Impaired fetal growth

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Outline

- Terms and definitions
- Factors influencing size at birth
- Problems associated with impaired fetal growth and their significance
- Diagnosis
- Management
- Prevention
Terms and Definitions
Commonly used terms

- Prematurity
- Low birthweight (LBW)
- Small for gestational age (SGA)
- Intrauterine growth restriction (IUGR)
Prematurity

• Should refer to functional immaturity of organ systems
  – E.g. Respiratory immaturity
• When is functional maturity achieved?
• “Preterm” refers to relation to chronological age
  – Refers to gestation less than 37 weeks
Low birthweight (LBW)

- All infants weighing less than 2500 g at birth
- Does not consider gestational age
- Different problems included in the same group
  - Small and average sized preterm infants
  - Small sized term infant
- Proxy indicator for growth restriction and prematurity
- VLBW < 1500g; ELBW < 1000 g
Small for gestational age (SGA)

- Smaller than expected for given gestational age
- How much smaller?
  - Less than 10\textsuperscript{th} centile
  - Less than 5\textsuperscript{th} centile
  - Less than – 2 SD
- Synonyms
  - Small for dates (SFD), Light for dates (LFD)
Intrauterine growth restriction

- Restriction or slowing of the rate of intrauterine fetal growth
- Not synonymous with SGA
- Demonstration of slowing of growth rate
Factors influencing size at birth
Size at birth

- Size at birth depends on:
  - Gestation at birth
  - Fetal growth rate

- A baby may be small at birth because:
  - It was born earlier than normal, or
  - Its rate of intrauterine growth was slower than normal, or
  - It had impaired growth and was born early
Factors influencing growth

- Fetal
- Placental
- Maternal
- Environmental
Fetal factors

• Abnormal karyotype
  – Trisomies

• Fetal sex
  – Male fetuses heavier by 100-150 g

• Genetic influences
  – Parental size
  – Ethnic group
Placental factors

• Placental infections
  – Malaria, syphilis
• Placental infarction
• Placentation
  – Later born babies are 100-150 g heavier than first born babies
Maternal factors

• Maternal size
  – limiting effects
  – adjusting birthweight centiles for maternal height

• Maternal illness

• Nutrition
  – Anaemia
  – Malnutrition
Environmental factors

• Altitude
  – Lower birthweight at higher altitudes

• Tobacco abuse
  – Active smoking
  – Passive smoking
  – Tobacco chewing
Environmental factors

• Cooking fuels
  – Coal, wood, animal dung
  – Poor ventilation
  – Carbon monoxide inhalation

• Other heavy manual work
  – Agriculture
  – Carrying water
Problems associated with impaired fetal growth
• Low birthweight babies are approximately 20 times more likely to die than heavier babies
• Goal of reducing low birthweight incidence by at least one-third between 2000 and 2010 is a major goal in “A World Fit for Children” (UN 2002)
Morbidity

• Immediate
  – Increased risk of suspected fetal distress
  – Increased risk of interventions
  – Increased risk of problems after birth
    • Hypoglycemia, hypothermia, poor feeding

• Medium to long term
  – Learning disabilities
  – Increased risk of hypertension, heart disease, diabetes
Birthweight & early neonatal mortality – Vellore 2001
Birthweight and perinatal mortality

- Birthweight < 5\textsuperscript{th} centile OR 5.6
- Birthweight 5\textsuperscript{th} - 10\textsuperscript{th} centile OR 2.8
- Birthweight 10\textsuperscript{th} – 15\textsuperscript{th} centile OR 1.9

- Growth rate in third trimester is a better predictor of intrapartum problems and immediate perinatal outcomes than estimates of fetal size
Diagnosis
Clinical methods

- Identification of risk factors
- Maternal weight gain
- Abdominal palpation
- Tape measurements
Laboratory methods

• Biochemical methods

• Ultrasound
  – Routine vs selective use
  – Fetal biometry
  – Biophysical score
  – Cardiotocography
  – Doppler
Birthweight standards

- Cross sectional data on birthweight and gestation
- Graph of birthweight against gestation
- Cut off levels for classification
  - 10th and 90th centile
  - Small, appropriate and large for gestation
Population based standards

- Hospital births
- Physiological and pathological factors influencing size at birth
  - Misclassification if appropriate adjustments are not made
- Ethnic composition
- Accuracy of gestation
- Growth and preterm births
Antenatal clinical estimation

- Possible everywhere but requires training and experience
- Abdominal palpation
- Tape measurements of fundal height
  - Widely used for assessing fetal growth and size
  - Insufficient evidence from only randomized trial
Ultrasound based standards

- Hospital based
- Mostly cross-sectional studies
- Measurements include
  - Head size (BPD, HC)
  - Abdominal circumference
  - Femur length
- Weight estimation
- Interval growth measurements
Ultrasound based standards

• Equations for estimation of fetal weight
  – Hadlock equations commonly used

• Rossavik model
  – Early estimate of fetal growth rate
  – Project fetal weight at birth based on growth rate
Population based or individualised standards for fetal growth?

- Physiological factors
  - Size of the mother
  - Birth order
  - Sex
  - Ethnicity

- Adjustments made while interpreting size at birth
Individualise

• For physiological factors
• Computer generated graph (Gardosi et al)

• Higher antenatal detection of small for dates (48% vs 24%; OR 2.2, 95% CI 1.3-1.5)

• OR for stillbirth in small for dates by
  – Individualised graph 6.1 (95% CI 5.0-7.5)
  – Standard graph 1.2 (95% 0.8-1.9)
Management
Management options

NO EVIDENCE OF BENEFIT

• Bed rest in hospital
• Hormone therapy
• Betamimetic therapy
• Antihypertensive therapy
• Nutrient supplementation
• Maternal oxygen administration
• Plasma volume expansion
• Routine ultrasound
• Cardiotocography
• Biophysical scoring
Possible benefit

• Delivery at the appropriate time
  – Will the baby survive better in the uterus or outside it?
    • Nursery facilities
    • Costs of treatment

• Reducing birth asphyxia
  – Mode of delivery?
Beneficial interventions -1

• Doppler ultrasound for deciding on the time of delivery
  – Fewer inductions OR 0.83 (0.74-0.93)
  – Less hospital admissions OR 0.56 (0.43-0.72)

• Corticosteroids prior to preterm delivery
  – Less RDS OR 0.53 (0.44-0.63)
  – Less IVH OR 0.48 (0.48-0.75)
  – Fewer neonatal deaths OR 0.60 (0.48-0.75)
Beneficial interventions - 2

• Amnioinfusion in labour
  – Less FHR decelerations RR 0.54 (0.43-0.68)
  – Less CS for suspected fetal distress RR 0.35 (0.24-0.52)
  – Nursery stay > 3 days RR 0.40 (0.26-0.62)
Prevention
Beneficial effect

• Smoking cessation
  – LBW RR 0.81 (0.70-0.94)
  – Preterm births RR 0.84 (0.72-0.98)
  – Mean birthweight increase 33 g (11-55g)

• Balanced energy and protein supplementation
  – Less SGA RR 0.68 (0.56-0.84)

• Treatment of asymptomatic bacteriuria
  – LBW/Preterm RR 0.60 (0.45-0.80)
Summary

• Impaired fetal growth is associated with increased perinatal morbidity and mortality and increased risks in later life
• Diagnosis is made by demonstrating slowing of growth over a period of time using appropriate standards for fetal size
• There are few beneficial interventions that improve fetal growth
• Delivery at the appropriate time with skilled newborn care is the key to improved newborn survival