Intrapartum fetal surveillance

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Abstract

Electronic fetal monitoring (EFM) is the recommended method of intrapartum fetal surveillance for high-risk pregnancies. The cardiotocogram (CTG) trace forms a central piece of documentary evidence in medico-legal cases related to intrapartum hypoxia and birth asphyxia. Cardiotocography was introduced in 1960s as a screening tool with the view to reduce fetal hypoxic brain injury and cerebral palsy rates. However, its positive predictive value for intrapartum fetal hypoxia is as low as 30%, with false positive rate of around 60%. Since its introduction in obstetric practice there has been an increase in intrapartum caesarean section and operative delivery rates, but there has been no demonstrable reduction in occurrence of cerebral palsy or intrapartum fetal deaths. The low specificity of CTG for detection of fetal hypoxia therefore necessitates confirmatory tests such as fetal scalp blood sampling (FBS) or analysis of fetal electrocardiography. The National Institute for Health and Clinical Excellence (NICE) recommends continuous intrapartum fetal monitoring with CTG for high-risk pregnancies and storing the CTG electronically for at least 25 years for medicolegal purposes.

It is mandatory that all healthcare professionals who are responsible for the care of women in labour are adequately trained and assessed on pathophysiology of fetal heart rate (FHR) changes in labour to improve interpretation of CTG and avoid adverse maternal and/or fetal outcomes.

Confidential enquiries into intrapartum morbidity and deaths have shown that the four main contributors to poor perinatal outcomes are – an inability to interpret CTG by the health professionals, a failure to incorporate the overall clinical condition, a failure to communicate or escalate, and delay in taking appropriate action. In this article we discuss three cases, two of which led to adverse perinatal outcomes. The key learning points and risk management issues relevant to the cases are also discussed.

Keywords asphyxia; cardiotocogram; CTG; EFM; hypoxia; intrapartum fetal monitoring

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Introduction

The fetal intrauterine environment changes dramatically during labour due to uterine contractions which result in compression of the fetal presenting part and the umbilical cord. The fetus responds to this stress by releasing catecholamines from the adrenal glands. The ability of the fetus to cope with the stress caused by uterine contractions and/or umbilical cord compression depends on the physiological reserve of the fetus as well as presence of any infection or meconium. Reduced utero-placental reserve is a feature of pregnancies complicated by intrauterine fetal growth restriction and pre-term or post-term pregnancies.

While intermittent auscultation continues to be the method of choice for intrapartum fetal monitoring in low-risk pregnancies and in settings with limited resources, continuous electronic fetal monitoring (EFM) by cardiotocography has formed the mainstay of fetal surveillance in high-risk pregnancies in most of the developed world. The aim of CTG monitoring in labour is to assess fetal wellbeing and to detect any changes in fetal heart rate (FHR) that are suggestive of possible fetal hypoxia so that timely action can be taken to prevent adverse outcomes. It is important that all healthcare professionals managing women in labour understand the normal physiological changes in FHR during labour and accurately detect any deviations from 'normal pattern' as well as recognize the probable causes for such deviations.

The National Institute for Health and Clinical Excellence (NICE) has published guidance on interpretation of CTG and recommended actions based on the CTG changes (Tables 1–3). In the examples that follow, we have applied a commonly followed systemic approach of interpreting the CTG based on characteristics such as DR – determine risk, C – contraction frequency, BR – baseline rate, A – acceleration, VA – variability, D – deceleration and O – overall impression.

Case 1

A 30-year-old primigravida booked for antenatal care at 10 weeks gestation. Her booking bloods and fetal ultrasound scans were normal. The antenatal period was uneventful and she presented at 37 weeks and 5 days to the day assessment unit with history of spontaneous rupture of membranes. Speculum examination did not show any evidence of liquor. Since the CTG was normal and the mother was clinically well, she was discharged home with advice to return if there were any concerns. She presented after 2 days at 15:00 hours with a history of irregular uterine contractions and reduced fetal movements. On admission, her heart rate was found to be 100 beats per minute (bpm). Her blood pressure (BP) was 110/70 mmHg and her temperature was 36.7 °C. CTG monitoring was commenced (Figure 1A: DR – suspected prolonged spontaneous rupture of membranes (SROM), C – 2 to 3 in 10 minutes, BR of 145, VA – >5, A – present, D – nil, O – normal CTG). Abdominal examination showed a soft non-tender uterus with the fetus in cephalic presentation and head 3/5th palpable. She was admitted in view of the increased maternal heart rate and investigations such as full blood count (FBC) and C reactive protein (CRP) were requested. With time, the uterine contractions became stronger and a vaginal examination was performed which showed a cervical dilatation of 3 cm. The membranes were not intact. In view of the suspected prolonged rupture of membranes, augmentation of labour with oxytocin

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Description of cardiotocograph trace features (based on NICE guidance)

Principles for intrapartum CTG trace interpretation

- When reviewing the CTG trace, assess and document contractions and all four features of fetal heart rate: baseline rate; baseline variability; presence or absence of decelerations (and concerning characteristics of variable decelerations if present); presence of accelerations.
- If there is a stable baseline fetal heart rate between 110 and 160 beats/minute and normal variability, continue usual care as the risk of fetal acidosis is low.
- If it is difficult to categorize or interpret a CTG trace, obtain a review by a senior midwife or a senior obstetrician.

Accelerations

- The presence of fetal heart rate accelerations, even with reduced baseline variability, is generally a sign that the baby is healthy.

Description	Feature		
	Baseline (beats/minute)	**Baseline variability (beats/minute)**	**Decelerations**
Reassuring	110 to 160	5 to 25	None or early Variable decelerations with no concerning characteristics* for less than 90 minutes
Non-reassuring	100 to 109† OR 161 to 180	Less than 5 for 30—50 minutes OR More than 25 for 15—25 minutes	Variable decelerations with no concerning characteristics for 90 minutes or more OR Variable decelerations with any concerning characteristics in up to 50% of contractions for 30 minutes or more OR Variable decelerations with any concerning characteristics in over 50% of contractions for less than 30 minutes OR Late decelerations in over 50% of contractions for less than 30 minutes, with no maternal or fetal clinical risk factors such as vaginal bleeding or significant meconium
Abnormal	Below 100 OR Above 180	Less than 5 for more than 50 minutes OR More than 25 for more than 25 minutes OR Sinusoidal	Variable decelerations with any concerning characteristics in over 50% of contractions for 30 minutes (or less if any maternal or fetal clinical risk factors [see above]) OR Late decelerations for 30 minutes (or less if any maternal or fetal clinical risk factors) OR Acute bradycardia, or a single prolonged deceleration lasting 3 minutes or more

Characteristics of variable decelerations include — decelerations lasting more than 60 seconds; reduced baseline variability within the deceleration; failure to return to baseline; biphasic (W) shape and no shouldering.
Although a baseline fetal heart rate between 100 and 109 beats/minute is a non-reassuring feature, continue usual care if there is normal baseline variability and no variable or late decelerations.

Table 1

was discussed and an oxytocin infusion was commenced at 20:00. At 21:30 the maternal blood pressure was 130/82 mmHg, her pulse was 92 bpm, the temperature was 36.8 °C and the respiratory rate was 14/minute. At 21:45 the blood test results were reviewed, these showed an elevated white blood cell count of 19 and a CRP of 40. At 23:30 hours the maternal heart rate increased to 120 bpm with a temperature of 37.9 °C and the CTG continued to be suspicious (Figure 1B: DR — prolonged SROM, pyrexia, augmentation of labour, C — 3—4 in 10 minutes, BR — 155, VA — 5, A — nil, D — nil, O — normal CTG); a diagnosis of chorioamnionitis was considered. A decision was made to perform a category 2 caesarean section at this time by the obstetric team. Figure 1C depicts the CTG trace in the theatre during spinal anaesthesia, just before commencing the caesarean section procedure (DR — prolonged SROM, chorioamnionitis, augmentation of labour, C — 3—4 in 10 minutes, BR — 165, VA — 5, A — nil, D — nil, O — suspicious CTG). The baby was born in poor condition at 00:30 with APGAR scores of 1 at 1 minute and 0 at 5 minutes. The cord blood pH was 7.326 with a base excess of −6.7 mmol/L and lactate of 3.5 kPa. Neonatal resuscitation was

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