OB GYN SONOGRAPHY REVIEW

Fetal Biometry

Course Outline

- Biometric Parameters
- Measuring Gestational Age
- 1st Trimester Measurements
- 2nd and 3rd Trimester measurements
- Fetal Biophysical Profile

Biometric Parameters

- Entire gamut of quantitative measurements taken during 2nd and 3rd trimesters
- 1st trimesters measurements limited to GS size and embryonic length (*not true biometry*)
- Measurements of fetal anatomic structures (absolute values and ratios) provide information on:
  - Gestational age
  - Weight
  - Size
  - Fetal growth

Basic Parameters

- Biparietal diameter (BPD)
- Head circumference (HC)
- Abdominal circumference (AC)
- Femur length (FL)

Additional Parameters

Common	Others
Cephalic index (CI)	Fetal long bones
HC/AC ratio	Thoracic circumference
FL/AC ratio	Nasal bone length
FL/BPD ratio	Renal length
FL/HC ratio	Spleen, liver, lung length

Parameters for Multiple Gestations

- Biometric data acquired over decades from singleton pregnancies
- Growth charts for multiples do exist
- Singleton data is accurate up to 30 weeks
- After 30 weeks, biometry is useful in evaluating growth of fetuses

Parameters for Multiple Gestations

- Biometric data acquired over decades from singleton pregnancies
- Growth charts for multiples do exist
- Singleton data is accurate up to 30 weeks
- After 30 weeks, biometry is useful in evaluating growth of fetuses

Measuring Gestational Age

- Clinically, age is based on 1st day of last menstrual period (LMP)
- Menstrual age = gestational age (*terminology*)
- Most accurate assessment of age is done during 1st trimester. Statistical variation:
  - ± 3-5 days (*1st trimester*)
  - ± 1 week (*mid 2nd trimester*)
  - ± 2 weeks (*3rd trimester*)

Importance of GA Estimation

- Scheduling of invasive procedures (*CVS, amnio*)
- Interpretation of biochemical tests (*MSAFP, hCG*)
- Anticipation of normal vaginal delivery date vs. cesarean section planning
- Manage fetal outcomes in preterm or posterm labor
- Early age determination essential in following possible IUGR
- All important clinical decisions require accurate knowledge of menstrual age

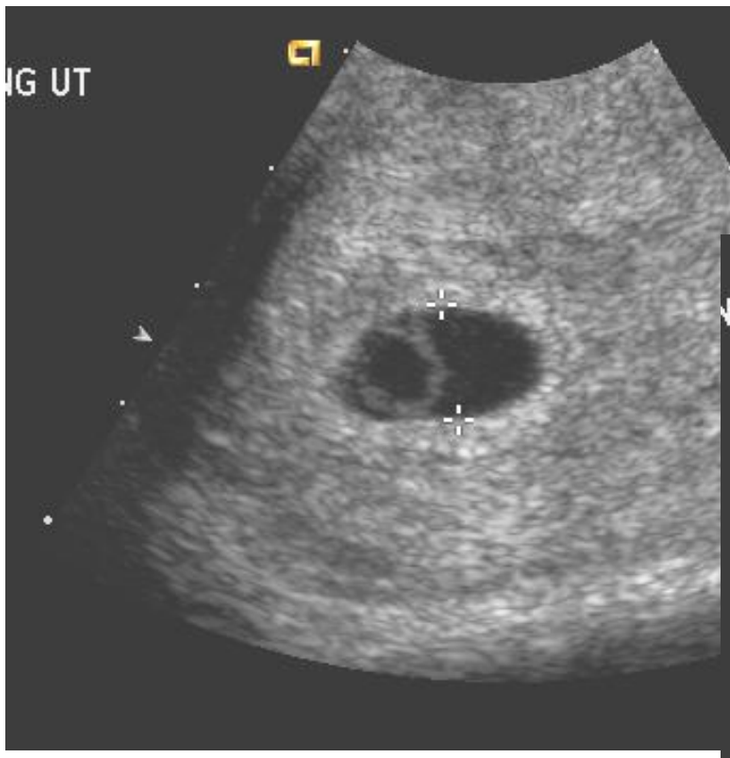
First Trimester Measurements

- Most accurate method throughout all pregnancy
- Parameters include:
  - Mean sac diameter
  - Crown-rump length

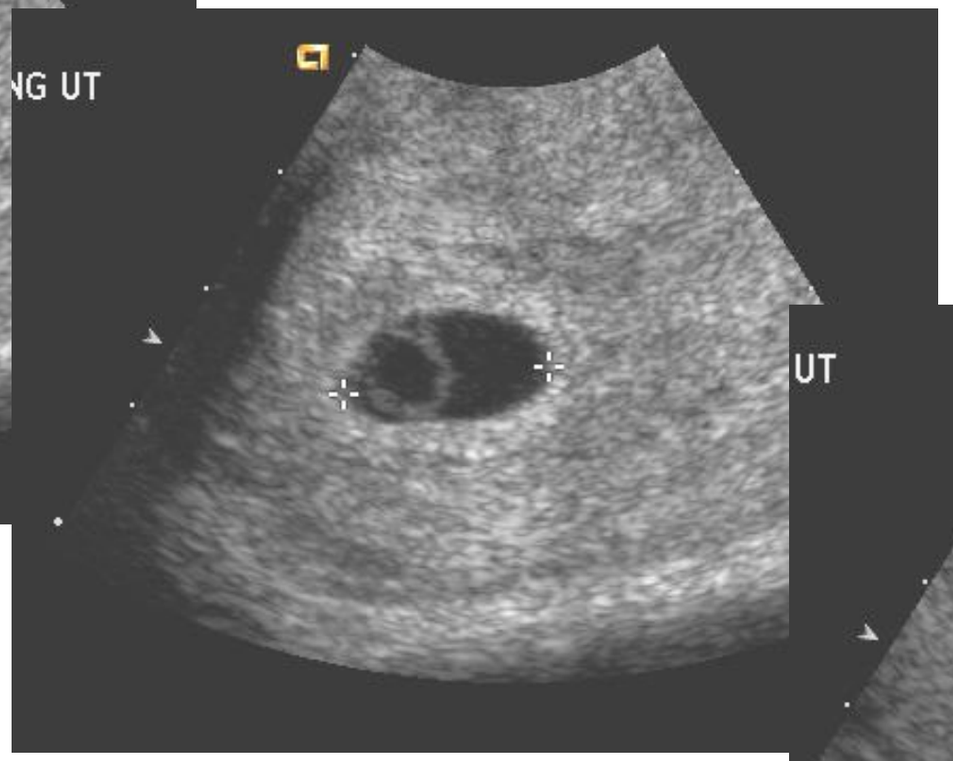
Mean Sac Diameter

- Mean sac diameter (MSD)
  - AP + Long + Trans ÷ 3 (L+W+D ÷ 3)
  - Rule of thumb: MSD = 5mm @ 5 weeks
  - Grows ≈ 1mm/day
  - Best used prior to 6 weeks

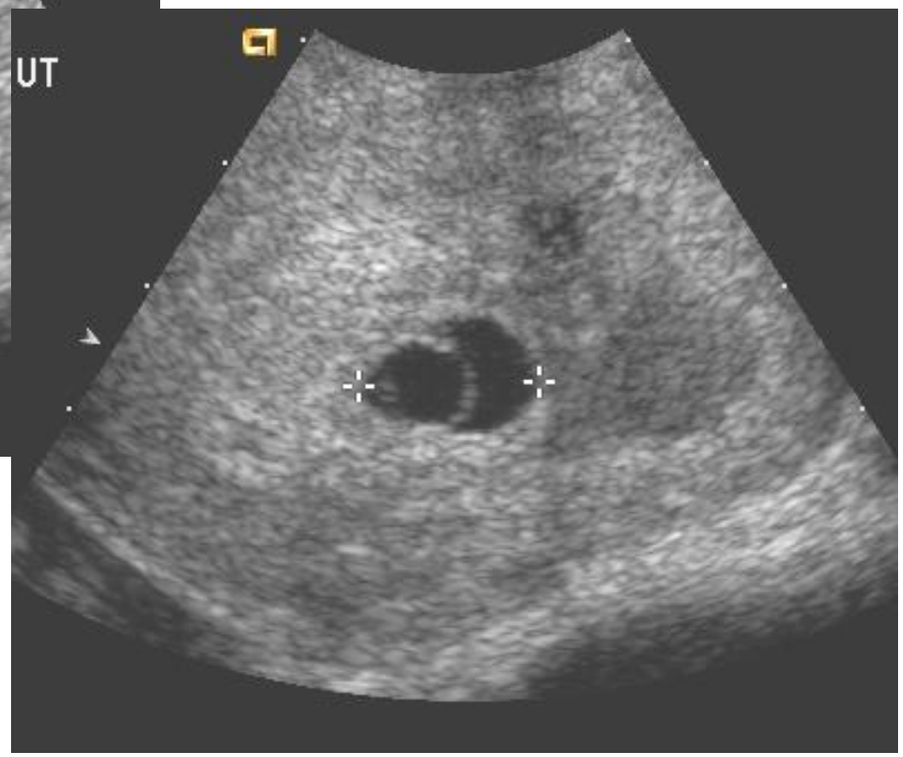
MEAN SAC DIAMETER



AP

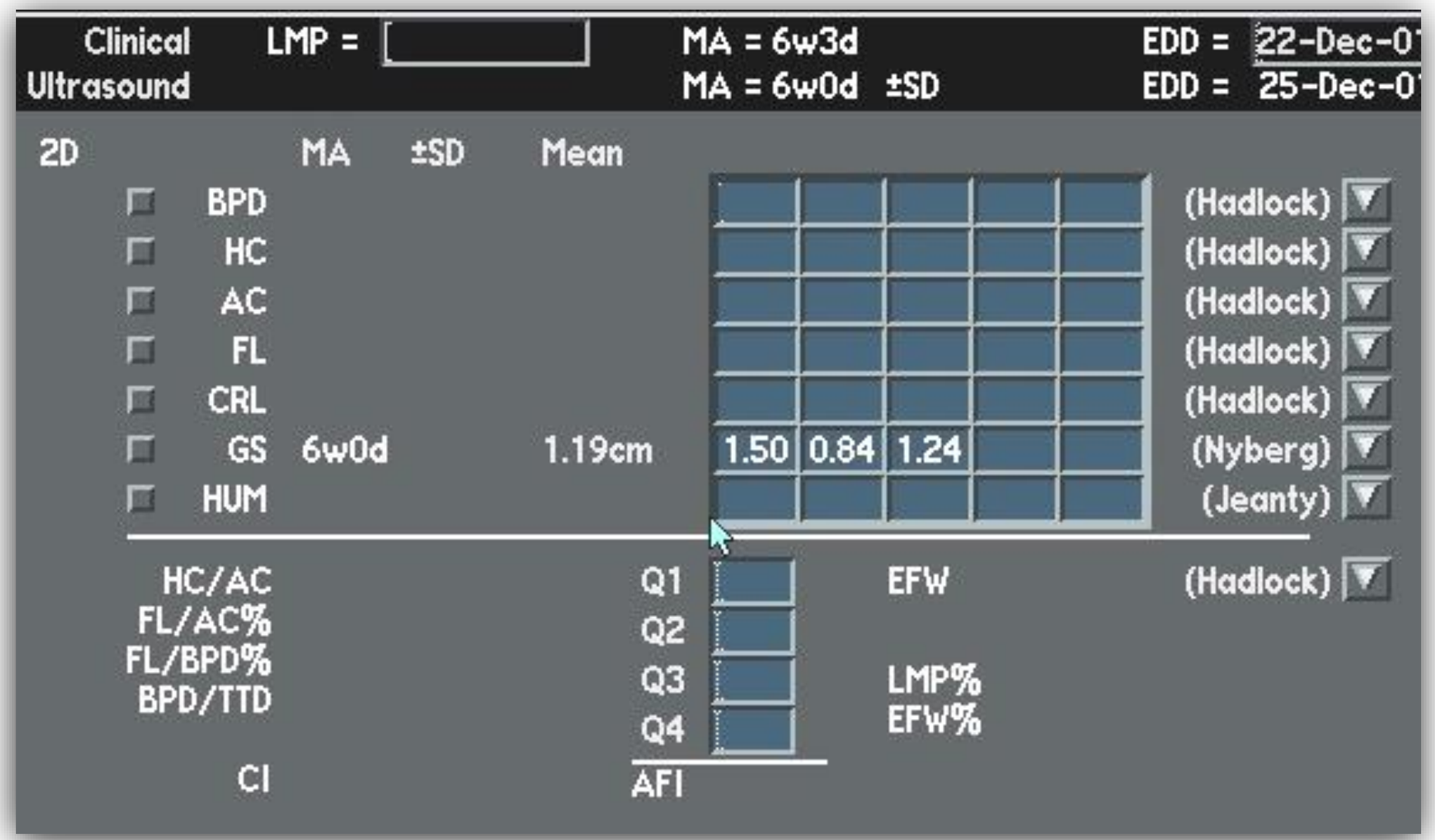


Longitudinal



Transverse

MEAN SAC DIAMETER



Crown Rump Length

- Most accurate of all measurement throughout pregnancy
- Accurate within 3 – 5 days if measured properly
- Measured from top of head to bottom of rump (excluding legs)
- Embryonic pole should be visible of the MSD measures ≥ 2.5 cm

CROWN-RUMP LENGTH

7 weeks, 3 days

Crown Rump Length

Examples:

- ☑ **Size in cm + 6 = GA in weeks**
- ☑ **Size in mm + 42 = GA in days**

Crown Rump Length

Two rules of thumb:

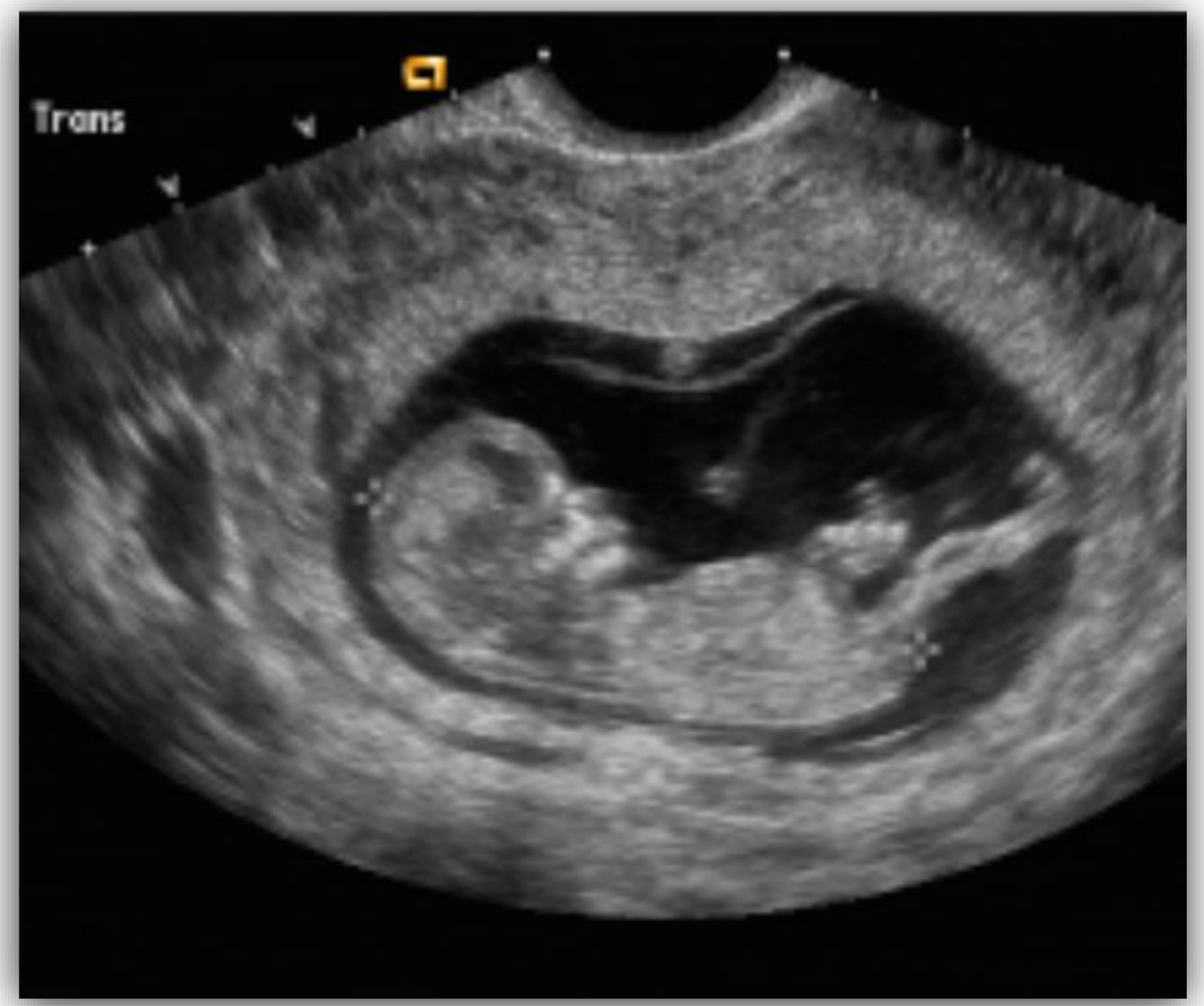
Size in cm + 6 = GA in weeks

CRL = 2 cm
2 + 6 = 8 weeks

Size in mm + 42 = GA in days

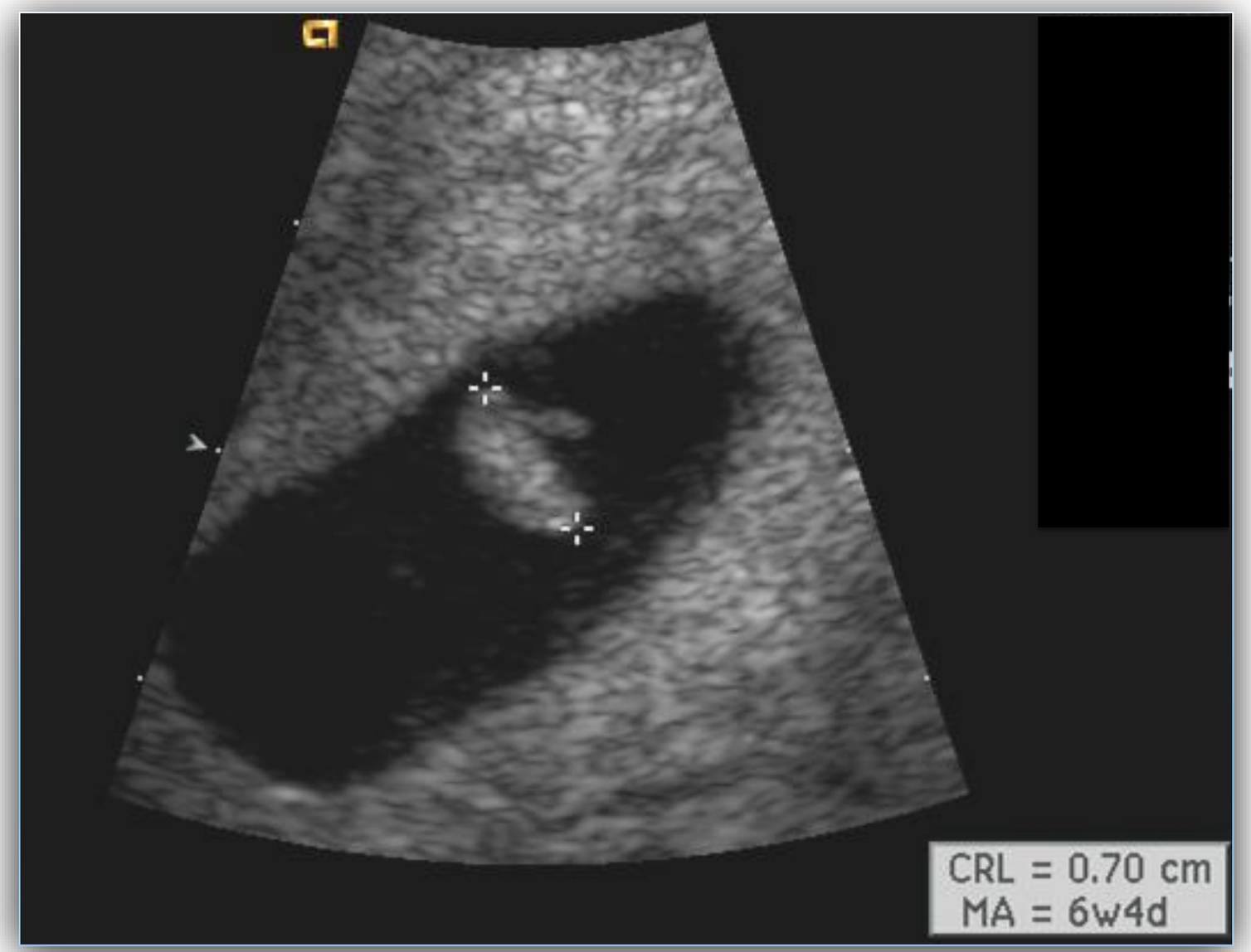
CRL = 20 mm
20 + 42 = 62 days
62 ÷ 7 = 8.9 weeks

CROWN-RUMP LENGTH



10 weeks

CROWN-RUMP LENGTH



0.7 cm + 6 = 6.7 weeks

7.0 mm + 42 = 49 days ÷ 7 = 7 weeks

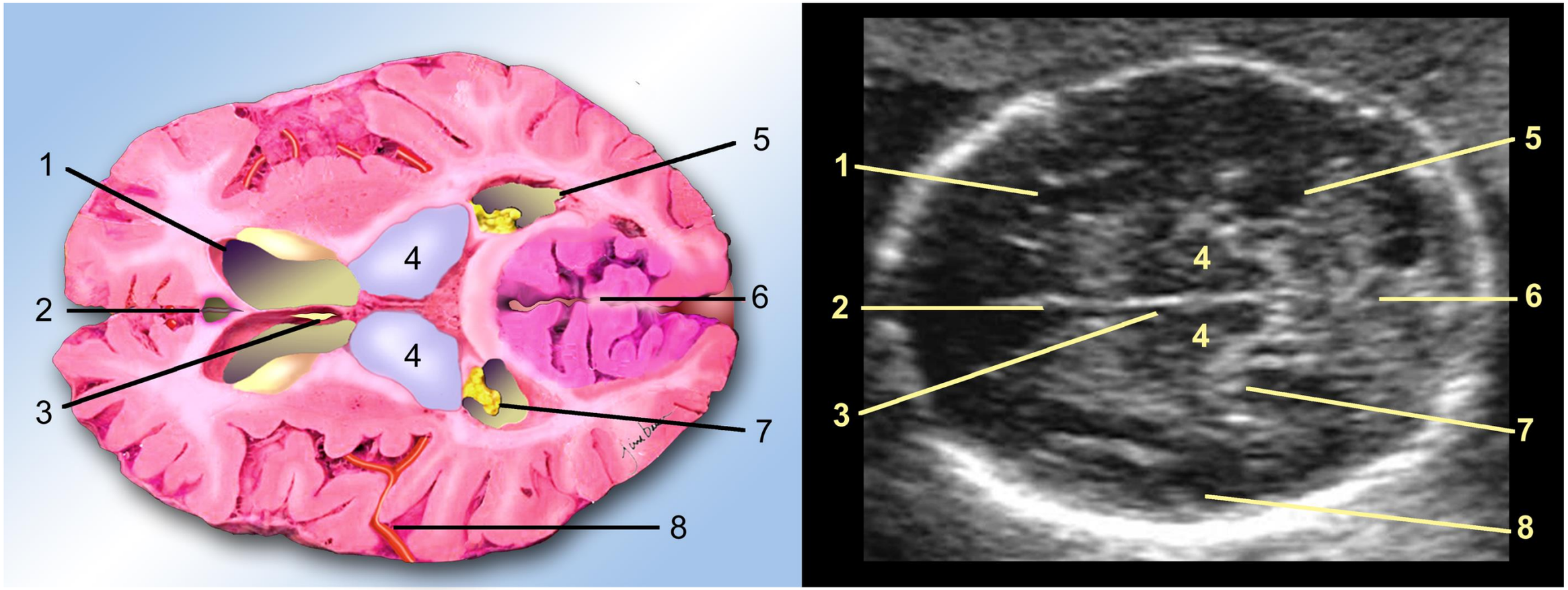
2nd and 3rd Trimester Measurements

- Since accuracy is ± 2 weeks, multiple measurements should be obtained (*BPD, HC, AC, FL*)
- Rules of thumb:
  - If AC < 2 SD below mean, look for signs of IUGR
  - If FL < 2 SD below mean, look for signs of skeletal dysplasia
  - If HC or AC values fall short, use HC/AC ratio
  - Cephalic index helps determine head shape

Biparietal Diameter (BPD)

- Axial section through fetal head at level of thalami and cavum septi pellucidi
- Measure outer edge of near parietal bone to inner edge of far parietal bone (*leading edge to leading edge*)
- First measurable between 10 – 12 week
- Angle of asynclitism should be 90° to fetal cranial sutures

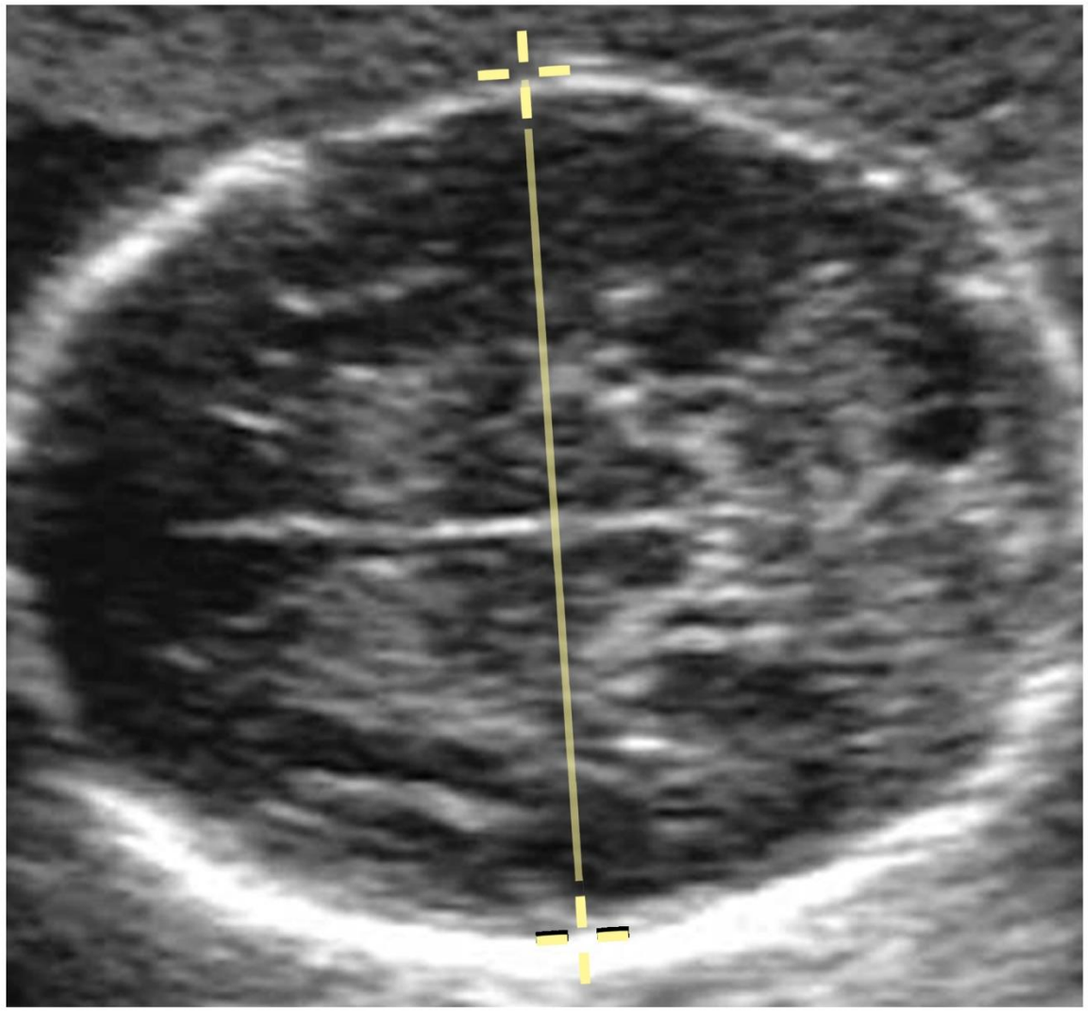
BIPARIETAL DIAMETER



1 = lateral ventricle - frontal horn
2 = cavum septum pellucidum
3 = 3rd ventricle
4 = thalamus

5 = lateral ventricle - atrium
6 = cerebellum
7 = choroid plexus
8 = Sylvian fissure

BIPARIETAL DIAMETER



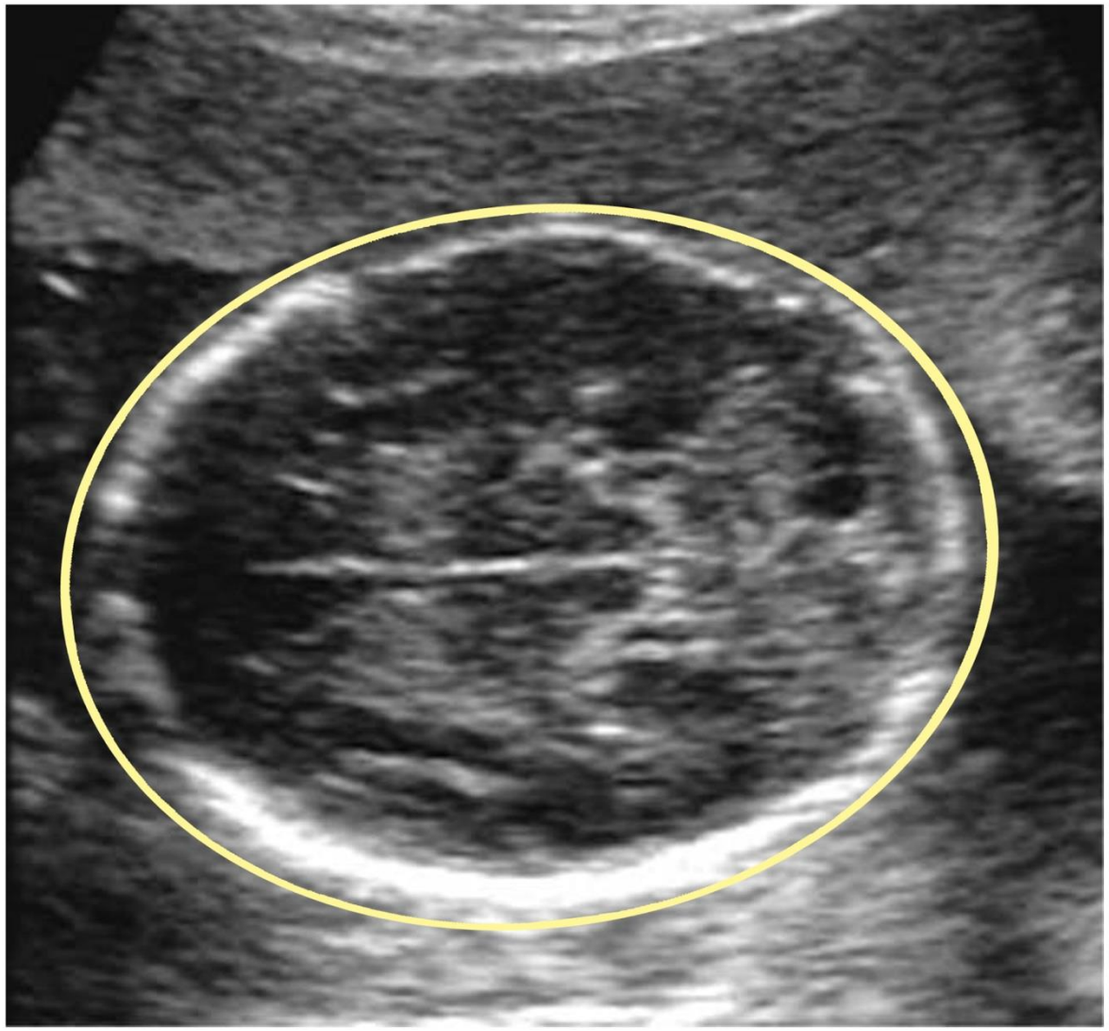
BPD – proper cursor placement

Head Circumference (HC)

HC = (BPD+ OFD) x 1.57

- Measured at same level as BPD
- Should include cranial echoes, not soft tissue scalp (*electronic ellipse*)
- If using OFD in conjunction with BPD, OFD measured outer-to-outer (*2 linear measurements*)
- More accurate that BPD in cases of dolichocephaly or brachycephaly

BIPARIETAL DIAMETER



HC – proper cursor placement

Cephalic Index (CI)

CI = BPD/OFD x 100

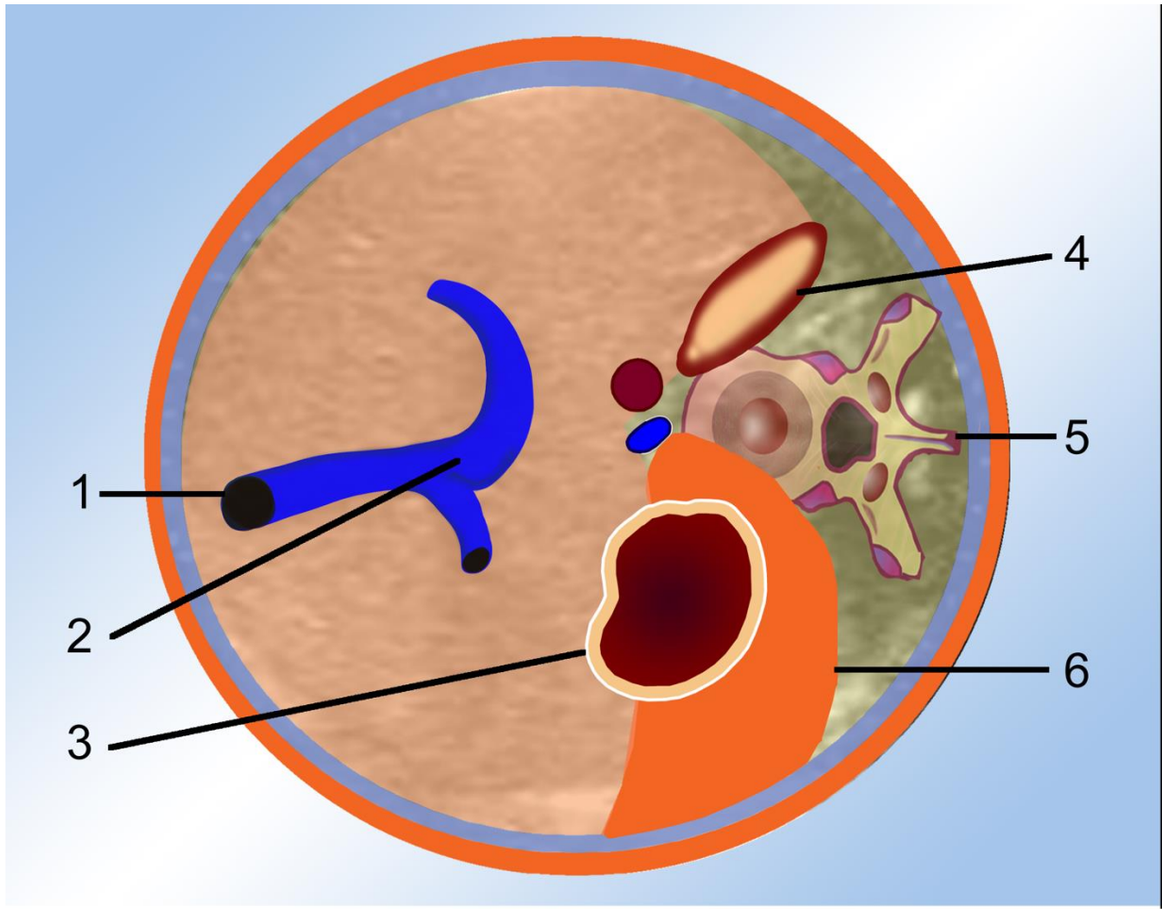
- Useful when normocephalic shape I distorted by oligohydramnios, breech presentation, or crowded twinning

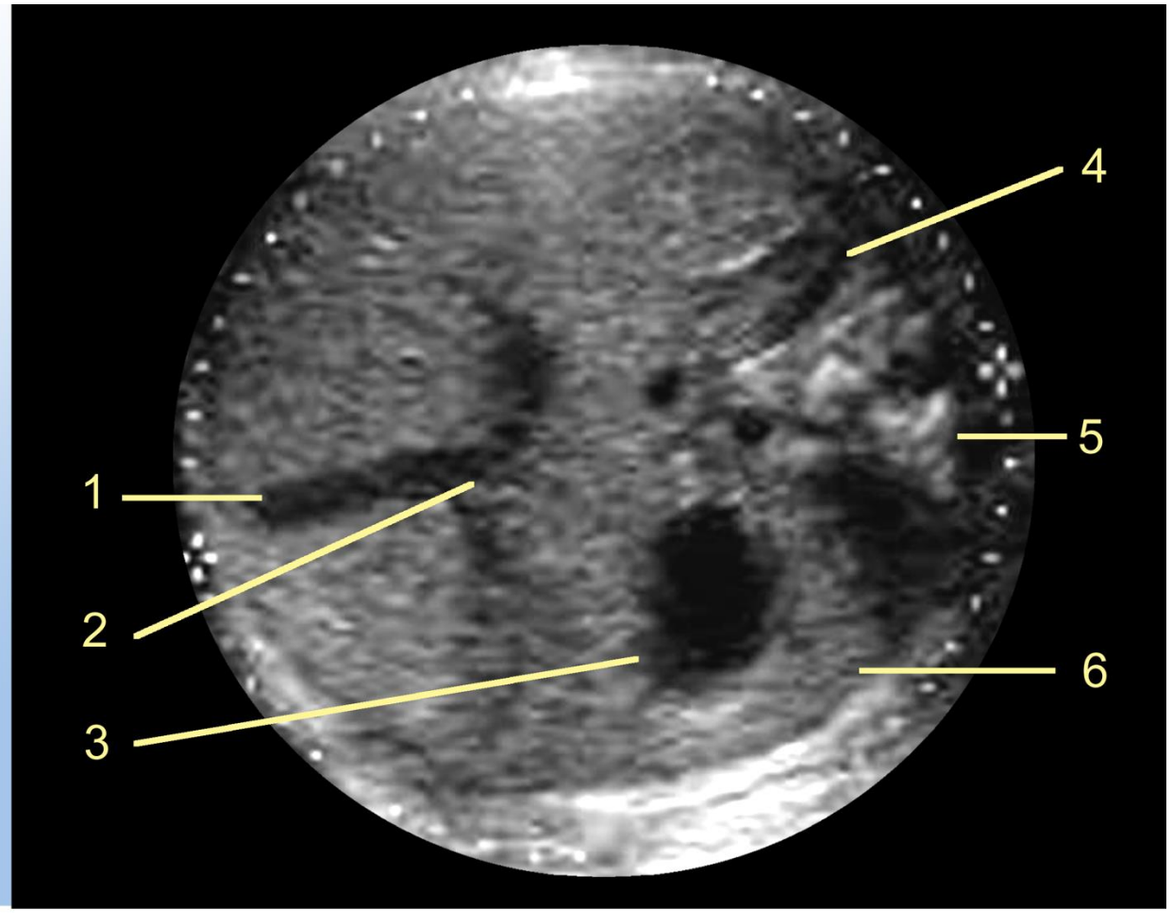
Abdominal Circumference (AC)

AC = (D1 + D2) x 1.57

- Measured at level of portal vein and stomach
- Circumference measurement should include soft tissue
- Least reliable method of estimating gestation age due to significant genetic and somatic variations after 25 weeks

ABDOMINAL CIRCUMFERENCE





1 = umbilical vein
2 = portal sinus
3 = stomach

4 = adrenal gland
5 = spine
6 = spleen

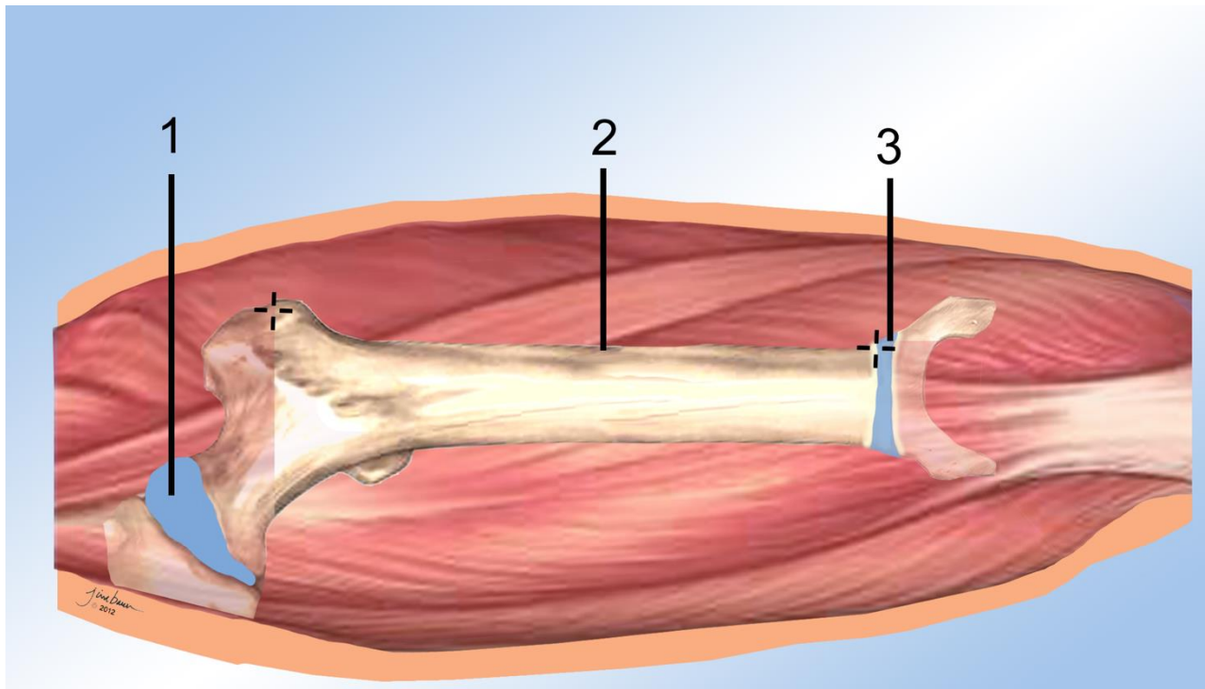
ABDOMINAL CIRCUMFERENCE

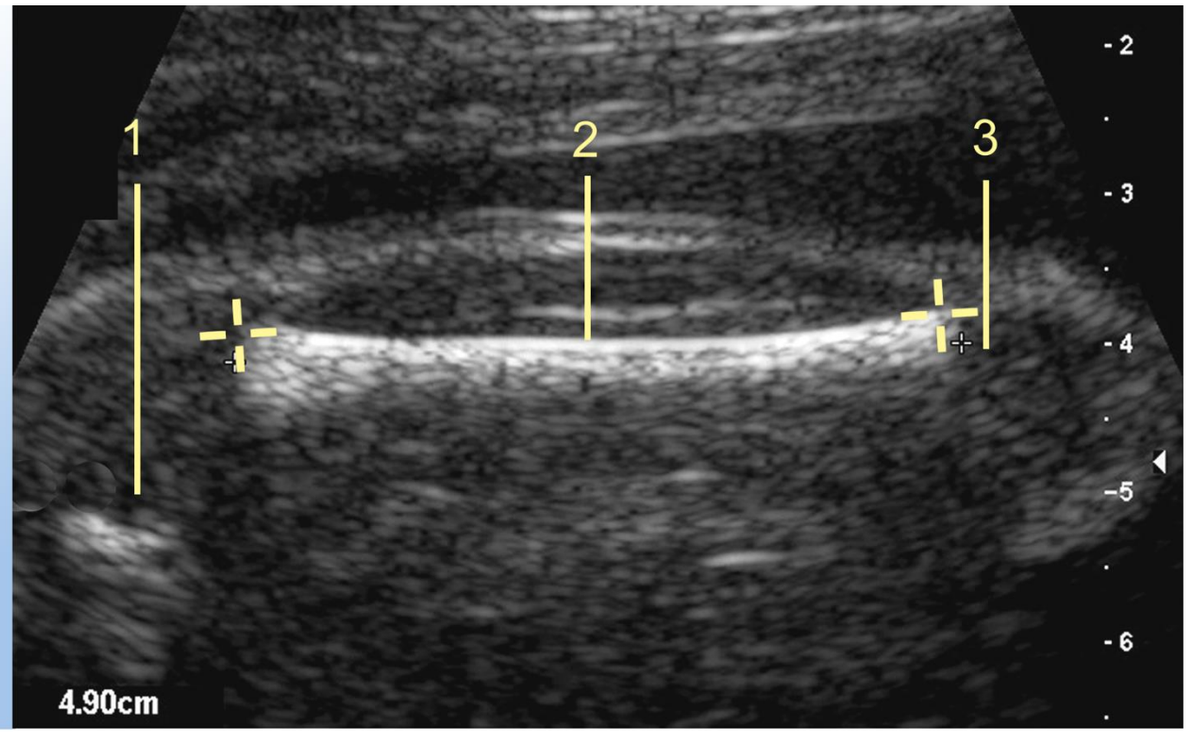
AC– proper ellipse placement

Femur Length (FL)

- Linear array preferred to minimize errors related to beam distortion
- Position cursors at junction of bone with cartilage
- Include only ossified diaphysis and exclude epiphyseal cartilage
- If measurement < 2 SD of mean, measure other long bones

FEMUR LENGTH



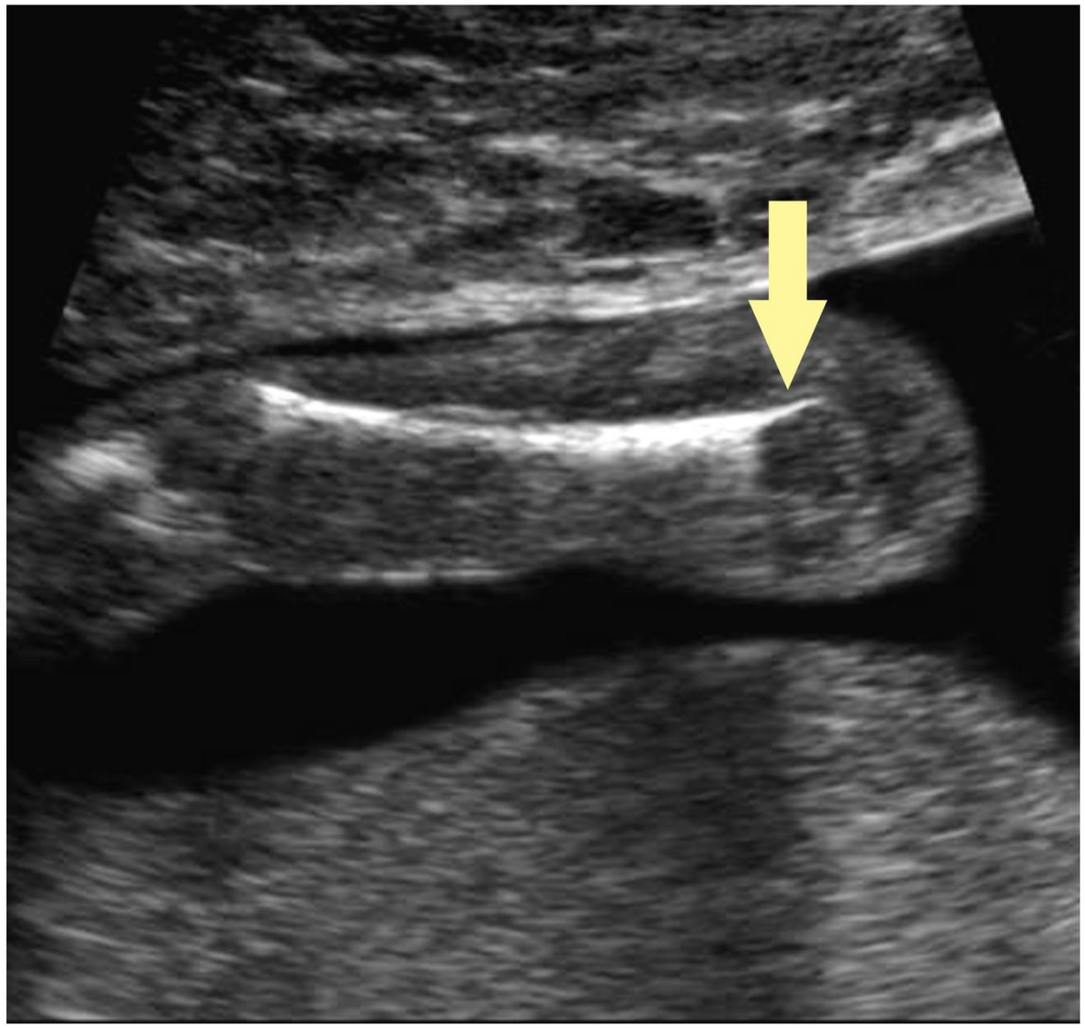


1 = proximal femoral epiphysis
2 = ossified diaphysis
3 = distal femoral epiphysis

Tips & Pitfalls

- Phased sector probes may cause artifactual “bowing”
- Measurement cursors should exclude epiphyseal cartilage
- “Distal femur point” should not be included
- Femur length can be underestimated in an obliquely obtained image

FEMUR LENGTH



“Distal femur point"

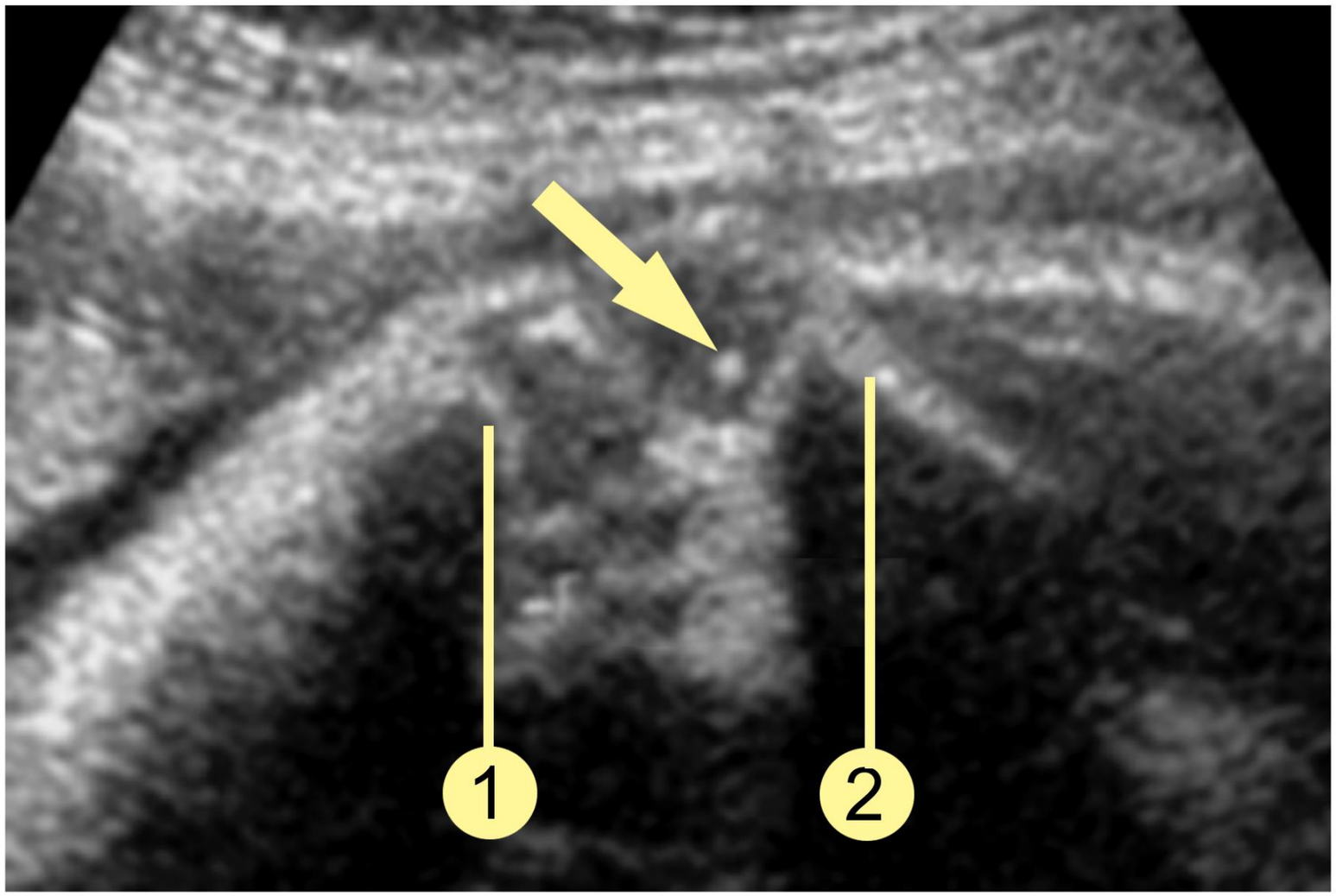
Epiphyseal Appearance

- Ossification begins in embryonic period
- Long bones begin to ossify in diaphysis (shaft) and continue distally
- Junction of ossified shaft and cartilaginous end is called *epiphysis*
- Observation of appearance can be useful in estimating gestational age

Epiphyseal Appearance

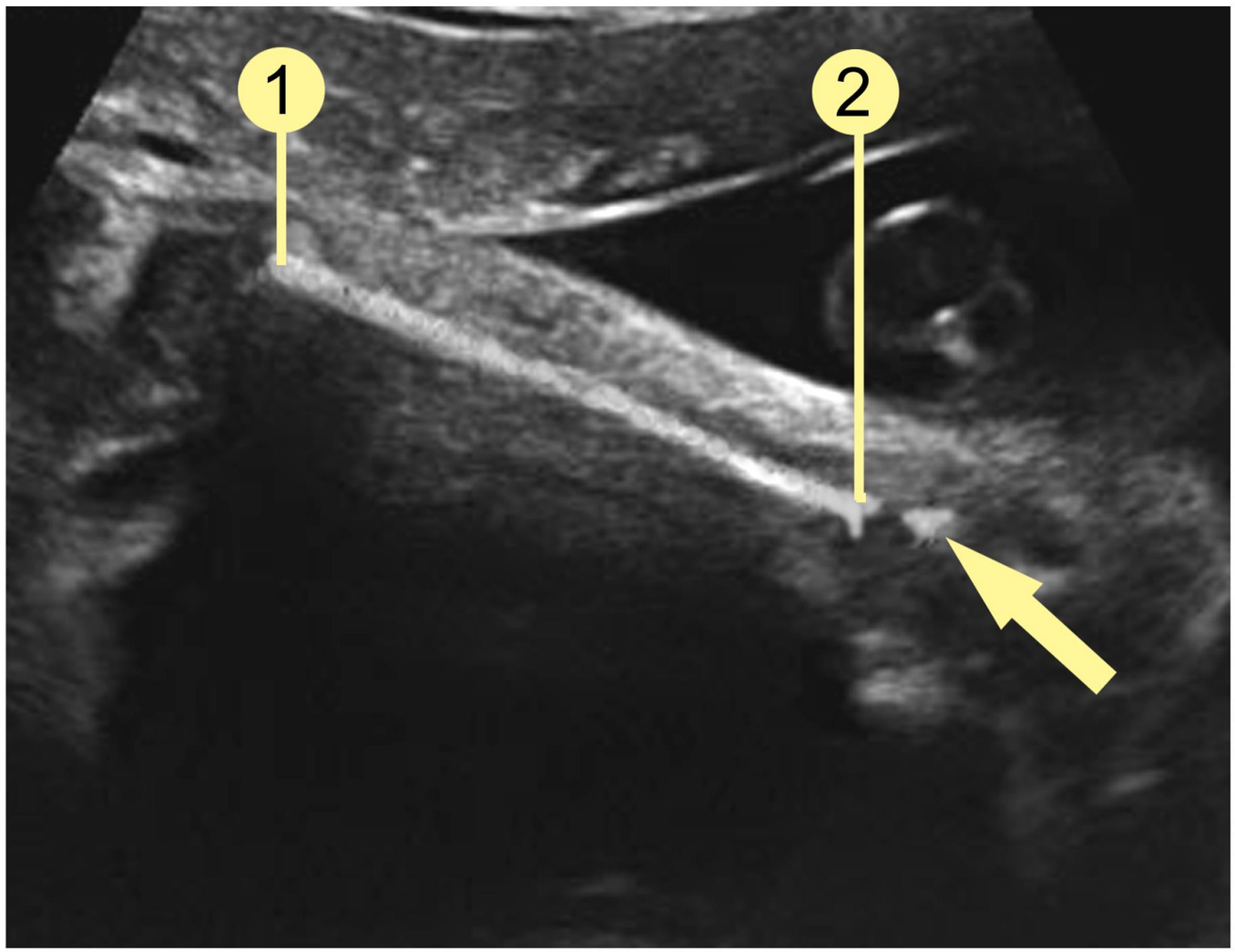
Epiphysis	Menstrual Age (weeks)
Distal femoral	33
Proximal tibial	35
Proximal humeral	38

EPIPHYSEAL APPEARANCE



Distal femoral epiphysis (arrow)
1 = proximal tibia
2 = distal femur

EPIPHYSEAL APPEARANCE

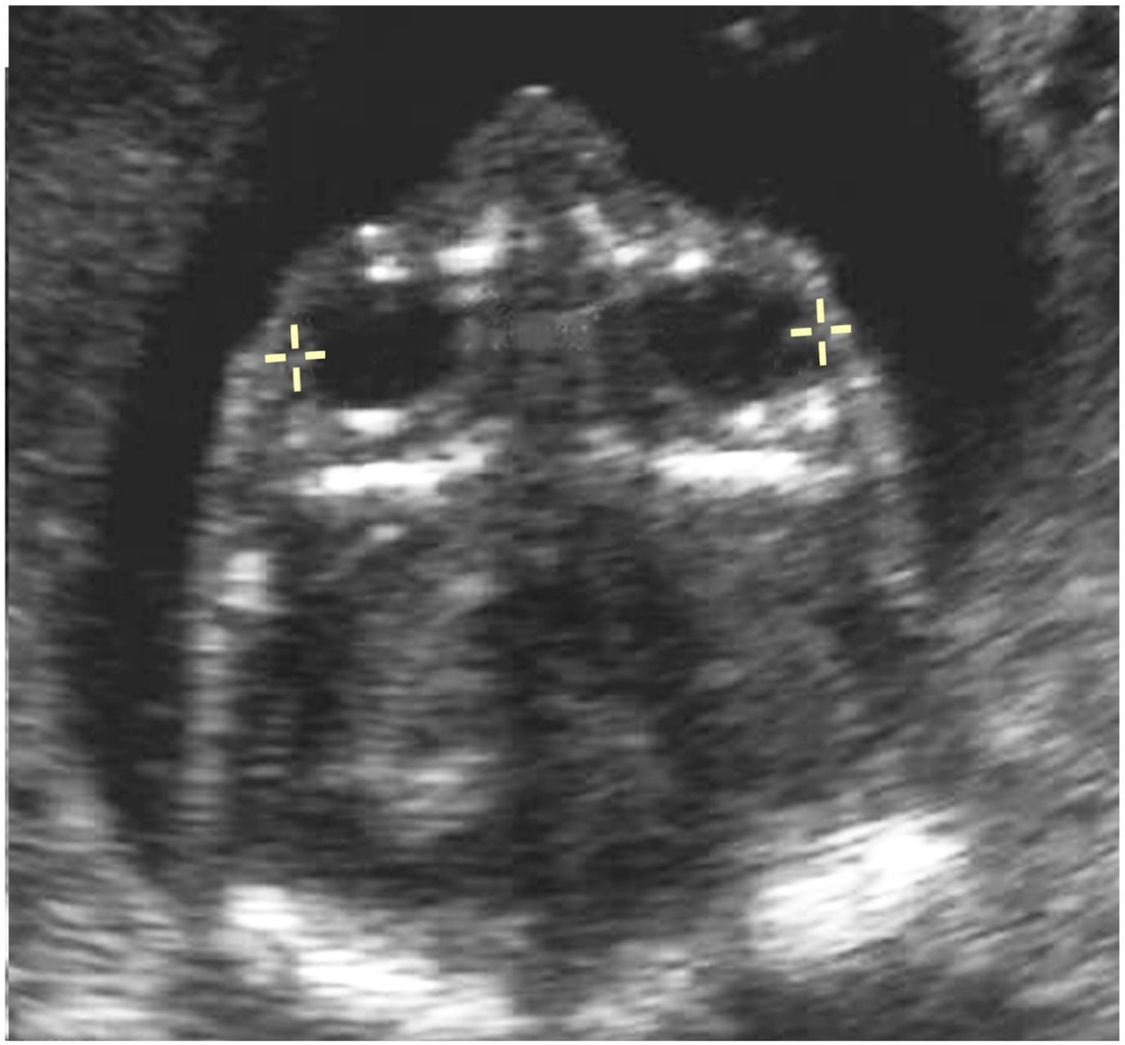


Proximal tibial epiphysis (arrow)
1 = distal tibia
2 = proximal tibia

Orbital Measurements

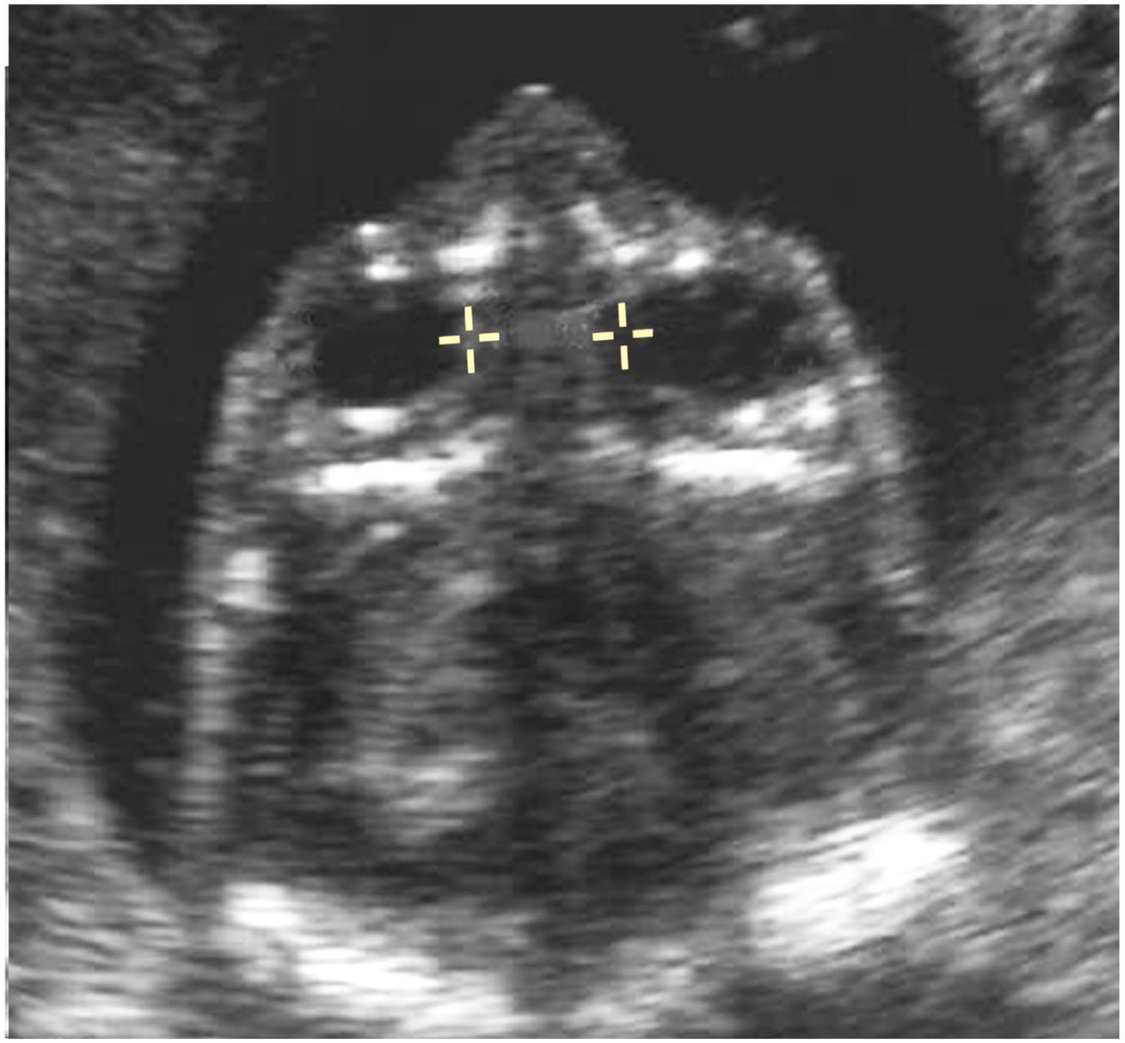
- Binocular distance: *distance from lateral edge of one orbit to lateral edge of the other orbit*
- Interorbital distance: *distance between two orbi*ts
- Orbital diameter: *diameter of a single orbit from medial inner bony surface to lateral inner bony surface*

ORBITAL MEASUREMENTS



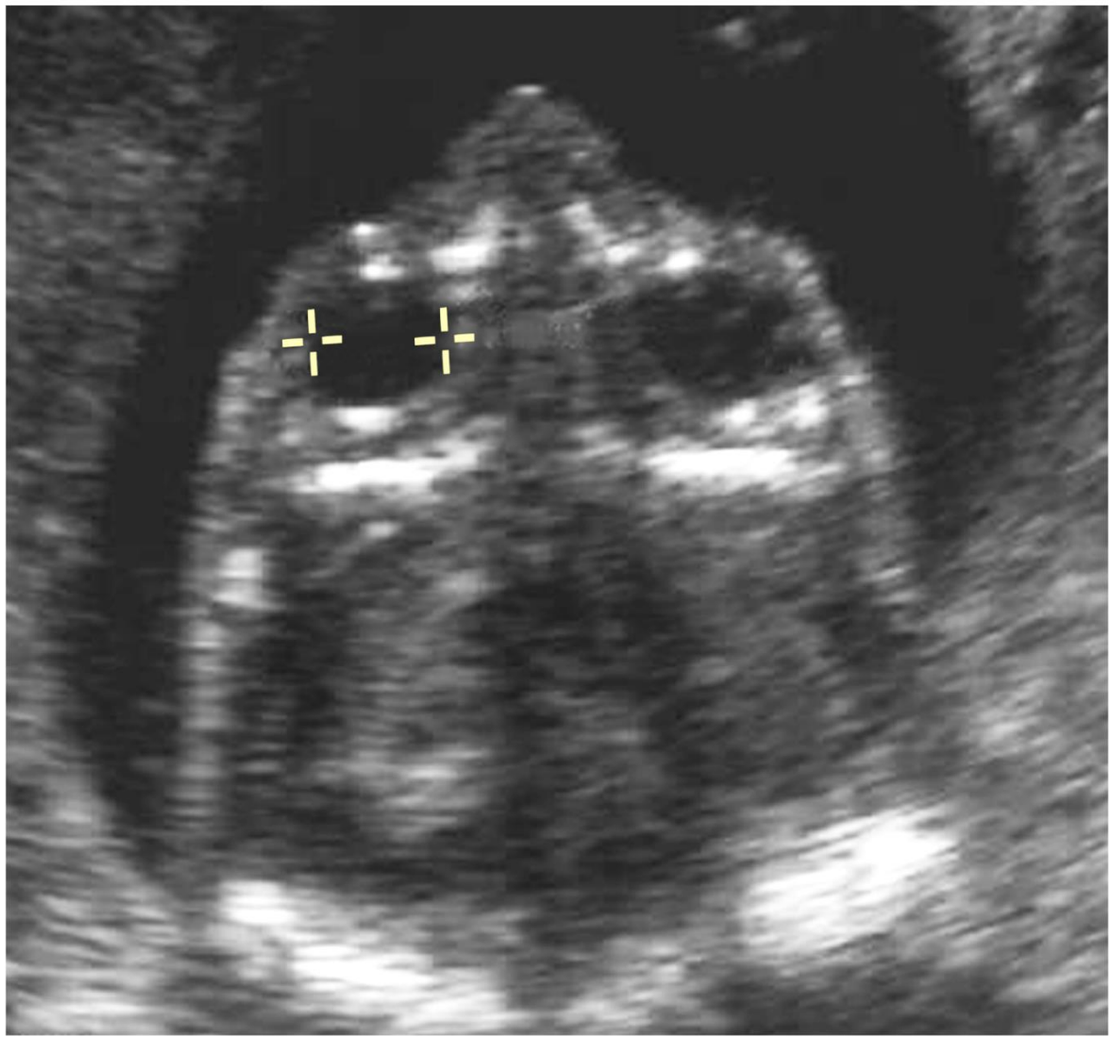
Binocular distance

ORBITAL MEASUREMENTS



Interorbital distance

ORBITAL MEASUREMENTS



Orbital diameter

Transcerebellar Diameter (TCD)

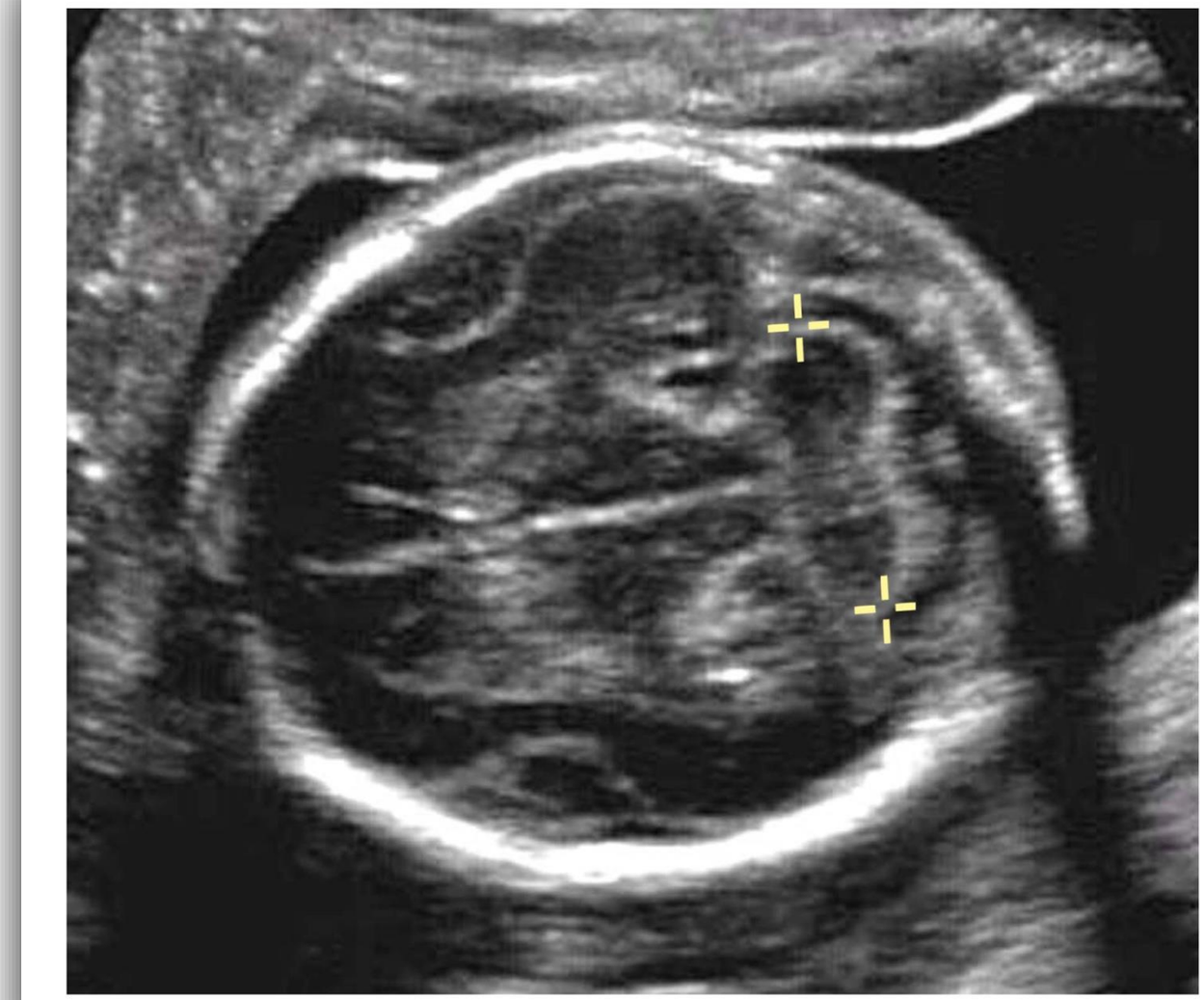
- Useful when HC measurement is difficult to obtain
- Measure right to left lateral aspect of cerebellum in axial plane

Rule of Thumb

Between 14 – 20 weeks

TCD (mm) = age in weeks

ORBITAL MEASUREMENTS



Transcerebellar diameter

Fetal Biophysical Profile

- US assessment of fetal well-being performed in late 2nd and 3rd trimesters
- Designed to detect fetal asphyxia
- Includes 5 parameters that are scored 2(observed)or 0 (not observed)

Fetal Biophysical Profile

- Includes 5 parameters that are scored 2 (observed) or 0 (not observed)
  - *Fetal breathing movements*: ≥ 20 seconds over 30 minutes
  - *Gross body movements*: 3 episodes over 30 minutes
  - *Fetal tone*: 1 episode of extension/flexion over 30 minutes
  - *Amniotic fluid volume*: > 5 cm
  - *Non-stress test*: 2 episodes of reactive heart acceleration >15 bpm over 30 minutes

Fetal Biophysical Profile

BIOPHYSICAL PROFILE SCORING		
SCORE	**EXPLANATION**	**MANAGEMENT**
10	No evidence of asphyxia	Conservative
8	No acute asphyxia	Serial testing
6	Acute asphyxia likely	Deliver if > 32 weeks
4	Acute asphyxia likely	Deliver if > 26 weeks
2	Acute asphyxia very likely	Deliver if >26 weeks
0	Acute asphyxia certain	Deliver if > 26 weeks

Fetal Weight Estimation

- Useful in helping predict fetal, maternal, and neonatal complications
- Inaccurate method of predicting birth weight
- Serial weight estimations may be helpful in assessing growth changes (*IUGR, macrosomia*)
- Estimated fetal weight < 10th percentile suggests IUGR
- Estimated fetal weight >90th percentile suggests macrosomia

OB GYN SONOGRAPHY REVIEW

Fetal Biometry