Second and third trimester sonography

NIAMH CONDON DO, FACOG
ASSISTANT PROFESSOR, MATERNAL FETAL MEDICINE
DEPARTMENT OF OBSTETRICS AND GYNECOLOGY
PENN STATE UNIVERSITY, COLLEGE OF MEDICINE
THE MILTON S. HERSHEY MEDICAL CENTER

Dating a Pregnancy: Sonography

<table>
<thead>
<tr>
<th>Gestational Age Range</th>
<th>Method of Measurement</th>
<th>Discrepancy between US and LMP that Requires Redating</th>
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<tbody>
<tr>
<td>8 6/7 weeks or less</td>
<td>CRL</td>
<td>More than 5 days</td>
</tr>
<tr>
<td>9 0/7 to 13 6/7 weeks</td>
<td>CRL</td>
<td>More than 7 days</td>
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<tr>
<td>14 0/7 to 15 6/7 weeks</td>
<td>BPD, HC, AC, FL</td>
<td>More than 7 days</td>
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<tr>
<td>16 0/7 to 21 6/7 weeks</td>
<td>BPD, HC, AC, FL</td>
<td>More than 10 days</td>
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<tr>
<td>22 0/7 to 27 6/7 weeks</td>
<td>BPD, HC, AC, FL</td>
<td>More than 14 days</td>
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<tr>
<td>28 0/7 weeks and beyond</td>
<td>BPD, HC, AC, FL</td>
<td>More than 21 days</td>
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Other dating tricks

TCD- transverse diameter (TDC = gestational age between 18-24 weeks)
- Spared in FGR

Foot length
Epiphyses
Distal femoral epiphysis
- < 12 weeks = not identifiable
- Size ≥ 5mm = gestational age > 17 weeks
Proximal Tibia Epiphysis
- < 15 weeks not identifiable

Ratio of biometric parameters
Serial sonography: best!!!
Transverse cerebellar diameter

Who needs an ultrasound?

ACOG Recommendation

• “...an ultrasound examination is an accurate method of determining gestational age, fetal number, viability, and placental location, and it is recommended for all pregnant patients”

• “An ultrasound examination in the second trimester also should include screening for structural abnormalities”

“In the absence of other specific indications, the optimal time for a single ultrasound examination is at 18–22 weeks of gestation”
AIUM - Consensus report on the detailed fetal anatomic ultrasound examination: indications, components, and qualifications.


Image orientation

- Every transducer has a mark which you can feel and see
- Check the position of the transducer and the image on the monitor

Orientation of the probe
Placenta, standard evaluation and maternal anatomy

- Lower uterine segment & presenting fetal part
- Placenta
  - Location
    - Relationship to cervix (Endovaginal US if low lying placenta)
    - Placental Cord Insertion (PCI) (color scale)
- Fetal position & number
  - Determine situs
- Fluid assessment
- Uterus (Hemato)
- Adnexa
- Cervix
The 6-step approach


Begin at 4:27

Lower uterine segment
Previa?

Cervical length
Transabdominal or Transvaginal?

Cervical length
Transabdominal or Transvaginal?
First thing we do when we begin fetal exam:

- **Ask: Are the Heart and Stomach on the Same Side?**
- **Determination of situs is required prior to the fetal evaluation**
  - The stomach and cardiac apex are normally on the left
  - If both are on the right, need to consider complete situs inversus
  - Has a good prognosis
  - If heart and stomach are located on opposite sides, heterotaxy or situs ambiguous is present
  - Heterotaxy carries a very high likelihood of complex congenital heart disease

**Head & Neck**

- Lateral ventricles
  - Ventricular atrium – measure size
- Choroid plexus
- Mallampati score
  - Absence of midline structures – think holoprosencephaly
- Cerebral falx
  - Absent – think ACE
- Posterior fossa
  - Cerebellum & cisterna magna
- Nuchal skin fold thickness (5-38 weeks, ideal 1-4mm)
- BPD & HC
  - If HC <5%, document standard deviation
Landmarks for the Measurement of the biparietal diameter (BPD) & head circumference (HC)

- Transverse plane of the fetal head at the level of the biparietal diameter (BPD)
- In this plane, you should see the cavum septum pellucidum (CSP), the falx, the thalami (T), 3rd ventricle (3V) and the insula
- A portion of the lateral ventricle is also seen

Transventricular view:

- Cross sectional view of the fetal head at the level of the posterior horns of the lateral ventricles (black cavity)
- Within the cavity bright sonolucent structure (choroid plexus)
- Ideal angle of insolation is 90° to the midline echoes
- Continuous midline echo (falx cerebri) broken in the middle by the cavum septum pellucidum
- Symmetrical appearance of both hemispheres
- No cerebellum visualized
- Proximal ventricle often not visualized
Transventricular view

- The width of the ventricle should be measured:
  - At the level of the glomus of the choroid plexus
  - Perpendicular to the ventricle
  - Position calipers "IN-IN"

Choroid Plexus Cyst

- Unilateral, bilateral, septated
- Aneuploidy more with other anomalies (increased 18q)
- 95% resolve by 26 weeks
- No local damage
Normal and abnormal ventricles

Anterior complex

Cavum septi pellucidi: Square shaped structure in center of brain which is fluid filled

Abnormal anterior complex
Cerebellar view

- The transcerebellar diameter
- If measuring cerebellum: Measure from outer to outer aspect

Nuchal fold: 15-20 weeks

The fetal head is imaged in a transverse plane. The distance between the external surface of the occipital bone and the external surface of the skin is measured.
- Normal ≤ 6 mm

Abnormal posterior fossa

- Megacisterna magna (≥10mm)
- Open 4th ventricle (Dandy-Walker, no vermis)
- Absent cisterna magna
Spine
Evaluate curvature, ossification centers, skin plane

Longitudinal spine imaging
Mid sagittal scan plane with a slight oblique, medial angle
- Image vertebral bodies and vertebral arches including skin from the cervical spine to the sacral spine

- Spine appears as 2 parallel lines (railroad track)
  - Thicker line represents the vertebral body
  - Thinner line represents the posterior elements of the vertebra
Transverse spine

Imaging skin line and 3 ossification centers (vertebral arches and vertebral bodies)

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Abnormal spine

Spina bifida

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Spine & Brain

Cranial signs are present in >95% of open spina bifida
Face

Nose & lips
Profile
Orbits
Palate

Nose & lips

Nose
- Mid sagittal scan plane imaging forehead, echogenic nasal bone, lips and chin
Lip
- Coronal scan imaging upper lip, nostrils and tip of the nose
Nose & lips

Profile
Mid sagittal scan plane
Image forehead, nasal bone, upper and lower lips, and chin

Profile
Anencephaly- absence of skull vault

Orbits
- Transverse (axial) scan, slightly caudal to the BPD level
  - Including bony orbits, eyes and bridge of nose
- Measurements
  - Measure if abnormality is suspected
  - Inner orbital
    - Measure from the inner medial wall to the inner medial wall of each orbit
  - Outer Orbital
    - Binocular distance
      - Measure outer to outer orbital distance
- TIP: the distance between eyes is approximately the diameter of another eye
Outer Orbital

Inner Orbital

Eye anomalies
Palate

Move transducer caudal from image of orbits.

Echogenic bow shaped structure with symmetrical bend:
- Thick echogenic arc

Transverse axial or oblique coronal scan plane

Notching is present in both it's superior and inferior edges.

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Normal palate & cleft palate

- Palate
- Cleft lip/cleft palate
- Alveolar ridge with tooth buds
- Hard palate
Chest

Cardiac situs
4 chamber heart
LVOT/RVOT
Aortic arch
- if abnormality suspected, document ductal arch

3V/IVC
3V & 3 vessel trachea view
2D cine clip from 3 vessel view; to outflow tracts to 4 chamber view
Fetal chest

- Need cross section of the fetal chest (check for symmetry of ribs), perpendicular to fetal spine
- Heart in the center of the thorax, with apex to the left
- Occupies 1/3 of the thoracic area

Fetal Chest

Thoracic anomalies

- Bilaterally enlarged lungs (erythema toxicum)
- Cardiac-thoracic disproportion (cardiomegaly, thoracic restriction)
- Pleural effusion
Cardiac displacement useful to diagnose lung anomalies

Heart in the center of the thorax?

- Normal
- Diaphragmatic hernia
- Extralobar lungs
- Cystic lungs

4 chamber view

Fetal heart: 4-chambers view
- 4 chambers
- Two patent atrioventricular valves
- Intact crux cordis
- Intact septa

Atroventricular canal defect: absence of the crux cordis
Single and hypoplastic ventricles

- Double inlet single ventricle
- Atresia of one atrioventricular valve
- Hypoplastic ventricle

Ventriculo-arterial connections – LVOT

Ventriculo-arterial connections – RVOT
Conotruncal malformations

Abnormal connections: overriding vessel (Fallot, DORV, truncus)

Parallel great vessels (TGA)
Abdomen/pelvis

- Diaphragm
- Abdominal circumference
- Stomach
  - Esophageal atresia: small/absent stomach
  - Site of stomach
- AC
- UV
  - r/o persistent right umbilical vein
- Bowel
- Bladder with 3 vessel cord
- Kidneys

Abdominal circumference (AC): transverse plane

- Stomach and umbilical vein should be visualized
- Calipers should be around the skin surface
- Kidneys and cord insertion should not be visible
- Umbilical vein should not be seen up to the skin line

Bowel obstruction

- Small stomach
- Esophageal atresia
- Double bubble
- Duodenal atresia
- Bowel dilatation
- Small bowel atresia, volvulus, meconium peritonitis
Abdominal wall defects

Diaphragm

Stomach, diaphragm and heart should be seen in one image to document that the cardiac apex and gastric bubble are on the left side.

The diaphragm should be seen as a continuous line with no defect.
Kidneys & Bladder

Urinary tract anomalies are the second most common malformation after cardiac malformations.

Fetal bladder cycle: fills up and empties every 15-20 minutes.

Normal urinary tract

Multidisciplinary consensus on classification of urinary tract dilation (2014)

- Anterior-posterior renal pelvis diameter (AAPPD) is normal when it measures <4mm at ≤28 weeks, and <7mm at >28 weeks.

- Journal of Pediatric Urology
Urinary tract enlargement

Enlarged renal pelvis

Enlarged (keyhole) bladder (possible urethral obstruction)

Bilateral and unilateral renal agenesis

Renal arteries

- Normal renal arteries doppler
- Absent renal arteries
Renal cystic dysplasia

Failure to visualize bladder

Normal bladder with 3 VC
Single Umbilical Artery

Extremities

- Humeral length
- Femur length
- Bilateral distal extremities with hand & feet
  - If abnormality is suspected, image fingers and toes
  - If CPC seen, verify and document unclenched hands
Long bones

- Femur, humerus, tibia, fibula, radius, ulna
- Transducer aligned perpendicular to the long axis of the bone
- Tib/fib should be documented on the same image
- Radius/ulna should be documented on the same image

Humeral length

Anomalies of the skeleton: short limbs syndromes
Ulna is longer than the radius, and it extends into the elbow higher than the radius.

Feet & toes
Feet
- Longitudinal or plantar scan plane
Toes
- Plantar scan plane
Measure heel to big toe

Foot
Fingers & Hands

Hand
- Coronal scan plane metacarpal and phalanges

Fingers
- Coronal or transverse scan plane showing phalanges

Polydactyly
M-Mode Ultrasound – Atrial-Ventricular Wall Motion

- The M-mode cursor is placed through the right atrial wall and the left ventricular wall.
- The recording illustrates atrial systole, recorded from the right atrial wall, and ventricular systole, recorded from the left ventricular wall.
- Evaluating the relationship between atrial systole and ventricular systole can help when evaluating the fetal heart for arrhythmias, such as premature atrial contractions.

The End

Questions?

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