Impaired fetal growth

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Training in Research in Reproductive Health
Geneva 2005

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 10th centile
  - Less than 5th 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

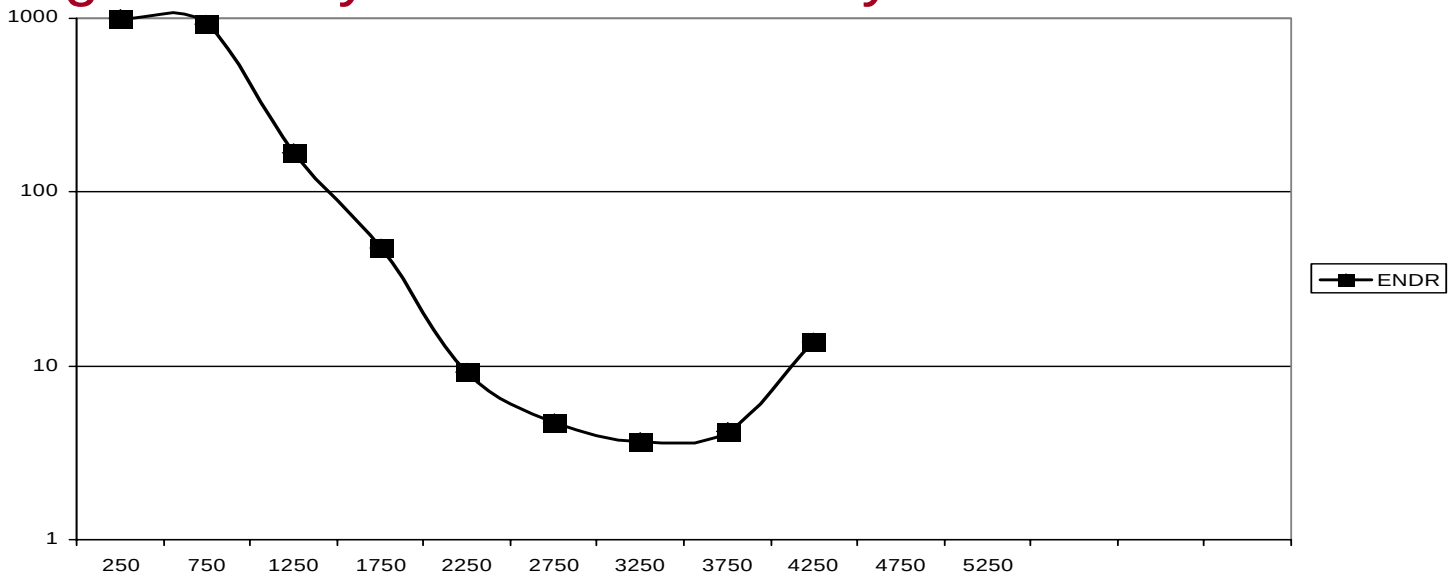
Problems associated with impaired fetal growth

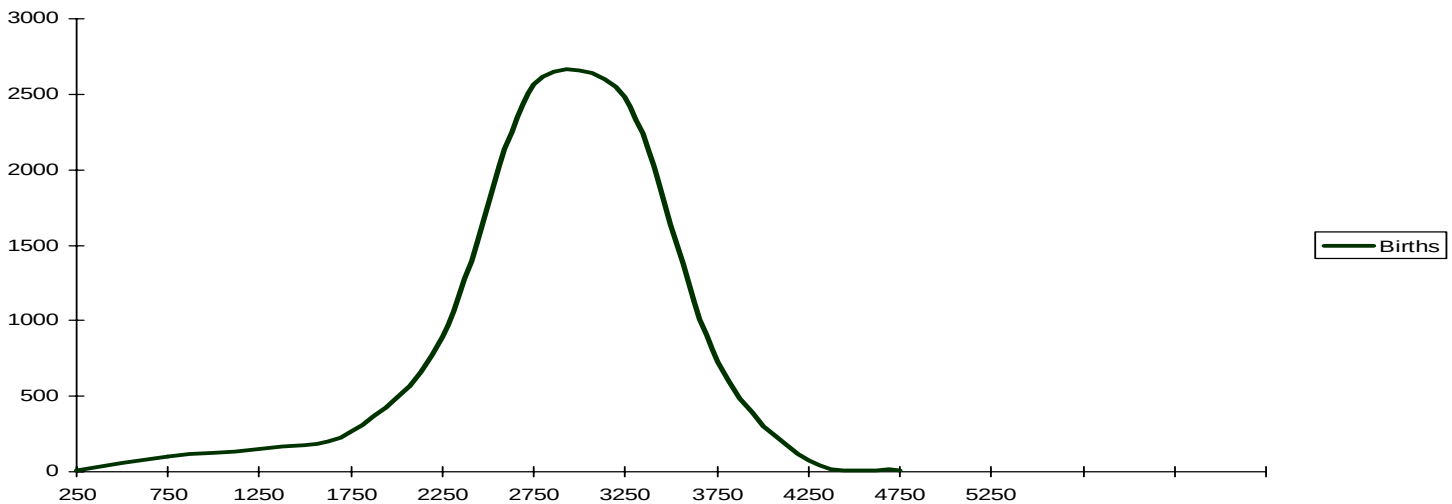
- Low birthweight babies are approximately 20 times more likely to die than heavier babies
- Goal of reducing low birthweight incidence by at least one-third between 2000 and 2010 is a major goal in “A World Fit for Children” (UN 2002)

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 < 5th centile OR 5.6
- Birthweight 5th - 10th centile OR 2.8
- Birthweight 10th – 15th 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
  - 10^{th} and 90^{th} centile
  - Small, appropriate and large for gestation

Population based standards

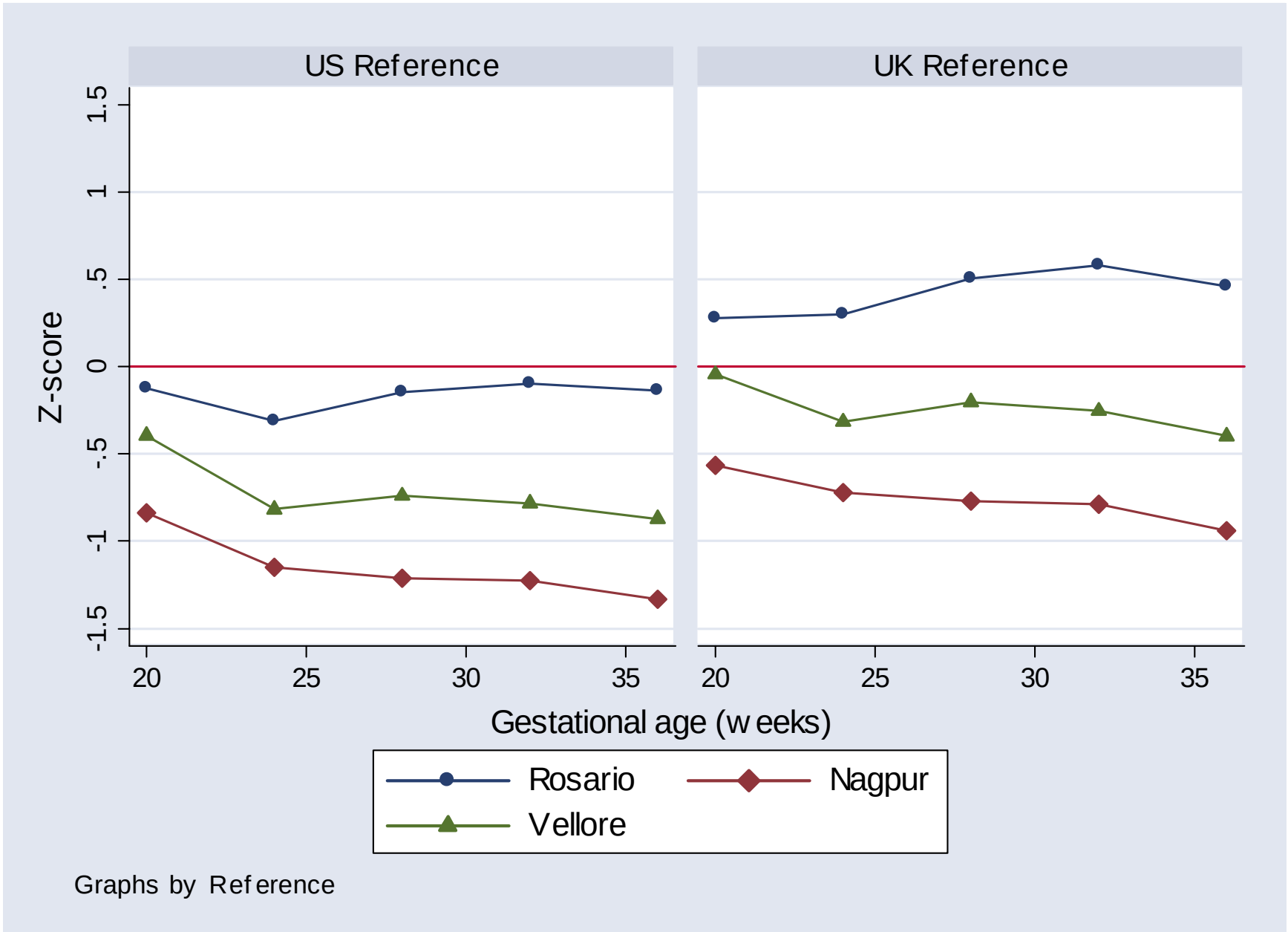
- Hospital births
- Physiological and pathological factors influencing size at birth
  - Misclassification if appropriate adjustments are not made
- Ethnic composition
- Accuracy of gestation
- Growth and preterm births

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


US Reference
UK Reference
Z-score
1.5
1
.5
0
-.5
-1
-1.5
20
25
30
35
Gestational age (weeks)
Rosario
Nagpur
Vellore
Graphs by Reference

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