Audit of fundal height measurement plotted on customised growth charts

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Introduction

One of the most important components of maternity care is fetal surveillance. For the surveillance of the fetus in the third trimester, a principle aim is to monitor fetal growth. Growth restriction is associated with an increased risk of poor perinatal outcomes such as low Apgar score, stillbirth, and neonatal death. Current methods of clinical assessment fail to detect most babies that are small for gestational age (Hepburn & Rosenburg 1986, Backe & Nakling 1993). Risk assessment is often not predictive, and detection of growth problems is even lower in pregnancies designated 'low risk' (Kean & Liu 1996). Detection of intrauterine growth restriction (IUGR) has been identified as the most common problem associated with substandard care (MCHC 2001).

The challenge is to identify antenatally those babies that are not growing appropriately. There is evidence that plotting serial fundal height measurements on individually customised growth charts can significantly improve detection of fetal growth problems while reducing unnecessary referrals for investigations (Gardosi 1999). Customised antenatal growth charts are now recommended by the Royal College of Obstetricians and Gynaecologists guidelines (RCOG 2002) and serial fundal height measurements are recommended by the National Institute for Health and Clinical Excellence (NICE 2003).

This article reports on the results of an audit of antenatal growth assessment in association with the use of customised growth charts in a Birmingham inner city hospital. The charts were introduced in October 2003 as part of a West Midlands regional roll-out. Full guidelines for the use of customised antenatal growth charts and referral protocols are available at www.perinatal.nhs.uk/growth.

Aim

To assess the effect of introduction of customised growth charts on the detection of fetal growth problems and referral rate for investigations.

Objectives

- To identify antenatal detection rates of small and large for gestational age (SGA/LGA) babies
- To assess scan referral rates
- To assess referrals to hospital of women with suspected fetal growth problems.

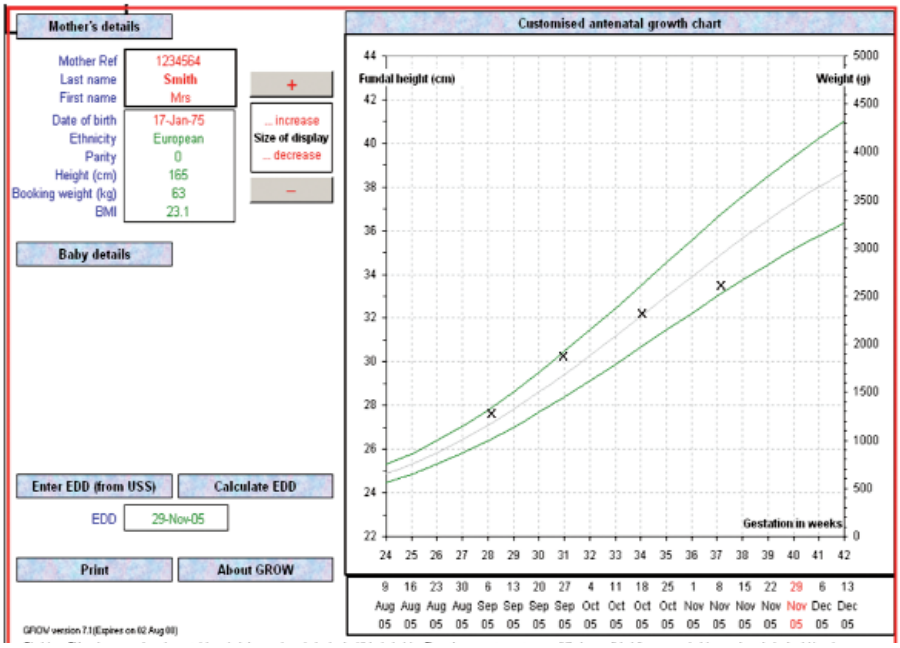
Setting

Birmingham City Hospital has a maternity unit which undertakes 3400 deliveries per year and the customised charts were introduced in 2003. The audit was based on notes from births taken over a set period before and after their introduction.

Method

A retrospective audit was undertaken on a sample of women's case notes prior to the introduction of customised growth charts (Figure 1). Data were obtained on the recording of fetal growth assessment, including fundal height estimation and referral. A second audit was then undertaken on women's case notes after the introduction of the customised growth charts and data were obtained on the plotting of fundal height measurements and estimated fetal weight (EFW) entered on these charts. The findings from the two groups were then compared. The charts were used according to a set of guidelines and recommendations for

Figure 1. A scanned example of the customised growth charts



fundal height measurement (Figure 2) and the protocol for referral for further investigation (Figure 3).

Sample

Group 1 was the control group, based on case notes of deliveries during November and December 2002, ie 10 months before the introduction of customised growth charts. Group 2 was the study group, based on case notes of deliveries during July and August 2004, ie 10 months after the introduction of the customised charts.

To test whether there was an increase in antenatal detection rate of SGA fetuses, as previously described (Gardosi 1999), a rise from 16% to 45% was used for sample size calculations (with power 0.8 and significance level 0.05) suggesting the need for at least 272 cases in each group. We therefore set out to collect data from 300 deliveries during each period.

Data collection

Case notes were requested from the medical records department on 300 consecutive deliveries between the two periods.

Inclusion criteria were defined as:

- singleton pregnancies
- dated before 22 weeks
- delivered from 24 weeks gestation.

Two researchers (JW and SK) worked together to ensure consistency of data collection and interpretation of case notes.

Information was extracted on maternal details, recording of fetal growth assessment including fundal height estimation, whether there was concern about fetal growth leading to referral for further investigation, and outcome of pregnancy including birthweight and gestational age.

Analysis

The data were entered into spreadsheets (MS Excel). Analyses were performed with 2 by 2 tables using odds ratios with 95% confidence intervals to test for statistical significance.

Results

With regard to clinical practice, there were obvious changes in practice between the two time frames. These were identified as part of the data collection and Table 1 illustrates the specific changes in practice in this area between the two groups.

Two pregnancies in the study group terminated before 24 weeks. There were therefore 300 cases in the control group (Group 1) and 298 cases in the study group (Group 2).

Both groups were similar in average maternal age and parity. The majority of women were of non-British/European ethnic origin, in both the control group (88.8%) and the study group (88.5%). No comparison could be made for maternal height as this information was not recorded in the notes before the introduction of the customised charts. Consequently, we were also not able to compare BMI. In the study group (Group 2), the average BMI was 25.2 (range 15.8–43.4).

Plotting of fundal height

There were 277 (93%) fundal height charts of women delivering at term (37+ weeks) in Group 2. On 251 (91%) of these, three or more fundal height measurements were plotted, which suggests that the majority of women were serially measured.

Plotting adhered to the guidelines in the majority of instances. Where they did not, it was due to one of the following reasons, alone or in combination:

- measuring weekly or in half centimetres 35.5%
- use of an incorrect symbol 6.3%
- numerical value wrongly documented, or in wrong place 7.0%
- plots documented as 'equal to dates' 2.6%
- Not plotted 2.6%

Detection of SGA fetuses

The antenatal detection of SGA fetuses increased from 16% to 36% in Group 2 (see Table 2). However, better adherence to referral guidelines would have resulted in antenatal detection of SGA in a further 12 cases. This means that the potential detection rate could have been 57% (33/58).

Figure 2. Recommendations for fundal height measurement

- Non-elastic tape measure, trained midwife/doctor
- Measurement/plotting on customised chart from 26–28 weeks
- Fundal height measurements required to be done 2–3 weekly to allow adequate monitoring of growth
- Too frequent measurements – eg weekly – are not recommended as the degree of measurement error can be greater than the growth of the fundus
- Measurements according to standard method, preferably by the same person to reduce error due to inter-observer variation
- The symbols of **X** for fundal height and **O** for estimated fetal weight (EFW) should be used, to distinguish clearly the two separate growth curves
- Measurements should be plotted in whole centimetres on customised charts
- Documentation as 'equal to dates' (= D) is inaccurate and should not be used

Figure 3. Protocol for referral for further investigation

Referral for ultrasound biometry, amniotic fluid assessment, ± Doppler flow is recommended if:

- the first fundal height measurement plots below 10th centile line on the customised chart
- based on consecutive measurements, growth is static (flat) or slow compared to the slope of the curves on the chart
- based on consecutive measurements, growth is excessively steep compared to the slope of the curves on the chart.

A first measurement above the 90th centile line does not need referral for scan for query LGA, unless there are other clinical concerns, eg polyhydramnios.

Follow up

If ultrasound assessment is:

- normal: revert to serial fundal height measurement
- abnormal: refer for urgent obstetric review.

NB: The fundal height growth curve on a customised chart is not a predictor of birth weight, but an indicator of when to refer for further investigations. The centile lines are curves of estimated fetal weight (EFW) and both fundal height and EFW can be plotted on the same chart using the opposing axes. EFW is a measurement of the fetus and fundal height measures the fetus, liquor, placenta, uterus and abdominal wall thickness.

For further information and examples, please see **www.perinatal.nhs.uk/growth**

Detection of LGA fetuses

The antenatal detection of LGA fetuses (defined as a birth weight above the 90th centile) increased in the study group from 11 to 53% (see Table 3). Adherence to the referral guidelines would have resulted in detection in a further six cases, ie a total of 9 + 6 = 15 of 17 LGA cases (88%) could have been detected antenatally.

Referrals

There appeared to be more scan referrals based on fundal height measurement in Group 2, although the difference was not significant (57 *vs* 49; $p = 0.3$). At the same time, there were significantly fewer scans overall in Group 2 (191 *vs* 219, $p = 0.02$) (Table 4). This was because of fewer repeat scan referrals for fetal growth. It was apparent from the audit that many referrals for ultrasound scan in group 1 did not have clear reasons recorded for referral. As a result, there were significantly fewer growth scans per pregnancy in the group 2 compared to Group 1 (0.3 *vs* 0.4; $p = 0.01$). Scans for reasons other than growth were similar in both groups.

Table 5 shows a significant decrease in the study group of referrals to the Pregnancy Assessment Unit (PAU) for growth assessment (8 *vs* 37; $p < 0.01$). Women who were initially referred for scans based on the fundal height referral guidelines and found to have an appropriately grown fetus did not require follow-up in the PAU. In Group 1, before introduction of the customised charts, there appeared to be a number of repeat referrals as a result of the lack of clarity in interpretation of appropriate growth.

Discussion

This audit looked at the effect of the introduction of customised growth charts. It showed that their use resulted in an increase in the detection of SGA and LGA fetuses, while reducing unnecessary referrals to the PAU and ultrasound scan department. More women were referred for scans based on fundal height in the customised chart group, but with lower subsequent scan referrals for growth. This was because where the scan identified fetal growth as appropriate, growth monitoring could then revert to fundal height measurements.

Where a SGA fetus was identified, this was followed up by serial scans with assessment of estimated fetal weight (EFW), liquor volume and Doppler if necessary. This included the 'small normal' group, which required vigilance, but not intervention, unless further growth problems were identified. Thus the appropriate women were investigated.

The numbers of scans based on clinical assessment in the control group were higher due to re-referrals to check growth, because of the lack of clarity in interpreting appropriate growth. This was also apparent in many unnecessary referrals to the PAU for growth assessment. It is apparent that better protocols will result in more appropriate use of facilities for further investigation of those cases which are at risk.

Table 1. Specific changes in practice related to antenatal fetal growth assessment

Previous practice (Group 1)	*Practice after introduction of customised growth charts (Group 2)*
Variable practice in assessment of fetal growth	Standardised practice of fundal height measurement
Abdominal palpation and estimation of size Various tape measures and techniques	Non-elastic tape measure, same technique One measurement, aim for continuity
Variable frequency of assessment Variable documentation, common recording as 'equal to dates'	Fundal height measured and plotting every 2–3 weeks
3–4 cm range for expected 'normal'	No 'normal' range, actual measurement in cm plotted
Plotting only done when concerned; on population based chart	Fundal height measurements done and plotted on customised chart produced after the dating scan
Ultrasound scan measurements plotted on population norm charts	Scan measurements plotted on same, individually customised chart
Growth on chart — initially referred to consultant	Query on growth initially referred directly to ultrasound department

Table 2. Detection rates for small for gestational age (SGA)*

	Group 1 — Control population chart (n = 300)	*Group 2 — Study customised chart (n = 298)*
SGA (% of total)	62 (22)	58 (19)
SGA detected antenatally (% of all SGA births)	10 (16)	21 (36)**

* Defined as <10th birth weight centile at birth
** $p = 0.02$

Table 3. Detection rates for large for gestational age (LGA)*

	Group 1 — Control population chart (n = 300)	*Group 2 — Study customised chart (n = 298)*
LGA (% of total)	26 (9)	17 (6)
LGA detected antenatally (% of all LGA births)	3 (11)	9 (53)**

* Defined as >90th birth weight centile at birth
** $p = 0.01$

Table 4. Referrals for ultrasound scan

	Group 1 — Control (n = 300)	*%*	*Group 2 — Study (n = 298)*	*%*
Total third trimester scans	219	73	191	64
Scans based on fundal height*	49	22	57	30
Scans for 'growth'*	118	54	87	45
Scans for other reasons*	101	46	106	55
Scans for 'growth' per pregnancy	0.4		0.3	

* Denominator is total number of third trimester scans in each group.

Table 5. Referrals to Pregnancy Assessment Unit (PAU)

	Group 1 — Control (n = 300)	*%*	*Group 2 — Study (n = 298)*	*%*
Number	58	19	22	7
Growth assessment	37	12	8	3
Others	21	7	14	5
Referrals to PAU for growth, per pregnancy	0.12		0.03	

However, the study also showed that there was further room for improvement. Closer adherence to the fundal height measurement referral guidelines would have increased the detection of SGA fetuses to 57% and the detection of LGA fetuses to 88%. This suggests the importance of the need for strict adherence to protocol when monitoring fetal growth.

While there are potential problems with historical controls, as other confounders may come into play, we believe that antenatal practice was essentially unchanged within the unit other than the introduction of customised growth assessment. In fact, a strength of such a comparison is that it measures the effect of an intervention in the same unit, with the same staff and patient population.

The increase in detection of LGA fetuses in the study group was not accompanied by an increase in false positives, and there was good adherence to the amended referral protocol for LGA fetuses, which states that a first plot above the 90th centile line on the customised chart, or consistent growth above but parallel to the 90th centile, is not an indication for referral. As a result, most (82%) of the fundal height curves which were above and parallel to the 90th centile line were not referred.

However, only 35% of fundal height curves of LGA babies confirmed at birth consistently plotted above the 90th centile antenatally.

The study audited the process of fetal growth assessment and was too small to evaluate outcome in terms of the consequences of fetal growth restriction, such as perinatal morbidity and mortality. However, this method is being used in a recently commenced, much larger study across all nine PCTs in Birmingham and the Black Country, with one of the study's principal outcomes being the reduction of stillbirth as a result of improved antenatal detection of fetal growth restriction. The project initiation document can be downloaded from http://www.perinatal.org/rpnm/rpnmmain.htm (Perinatal Institute 2004)

In conclusion, this audit has confirmed the findings of a previous controlled study (Gardosi & Francis 1999) that standardised fundal height measurements plotted on customised charts result in increased antenatal detection of SGA and LGA fetuses and reduce referral for investigation. Unlike the original study in Nottingham, which was

undertaken by a small group of staff trained on a one-to-one basis, the charts were introduced across the West Midlands region with training facilitated throughout the maternity services. While the study confirms the value of customised growth charts in the assessment of fetal growth, this audit also shows that detection rates for SGA fetuses could be even better if the referral recommendations are fully adhered to. This highlights the need for a continuous, rolling programme of education and training.

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'Just a bystander?' Men's place in the process of fetal screening and diagnosis

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Despite increasing research into men's experience of pregnancy and fatherhood, experiences of men whose partner is undergoing fetal screening and diagnosis have been less well-studied. This paper begins to fill a gap in the literature by identifying several potentially conflicting male roles in screening, diagnosis and subsequent decision-making. Drawing on a wider qualitative study in the UK of experiences of antenatal screening, it is suggested men may play inter-linked roles: as parents, bystanders, protectors/supporters, gatherers and guardians of fact, and deciders or enforcers. These may be roles they have chosen, or which are assigned to them intentionally or unintentionally by others (their female partner, health professionals). Men's status and feelings as fathers are sometimes overlooked or suppressed, or may conflict with their other roles, particularly when screening detects possible problems with the baby. The paper concludes by discussing these findings in the context of the wider literature on men and pregnancy.

Introduction – men's experience of pregnancy, fatherhood and fetal screening

For many years, research into pregnancy focused primarily (and perhaps unsurprisingly) on women's experiences. As the discourse of 'new fatherhood' became established, research into men's experiences became more common. However, fatherhood has sometimes been characterised as potentially pathological or as a series of problems requiring solutions (Barclay & Lupton 1999). Several critics note that both service provision and research have too often focused on men's role as supporters rather than on their own feelings (Barclay & Lupton 1999, Daly 1995, Donovan 1995, Finnbogadóttir, Crang-Svalenius, Persson 2003, Hildingsson & Häggström 1999, Kaila-Behm & Vehviläinen-Julkunen 2000, Mander 2004).

From her ethnographic study of 18 middle class men, Draper found the 'inability to directly experience the embodied nature of pregnancy' to be a key factor (Draper 2002a, p565). Seeing men as supporters rather than direct participants reinforces their sense of exclusion. Shapiro (1987, p38) notes:

Men are encouraged to participate fully in the pregnancy and birth of their children but are simultaneously given to