Intrapartum fetal surveillance

Sarala Premila

Sabaratnam Arulkumaran

Abstract

The course of labour is one of the most hazardous journeys one ever undertakes. The uterine contraction of labour subjects the fetus to a possible risk of hypoxic injury due to repeated cord compression or reduction of retro-placental perfusion. If the hypoxia is prolonged and/or severe, babies are at risk of either being born with a disability (physical or mental) or of dying during labour. Detection of fetal compromise should be followed by appropriate and timely intervention to reduce the incidence of intrapartum fetal deaths and neurological sequel related to birth asphyxia. Neonates who develop grade II or III hypoxic ischaemic encephalopathy due to birth asphyxia have a high risk of death or neurological sequel (up to 50%) that leads to major motor cognitive impairment (i.e. cerebral palsy). This article will discuss the principles of intrapartum fetal surveillance and highlight the areas of shortfall, and suggest actions that could be pursued to reduce avoidable morbidity and mortality.

Keywords birth asphyxia; electronic fetal monitoring; encephalopathy; fetal surveillance; hypoxia

Introduction

The 4th Confidential Enquiry into Stillbirths and Deaths in Infancy that reviewed intrapartum mortality of the fetus weighing >1500 g with no chromosomal or congenital malformation revealed it to be 1 in 1600 in 1995. In the UK the incidence of hypoxic ischaemic encephalopathy (HIE) grades I–III is about 2–3 in 1000 whilst of grades II and III it is about 1 in 1000. In 2007 the NHS Litigation Authority (NHSLA) estimated potential liabilities of £3.7 billion related to clinical negligence in obstetrics. Although the cause for most cases of cerebral palsy is unknown, obstetricians are often held responsible for adverse outcome attributed to intrapartum asphyxia as evidenced by fetal heart rate (FHR) abnormalities, meconium staining, low Apgar score, umbilical cord blood acidosis and neonatal encephalopathy. However, many of these surrogate markers have limitations in identifying the timing of hypoxic injury and are a frequent cause of controversy in the determination of causation, preventability and liability. Although most perinatal morbidity and mortality may not be prevented by improved fetal monitoring in labour, failure to identify abnormal FHR patterns and lack of appropriate action are considered to be significant contributing factors. Soaring litigation and associated costs make the prospect of a career in obstetrics unattractive for many medical professionals.

Historically, FHR monitoring has been used to assess the well-being of the fetus during labour. In most maternity units in the UK, monitoring of low risk labour is performed by auscultation of the FHR whilst cardiotocograph (CTG), fetal electrocardiogram (ECG) analysis and/or assessment of fetal acid base or lactate is used for high risk labour.

Women are encouraged to make informed decisions together with their obstetrician, GP or midwife about intrapartum fetal surveillance based on accurate information and consideration of particular risk factors. There should be a clear communication with the individual woman in labour and the healthcare professionals. A clear consistent terminology to describe the FHR patterns should reduce errors in interpretation and management.

Methods of intrapartum fetal monitoring

Intermittent auscultation

This is a non-continuous method of listening to the FHR at predetermined intervals during labour, either by a Pinard stethoscope, a hand-held Doppler ultrasound device or intermittent electronic fetal monitoring (EFM). Intermittent auscultation (IA) is recommended as a minimum for women who, at the onset of labour, are identified as low risk of developing fetal compromise.

One randomized controlled trial (RCT) comparing the methods of intermittent monitoring concluded that there was a significant increase in the caesarean section rate when FHR was monitored with either intermittent EFM or a hand-held Doppler device. Although there is a lack of empirical evidence on the optimal frequency of IA, the following recommendations were made by the National Institute of Clinical Excellence (NICE):

> 'FHR should be auscultated every 15 minutes for duration of one minute soon after a contraction during the first stage of labour and every 5 minutes or after every other contraction during the second stage of labour. The maternal pulse should be palpated and the fetal heart rate auscultated to differentiate between maternal and fetal heart rate.
>
> The uterine contractions should be palpated and the frequency and duration of contractions noted.
>
> IA should be practised by experienced practitioners. There should be defined clinical interventions when non re-assuring findings are present.'

The Cochrane systematic review comparing RCTs of IA and continuous EFM for low-risk women in labour suggested that the only clinical significant benefit from the use of routine continuous EFM monitoring was in the reduction of neonatal seizures, whilst it increased the caesarean section and operative vaginal delivery rates.

Continuous electronic fetal monitoring

This is the most widely used method of intrapartum fetal surveillance in high-risk labour. This is achieved by using a Doppler

Sarala Premila *MSc MRCOG is a Specialist in Obstetrics and Gynaecology at St George's Hospital, Blackshaw Road, London, UK.*

Sabaratnam Arulkumaran *FRCS FRCOG PhD MD is Professor and Head of Department of Obstetrics and Gynaecology, St George's Hospital, Blackshaw Road, London, UK.*

ultrasound transducer placed on the mother's abdomen (external CTG) or a scalp electrode (internal CTG) to monitor the baby's heart rate. A pressure gauge transducer is placed on the abdomen between the uterine fundus and the umbilicus to monitor uterine contractions. CTG is a continuous recording of the fetal heart rate combined with a recording of uterine activity. The 4th Confidential Enquiry into Stillbirths and Death in Infancy Report (CESDI, 1997) highlighted the recurring problems related to incorrect interpretations of intrapartum FHR tracings. Avoidance of morbidity and mortality could be achieved only by having protocols for appropriate interpretations, adequate communication of the findings and timely clinical response for a suspicious or pathological CTG. The clinical picture needed to be considered to take appropriate action based on the CTG.

Since the introduction of EFM, there are growing allegations of obstetric malpractice based on the failure to perform prompt delivery in the presence of abnormal FHR patterns. To minimize errors in interpretation, the Royal College of Obstetrician and Gynecologists (RCOG) recommends that the settings on CTG machines should be standardized so that the paper speed is 1 cm/min; sensitivity displays are 20 bpm/cm and the FHR range displays are 50–210 bpm.

The patient's name, hospital number, date of birth, date and time of the recording, pulse rate and temperature should always be checked and recorded before starting actual recording. The FHR should be auscultated by a Pinard's stethoscope or a Doppler device before commencing EFM to avoid the maternal pulse being recorded by the fetal monitor. Ideally both tocograph and cardiograph tracings should be clearly recorded in a continuous manner, i.e. a technically satisfactory trace. All intrapartum events (i.e. vaginal examination, fetal blood sample, epidural, mode of delivery) should be noted on the CTG. CTGs should be kept for a minimum of 25 years and therefore adequate provisions should be available for their secure storage and easy retrieval.

Some hospitals in the UK incorporate central fetal monitoring into labour and delivery suites. This allows FHR patterns from different labouring women to be viewed simultaneously. This allows input from colleagues and senior personal and may provide a higher level of vigilance leading to a better perinatal outcome (similar to 'neighborhood watch'). The system also avoids medical personal walking too often into rooms to review CTGs which disturbs the privacy of the woman and her partner. However, the impact of such a system needs to be studied further as a study by Weiss et al concluded that central fetal monitoring did not improve perinatal outcome but did increase the caesarean section rate.

In high-risk women where continuous EFM is recommended in labour, if the EFM is normal, monitoring may be interrupted for short periods of up to 15 min to allow personal care (shower, toilet). These interruptions should not occur immediately after any intervention that might be expected to alter FHR (e.g. amniotomy, epidural insertion or top up, or whilst on oxytocin infusion).

Indications for the use of continuous EFM are listed in Table 1.

Indications for the use of continuous electronic fetal monitoring

Maternal problems
- Previous caesarean section
- Hypertension
- Post-term pregnancy (>42 weeks)
- Prolonged rupture of membranes (>24 h)
- Induced labour
- Diabetes
- Antepartum haemorrhage (placental abruption)
- Medical disorders such as systemic lupus erythematosus

Fetal problems
- Fetal growth restriction
- Prematurity
- Oligohydramnios
- Abnormal Doppler artery velocimetry
- Multiple pregnancy
- Meconium stained liquor
- Intrauterine infection

Intrapartum risk factors
- Oxytocin augmentation
- Epidural analgesia
- Vaginal bleeding in labour
- Maternal pyrexia
- Fresh meconium stained liquor

Table 1

Admission CTG

The admission CTG is a screening test which is used in most units on admission to the delivery suite, and aims to identify the fetus at increased risk of intrapartum hypoxia. There is no evidence that the admission CTG in low-risk pregnancies confers any significant benefits in perinatal outcome. It is associated with an increase in the continuous use of EFM, augmentation of labour, epidural analgesia and operative delivery. Despite lack of evidence, the admission test followed by continuous EFM is practised in several units in the UK in low-risk labour and is probably linked to lack of staff to perform one-to-one care and auscultation every 15 min.

Interpretation of the CTG

FHR pattern recognition should be in relationship to the uterine contractions. The four features of the heart rate – the baseline rate, baseline variability, accelerations and decelerations – should be described. The features of CTGs need to be defined when describing a trace. The terminology used in describing these features is given in Table 2.

After defining the individual features, the CTG trace needs to be classified as normal, suspicious or abnormal (Table 3).

Based on the contribution of all the features, the whole CTG is classified as normal, suspicious or pathological (Table 4).

A normal CTG is associated with a low probability of fetal compromise and has the following features: baseline rate 110–160; baseline variability of 5–25 bpm; accelerations of 15 bpm for 15 s; no decelerations. A poor outcome despite a normal CTG (false negative) may be due to maternal (pyrexia, intrauterine infection) or fetal (congenital or metabolic) problems.