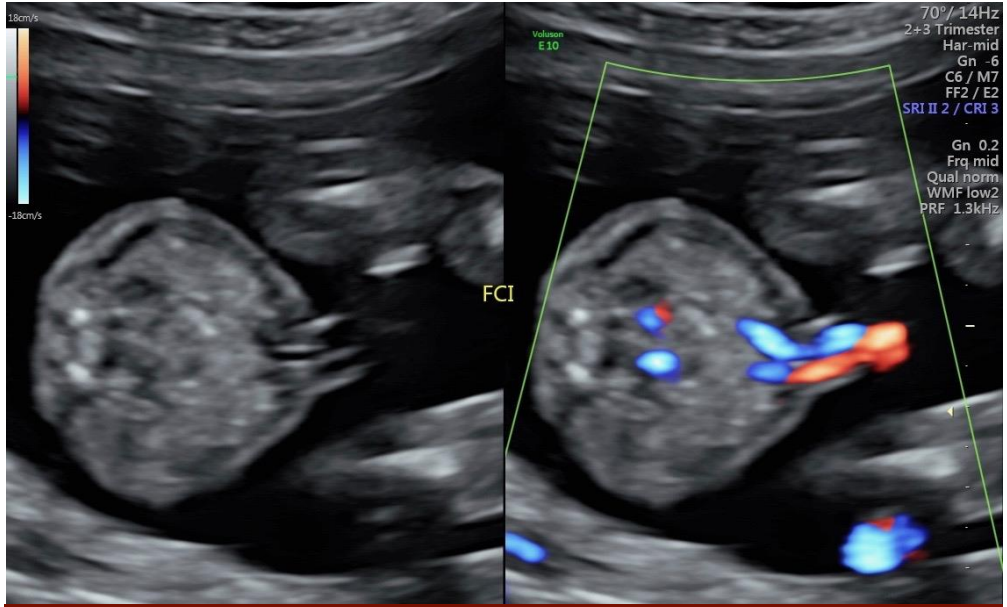
Plane 12 - cord insertion
Ultrasound features

- Transverse view
- Spine
- Cord insertion at abdominal wall
- Above the urinary bladder
- Intact abdominal wall





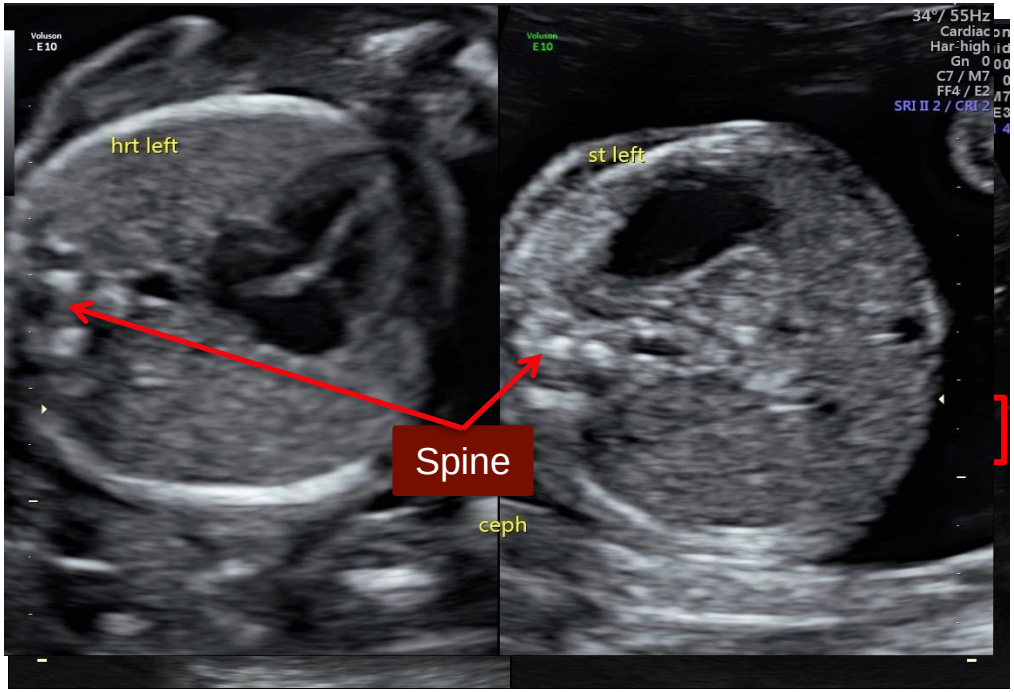
Plane 12
Umbilical cord insertion



Colour Doppler showing cord insertion

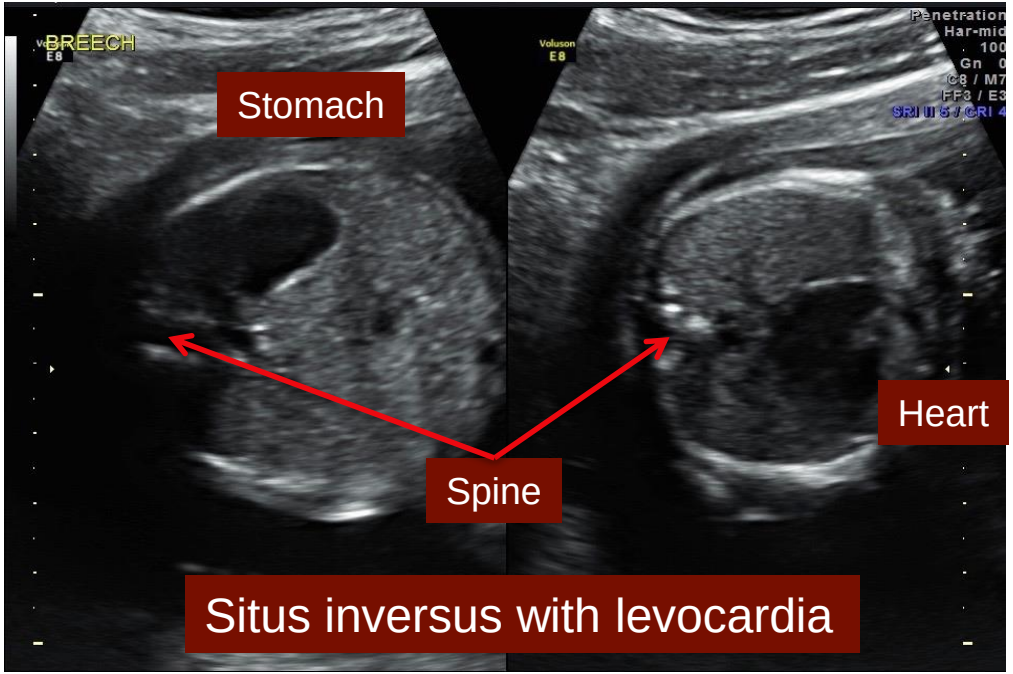
Fetal abdomen organ *situs*

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



Fetal abdomen organ *situs*

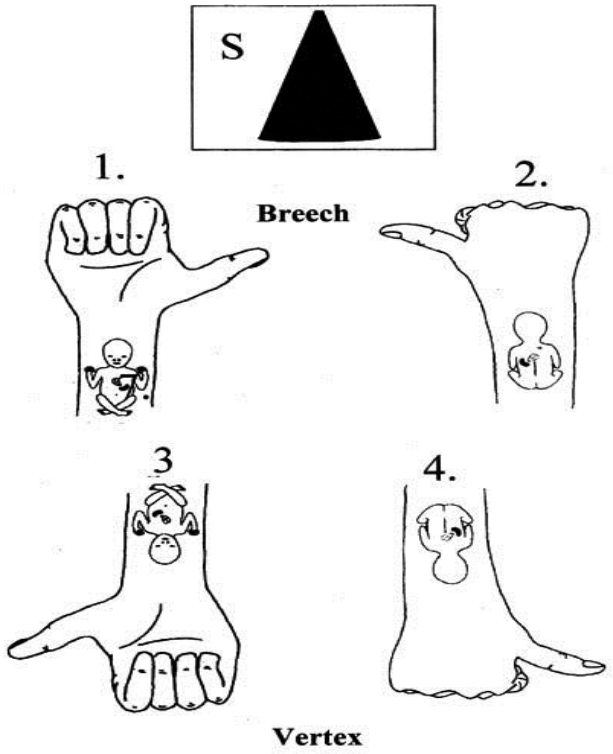
- Left & right axes
- Important for cardiac & abdominal abnormalities



Sonographic definition of the fetal situs

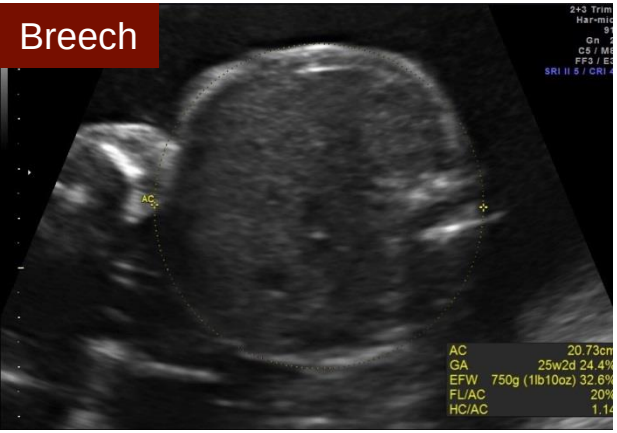
Right-hand rule of thumb for TA scanning

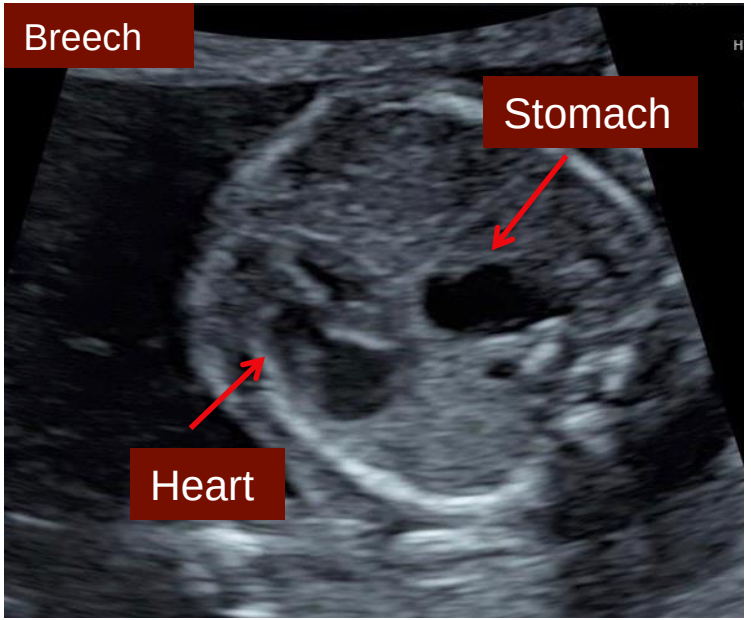
Hand	Fetus
Dorsum	Back
Palm	Abdomen
Fist	Head
Thumb	Left



Bronshtein, M et al. Obstet Gynecol.2002; 99(6):1129-1130

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

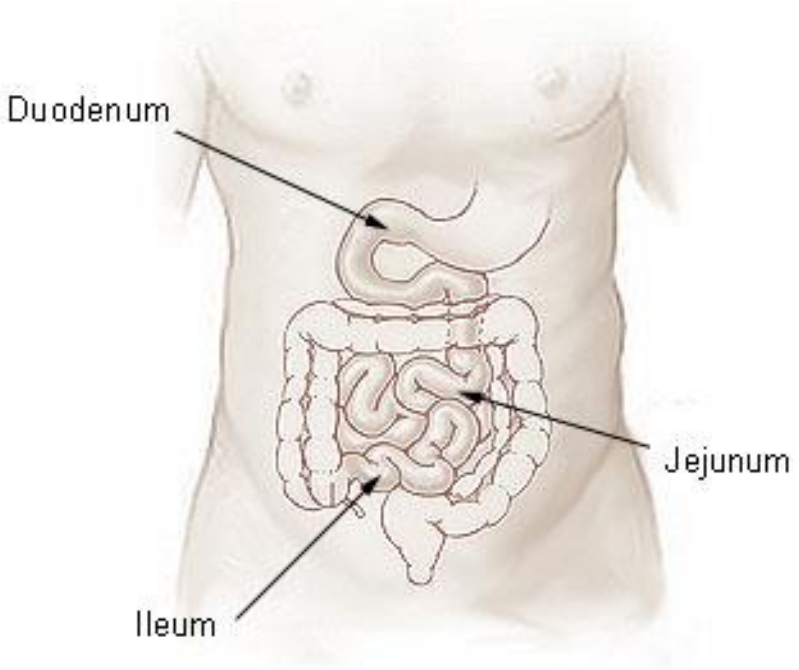
Abnormal fluid collections

- 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

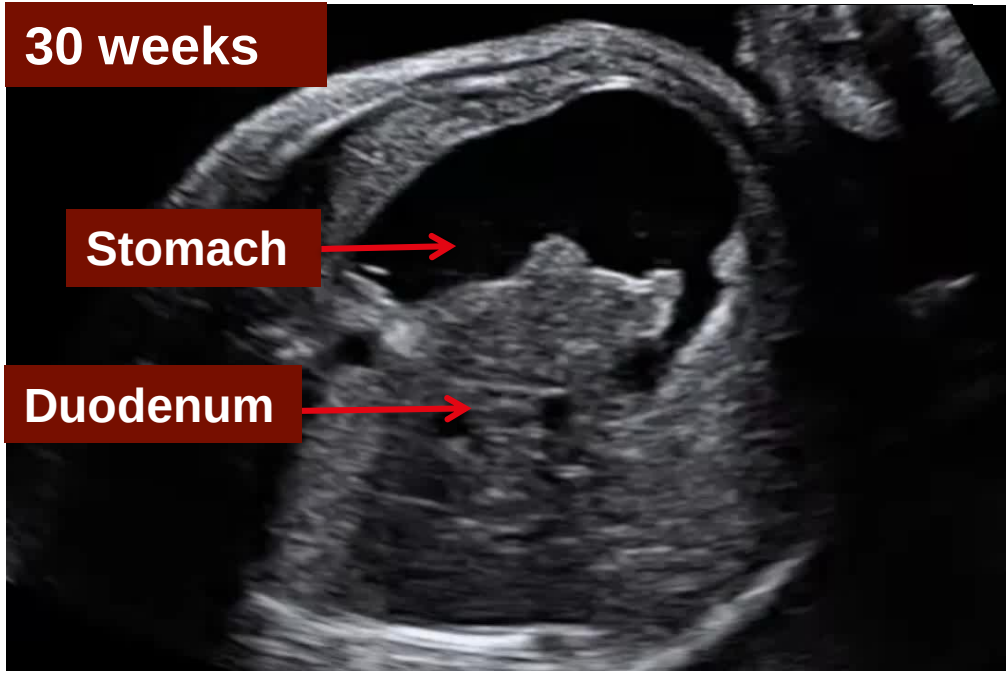
- 1:3,500 live births
- Low prenatal detection rate
- Polyhydramnios
- Absent or small stomach
  - Partial obstruction
  - Tracheoesophageal fistula



Abnormal stomach – double bubble

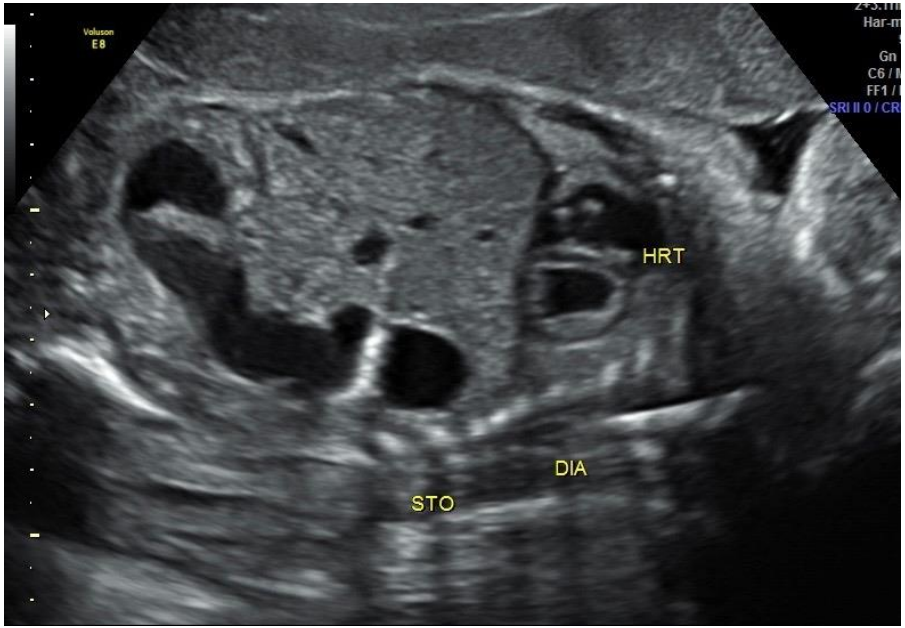
Duodenal atresia

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



Dilatation of small and large bowel

Bowel	Upper limit
Small	6.0 mm
Colon	20.0 mm

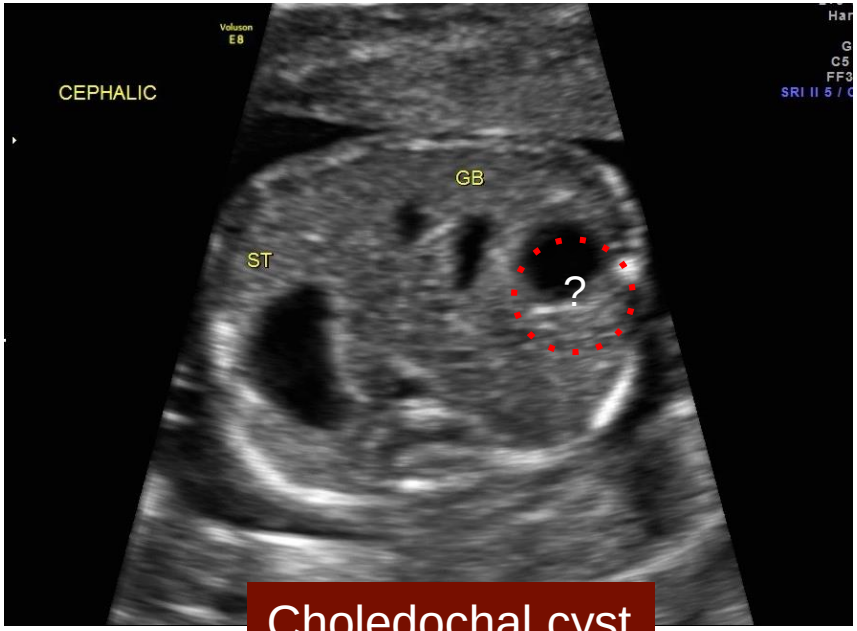


Fetal abdominal cyst

Key to diagnosis - origin of cyst

- Reproductive ?Gender
- Bowel
- Mesentery
- Renal
- 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



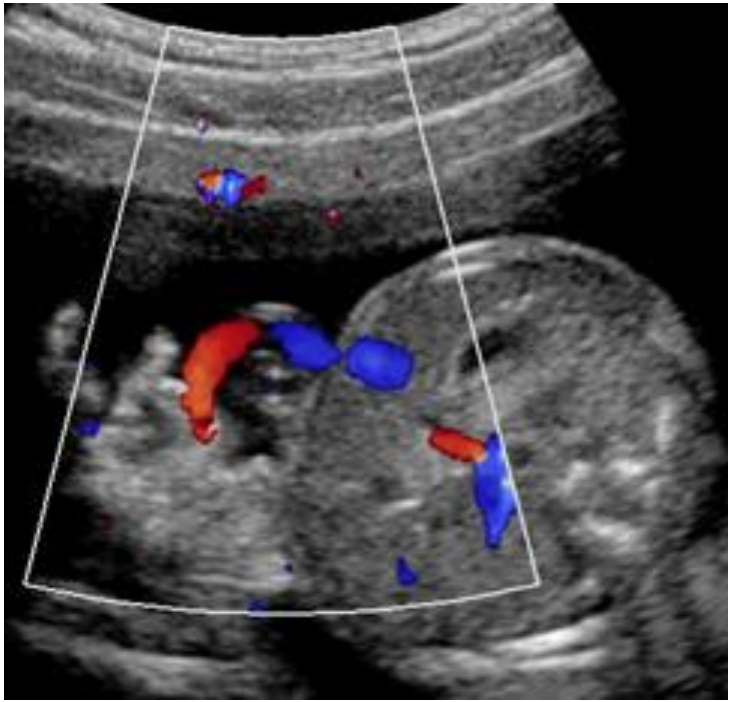
Abdominal wall defect - omphalocele





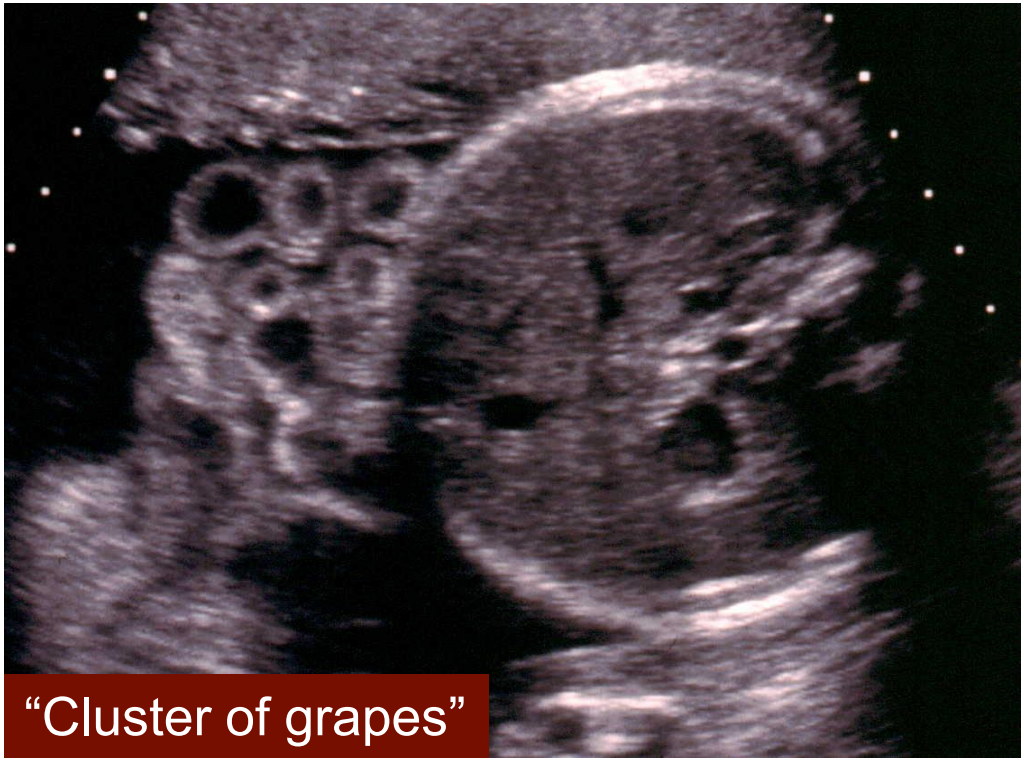
Abdominal wall defect - gastroschisis





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



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 14 weeks of gestation
   - Abnormal fluid collection(s), such as dilated bowel loops or enteric cyst, are seen