Antepartum fetal health

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Abstract

Delivery of a healthy full term baby following an uneventful antenatal period occurs in the majority of pregnancies. These are classified as a low-risk pregnancy group. There are, however, some pregnancies that are complicated due to maternal or fetal disease that can increase the risk of perinatal morbidity and mortality. This is classified as a high-risk group. The aim of fetal surveillance is to identify these threatened fetuses with the prospect of altering the timing of delivery to prevent the worst outcome, stillbirth. This article looks at the tools available to assess antenatal fetal health in all pregnancies and their ability to identify the at-risk pregnancies that require extra surveillance to improve outcomes. This article does not address fetal surveillance during labour.

Keywords amniotic fluid index; biophysical profile; cardiotocography; customized growth chart; middle cerebral artery Doppler; symphysis-fundal height; ultrasound biometry; umbilical artery Doppler; uterine artery Doppler; venous Doppler

Introduction

The aim of midwives and obstetricians is to identify those pregnancies considered high-risk, due to numerous circumstances (maternal disease, fetal pathology, placental pathology or intrapartum complications), and provide a level of support necessary to take these pregnancies to healthy positive outcomes. In doing so, there is an increased need for monitoring in the pregnancy. The aim for undertaking this monitoring is to reduce perinatal morbidity and mortality and to identify the ideal timing for delivery to achieve the most successful outcome. The vast majority of pregnancies, however, are considered low-risk and result in a healthy term delivery. As a result of this and the fact that pregnancy is a normal physiological process it should be central that any intervention should be beneficial and acceptable to pregnant women. This review looks at the surveillance options available for low-risk pregnancies as well as methods used when a pregnancy is deemed high-risk. This article does not address fetal surveillance during labour or management of established complications like pre-eclampsia or growth restriction.

Assessment of risk and surveillance strategies

The RCOG recommends that all women undergo an assessment of risk factors for growth restriction at the time of booking to allow increased surveillance in those at-risk. They have defined risk factors as either major or minor (Table 1) on the basis of the risk of a small for gestational age (SGA) baby. SGA is defined as weight less than a specified percentile (in this case the 10th percentile). Major risks have an odds ratio (OR) of greater than 2.0 for SGA whilst minor risks have an OR of less than 2. The presence of one major risk factor should prompt referral, from 26 to 28 weeks gestation, for serial USS measurements of fetal size and growth together with umbilical artery Doppler for fetal wellbeing. Uterine artery Doppler assessment at 20–24 weeks should be offered in the presence of three or more minor risk factors. Those women with abnormal values should also be offered serial USS assessments of growth and wellbeing, whilst a single third trimester assessment of fetal size and umbilical artery Doppler is recommended if the uterine artery Doppler is normal. The final group who should be offered serial growth surveillance is where the SFH measurement is considered to be flawed e.g. body mass index (BMI) >35 kg/m^2, large fibroids or abnormal liquor volume.

Low-risk pregnancy

It is recommended in NICE guidelines in an uncomplicated singleton pregnancy that there should be ten scheduled antenatal appointments for nulliparous women and seven for multiparous women. Reducing the number of antenatal visits reduces women's satisfaction of the care provided. A review of the antenatal care pathway in middle- and low-income countries, where the number of visits in a standard pathway may already be limited, also suggested a 15% increase in perinatal mortality with reduced antenatal care visits. For high income countries perinatal mortality was low (0.6% overall compared to 2% in low-income countries) limiting the power of the study- no clear difference between the two pathways was evident.

The first appointment should preferably be prior to 10 weeks' gestation in order to identify risk factors in the pregnancy and schedule a dating scan to accurately determine the estimated date of confinement for which all further appointments and tests will be related/compared to. Failure to assign an accurate gestational age will make the precise diagnosis of a SGA baby difficult. Ultrasound based establishment of gestational age is also important for reducing the number of post term inductions, as using the last menstrual period to calculate confinement dates has inaccuracies of between 11 and 42%. Throughout their pregnancy women should be given information that is easy to understand, is accurate, balanced and based on current evidence. This is to allow women to make informed choices about the care they receive throughout pregnancy (Box 1).

Antepartum assessment of fetal health aims

- To prevent the death of the fetus
- To optimize the timing of delivery, minimizing fetal and neonatal morbidity
- To avoid unnecessary intervention (e.g. pre-term delivery) if fetal health is confirmed

Box 1

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Risk factors for a SGA neonate (adapted from the RCOG 'Investigation and management of SGA fetus' guideline)

Category	Major risk factors (OR > 2.0 for SGA)	Minor risk factors (OR < 2.0)
Booking history	Maternal age >40 years Smoker ≥11 cigarettes/day Cocaine use Daily vigorous exercise Maternal SGA Paternal SGA	Maternal age ≥35 years Smoker 1–10 cigarettes/day Nulliparity BMI<20 kg/m^2 BMI 25–30 kg/m^2 Low fruit intake pre-pregnancy
Previous pregnancy	Previous SGA Previous stillbirth	Previous pre-eclampsia Pregnancy interval <6 months or ≥30 months
Maternal medical history	Chronic hypertension Diabetes and vascular disease Renal impairment Antiphospholipid syndrome	
Current pregnancy	Threatened miscarriage with vaginal bleeding similar to period Pre-eclampsia Severe pregnancy induced hypertension Unexplained APH Low maternal weight gain PAPP-A <0.4 MoM Echogenic bowel	IVF singleton pregnancy

Table 1

Measuring symphysis-fundal height (SFH)

This is a low cost, easily performed method of fetal surveillance with the operator using a tape measure to identify the uterine fundus and symphysis pubis and taking a measurement of the distance between the two points. The aim of measuring SFH in antenatal surveillance is to identify those fetuses at-risk of being SGA.

However, of the fetuses identified below the 10th centile on growth charts, who are labelled as SGA, 50–70% of them are actually constitutionally small fetuses. These fetuses are appropriately sized in relation to parental body mass index, ethnicity and parity. They are not at higher risk of perinatal morbidity and mortality. In contrast, fetuses with growth restriction fail to reach their genetic growth potential due to a tail off in fetal growth. These fetuses are at higher risk of perinatal morbidity and mortality. The SFH measurement will not detect a fetus that is growth restricted but above the 10th centile.

Palpation of the abdomen alone has a sensitivity of 21% and specificity of 96% for the detection of SGA fetuses and should not be routinely used for this purpose. The addition of SFH measurement makes little alteration in prediction, with a sensitivity and specificity of 27% and 88% respectively, although studies vary widely in the predictive accuracy quoted. The addition of serial measurements may improve the sensitivity and specificity of this test by allowing changes in the rate of growth to be observed, particularly for repeated measurements by the same individual.

In the UK NICE recommend, at every antenatal appointment after 24 weeks, the SFH is measured and plotted on growth charts to identify fetuses crossing growth centiles and/or fetuses below the 10th centile on a single SFH measurement. These women should be referred on for further assessment of growth with the use of ultrasound.

Although there are concerns that there is inter-operator variability using this technique, its low cost and requirement of minimal time, training and equipment make it a valuable screening method, especially in low-income countries where ultrasound resources are greatly limited. There are also concerns that SFH measurement is inaccurate in women with raised BMI (>35 kg/m^2) and USS assessment of fetal size may be more appropriate for surveillance in this group. In low-risk pregnancies ultrasound assessment of fetal size is not recommended for suspected large for gestational age fetuses by SFH measurement.

Customized growth charts

When plotting SFH measurements, customized growth charts adjusting for maternal height, weight, parity, ethnicity, and other physiological variables have been suggested in an attempt to improve the identification of SGA fetuses. A Cochrane Collaboration review of using customized versus population growth charts demonstrated better identification of SGA fetuses with the former method (relative risk: RR 0.74). This however did not translate to better perinatal outcomes. There was no randomized controlled trial evidence comparing population to customized growth charts – evidence was derived from an observational cohort study. The most up-to-date RCOG guidelines recommend use of customized growth charts to aid in prediction of SGA babies.

Auscultating fetal heart

Routine auscultation of the fetal heart at appointments is not recommended in current NICE guidelines. Fetal wellbeing cannot accurately be predicted with the use of fetal heart auscultation as it cannot detect subtle variations in beat-to-beat variability or, on a larger scale, fetal accelerations and decelerations which could be demonstrated on a continuous cardiotocograph monitor. NICE guidelines state that it may be performed for reassurance of the mother, on her request, although it may also increase anxiety if detection is protracted.

Ultrasound biometry

In the low-risk population a Cochrane review ($n = 27{,}024$) found no improvement in perinatal mortality and no difference in obstetric interventions (including induction of labour, instrumental deliveries) or neonatal measures (Apgar scores, NNU admission) in women who underwent third trimester fetal biometry by ultrasound compared to those that did not. Therefore routine third trimester USS is not recommended in this group by the Cochrane review or current RCOG guidelines.

High-risk pregnancy

The aim of assessing the fetus in the antenatal period is to identify those fetuses at-risk of developing complications such as