Arias' Practical Guide to High-Risk Pregnancy and Delivery

A South Asian Perspective

Fourth Edition

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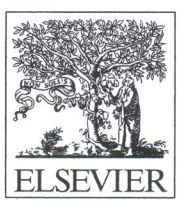

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Chapter 20

Fetal Surveillance in Labour

Rohana Haththotuwa, Muhunthan K, and Sabaratnam Arulkumaran

Chapter Outline

INTRODUCTION

The purpose of intrapartum fetal surveillance is to avoid fetal deaths due to birth asphyxia or babies born in poor condition that would lead to neurological injury such as cerebral palsy. However confidential inquiries over the last two decades suggest that substandard care in labour leads to poor outcome despite using modern technology of cardiotocography (CTG).[1,2] Inability to interpret the CTG trace, i.e., poor pattern recognition; failure to correlate to the pathophysiology that causes the CTG changes, not taking into consideration the clinical situation that may suggest the feto-placental reserve and delay in taking appropriate action due to poor communication and team work are the identified reasons for the poor outcome.

The surrogate markers of birth asphyxia are Apgar scores at birth, cord arterial acid–base balance, the need for assisted ventilation and the neurological status of the newborn after birth. Of these parameters, neonatal encephalopathy grades II (neonatal convulsions) and III (coma) have a strong correlation to cerebral palsy.[3] It is known that pure intrapartum hypoxia contributes to less than 10%, whilst the combination of an antenatal and intrapartum insult may contribute to about 25% of those who suffer from neonatal encephalopathy.[4]

The brain tends to get injured due to infection, trauma, metabolic disorders and asphyxia. The time of gestation at which the asphyxia occurs will determine which part of the brain would get affected (Table 20.1). Asphyxia in animal models have provided us with information when we evaluate injury in human fetuses.[5]

'Acute profound hypoxia' results in athetoid type cerebral palsy (CP). Partial prolonged hypoxia results in spastic quadri-paretic CP. Magnetic resonance imaging (MRI) would show the scarring that reflects the injury at any date after the injury and will be a permanent marker. MRI studies of babies with cerebral palsy in Gothenborg, Sweden with a stable population have revealed that nearly 28% of the babies had some asphyxia contribution for their injury in the peripartum period.[6]

INDICATIONS FOR CONTINUOUS ELECTRONIC FETAL MONITORING

There are number of antenatal and intrapartum high-risk factors that are known to be associated with poor outcome and most guidelines recommend continuous electronic monitoring in these cases and are given in Table 20.2.[7] Intermittent auscultation is recommended for those identified as low risk.

INTERMITTENT AUSCULTATION

In low-risk labour, the fetal heart should be auscultated every 15 minutes for aduration of one minute soon after a contraction during the first stage of labour and after every 5 minutes or after every other contraction during the second stage of labour. It is a good practice to palpate the maternal pulse to make sure one is listening to the fetal heart and not to a maternal pulse. The contractions are assessed by palpation that provides a good estimate of the frequency an approximation of the duration and does not provide good information of the amplitude. In practice it is plotted in a partogram as the frequency over 10 minutes (dots for duration of <20 seconds; lines if 20–40 seconds and fully

TABLE 20.1 Patterns of Asphyxial Injury Seen in Term Animals

Brainstem, thalamus and hypothalamic area get affected with acute profound hypoxia and are reflected as prolonged bradycardia.
Prolonged partial hypoxia that is reflected by intermittent decelerations over a long period of time which is associated with acidosis causes brain swelling and cortical necrosis.
Prolonged partial hypoxia without acidosis causes white matter injury.
Total asphyxia preceded by prolonged partial hypoxia with mixed acidosis causes injury to the cortex, thalamus and basal ganglia.

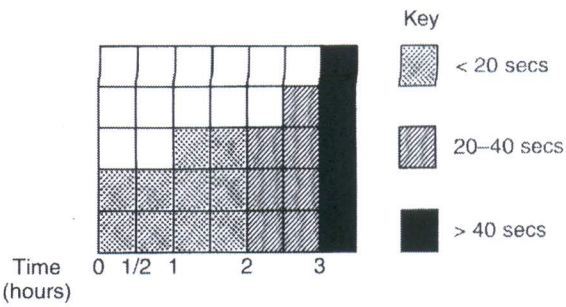

FIGURE 20.1 Monitoring and recording of uterine contractions based on clinical palpation.

shaded if >40 s) (Fig. 20.1). Intermittent auscultation (IA) could be done by a fetal stethoscope or by using a fetal Doptone. One should encounter meconium in the amniotic fluid, or have difficulty with auscultation, or an abnormal heart rate then electronic fetal heart rate monitoring (EFM) is advisable. It is known EFM in low-risk mothers increases surgical interventions without reduction in cerebral palsy.

CONTINUOUS CARDIOTOCOGRAPHY (CTG) / ELECTRONIC FETAL HEART RATE MONITORING (EFM)

Continuous tracing of the fetal heart rate (FHR) can be obtained with the use of an ultrasound transducer or by applications of a scalp electrode. Modern fetal monitors use auto-correlation technology that provides a good trace with the ultrasound transducer and hence the use for a scalp electrode is reduced. The scalp electrode is also contraindicated in cases of hepatitis B, AIDS and if Herpes infection is suspected.

An external transducer placed between the uterine fundus and the umbilicus to record the uterine contractions. The forward movements of the uterus with the contractions compress the toco-transducer's diaphragm to reflect the uterine contraction. From a recording of these events, the frequency, duration and approximate amplitude are calculated. Internal tocography is invasive and is not used in clinical practice as its benefit in labour is not proven.[8]

Technical error of inadvertently recording the mother's heart rate should be avoided by listening to the fetus prior to application of the ultrasound transducer. The use of CTG machines is standardized in terms of paper speed (1 cm/min in the UK and 3 cm/min in the USA) and the scale in which the FHR is displayed on the recording paper.[9]

In labour, there are number of interventions like sitting up, use of bed pan, performing a vaginal examination, etc. that would change the FHR and hence these activities should be recorded in the notes.

Central monitoring system allows the senior midwife or consultant to have an overview of the CTGs in all the rooms. It is a great tool for teaching and research by making use of the archived information. A 'second or fresh eye' approach provides better scrutiny of the traces.

TABLE 20.2 Recommended High-Risk Situations for the Use of Continuous EFM

Maternal	Fetal	Intrapartum Risk Factors
Induction of labour Trial of vaginal delivery after previous caesarean section Hypertensive disorders of pregnancy Prolonged pregnancy (>42 weeks) Prolonged rupture of membranes (>24 hours) Diabetes Antepartum haemorrhage Medical disorders, e.g. systemic lupus erythematosus	Intrauterine growth restriction (IUGR) Fetus at pre-term gestation Oligohydramnios Abnormal antenatal fetal tests (e.g., Doppler velocimetry of fetal vessels) Twin pregnancy (Triplets are usually delivered by CS due to difficulties in monitoring) Meconium stained liquor Pyrexia in labour or suspected intrauterine infection	Oxytocin augmentation Epidural analgesia – especially at the time of administration and soon afterwards; more risks when the head is low in the pelvis Vaginal bleeding in labour especially if associated with pain or uterine irritability Maternal pyrexia Fresh meconium-stained liquor

ADMISSION CTG

A 20 minutes CTG tracing with a few contractions on arrival to the labour ward, called the *admission CTG*, to screen for those fetuses that may not have the physiological reserve to tolerate labour is practiced in some countries like Sweden.[12] In the United Kingdom, it is not recommended by the National Institute of Clinical Excellence (NICE) because of inadequate evidence. Despite the recommendation the admission test is used by some when there is insufficient midwifery staff to provide one-to-one care and perform auscultation of the FHR for one minute every 15 minutes in the first stage and every 5 minutes in the second stage of labour.

Features of the CTG

On the CTG trace, the upper channel has the fetal heart rate (FHR) recording. Four features related to the FHR need to be identified and described; the baseline rate, baseline variability, accelerations and decelerations (Table 20.3). Individual features have the norms and the deviation from the norms and are described as reassuring or normal, non-reassuring and abnormal (Table 20.4). Based on the description of these four features, the CTG trace is classified as normal, suspicious or pathological (Table 20.5). The lower channel of the CTG has the contraction recording and has four features; baseline tone, frequency, duration and

TABLE 20.3 Definitions of Individual Features of Fetal Heart Trace as Described by NICE[7]

Term	Definition
Baseline fetal heart rate	The mean fetal heart rate when this is stable excluding accelerations and decelerations. It is determined over a period of 5–10 mins and expressed in bpm.
Normal baseline FHR	110–160 bpm
Moderate bradycardia	100–109 bpm
Moderate tachycardia	161–180 bpm
Abnormal bradycardia	<100 bpm
Abnormal tachycardia	>180 bpm
Baseline variability	Minor fluctuations in baseline FHR occurring at 3–5 cycles/minute. It is measured by estimating the difference in beats per minute between highest peak and lowest trough of fluctuation in a one minute segment of the trace.
Normal base line variability	Greater or equal to 5 bpm – 25 bpm between contractions
Non-reassuring baseline variability	Less than 5 bpm for 40 mins or more but less than 90 minutes
Abnormal baseline variability	Less than 5 bpm for 90 minutes or more
Accelerations	Transient increase in FHR of 15 bpm or more and lasting 15 seconds or more (Fig. 20.2)
Decelerations	Transient episodes of slowing of FHR below the baseline level of more than 15 bpm and lasting 15 seconds or more.
Early decelerations	Uniform, repetitive, periodic slowing of fetal heart rate with onset early in the contraction and return to baseline at end of contraction (Fig. 20.3.)
Late decelerations	Uniform, repetitive, periodic slowing of FHR with onset of deceleration 20 s later than onset of contraction or nadir of deceleration more than 20 s after the peak of the contraction or end of deceleration 20 s after the end of contraction. In the presence of a non-accelerative trace with baseline variability <5 bpm the definition would include decelerations of <15 bpm (Fig. 20.4).
Variable decelerations	Variable, intermittent, periodic slowing of FHR with rapid onset and recovery. Time relationships with contraction cycles are variable and they may occur in isolation (Fig. 20.5)
Prolonged decelerations	An abrupt decrease in FHR <80 bpm. It is suspicious if it is <3 mins and is pathological if it is >3 mins.
Sinusoidal pattern	A regular oscillation of the baseline resembling a sine wave with little baseline variability. This smooth, undulating pattern, lasting at least 10 mins, has a relatively fixed period of 3–5 cycles per minute and an amplitude of 5–15 bpm above and below the baseline (Fig. 20.6)

Reproduced from guidelines collated by RCOG in association with NICE (2001).[9]