ISUOG Basic Training

Fetal Biometry – Dating, Assessing Size & Estimating Fetal Weight

Learning objective

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

- List the measurements commonly used in obstetric ultrasound examinations and describe how these are used

Topics covered

- Estimating gestational age/assessing fetal size
- Standard fetal biometry – BPD, HC, AC & FL
- Correct anatomical planes for measurement & assessment of head, abdomen and leg
- Components for EFW
- 3rd trimester ga assignment (late referral)

Key questions

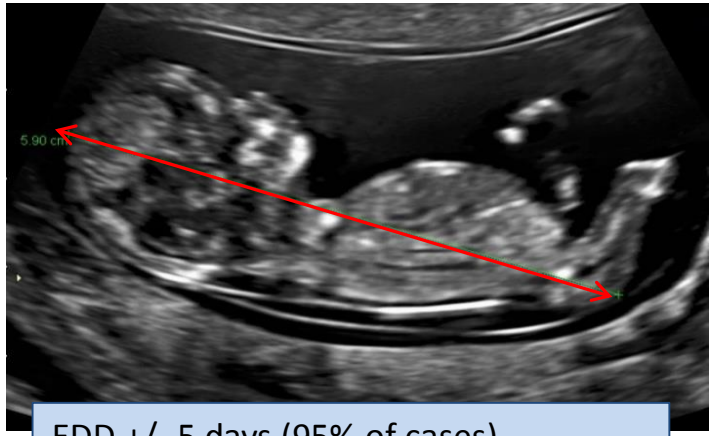
1. How, and when in gestation, should the gestational age be assigned?
2. What are the key features of the section of the fetal head required to measure the HC and BPD correctly?
3. What are the key features of the section of the fetal abdomen required to measure the AC correctly?
4. What are the key features of the section of the fetal femur required to measure the FL correctly?

Estimating gestational age

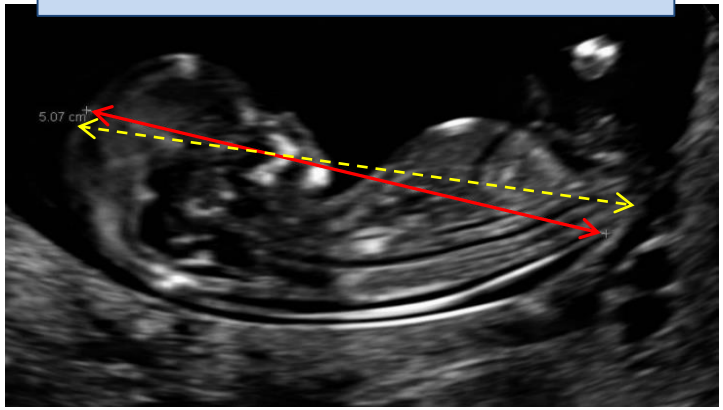
- Between 4^{+3} and 5^{+6} weeks - MSD of gest sac not recommended
- Between 6^{+0} and 9^{+6} weeks – CRL (5.0 – 31.9mm)
- Between 10^{+0} and 13^{+6} weeks - CRL (32.0mm – 80.0mm)
- Between 14^{+0} and 24^{+0} weeks – hc and/or fl, both should 'agree'
- After 24^{+0} weeks, assess size not gestational age

Dating by CRL

- Midline sagittal section of whole embryo/fetus
- Neutral position – fluid visible between chin and chest
- End points clearly defined
- Horizontal position - 90^0 to ultrasound beam
- Fills at least 75% of the screen
- Calipers at crown and rump

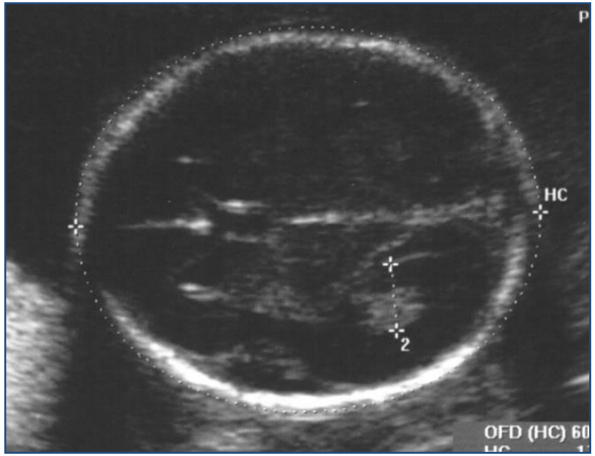


EDD +/- 5 days (95% of cases)

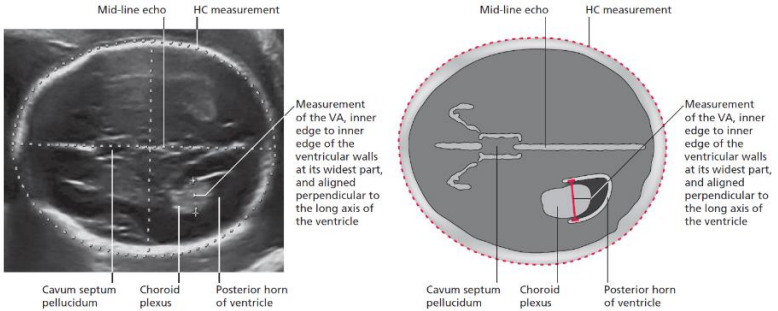


Correct anatomical plane HC/BPD

1. Cross section at level of lateral ventricles/ thalami *(slide)*
2. Midline (falx cerebri) horizontal *(dip)*
3. Midline equidistant from upper & lower parietal bones *(angle)*
4. Cavum septum pellucidum bisects midline, 1/3 from synciput (front) to occiput (back)
5. Rugby football shape, rounded at back, more pointed at front *(rotate)*
6. Skull contour regular *(angle)*

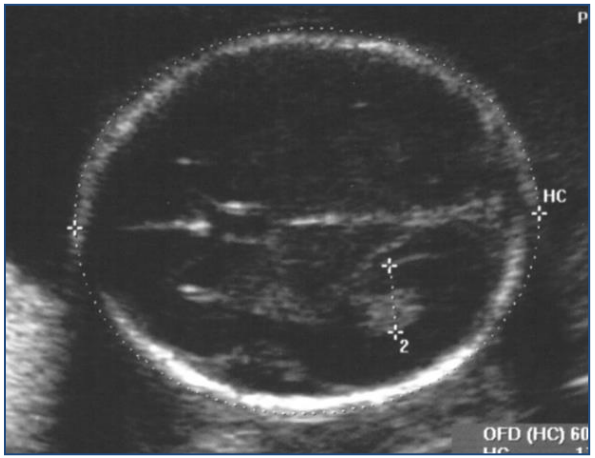


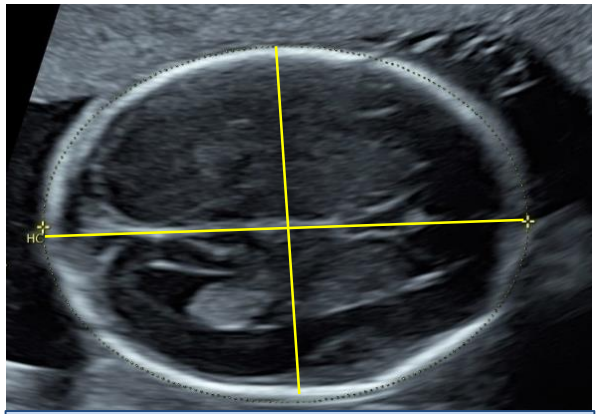
Head circumference (HC) and ventricular atrium (VA)



Dating by HC

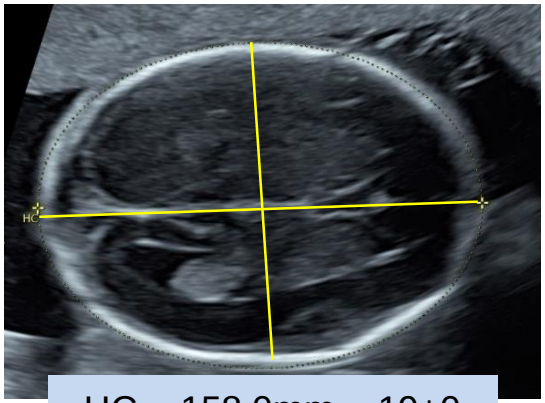
- Cross section of head at level of lateral ventricles/thalami
- HC from ellipse round outer skull border
- HC calculated from measurement of
  BPD (outer to outer) + OFD (outer to outer)
  HC = (BPD + OFD) x 1.62





HC = 158.0mm = 19+0 wks

Dating by HC

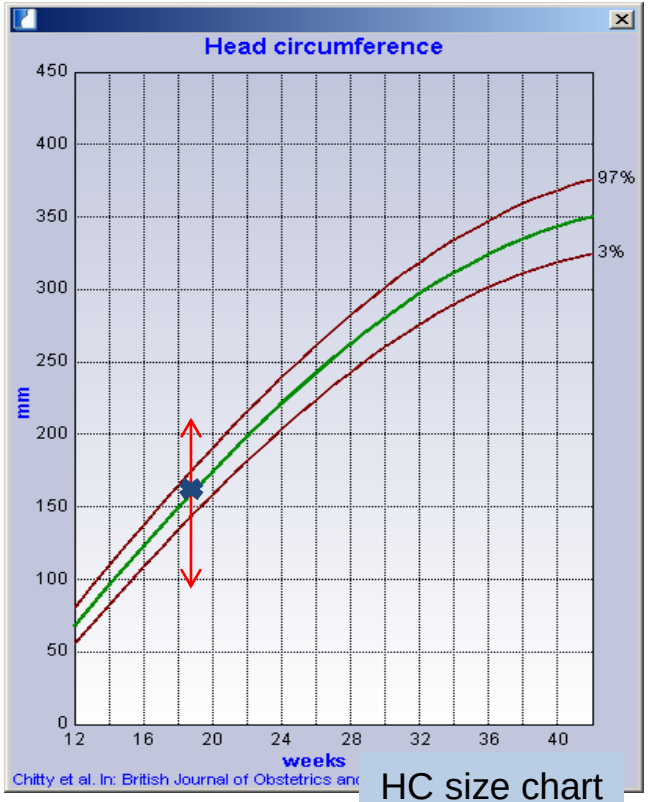


HC = 158.0mm = 19+0 wks

Look-up table to date
Size chart for reporting

length (mm)	GA(wks + days)	5th centile	95th centile
80	12+4	11+3	13+5
85	12+6	11+6	14+1
90	13+2	12+2	14+4
95	13+5	12+4	15+0
100	14+1	13+0	15+3
105	14+4	13+3	15+5
110	15+0	13+6	16+1
115	15+3	14+2	16+4
120	15+6	14+5	17+0
125	16+2	15+1	17+3
130	16+4	15+4	17+6
135	17+0	15+6	18+2
140	17+3	16+2	18+5
145	17+6	16+5	19+1
150	18+2	17+1	19+3
155	18+5	17+4	19+6
160	19+1	17+6	20+2
165	19+3	18+2	20+5
170	19+6	18+5	21+1
175	20+2	19+1	21+4
180	20+5	19+3	22+0
185	21+1	19+6	22+3
190	21+4	20+2	22+6
195	22+0	20+4	23+2
200	22+2	21+0	23+5
205	22+5	21+3	24+2
210	23+1	21+5	24+5
215	23+4	22+1	25+1
220	24+0	22+4	25+5
225			26+1

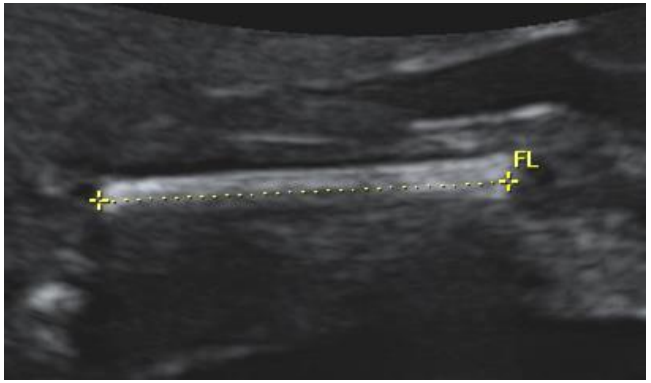
HC dating table

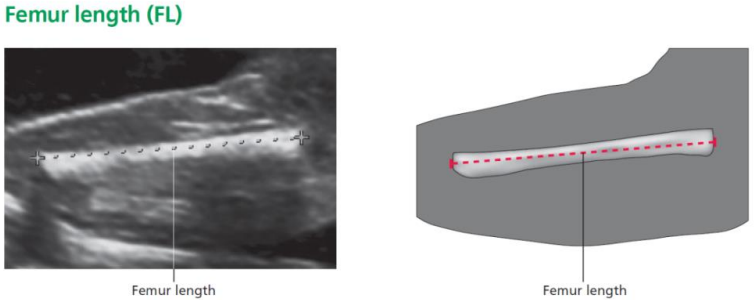


HC size chart

Correct anatomical plane FL

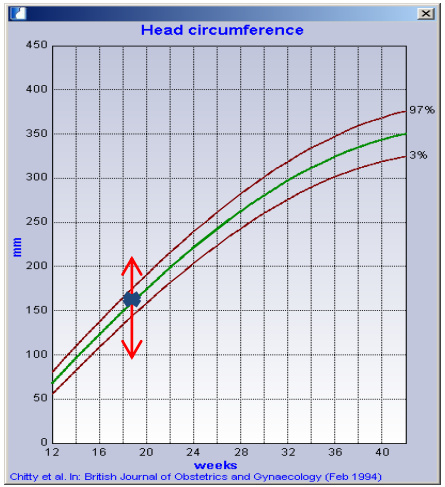
1. Both ends of ossified metaphysis clearly visible *(rotate + slide)*
2. Longest axis measured
3. Distal femoral epiphysis if visible or spur artefacts should not be included
4. Angle of femur to incident beam should correspond to technique of reference chart *(dip)*
5. Recommend 0^0-15^0 to horizontal

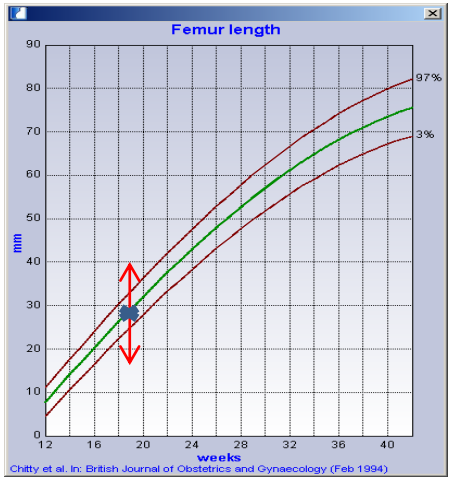


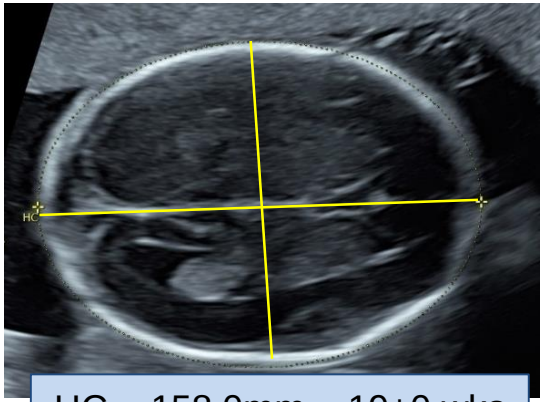


Dating by HC and FL

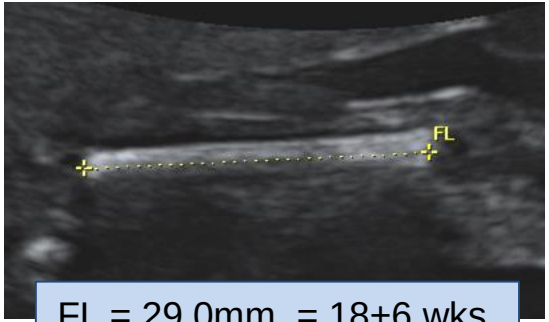
- Assigning GA accurately requires GA from HC & FL to ‘agree’
- Both 50th centile – straightforward







HC = 158.0mm = 19+0 wks



FL = 29.0mm = 18+6 wks

Dating by HC and FL

- Assigning GA accurately requires GA from HC & HC & FL to ‘agree’
  - Same centile?
  - +/- 10 centiles?
  - +/- 45centiles?

- Disagree
  - Review HC & FL sections & caliper placements
  - Repeat sections & re-measure
  - Consider significance of genuine discrepancy

HC and FL discrepancy

- ✓Review HC & FL sections & caliper placements
- ✓Repeat sections & re-measure
- ✓Consider significance of genuine discrepancy

Small FL (below 5th centile)

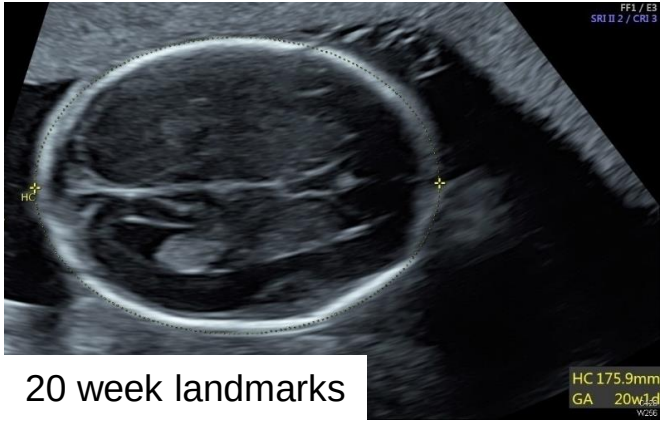
- Skeletal dysplasia
- Down's syndrome
- ?early IUGR

Refer for further assessment

Small HC (below 5th centile)

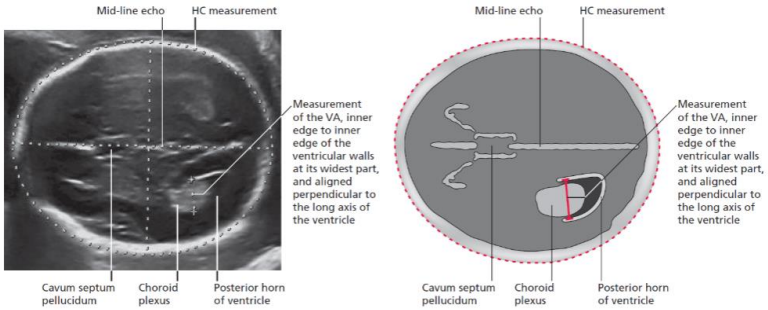
- Microcephaly
- Spina bifida

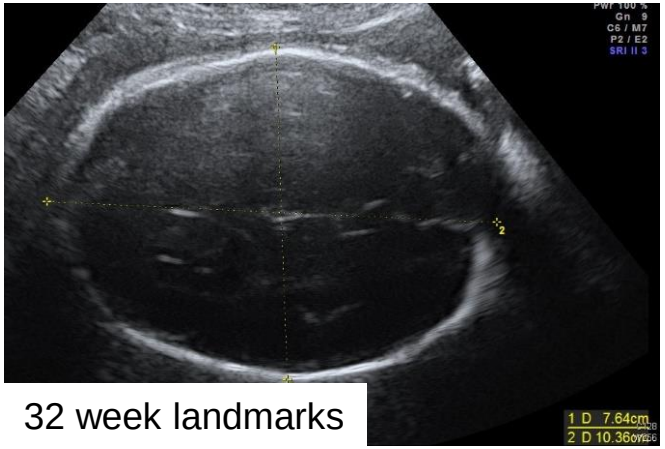
Refer for further assessment



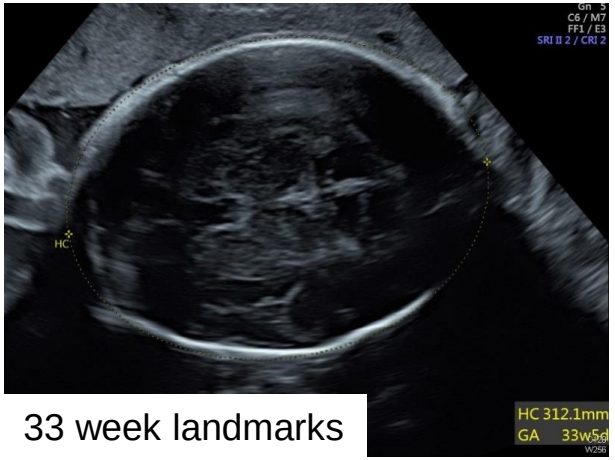
20 week landmarks

Head circumference (HC) and ventricular atrium (VA)





32 week landmarks

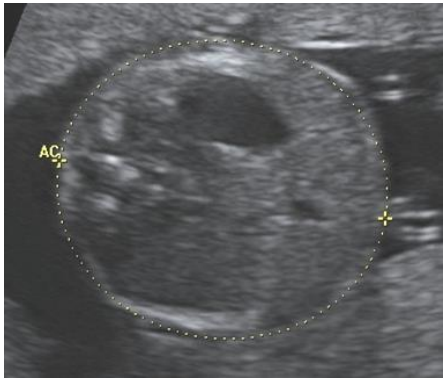


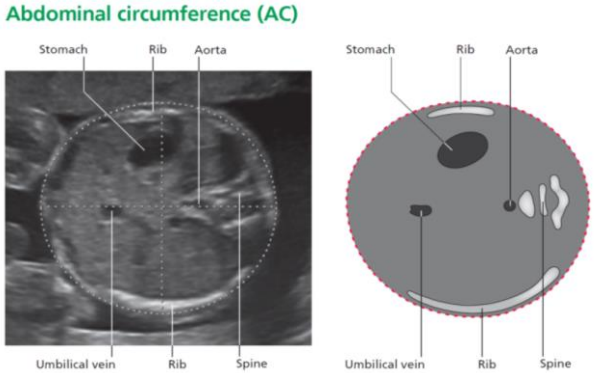
33 week landmarks

Correct anatomical plane AC

Transverse section of fetal 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)*



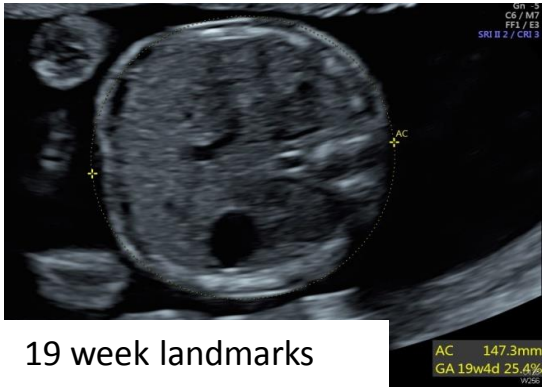


Measurement of AC

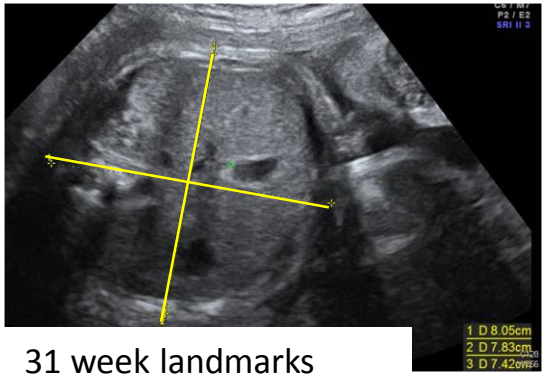
- Caliper(s) at outer surface of skin line

a) Ellipse

b) Linear
  - anteroposterior diameter (APAD)
  - transverse abdominal diameter (TAD)
  - diameters 90^0 to each other, outer to outer
  - AC = (APAD + TAD) x 1.57



19 week landmarks



31 week landmarks

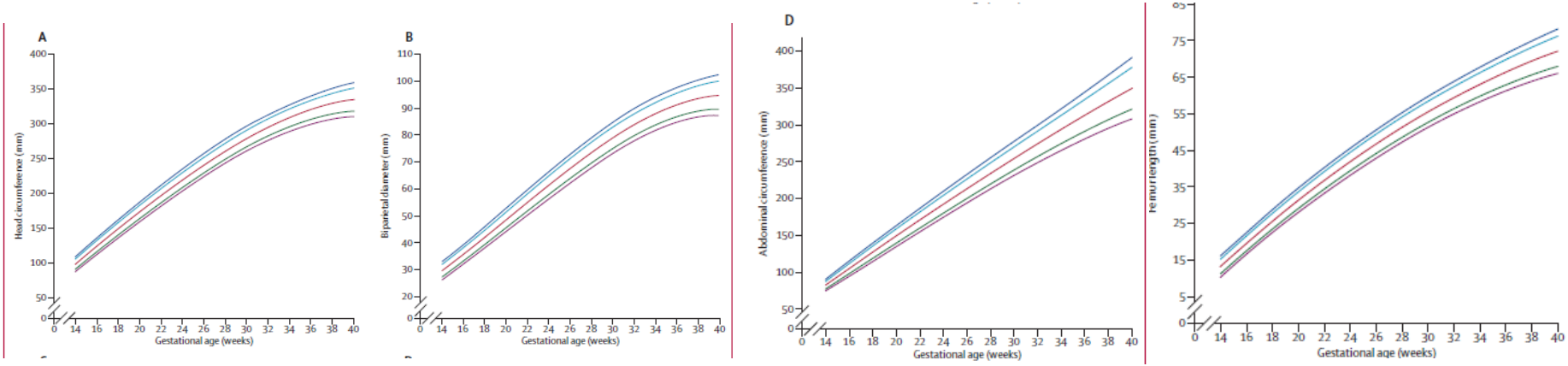
Assessing fetal size

- Once the EDD has been assigned (CRL), fetal biometry is used to assess
  - Fetal growth velocity
  - Fetal size
  - Fetal weight
- Measurements should not be used to reassign the EDD

- Time interval between scans - optimally at least 3 weeks

Fetal growth

Fetal growth

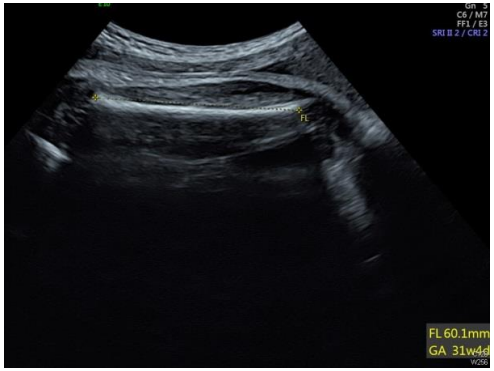


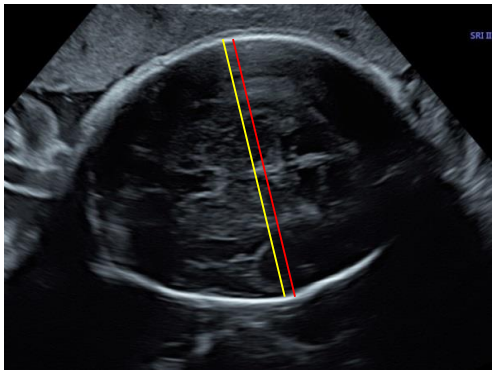
International standards for fetal growth based on serial ultrasound measurements: the Fetal Growth Longitudinal. Study of the INTERGROWTH-21st Project

Papageorghiou et al Lancet 2014;384:869-79

Components for EFW

- AC alone
- AC, HC
- AC,HC, F
- AC,HC, FL, BPD

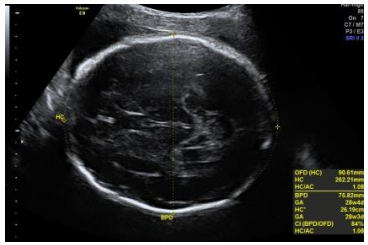


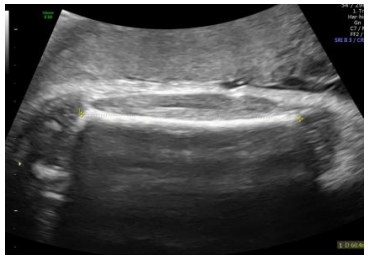


Caliper placement and estimating fetal weight

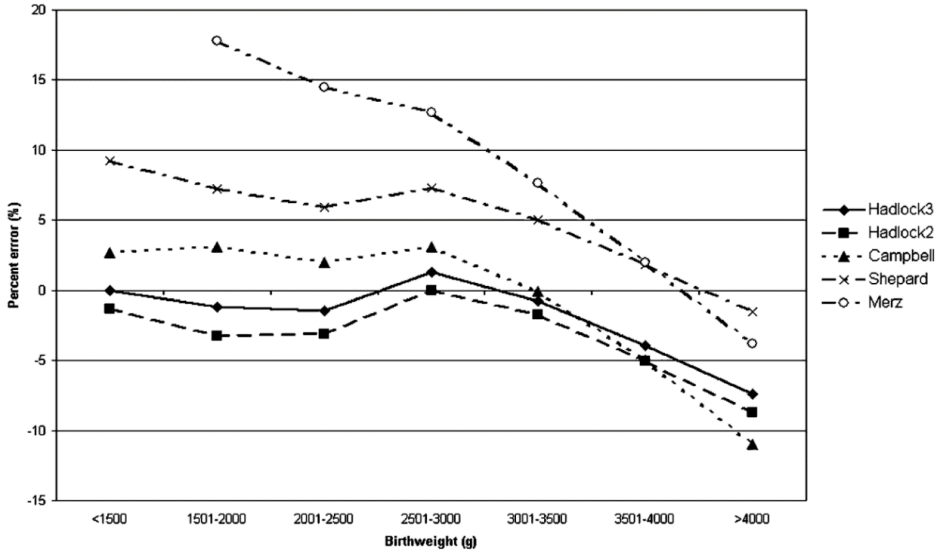
AC 310.3mm
FL 60.1mm

AC 322.8mm
FL 65.4mm





Estimated fetal weight



Hadlock 2 and 3 - most reliable formulae

- > 3 kg, % error increases

Kurmanavicius et al J Perinat Med 2004;32:155-61

3rd trimester GA assignment (late referral)

- Pregnancy dating >24 weeks unreliable
  - ?average 30 weeks
  - ?small 32 weeks
  - ?large 28 weeks

- Biometry used to assess fetal size (& wt), not gestational age
- Subsequent examination(s) to assess growth velocity

3rd trimester GA assignment (late referral)

- Biometry used to assess fetal size (& wt), not gestational age
- Subsequent examination(s) to assess growth velocity

Key points

1. Correct the incorrect level by sliding the probe, the shape by rotating the probe, the symmetry of the contents by angling the probe and the position of the structures relative to the horizontal by dipping the probe
2. Ideally pregnancies should be dated by CRL, between 10^{+0} and 13^{+6} weeks, i.e. 32.0mm – 80.0mm
3. Pregnancies scanned for the first time between 14 and 24 weeks should be dated by HC or FL. These two parameters should ‘agree’
4. Gestational age should not be assigned if scanning a pregnancy for the first time after 24 weeks

Conclusions

- Accurate dating, assessment of size and/or estimating fetal weight requires
  - The correct section(s) to be obtained
  - The calipers to be placed correctly as described by the relevant reference chart(s)

- It is preferable not to report an inaccurate measurement than to provide potentially clinically misleading ultrasound information