ISUOG Basic Training

Distinguishing between normal & abnormal fetal size & growth patterns in singleton & twin pregnancies

Learning objective

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

- Use ultrasound to distinguish between normal & abnormal growth patterns in singleton & twin pregnancies

Key questions

1. What maternal conditions are most frequently associated with abnormal fetal growth patterns?

2. What measurements should be taken to assess fetal growth correctly?

3. What are the typical ultrasound features of poor fetal growth?

4. What are the typical ultrasound features of macrosomic fetal growth?

5. How is fetal growth assessed in twin pregnancies?

Growth patterns

- Macrosomia

- Fetal growth restriction (FGR)

Birth weight

A **Birthweight**

Boys   Girls
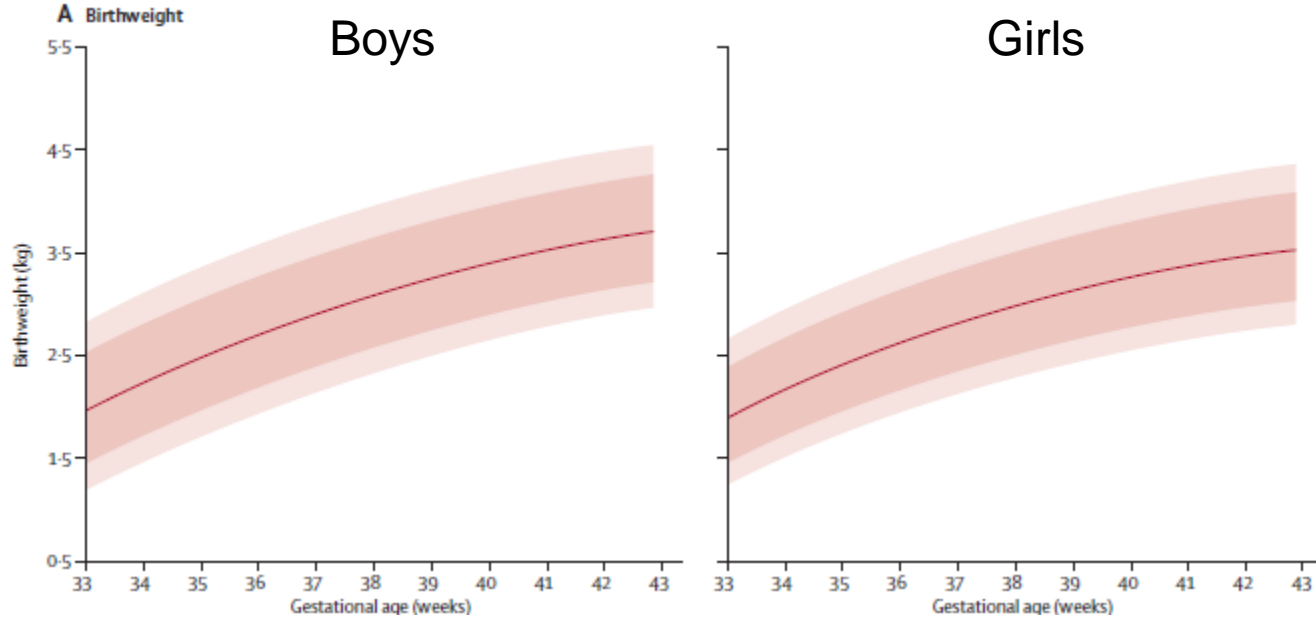
3rd, 10th, 50th, 90th, and 97th centile curves

Villar et al, Lancet, 2014, 384: 867-68

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Fetal growth impacts late in our lives

# Detecting abnormal growth

- Clinical assessment
  - Maternal risk factors
  - Measurement of fundal height
- Ultrasound
  - Biometry (principally HC, AC)
  - Estimation of fetal weight (BPD, HC, AC, FL)
  - Measurement of amniotic fluid (AFI or DVP)

Estimated fetal weight (EFW)

- Ultrasound superior to clinical estimate before 37 weeks
- Clinical estimate has accuracy similar to that of ultrasound at term
- 80% of EFW are within 10% of actual birthweight, remainder are within 20% of actual BW
  - Chauhan AJOG 1998
- Hadlock - EFW calculated from HC, AC & FL
  - AJOG 1985
- Intergrowth estimated fetal weight standards
  - Stirnemann et al, Ultrasound Obstet Gynecol 2017

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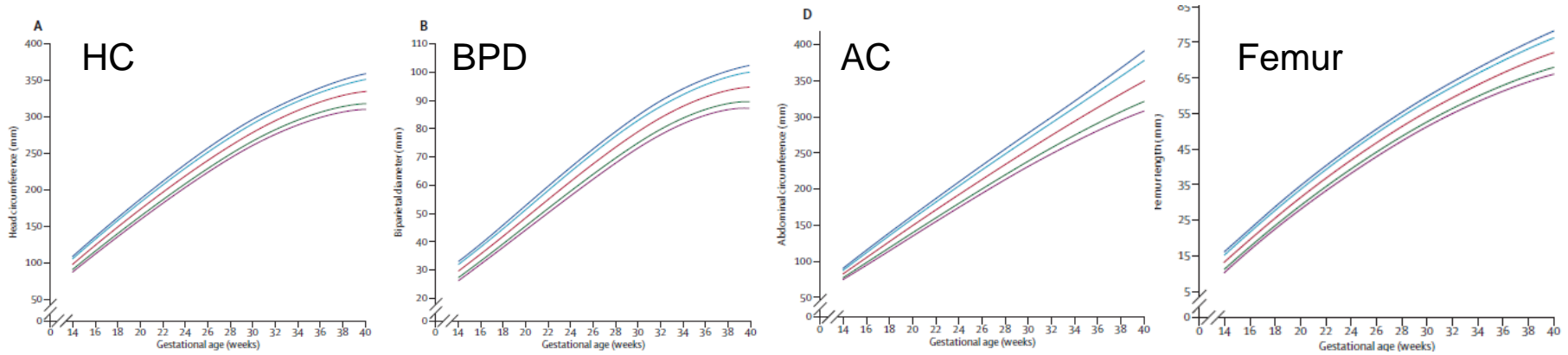
Fetal growth

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

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# The World Health Organization Fetal Growth Charts

- This study provides WHO fetal growth charts for EFW & common ultrasound biometric measurements, & shows variation between different parts of the world
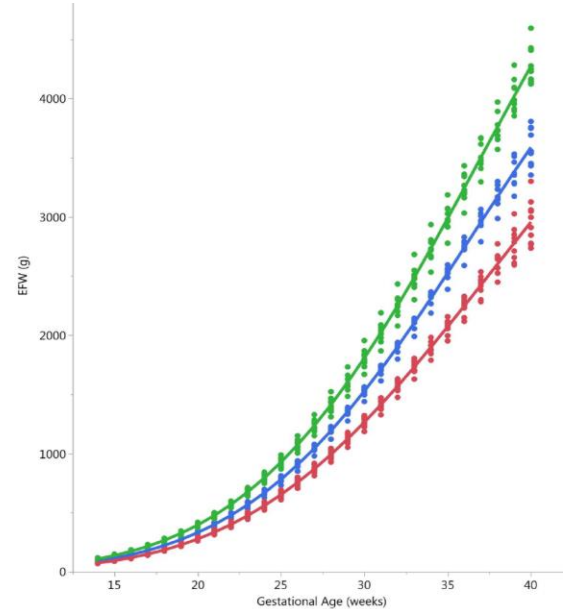
Fig 5. Country differences in estimated fetal weight. Selected percentiles for estimated fetal weight (EFW) for the ten participating countries, showing the magnitude of differences (red, 5th percentile; blue, 50th percentile; green, 95th percentile; each dot denotes a country).

Kiserud et al.. Am J Obstet Gynecol, 2018 Feb,218(2S):S619-S629

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Estimated fetal weight (EFW)
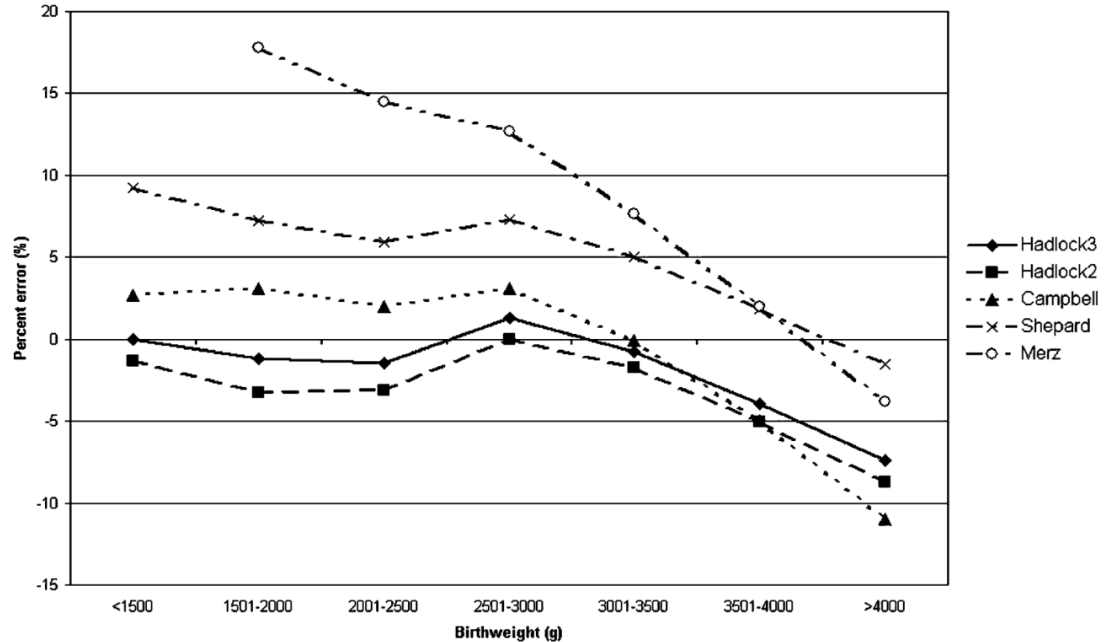
Hadlock 3: most reliable formula
> 3 kg percent error increases

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

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No international agreement exists
Use local charts

# Small for Gestational Age (SGA) or Fetal Growth Restriction (FGR)?

- SGA fetuses are smaller in size than normal for the gestational age (<10th percentile), constitutionally small

- FGR refers to poor growth of a fetus and associated to adverse outcome

- Difficult to differentiate because of overlap

SGA

FGR

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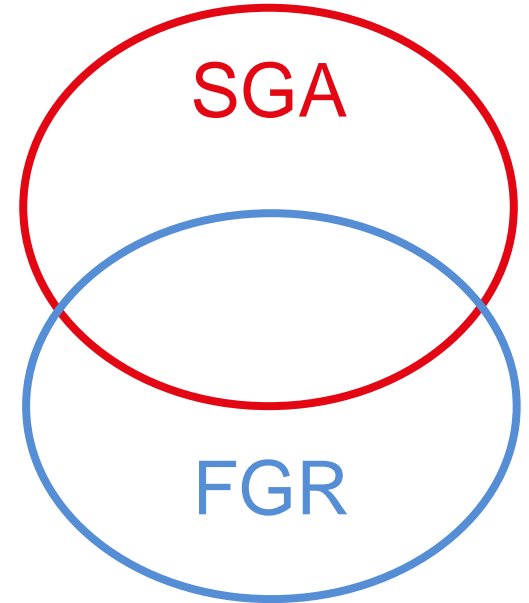
Distinguishing between SGA & FGR

- Correct dating

- Correct use of measurements

- Correct tools to assess biometry

- Appropriate management of clinical situation

Distinguishing between SGA & FGR

Umbilical artery

Uterine artery

Middle cerebral artery

Ductus venosus
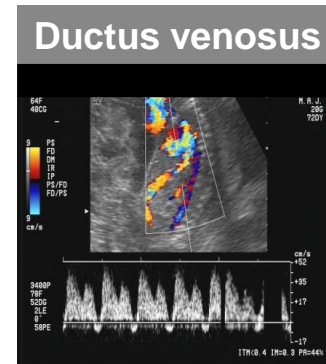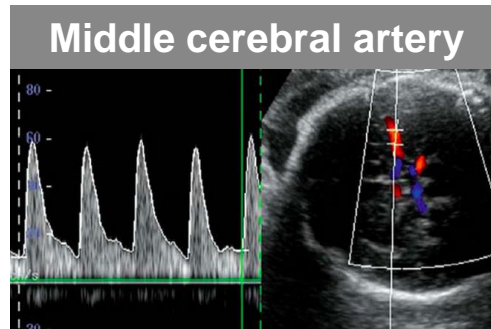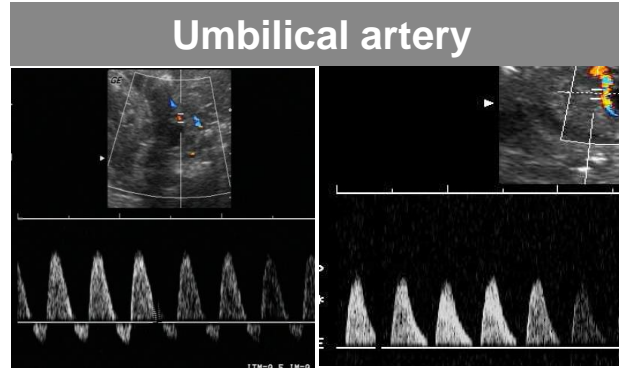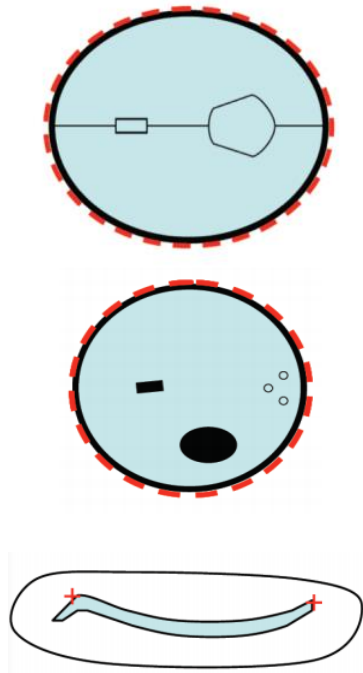
Differentiation between SGA & FGR

- SGA
  - Between 3rd &10th percentiles, with normal Doppler studies (umbilical artery, uterine artery or middle cerebral artery)

- FGR
  - <3rd percentile
  - <10th percentile, with abnormal Doppler changes (umbilical artery, uterine artery or middle cerebral artery)

Figueras F, Gratacos E Update on the Diagnosis and Classification of Fetal Growth Restriction and Proposal of a Stage-Based Management Protocol. Fetal diagnosis and therapy 2014

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Ultrasound detection of FGR

- Serial estimation of weight is superior to single estimates in the prediction of FGR
  - Repeated measurements every 2-3 weeks

- Routine ultrasound after 24 weeks in low-risk pregnancy does not improve perinatal outcome

Risk factors FGR

Fetal:
- Chomosome anomaly
- Genetic syndrome
- Congenital anomaly

Maternal:
- Idiopathic
- Chronic disease
- Abnormal implantation
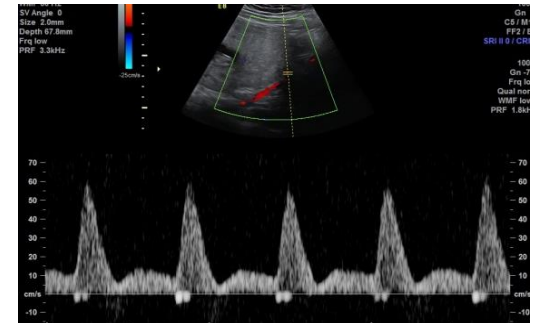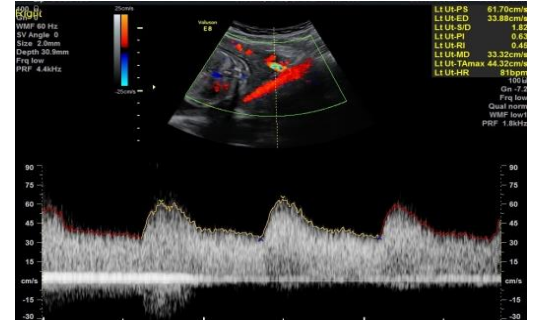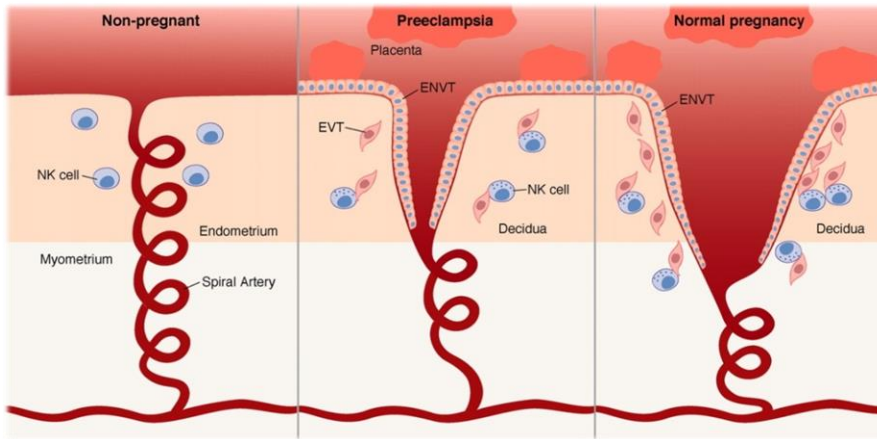(PE, HELLP, antiphospholipid IUGR)

Placenta:
- Mosaicism
- Uterus anomaly
- Velamentous insertion

External factors:
- Smoking
- Infection
- Psycho / social

FGR

Uterine circulation

- High risk woman
- Moderate predictor of FGR

Pijnenborg R, et al. Placenta. 2006, 27:939-58. Review.

Early FGR (<32 weeks) & late onset FGR (>32 weeks)

Early FGR, easy to diagnose, difficult to treat

Late FGR, difficult to diagnose, easy to treat

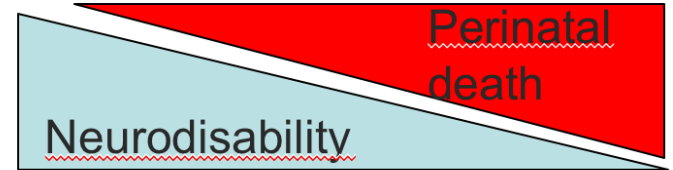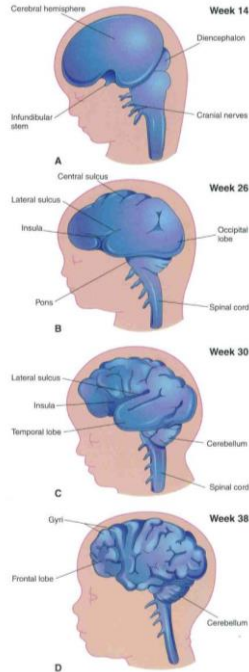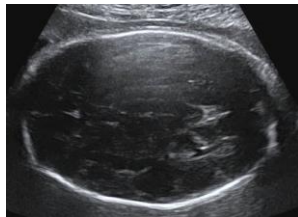# Timing of delivery of early FGR fetuses

Fetal brain development

12 w

20 w

30 w

Perinatal death

Neurodisability

Increasing gestational age

Early FGR

- Individualise
- Consider complications during pregnancy
- Clinical examinations
- Doppler umbilical artery + ductus venosus (DV)
- Cardiotocograph (CTG) - variation

Late FGR

- Consider PI in Middle cerebral artery (MCA) & Cerebroplacental ratio (CPR = MCA/UA)
- CPR should be > 1
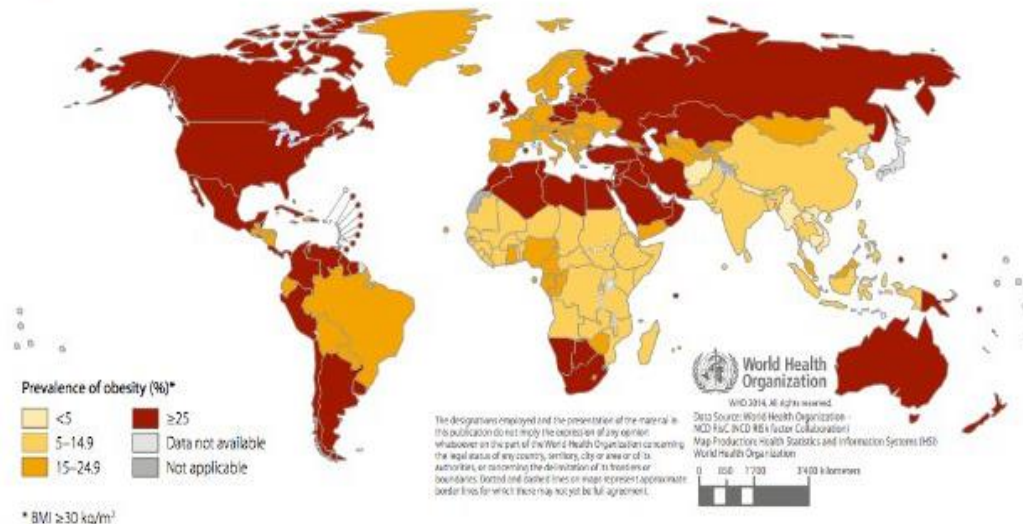- Induction at 37-38wks reduces the risk of adverse outcome

Macrosomia

Definition	Cut-off	Prevalence
Birth weight at term	> 4.5 kg	1,3 - 1,5%
Gestational age dependent	> 97th centile	
Birth weight at term	> 4 kg	7%
Gestational age dependent	> 90th centile	

Campbell S. UOG 2014; 43: 3–10

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Risk factors macrosomia

- Maternal diabetes
- Gestational diabetes
- Maternal obesity
- Family history
- Genetic syndromes
  - Beckwith-Wiedemann
  - Simpson-Golabi-Behmel
  - Sotos

Fig. 7.2 Age-standardized prevalence of obesity in women aged 18 years and over (BMI ≥30 kg/m²), 2014

Prevalence of obesity (%)*

<5	≥25
5–14.9	Data not available
15–24.9	Not applicable

* BMI ≥30 kg/m²

World Health Organization

Okun et al. J Matern Fetal Med 1997;6:285–290.

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Macrosomia

- Risk for mother
  - Emergency CS
  - Instrumental delivery
  - Shoulder dystocia
  - Trauma to birth canal
  - Bladder, perineum & sphincter injury
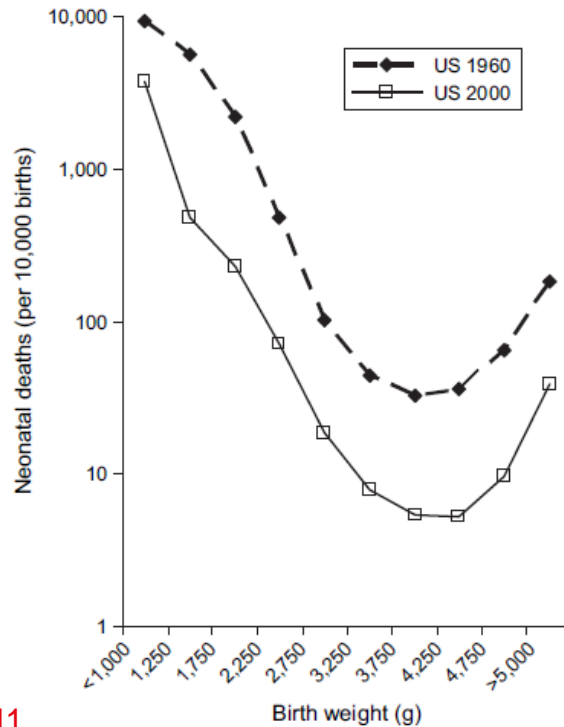
- Risk for infant
  - Mortality
  - Brachial plexus injury
  - Facial nerve injury
  - Fracture humerus / clavicle
  - Birth asphyxia

Basso et al Am J Epidemiol, 2006,164:303–311

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Ultrasound detection of macrosomia

- Assess risk factors

- US for fetal size at 32-34 weeks in women at risk

- If >90th centile repeat US at 38-39 weeks

Campbell UOG, 2014, 43: 3–10

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Monitoring growth in twins

- Dichorionic twins
  - US every 4 weeks from 20 weeks
  - Size difference > 20% every 2 weeks
- Monochorionic twins
  - US every 2 weeks from 14 weeks
  - Biometry
  - Amniotic fluid

Key points

1. Use BPD, HC, AC & FL to assess EFW
2. Leave two weeks between scans
3. Beware of the causes of impaired & increased fetal growth
4. Assess growth pattern to monitor risk of associated anomalies
5. Start onset & frequency of growth assessment in twins depending on chorionicity
6. Assess amniotic fluid & fetal wellbeing during scan

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