Fetal Growth Patterns: how to improve the antenatal detection of the Small or Large for gestational age fetus in a low risk population

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Fetal Growth Patterns

• What is considered Abnormal fetal growth
  – Small for gestational age (SGA)/intrauterine growth restriction (IUGR)
  – Large for gestational age (LGA)/macrosomia
• Increased morbidity and mortality
• Antenatal Assessment of risk factors
• Detection/screening
  – Abdominal palpation/SFH measurement
  – Customised SFH chart
  – Indications for referral
• How to manage a patient SGA/LGA fetus
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 (SA perinatal Practice Guidelines)

• Normal singleton fetal growth (Resnik 2002)
  – 5g/day at 14-15 weeks
  – 10g/day at 20w
  – 30-35g/day at 32-34 weeks
Small for Gestational Age (SGA)

- Birthweight below the 10\textsuperscript{th} centile of weight for gestation. This does not necessarily indicate fetal growth restriction (SA Perinatal Practice Guidelines)
Intrauterine Growth Restriction (IUGR)

- a condition in which a fetus is unable to achieve its genetically determined potential size.
  - This functional definition seeks to identify a population of fetuses at risk for modifiable but otherwise poor outcomes.
Not all SGA fetuses are IUGR (visa versa)

- 40% constitutionally small
- Only 40% of SGA babies benefit from intervention
Large for Gestational Age/Macrosomia

• Interchangeable terms
• fetal growth beyond a specific weight, usually 4,000 g or 4,500 g regardless of the fetal gestational age.
• Results from large cohort studies support the use of 4,500 g as the weight at which a fetus should be considered macrosomic.
• Weighing the newborn after delivery is the only way to accurately diagnose macrosomia.
Fetal Growth Patterns

INCREASED MORBIDITY AND MORTALITY
Morbidity associated with IUGR

- 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
Morbidity associated with IUGR

• In adult life
  – Type 2 diabetes and
  – hypertension (RCOG 2002)
  – mental health problems

• Children born below 2\textsuperscript{nd} percentile at increased risk: (Zubrick etal)
  – mental health morbidity (OR 2.9; 95% CI, 1.18-7.12)
  – Academic impairment (OR, 6; 95% CI, 2.25-16.06)
  – Poorer general health (OR, 5.1; 95% CI, 1.69-15.52)
Morbidity associated with LGA

• Maternal risks:
  – Protracted or arrested labour
  – Operative vaginal delivery
  – Caesarean delivery
  – Genital tract lacerations
  – Postpartum haemorrhage
  – Uterine rupture

• Fetal and neonatal risks:
  – Shoulder dystocia leading to birth trauma (brachial plexus injury, fracture) or asphyxia
  – Neonatal hypoglycemia
Morbidity associated with LGA

• Long-term risks in offspring:
  – Development of impaired glucose tolerance and obesity
  – Development of metabolic syndrome
  – Increase in aorta intima-media thickness, left ventricular mass, and abnormal lipid profile
Detection: Antenatal care

Is fetus growing at a normal rate = according to its genetic potential?

• Abdominal palpation
• Measurement of SFH

• BUT FIRST:
  – Identify those patients not suitable for low risk care or routine screening
  – Who are the patients that require additional screening ie. Serial USS
Identifying High Risk Patients

• At risk of IUGR
  – Multiple pregnancy
  – Previous hx of IUGR
  – Previous hx of Unexplained stillbirth
  – Hypertension/past hx of PET
  – Antiphospholipid syndrome
  – Autoimmune disease
  – Renal conditions
  – Diabetes
  – Maternal age 40+
  – Alcohol, drug misuse
Identifying High Risk Patients

• At risk of macrosomia
  – High body mass index
  – Multiparity
  – Advanced maternal age
  – Maternal diabetes
  – Post term pregnancy
  – Male infant
  – Previous macrosomic infant
  – Excessive weight gain in pregnancy
  – Maternal birth weight over 4000 grams
Indications for serial growth USS monitoring

• Increased risk based on an antenatal assessment
  – Risk factors mentioned
  – PAPPA low (<0.4)
  – Single umbilical artery on morphology

• Fundal Height measuring not possible/unreliable
  – Polyhydramnios
  – High BMI (35+)
  – Large fibroids
Detection: Antenatal care

Is fetus growing at a normal rate = according to its genetic potential?
- Abdominal palpation
- Measurement of SFH
Factors that contribute to the limited predictive Value of SFH measurement:
• Maternal obesity
• Large fibroids
• Hydramnios
• Fetal lie
• Head engagement

• a: fundal grip
• b: umbilical grip
• c: pawlick’s grip
• d: pelvic grip
Abdominal Palpation

• Limited accuracy in the detection of a SGA neonate in low risk populations

• **Low risk populations (Bais et al 2004)**
  – sensitivity 19-21%, specificity 98%

• In mixed risk populations,
  – the sensitivity increases to 32-44% (Hall et al 1980; Rosenberg et al 1982)

• In high risk populations
  – 53% for severe SGA (Bias et al 2004)
Fundal Height Measurement
Current SA guideline:

**A** Mother semi-recumbent, with bladder empty.

**B** Palpate to determine fundus with two hands.

**C** Secure tape with hand at top of fundus.

**D** Measure to top of symphysis pubis.
Single FH measurement approach

“The fetus is most likely AGA if
FH = Dates +/-2 cm”

Antenatal detection rates of SGA fetus (25-30%)
Case

- Primigravida presents at 36+ weeks
- Uneventful pregnancy

Obstetric examination:
- Fetus: longitudinal lie, cephalic presentation
- FHR: 145 bpm
- Fundal Height: 35.5 cm

What is your estimate of the fetal growth/weight? SGA<P10, AGA:P10-90 or LGA>P90?
SFH measurement

• SFH is associated with significant intra- and inter-observation variation
• Continuity of care provider further improves the accuracy of fetal growth surveillance
• **serial measurement** may improve predictive accuracy.
• Even better: Customised SFH charts!
Who does actually plot FH in chart?
Our case 36 weeks: serial plot population based chart

What is your view about fetal growth/weight? SGA<P10, AGA:P10-90 or LGA>P90?
Customised SFH Charts

• Evidence that improves detection whilst reducing unnecessary referrals for investigations (Gardosi and Francis 1999; Roex 2012)

• Customised antenatal growth charts are now recommended by the RCOG (RCOG guidelines 2002)

• Also currently being used in SA hospitals:
  – Lyell McEwin Hospital Service
  – Flinders Medical Centre
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).
>
> 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
Example Customised FH Chart

Para 0  European  
Maternal height (cm): 168  
Booking weight (kg): 82  
Body Mass Index: 29.1

\[ X = \text{Fundal height} \quad \bigcirc = \text{Estimated weight by scan} \]
Customised SFH charts

Mrs Large

Para 1 European
Maternal height (cm): 184
Booking weight (kg): 82
Body Mass Index: 24.2
C = customised centile
1. Girl; 40w 0d; 3000g = C 5, SGA

Mrs Small

Para 1 Indian
Maternal height (cm): 148
Booking weight (kg): 50
Body Mass Index: 22.8
C = customised centile
1. Girl; 40w 0d; 3000g = C 49

X = Fundal height  O = Estimated weight by scan
• Primigravida presents at 36+ weeks
• Uneventful pregnancy

Obstetric examination:
• Fetus: longitudinal lie, cephalic presentation
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What is your estimate of the fetal growth/weight? SGA<P10, AGA:P10-90 or LGA>P90?
Our case 36 weeks: serial plot population based chart

What is your view about fetal growth/weight? SGA<P10, AGA:P10-90 or LGA>P90?
Our case: serial FH plot customised chart

What is your view about fetal growth/weight? SGA<P10, AGA:P10-90 or LGA>P90?
Comparing trends
What about the ‘evidence’?

• No randomised controlled trials (Level II)

1. One cohort trial comparing laying on hands with plotting on customised chart (level III)

2. One cohort trial comparing non plotting with plotting on customised chart (level III)
Serial plotting FH in customised chart

1. West Midlands UK 1999
   • Improved detection of SGA fetus 29.2% vs 47.9%
     (OR 2.2; 95% CI 1.1-4.5; p 0.03)
   • Use of customised charts was also associated with
     fewer referrals for investigation and fewer admission.

2. Adelaide  NALHN 2012
   • Improved detection rate 24.8% vs 50.6%
     (OR 3.1; CI 1.7-5.5; P<0.001)
When to refer for Growth USS:
‘Fetal GROW’ guideline NALHN

1. Low first fundal height

U/S Scan:
- Liquor
- Estimated Fetal Weight
- +/- umb. art. Doppler
When to refer for Growth USS:

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2. Static growth

U/S Scan:
- Liquor
- Estimated Fetal Weight
- +/- umb. art. Doppler
When to refer for Growth USS:
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3. Slow growth

U/S Scan:
Liquor
Estimated Fetal Weight
+/- umb. art. Doppler
When to refer for Growth USS:

‘Fetal GROW’ guideline NALHN

4. Accelerated Growth

Accelerated growth

U/S Scan:
- Liquor
- Estimated Fetal Weight
  +/- umb. art. Doppler
‘Fetal GROW’ guideline NALHN

ANC visit > 24 wks

PLOT FH in Gardosi Chart

1. Low first FH
2. Static growth
3. Slow growth
4. Accelerated growth

US Fetal growth

Assess US & Plot EFW in Gardosi Chart

EFW>P10 & US findings 😊

Back to routine care and FH plotting

US EFW <P10

URGENT REFERRAL
OBSTETRICAL REVIEW
Where to find Customised charts

• [www.gestation.net](http://www.gestation.net) growth charts just download Australian FH charts
Improved detection: so what?

- Decreased mortality and morbidity
Crude Stillbirth Rates 2000-2009
West Midlands 5.74, England and Wales 5.33
Crude stillbirth rates 2000-2011
West Midlands versus England/Wales

- Significant drop in West Midlands, Gardosi’s health region 5.02 vs 5.24 / 1000 (p<0.05)
- Drop most significant in areas were customised FH charts were introduced first

Perinatal Institute Birmingham 2011
Conclusion

• In a low risk population serial plotting of the Fundal Height on a customised Gardosi chart combined with ‘GROW guideline’ appears to be the preferred method

• Laying hands on or just measuring FH and non plotting = non evidence based practice
Surveillance for suspected IUGR

- 2 weekly growth USS
- Weekly USS for AFI and doppler
- Weekly CTG
- Delivery <= 37 weeks
- Mode: often don’t tolerate labour
Management of Macrosomia

• + poorly controlled diabetes may lead to early IOL
• Evidence supports:
  – Offering elective LSCS if GDM and EFW >4.5kg or no GDM and EFW >5kg.
  – No evidence for improved outcomes with IOL (Two systematic reviews concluded that labour induction for suspected fetal macrosomia did not result in a lower rate of shoulder dystocia or caesarean delivery than expectant management)
Questions
‘Fetal GROW’ guideline NALHN

ANC visit > 24 wks

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URGENT REFERRAL OBSTETRICAL REVIEW