

Assessment of the fetus during labour

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Abstract

Perinatal death or cerebral palsy is devastating for families. In an attempt to prevent these pregnancy outcomes, fetal wellbeing is assessed during labour by a variety of means during labour. In this review, the most common means to confirm fetal wellbeing, the rationale for their use and evidence of their efficacy in each of these settings are discussed. With respect to labour, the indications for continuous electronic fetal monitoring are presented, together with a guide to interpretation of cardiotocography (CTG) or fetal blood samples (FBS).

Keywords Antenatal care; asphyxia; cardiotocography; fetal blood sampling; fetal monitoring; fetal movements; hypoxic-ischaemic encephalopathy; intrapartum care; intrapartum stillbirth

Royal College of Anaesthetists CPD Matrix: 2B05, 2B07, 3B00

Background

Perinatal asphyxia affects approximately 2–5 per 1000 liver births.¹ The aim of fetal assessment in the peripartum and intrapartum period is to prevent asphyxia and the resulting morbidity and mortality. The outcomes of perinatal asphyxia are poor; in high-income countries up to 40% of infants will die and 30% will have significant long-term neurodisability.¹ These outcomes are tragic for the families involved and also place a significant burden on the NHS. A recent analysis of claims made in maternity to the NHS Litigation Authority over a period of 10 years, found the most frequent causes of litigation were management of labour (14%), caesarean section (13%) and cerebral palsy (11%).² Claims for management of labour and cerebral palsy along with interpretation of intrapartum monitoring were the most expensive.² Thus, improving fetal assessment to prevent complications is highly desirable. Failure to identify infants at risk of complications was recently highlighted in the Kirkup report into maternal deaths, stillbirths and neonatal deaths occurring in a single secondary obstetric unit in the UK. This

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Learning objectives

After reading this article, you should:

- understand the reasons for monitoring fetal wellbeing in and around the time of labour
- understand the indications for fetal monitoring during labour
- be able to describe strategies for monitoring fetal wellbeing in early and established labour
- understand the limitations of each method of assessment of fetal wellbeing

report emphasized that the death of an otherwise healthy infant at term is a preventable tragedy; fetal monitoring in combination with appropriate action may prevent such events occurring.³ Fetal assessment may be divided into measures instituted during pregnancy (antenatal), around the onset of established labour (peripartum) and those used in established labour (intrapartum).

Antenatal care and fetal assessment

Care during the antenatal period involves assessment and identification of fetuses at risk of developing fetal growth restriction (FGR) and subsequent asphyxia, so that they can be monitored appropriately during pregnancy.⁴ Risk factors include pre-existing maternal disease (e.g. diabetes, hypertension) and suspected placental insufficiency in previous pregnancies (previous FGR and stillbirth).⁵ Women deemed to be high risk are then monitored more closely in the antenatal period with ultrasound measurement of fetal growth and liquor volume, and Doppler studies of the umbilical artery. Where the risk is thought to be low, screening continues with serial measurements of symphysis-fundal height. If concerns arise (e.g. rate of growth decreases or measurement estimates fetal weight <10th centile), assessment is made with ultrasound. The sensitivity and specificity of this method of screening is low (27% and 88%, respectively),⁶ and there is insufficient evidence to recommend scanning women at low-risk of FGR.⁷ If FGR is identified, the fetus is monitored primarily with the use of Doppler ultrasound of umbilical artery blood flow and this informs the timing of delivery. If abnormalities are present such as absent or reversed end-diastolic flow, delivery should be planned after 34 weeks' gestation.⁵

All women are advised to be aware of fetal movements in pregnancy and to seek medical advice if they perceive a reduction in fetal movements. Women should not perceive a reduction in the number of fetal movements until the onset of labour. If mothers perceive that fetal movements are reduced after 28 weeks' gestation, guidelines suggest that cardiotocography (CTG) should be performed (see below) and patients with an increased risk of FGR should then be offered ultrasound assessment of fetal size and liquor volume.⁸ A study in Norway investigated this approach, combining maternal education about fetal movements, cardiotocography and ultrasound measurements, and demonstrated a reduced perinatal mortality in cases of reduced fetal movement from 4.2% to 2.4%.⁹ CTG is used antenatally as well as in labour, although meta-analysis has shown that this does not reduce mortality in low-risk populations.⁹ This may be related to false reassurance provided by a

normal trace, that actually only provides an assessment of fetal wellbeing for the duration of the recording.¹⁰

Intrapartum monitoring of the fetus

Fetal monitoring in labour aims to recognize and prevent fetal asphyxia, reducing resulting acidaemia and ultimately the consequent complications such as hypoxic ischaemic encephalopathy (HIE), neurodevelopmental disorders and neonatal death.¹¹ The main method of fetal monitoring in labour is continuous electronic fetal monitoring using CTG, which may be supplemented with fetal scalp blood sampling (FSBS) or analysis of the fetal electrocardiogram (fECG).

The technique of CTG was first introduced in the 1970s in the absence of strong evidence and subsequent meta-analyses have failed to establish a significant relationship between its use and a reduction in perinatal death or cerebral palsy, although a reduction in neonatal seizures has been observed.¹² An increase in caesarean section and instrumental vaginal births with the use of CTG monitoring in labour has, however, been demonstrated. This may be related to the poor specificity of CTG monitoring, leading to intervention in the absence of acidaemia.¹² The risk assessment made antenatally should be reviewed during early labour, and revised during labour. Women who are deemed to be high risk of intrapartum fetal asphyxia are should be continuously monitored using CTG (Table 1).¹³ Risk assessment should continue throughout labour as risk factors such as bleeding per vagina, the presence of meconium-stained liquor or development of intrauterine infection may arise as labour progresses. The technique(s) of fetal monitoring employed depends upon the mothers' risk status for intrapartum asphyxia and the results from other monitoring techniques.

Intermittent auscultation

Women identified as 'low risk' for asphyxia should have intermittent auscultation of the fetal heart rate during labour. This should be undertaken for 60 seconds every 15 minutes after a contraction in the first stage of labour and every 5 minutes after a

contraction in the second stage of labour.¹³ Intermittent auscultation of the fetal heart is usually achieved with a handheld Doppler device, but a Pinard stethoscope may also be used. If an abnormality is suspected on auscultation, maternal pulse should be palpated simultaneously to identify a difference between the two heart rates.¹³

Continuous electronic fetal monitoring by CTG

The fetal heart rate is usually recorded by trans-abdominal Doppler ultrasound combined with a pressure transducer to measure contractions. If fetal heart rate trace cannot be obtained in this way, a fetal scalp electrode may be applied. The pressure transducer measures the frequency of contractions (but no indication of the intensity of contractions can be obtained). The number of contractions is usually expressed as x in 10 minutes.⁴

Several aspects of the fetal heart rate are used to interpret the trace. Each individual feature is classified as normal, non-reassuring or abnormal and an overall judgement made whether the CTG is normal, non-reassuring or abnormal. The features of a CTG are: (i) baseline rate – the average fetal heart rate; (ii) baseline variability – the fluctuations of fetal heart rate (similar to the amplitude of the trace); (iii) the presence of decelerations – downward deflections of fetal rate more than 15 beats per minute beneath the baseline for more than 15 seconds. The presence of accelerations – upward deflections of fetal heart rate for more than 15 beats per minute above the baseline for more than 15 seconds, is thought to be reassuring. However, in an otherwise normal trace in labour, their absence does not indicate acidosis.¹³ Decelerations are classified as early decelerations when they occur with contractions and late decelerations when they commence after the contraction starts, have their nadir after the peak of the contraction and end after the contraction. Variable decelerations have variable timing and morphology. Early decelerations are due to head compression so are not viewed as pathological. Late decelerations and variable decelerations indicate placental insufficiency and cord compression, these are viewed as pathological and associated with fetal

Factors which indicate the need for continuous electronic fetal monitoring in labour

Antenatal period		
<i>Maternal</i>		<i>Fetal</i>
Antepartum haemorrhage		Breech presentation
Cardiac disease		Intrauterine growth restriction
Connective tissue disorder		Multiple pregnancy
Diabetes mellitus		Postmature pregnancy (>42 weeks)
Hypertension/preeclampsia		Preterm birth (<37 weeks)
Renal disease		
Previous caesarean section/uterine surgery		
In labour		
<i>Maternal</i>	<i>Fetal</i>	<i>Labour</i>
Bleeding in labour	Abnormal fetal heart rate on intermittent auscultation	Augmentation with oxytocin
Epidural analgesia	Meconium-stained liquor	Induction of labour
Signs of infection (pyrexia, offensive liquor)		Prolonged rupture of membranes

Table 1

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