

Cardiotocograph (CTG) Interpretation and Response

1. Purpose

This document provides guidelines for clinicians in CTG interpretation and response to the CTG pattern of fetuses greater than 28 weeks gestation. It defines a standardised process of interpretation, documentation and management of cardiotocographs (CTG), in particular where variations from 'normal' occur.

For interpretation and response of the very preterm fetus, please refer to the guideline [CTG Interpretation: Very preterm <28 weeks, antenatal management](#).

Where processes differ between campuses, those that refer to the Sandringham campus are differentiated by pink text or have the heading **Sandringham campus**.

Background

Cardiotocography (CTG) or electronic fetal monitoring (EFM) is the most widely used technique for assessing fetal wellbeing in labour in the developed world. The primary purpose of fetal surveillance by CTG is to prevent adverse fetal outcomes².

CTGs have a high degree of sensitivity but a low level of specificity which means that they are very good at telling us which fetuses are well but are poor at identifying which fetuses are unwell. The differences in individual fetal responses to a decrease in oxygen (and therefore differences in heart rate changes) mean that the positive predictive value of CTG for adverse outcome is low and the negative predictive value high. The increased intervention rates associated with EFM can be reduced with the use of fetal blood sampling (FBS). This guideline can be used in conjunction with the guidelines [Fetal Blood Sampling](#) and [Hyperstimulation-Uterine, Management of Tachysystole and Hypertonus](#).

2. Definitions

Baseline fetal heart rate (FHR) is the mean level of the FHR when this is stable, excluding accelerations and decelerations. It is determined over a time period of 5-10 minutes, expressed as beats per minute (bpm)¹. Preterm fetuses tend to have values towards the upper end of the normal range.

Baseline variability is the minor fluctuation in baseline FHR. It is assessed by estimating the difference in bpm between the highest peak and lowest trough of fluctuation in one minute segments of the trace¹.

- Normal variability 6-25 beats per minute
- Reduced variability 3-5 beats per minute
- Absent variability <3 beats per minute
- Increased (salutatory) variability > 25 beats per minute.

Accelerations are transient increases in FHR of 15bpm or more above the baseline and lasting 15 seconds. Accelerations in preterm fetuses may be of lesser amplitude and shorter duration¹.

Decelerations are transient episodes of decrease of FHR below the baseline of more than 15 bpm lasting at least 15 seconds. The specific features of the deceleration inform the classification. Decelerations should never be described as 'unprovoked'; the fetus will not decelerate its heart rate without physiological provocation. Uterine activity, even in its mildest form, will result in decelerations in a fetus whose oxygenation is already compromised¹.

NB: late decelerations can be less than 15 beats from the baseline- see below.*

- **Early decelerations** are benign and associated with the sleep cycle and often in the range of 4-8 cm of cervical dilatation. They are caused by head compression and in general are a normal physiological response to a mild increase in intracranial pressure. Importantly they are uniform in shape and start and finish with the contraction. They may be said to mirror the contraction².
- **Variable decelerations** are a repetitive or intermittent decreasing of FHR with rapid onset and recovery. Time relationships with contraction cycle may be variable but most commonly occur simultaneously with contractions¹. The significance of variable decelerations depends on the overall clinical picture and specific features of the decelerations themselves, as well as other features of the CTG². Variable decelerations in association with other non-reassuring or abnormal features change the category of the deceleration to 'complicated'.

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- Complicated variable decelerations are defined by their features as well as the other features of the CTG. These additional features indicate the likelihood of fetal hypoxia and the definition includes one or more of the following:
 - Rising baseline rate or fetal tachycardia
 - Reduced or absent baseline variability
 - Slow return to baseline FHR after the end of the contraction
 - Onset of the nadir after the peak of the contraction
 - Large amplitude (by 60bpm or to 60bpm) and /or long duration (60 seconds)
 - Loss of pre and post deceleration shouldering (abrupt brief increases in FHR baseline)
 - Presence of post deceleration smooth overshoots (temporary increase in FHR above baseline)¹.

Note: although complicated variables are often associated with a rising baseline and reduced baseline variability, it is not uncommon for complicated variables to have normal baseline variability e.g. typical variables with a baseline tachycardia.

- **Prolonged decelerations** are defined as a decrease of FHR below the baseline of more than 15 bpm for longer than 90 seconds but less than 5 minutes¹
- **Late decelerations** are defined as uniform, repetitive decreasing of FHR with, usually, slow onset mid to end of the contraction and nadir more than 20 seconds after the peak of the contraction and ending after the contraction¹. Late decelerations are caused by contractions in the presence of hypoxia. This means that they will occur with each contraction and the fetus is already hypoxic. There will be no features of a well oxygenated fetus, like early or typical variable decelerations, normal baseline variability or shouldering. They start after the start of the contraction and the bottom of the deceleration is more than 20 seconds after the peak of the contraction. Importantly, they return to the baseline after the contraction has finished. In the hypoxic fetus, this will include decelerations of less than 15bpm (and occasionally less than 5bpm)*.

A sinusoidal pattern is an oscillating pattern which is typically **smooth and regular**. It has a relatively fixed period of 2-5 cycles per minute and has an amplitude of between 5 and 15 bpm around the baseline rate. Baseline variability is absent and there are no accelerations. It is typically reflective of severe anaemia, with haemoglobin levels below 50 gm/L ².

The pseudo sinusoidal pattern is a false sinusoidal pattern. While it may on outward appearance share some features of the sinusoidal pattern, it is not as smooth and is not regular. The hallmark feature of a pseudo sinusoidal trace is the appearance of some period of normal baseline variability and accelerations. This pattern is not typically associated with fetal compromise and biophysical assessment will reflect this ².

Features that are unlikely to be associated with significant fetal compromise when occurring in isolation¹:

- Baseline FHR is between 100-109 bpm
- Absence of accelerations
- Early decelerations
- Decelerations are variable without complicating features.

Features that may be associated with significant fetal compromise and require further action¹:

- Baseline fetal tachycardia >160bpm
- Reducing or reducing baseline variability 3-5bpm
- Rising baseline fetal heart rate
- Complicated variable decelerations
- Late decelerations
- Prolonged decelerations.

Features that are likely to be associated with significant fetal compromise and require immediate management, which may include urgent delivery¹:

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- Prolonged bradycardia (100bpm for > 5 minutes)
- Absent baseline variability <3bpm
- Complicated variable decelerations with reduced or absent variability
- Late decelerations with reduced or absent variability.

2.1. Classification of CTGs

Normal antenatal CTG trace: The normal antenatal CTG is associated with a low probability of fetal compromise and has the following features:

- Baseline fetal heart rate (FHR) is between 110-160 bpm
- Variability of FHR is between 5-25 bpm
- Decelerations are absent or early
- Accelerations x2 within 20 minutes.

Normal intrapartum CTG trace: The normal intrapartum CTG is associated with a low probability of fetal compromise and has the following features:

- Baseline FHR is between 110-160 bpm
- Variability of FHR is between 6-25 bpm
- Decelerations are absent or early
- The significance of the presence or absence of accelerations is unclear. Therefore, exclude accelerations during interpretation.

Any CTG that does not meet these criteria is by definition abnormal. The full clinical picture must be considered when evaluating any CTGs.

3. Responsibilities

Medical and midwifery staff are responsible for decision-making regarding identification of women and babies who require electronic fetal monitoring, for the interpretation of the CTG with regard to the total clinical picture and for the clinical management response to the CTG interpretation.

Note: in cases where a CTG has been interpreted as abnormal or is of concern, the on-duty or on-call consultant obstetrician must be notified and the notification, discussion and outcome documented in the woman's record.

Clinical staff involved in assessing fetal well-being are expected to ensure regular professional development activities with this important clinical skill on an annual basis. At the Women's all clinical staff involved in fetal assessment using CTG are required to attend annual CTG education.

4. Guideline

4.1. *Antenatal risk factors requiring intrapartum monitoring*¹

- Abnormal antenatal CTG
- Abnormal Doppler umbilical artery velocimetry
- Abnormalities of maternal serum screening associated with an increased risk of poor perinatal outcomes e.g. low PAPP-A <0.4MoM.
- Antepartum haemorrhage
- Breech presentation

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- Decreased fetal movements
- Diabetes where medication is indicated or poorly controlled, or with fetal macrosomia
- Essential hypertension or pre-eclampsia
- Known fetal abnormality which requires monitoring
- Maternal age greater than or equal to 42
- Multiple pregnancy
- Oligohydramnios or polyhydramnios
- Other current or previous obstetric or medical conditions which constitute a significant risk of fetal compromise e.g. cholestasis, isoimmunisation, substance abuse
- Prior uterine scar / caesarean section
- Prolonged pregnancy ≥ 42 weeks gestation
- Prolonged rupture of membranes (≥ 24 hours)
- Suspected or confirmed intrauterine growth restriction

4.2. Intrapartum risk factors¹

- Induction of labour with prostaglandin / oxytocin
- Abnormal auscultation or CTG
- Oxytocin augmentation
- Regional analgesia e.g. epidural or spinal, paracervical block*
- Abnormal vaginal bleeding in labour
- Maternal pyrexia greater than or equal to 38°C
- Meconium or blood stained liquor
- Absent liquor following amniotomy
- Active first stage of labour >12 hours (i.e. after diagnosis of labour)
- Active second stage (i.e. pushing) >1 hour where birth is not imminent
- Preterm labour less than 37 completed weeks¹
- Tachysystole (more than 5 active labour contractions in 10 minutes, without fetal heart rate changes)
- Uterine hypertonus (contractions lasting more than 2 minutes or occurring within 60s of each other, without fetal heart rate changes)
- Uterine hyperstimulation (tachysystole/hypertonus with fetal heart rate changes).

*Following a decision to insert an epidural block, a CTG should be commenced to establish baseline features prior to the block's insertion.

4.3. Assessment

- Determine indication for fetal monitoring (see indications listed above)
- Discuss fetal monitoring with the woman and obtain permission to commence¹
- Perform abdominal examination to determine lie and presentation
- Give the woman the opportunity to empty her bladder
- The woman should be in an upright or lateral position (not supine)

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- Check the accurate date and time has been set on the CTG machine, and paper speed is set at 1cm per minute¹
 - If using the electronic CTG archiving system check that the date and time on the computer is correct
- CTGs must be labelled with the mother's name, UR number and date / time of commencement
 - If using the electronic CTG archiving system check that the correct woman's record is in the correct bed on the whiteboard. This will ensure that the CTG is saved to the correct electronic record.
- Maternal heart rate must be recorded on the CTG at commencement of the CTG in order to differentiate between maternal and fetal heart rates
 - If using the electronic CTG archiving system, this can be done by accessing the menu and documenting in the 'maternal heart rate' box which can be found under the 'observations' tab.

4.4. Other considerations¹

Consider a CTG when there are conditions which do not require monitoring where they occur in isolation but may warrant monitoring if multiple conditions are present. Multiple factors are more likely to have a synergistic impact on fetal risk. Antenatal risk factors include:

- Gestation 41. To 41.6 weeks
- Gestational hypertension
- Gestational diabetes without complications
- Obesity BMI 30-40
- Maternal age 40-42.

Intrapartum risk factors include:

- Maternal pyrexia greater than or equal to 37.8 and less than 38°C.

4.5. Interpretation and documentation

- CTG interpretation should follow a standardised process to ensure all features of the CTG are documented
 - If using the electronic CTG archiving system use the standardized menu to describe the features and response.
- On all occasions when a CTG is performed there must be documentation of all features in the woman record
 - If using the electronic CTG archiving system, use the options on the tabs in the menu.
- For women receiving continuous electronic fetal monitoring (EFM) the CTG should be reviewed at least every 15 to 30 minutes¹. This can be achieved by initialing the CTG trace at regular intervals as evidence of the review
 - On the electronic record, logging in and choosing the clinician type from the menu is sufficient to create an electronic signature.
- Interpretation and response to findings must be documented on an hourly basis.

Uterine activity

The CTG is a cardio-TOCO-graph. Attention must be paid to uterine activity as well as the fetal heart rate pattern. Uterine contractions reduce the blood flow to the placenta thus reducing fetal oxygenation. Consideration must be given to the frequency of contractions with particular attention paid to the rest between them. This is the time that allows fetal oxygenation to recover to fetal norms; a period of 60-90 seconds is required².

Refer to the procedure [Hyperstimulation-Uterine, Management of Tachysystole and Hypertonus](#) for further guidance.

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Response to the CTG trace should be guided by the algorithm (below), and any abnormalities documented in the woman's record and reported to (escalate in light of the woman's clinical circumstances):

- The senior midwife in Birth Centre and/ or
- The registrar rostered to Birth Centre and/ or
- The consultant obstetrician rostered to Birth Centre.

5. Evaluation, monitoring and reporting of compliance to this guideline

Compliance to this guideline will be monitored, evaluated and reported through review of incidents reported on VHIMS.

6. References

1. The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (2014) Intrapartum Fetal Surveillance Clinical Guidelines- Third Edition.
2. Baker L, Beaves M, and Wallace E. 2016. Assessing Fetal Wellbeing A Practical Guide. Southern Health and RANZCOG.

7. Legislation related to this guideline

Not applicable.

8. Appendices

Appendix 1: [CTG Interpretation and Response Algorithm](#).

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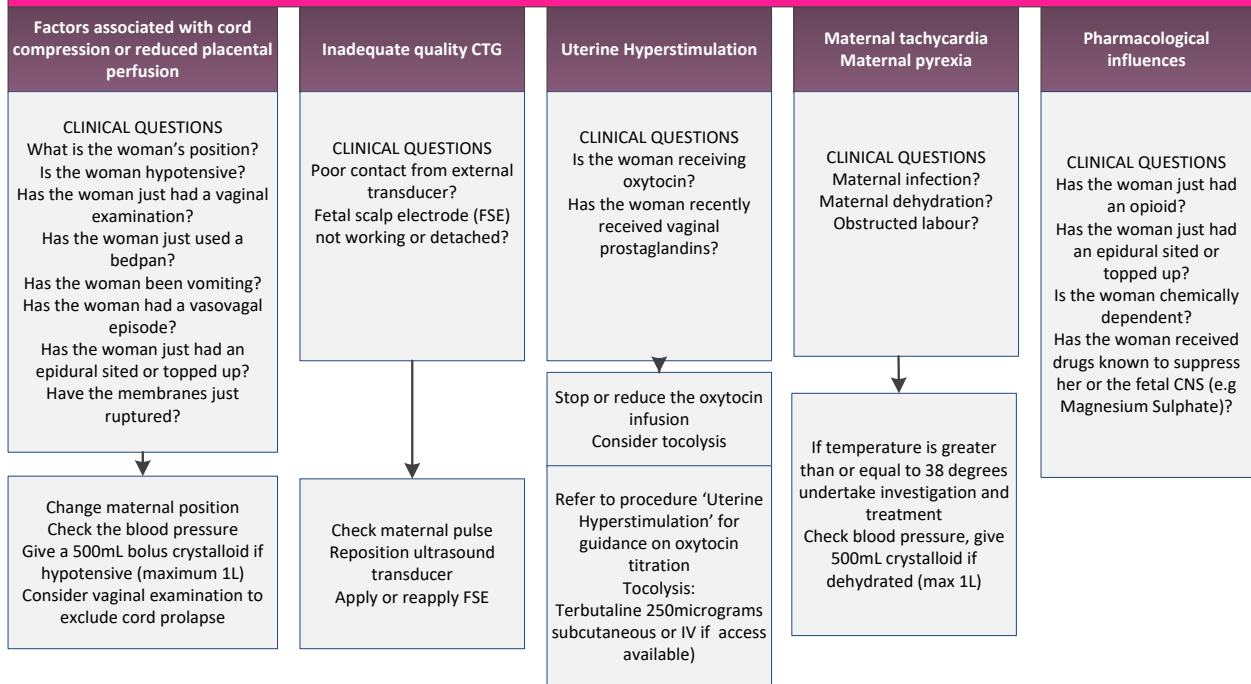
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CTG Interpretation and Response Algorithm



CTG Interpretation and Response				
By definition, all CTGs with these features are considered abnormal and require further evaluation. The total clinical picture must always be considered when interpreting fetal heart rate patterns				
	Normal features	Features UNLIKELY to be associated with fetal compromise when occurring in isolation	Features MAY be associated with fetal compromise AND	Features are LIKELY to be associated with fetal compromise
	NO further action	OBSERVE 2 OR MORE MAY REQUIRE FURTHER ACTION	REQUIRES FURTHER ACTION	IMMEDIATE MANAGEMENT OR URGENT DELIVERY
Baseline	110-160	100-109	>160 Rising baseline	Less than 100 > 5mins Greater than 170
Variability	6-25bpm		3-5bpm for >40 minutes >25bpm for >40 minutes	Absent <3bpm Sinusoidal pattern
Decelerations	None	Early decelerations Typical variable decelerations	Complicated variable decelerations Late decelerations Prolonged decelerations	Complicated variable decelerations with reduced or absent variability Late decelerations with reduced or absent variability
Accelerations	2 present in 20 minutes	Absence of accelerations		

Requires further action



Requires immediate management or urgent delivery

