ULTRASOUND LECTURE SERIES

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Council on Resident Education in Obstetrics and Gynecology





Common Methods of Ultrasound Dating in Pregnancy

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Areas to Be Covered

- Methods for estimating gestational age
- Biometric variation
- Other biometric parameters
- Clinical correlation

Definition

- Menstrual age: first day of the last menstrual period (most commonly used)
- Fetal age: begins at conception

Importance

- Knowledge of gestational age is important for many reasons.
 - Accurate dating is necessary for:
 - Timing of invasive procedures
 - Chorionic villus sampling, amniocentesis
 - Treatment of preterm delivery or post-term pregnancy
 - Management of maternal or fetal complications
 - Interpretation of serum screening results
 - Evaluation of growth



First Trimester

Yolk Sac

- Yolk sac (YS): first anatomic structure to appear within the gestational sac (GS)
- Confirms intrauterine pregnancy
- Suspicious if GS >8 mm and no YS



First Trimester

- By the 6th menstrual week, the early embryo can be identified.
 - Usually with cardiac activity
 - The crown-rump length (CRL) is the best estimation of GA once appears.



First Trimester

Crown-Rump Length

- CRL measured from 7-13 weeks:
 - Straight line measurement: maximum length.
 - Use average of 3.
 - Early studies suggest accuracy of 3-5 days.

Robinson HP, et al. BMJ 1973; 4:281 Robinson HP, et al. Br J Obstet Gynecol 1975; 82:702



Measurements Used

 At 13-14 weeks CRL replaced by: biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), and femur length (FL)

Biparietal Diameter

- Can be performed between 14-42 weeks
- Measurement:
 - Highly reproducible
 - $-\pm7$ days between 14-20 weeks

de Crespigny, LC et al. Obstet Gynaecol 1989 Hadlock FP, et al. Am J Roentgenol 1982

Measurement of BPD

• Plane:

- Through third ventricle and thalami
- Perpendicular to the parietal bones:
 - Calvaria should be symmetrical:
 - Symmetry is important to ensure correct plane
- Outer edge of near calvarium to inner edge of far calvarium





Head Circumference

Plane of measurement:

- Parallel to the base of the skull
- Through the third ventricle
- Thalami located centrally
- Cavum septi pellucidi, anteriorly

HC Measurement

- Placement of calipers: Outer margin of calvarium:
 - Must readjust calipers from BPD measurement.
 - Do not include skin.



Femur length

- Align transducer with long axis of bone.
- Measure only the ossified portions of the femur.



Abdominal Circumference

- Measured at the level of the liver.
- Right and left portal veins meet.
- Ellipse is fit to the outer skin edges.



Variability of Ultrasound Biometry

Second Trimester (14-20 Weeks)

Variability of Ultrasound Measurements in Weeks

Measurement	Hadlock, 1992	Benson, 1991
BPD	0.94	1.40
HC	0.84	1.20
AC	1.04	2.10
FL	0.96	1.40

Hadlock FP et al. J Ultrasound Med 1992 Benson C, Doubilet P. Am J Roentgenol 1991

Later Pregnancy (20-42 Weeks)

Variability of Ultrasound Measurements in weeks

Measurement	20-26 wks	26-32 wks	32-42 wks
BPD	2.1	3.8	4.1
HC	1.9	3.3	3.8
AC	3.7	3.0	4.5
FL	2.5	3.1	3.5

Benson CB, Doubilet PM. Am J Roentgenol 1991

Redating Based on Ultrasound

Discrepancy Between Ultrasound and LMP

Timing, weeks	Discrepancy,	
	>	
7-10	3 days	
10-14	5 days	
15-20	7 days	
<26	10 days	
26-30	2 weeks	
>30	3 weeks	
stein SR, etal. J Ultrasound Med 1994		

Hadlock FP. et al. SO Radiology 1992

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Other Useful Biometry Markers

Transcerebellar Diameter (TCD)

Measurement of TCD

- Additional measurements may be useful when there are biometric discrepancies.
- Transverse cerebellar diameter (in millimeters) correlates with gestational age up to 22 weeks of gestation.
 - For example, if the TCD is 19 mm, then the gestational age is approximate to 19 weeks.



Foot Length

Measurement

• The foot length is measured from heel to toe.



Foot Length

Gestational Age, weeks	-2 SD	Predicted Value	+2 SD
12	7	8	9
16	19	21	23
20	30	33	37
24	40	45	50
28	49	55	58
32	58	65	72
36	66	74	82
40	72	81	90

Mercer et al. Am J Obstet Gynecol 1987

Binocular Diameter

Measurement

- When measuring the binocular diameter, the lenses in the eyes should be noted.
- The outer orbital diameter and inner orbital diameter are measured:
 - Binocular distance or outer orbital diameter = measurement between the lateral orbital rims.
 - Intraorbital distance = measurement between the inner margin of the orbits.



Other Useful Ultrasound Measurements

Variability of Ultrasound Measurements in Weeks

Measurement	12-18	18-24	24-30	30-36	36-42wk
	wk	wk	wk	wk	
Binocular distance	1.8	2.4	3.0	4.0	4.0
TCD	1.0	1.8	2.0	2.4	3.2
Foot length	1.2	1.7	2.2	2.6	3.1

Hill LM et al, Doubilet PM. Am J Obstet Gynecol 1992 Hadlock FP, et al. J Ultrasound Med 1984 Bovicelli L et al . J Clin Ultrasound 1981

- Caution when changing the estimated delivery date (EDD) based on measurements obtained from an ultrasound examination performed *late* in pregnancy.
- The earliest ultrasound measurement most reliable.
- Serial measurements may be necessary :
 - Discriminate between intrauterine growth restriction and poorly dated pregnancy
 - Interval growth assessment

Conclusions

- Ultrasound: The earliest ultrasound assessment of gestational age is the most reliable.
- When gestational age is in question late in pregnancy, then serial measurements are most helpful.

THANK YOU