

# Fetal growth (restricted)

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## Introduction

- > The identification of fetuses and babies that are small for gestational age (SGA) is essential for antenatal as well as postnatal care
- > Normal singleton fetal growth is approximately:
  - > 5 g / day at 14 to 15 weeks of gestation
  - > 10 g / day at 20 weeks of gestation
  - > 30 - 35 g / day at 32 to 34 weeks of gestation (Resnik 2002)
- > After 34 weeks of gestation the growth rate decreases. The median growth rate in multiple gestations is lower than that of singletons during the third trimester (Resnik 2002)
- > Symmetric fetal growth restriction (FGR) comprises 20 to 30 percent of growth restricted fetuses and is a growth pattern in which all fetal organs are decreased proportionally due to impairment of early fetal cellular hyperplasia (Divon & Ferber 2010)
- > Asymmetric FGR is characterised by a relatively greater decrease in abdominal size (e.g. liver volume and subcutaneous fat tissue) than head circumference and accounts for the remaining 70 to 80 percent of the FGR population (Divon & Ferber 2010)
  - > Asymmetric fetal growth is thought to result from the capacity of the fetus to adapt to a hostile environment by redistributing blood flow in favour of vital organs (e.g. brain, heart and placenta) at the expense of non-vital fetal organs (e.g. abdominal viscera, lungs, skin, kidneys)

## Definitions

### Normal fetal growth

- > Defined as the expression of the genetic potential to grow in a way that is neither constrained nor promoted by internal or external factors
- > **(NB:** It is difficult to identify real or true variation from normal growth in an individual fetus)

### Small for gestational age (SGA)

- > Birthweight below the 10th centile of weight for gestation. This does not necessarily indicate fetal growth restriction
- > The majority of fetuses with a birthweight below the 10th centile for gestational age are constitutionally small (RCOG 2002)

### Fetal growth restriction

- > FGR is defined antenatally by an estimated fetal weight or serial antenatal ultrasound evidence of growth restriction or growth arrest and at birth a birthweight below the 10th percentile using the South Australian birthweight percentiles (Preston et al. 2010)

### Related birthweight definitions

- > Low birthweight < 2,500 g
- > Very low birthweight < 1,500 g

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- > Extremely low birthweight < 1,000 g
- > Low birthweight can be due to preterm birth, constitutionally small infants or growth restricted infants

## Common factors associated with low weight for gestation include:

- > Race
- > Maternal size
- > Female infant (as opposed to male infant)
- > Nulliparity (as opposed to 2nd or 3rd infants)
- > History of a baby of low weight for gestational age
- > Matrilineal tendency

## Common factors associated with fetal growth restriction include:

### Maternal factors

- > Multiple pregnancy
- > Smoking, alcohol, amphetamines, cocaine / crack
- > Social disadvantage / domestic violence
- > Preeclampsia
- > Previous stillbirth
- > Obesity
- > Chronic hypertension, especially if associated with atherosclerosis
- > Connective tissue disorders
- > Acquired and genetic thrombophilias
- > Diabetes – especially the white classes indicating diabetic vasculopathy
- > Cardiac disorders – primarily cyanotic cardiac disease
- > Hypotension (< 60 mm Hg diastolic)
- > Respiratory disease – severe asthma
- > Anaemia
- > Renal disease
- > Drugs (anticancer agents, narcotics)
- > Poor nutrition

### Fetal factors

- > Fetal infection
- > Malformations
- > Chromosomal defects

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## Placental factors

- > Abruptio placentae, placenta praevia
- > Thrombosis, infarction (fibrin deposition)
- > Placentitis, vasculitis
- > Chorioamnionitis
- > Placental cysts, chorioangioma
- > Decreased uteroplacental blood flow

## Uterine factors

- > Fibromyoma (large submucosal fibroids)
- > Morphologic abnormalities – especially uterine septum
- >

## Pre-pregnancy counselling

### Behavioural modification

- > Inform women that smoking has been associated with low birthweight, preterm birth and perinatal death
- > Encourage / offer enrolment in smoking cessation programs to reduce / stop smoking. Effective interventions for a small minority of smokers include physician advice, group sessions and behavioural therapy

### Nutrition

- > Severe dietary restriction is related to decreased birthweight
- > Under-nutrition may be recognised by a low fasting glucose or by low maternal weight for height
- > Low fasting glucose has also been associated with low birthweight in Australia
- > Encourage a well balanced diet
- > Nutritional advice is moderately effective in increasing the protein and energy intake of pregnant women

## Clinical assessment

- > Fetal biometry and Doppler flow are the mainstay for investigation and diagnosis of IUGR (Figueras & Gardosi 2011)

## Abdominal examination

- > The predictive value of abdominal palpation and symphysial-fundal height (SFH) measurements as the primary surveillance method for estimating fetal weight in the third trimester is limited
- > SFH measurement must be taken from the top of the fundus to the fixed point at the upper edge of the pubic symphysis. Measure along the fetal axis, using a non-elastic tape measure (Figueras & Gardosi 2011)

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- > Serial measurement of fundal height and plotting on a growth chart is a useful screening tool and is recommended
- > Pregnancies unsuitable for primary surveillance by SFH include:
  - > Fibroids
  - > High maternal body mass index
  - > High risk pregnancy e.g. previous IUGR
- > Refer for further investigations if:
  - > The first fundal height measurement is below the 10<sup>th</sup> centile
  - > Consecutive measurements suggest static or slow growth (do not follow the expected slope of the growth curve)

## Customised fundal height charts

- > The routine use of a customised growth chart is still being evaluated
- > Calculation of customised centiles (fundal height and ultrasound growth) requires computer software that can be downloaded free from the Internet ([www.gestation.net](http://www.gestation.net)).
  - > A customised SFH chart is adjusted for sex as well as maternal characteristics such as height, weight, parity and ethnic origin
  - > Pathological factors known to affect birth weight and growth such as smoking, hypertension, diabetes and preterm delivery are excluded

## Ultrasound

- > Routine dating and morphology scan at 18-20 weeks
- > All growth restricted fetuses require careful assessment for malformations
- > Serial measurements of abdominal circumference and estimated fetal weight are useful to identify restricted fetal growth
- > The serial relationship between the head circumference (HC) and abdominal circumference (AC) as well as the amniotic fluid index provides the most useful indices for growth pattern
  - > Reduced growth of the abdominal circumference with maintenance of growth in BPD in association with oligohydramnios are indicative of fetal growth restriction
  - > Serial measurements of AC and EFW (growth velocities) are superior to single estimates of AC or EFW in the prediction of FGR (abnormal neonatal ponderal index and skinfold thickness) and predicting poor perinatal outcome. However, use of fetal growth alone to diagnose growth restriction (especially when the interval between the scan is less than two weeks) can lead to high numbers of false positives
- > Fetal structural abnormalities with normal liquor volume and normal uterine or umbilical artery Doppler may also be associated with chromosomal defects (consider karyotyping) (RCOG 2002)
- > Oligohydramnios without an obvious cause (e.g. renal agenesis) is associated with high perinatal mortality

## Laboratory tests:

- > Complete blood picture (haemoconcentration, decreased platelet count)

## Monitoring fetal movements

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- > A large randomised trial failed to demonstrate that charting fetal movements is of value (Grant et al. 1989)
- > A general enquiry about fetal movements may be worthwhile

## Cardiotocography

- > Has not been found to be an effective screening test but is useful in the surveillance of growth restriction

## Umbilical artery Doppler

- > Abnormal Doppler wave forms are found in association with restricted growth
- > A systematic review found that monitoring high risk fetuses with umbilical artery Doppler reduces perinatal morbidity and mortality (Neilson and Alfrevic 2003)
- > Doppler surveillance also lowers the rate of antenatal admissions and inductions of labour
- > Close correlation between abnormal flow velocity wave forms and fetal hypoxaemia and acid base status has been reported
- > If increased resistance is found, repeat assessment in two weeks
- > If absent or reversed diastolic flow is found, admit and perform cardiotocography; reversed flow mostly requires delivery within days (consider steroids)

## Antenatal care

- > Detailed history to identify risk factors
- > Appropriate counselling as indicated (e.g. balanced diet, stop smoking or other substance abuse, stopping work)
- > The following options of management have been proposed for pregnancies at risk of fetal growth restriction but have not been demonstrated to be beneficial thus far:
  - > Aspirin
  - > Hospitalisation and bed rest
  - > Betamimetics or calcium channel blockers
  - > Plasma volume expanders

## Early onset growth restriction (identified at < 32 weeks gestation)

### Laboratory tests:

- > Maternal serology for CMV, toxoplasmosis, syphilis infection
- > Complete blood picture (haemoconcentration, decreased platelet count)

### In case of severe early onset IUGR consider:

- > Thrombophilia screen (LAC, aCL, aPC resistance, homocysteine, MTHFR 677, CT/1298 AC)
- > Chromosome or other congenital abnormality
- > Uteroplacental dysfunction (by exclusion)
- > Karyotype by amniocentesis, chorion villus sampling or cordocentesis particularly in the presence of polyhydramnios, fetal malformation or symmetrical growth restriction
- > Corticosteroids in anticipation of early delivery
- > One in five severely growth restricted fetuses will have episodes of bradycardia.
- > In partnership with the woman, develop a management plan (e.g. mode of delivery if sustained bradycardia)

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## Late onset growth restriction (detection after 32 weeks)

- > Usually mild to moderate uteroplacental dysfunction due to a variety of causes
- > Serial ultrasound measurement of growth (2 weekly) and amniotic fluid index

## Timing of delivery

- > Varies according to aetiology, severity and duration of pregnancy

## Moderate growth restriction

- > Management plan developed between the woman, the obstetrician and the neonatologist.
- > Consider induction of labour if the cervix is ripe at  $\geq 36$  week's gestation
- > Delivery can be delayed until  $\geq 37$  weeks in the presence of end diastolic flow and when other surveillance findings are normal (RCOG 2002)

## Significant growth restriction

- > Consider delaying delivery for the very preterm fetus until evidence or imminent signs of fetal compromise
- > Very growth restricted fetuses are usually delivered between 34-36 weeks
- > Consider delivery if gestation  $> 34$  weeks in the presence of absent or reversed end diastolic flow
- > Growth restriction with oligohydramnios  $\geq 36$  weeks indicates a need for delivery

## Delivery

- > Current evidence does not support elective caesarean section for all growth restricted fetuses, however, growth restriction associated with absent or reversed flow almost universally requires birth by LSCS
- > Continuous CTG in labour with use of fetal scalp blood sampling for significant signs of fetal compromise

## Placental pathology

- > Always send the placenta to an experienced placental pathologist. The examination can indicate the cause of growth restriction – e.g. maternal thrombophilias, infection, etc

## Complications

- > Poor perinatal outcome among small for dates infants is largely due to the high rate of fetal growth restriction among them (20 % of small for dates fetuses have growth below the 5th centile) (RCOG 2002; Walkinshaw and Cochrane 2003)

## Small for dates fetuses are at increased risk of:

- > Reduction in maternal perception of fetal movements

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- > Meconium stained liquor
- > Abnormal heart rate patterns intrapartum
- > Intrauterine fetal death
- > Hypoxic ischaemic encephalopathy
- > Poor neurological development
- > Delay in cognitive development
- > Sudden infant death syndrome

## In adult life

- > Type 2 diabetes and hypertension (RCOG 2002)
- > **NB:** Good catch up growth in the first few months of life may predict a healthy outcome

## Follow-up of low birthweight infants

### Routine supplementary iron

- > Iron supplementation is recommended for low birthweight infants (< 2,500 g).
- > Give 2 mg/kg/day ferrous fumarate or ferrous gluconate from 2 to 8 weeks of age until 12 months of age (Edmond & Bahl 2006)

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## Useful web sites

Gestation Network: Available from URL:

[http://www.gestation.net/birthweight\\_centiles/birthweight\\_centiles.htm](http://www.gestation.net/birthweight_centiles/birthweight_centiles.htm)

World Health Organisation (WHO)

Edmond K, Bahl R. Optimal feeding of low birth weight infants. Technical review 2006. Available from URL: [http://whqlibdoc.who.int/publications/2006/9789241595094\\_eng.pdf](http://whqlibdoc.who.int/publications/2006/9789241595094_eng.pdf)

## Abbreviations

FGR	Fetal growth restriction
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N.B.	Note
SGA	Small for gestational age
RCOG	Royal College of Obstetricians and Gynaecologists
SFH	Symphysial-fundal height
et al.	And others
e.g.	For example
g	Gram(s)
mm Hg	Millimetres of mercury
LSCS	Lower segment caesarean section
CTG	Cardiotocograph
mg	Milligram(s)
mL	Millilitre(s)
ACOG	American College of Obstetricians and Gynecologists
cm	Centimetre(s)
%	Percentage

## Version control and change history

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1.0	24 Nov 03	22 Nov 11	Original version
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