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Fetal Heart Monitoring (including Fetal Blood Sampling)

Summary statement: How does the document support patient care?	The purpose of this guideline is to provide good practice evidence for staff with regard to fetal heart rate monitoring.
Staff/stakeholders involved in development:	Labour Ward Leads (Obstetric and Midwifery), Audit and Fetal wellbeing Practitioners.
Division:	Women and Children's
Department:	Maternity
Responsible Person:	Chief of Service
Author:	Fetal Well-being Practitioner/Obstetric Consultants
For use by:	All Medical and Midwifery staff
Purpose:	To provide evidence based guidance on fetal monitoring and the use of fetal blood sampling during labour.
This document supports:	NICE CG190 (2017) Intrapartum care for healthy women and babies RCOG Saving Babies Lives Care Bundle v2 2019
Key related documents:	**UH Sussex (SRH&WH) Maternity Guidelines:** Care of Women in Labour, Induction of Labour and Use of Oxytocin, Caesarean Section.
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1.0	November 2010	Labour ward Coordinators	Archived	New Trust wide guideline
2.0	February 2011	CNST Lead Midwife	Archived	Admin update
3.0	May 2011	CNST Team	Archived	Amendments made to clinical response to classification of CTGs and information to record at start of CTG
4.0	December 2011	CNST Midwife	Archived	Minor amendments to data at start of CTG and cord blood procedure
5.0	October 2012	CNST Midwife	Archived	Minor amendments including CNST 2012-13 updates and new CTG assessment sticker
5.1	November 2013	CNST Midwife	Archived	3 year review: minor amendments and addition of antenatal CTG assessment sticker
5.2	May 2014	Patient Safety Midwife	Archived	Addition of IOL for maternal / fetal concerns to continuous EFM in labour
5.3	October 2016	Clinical Effectiveness Midwife	Archived	Addition of Dawes/Redman Criteria and NICE Guidance
5.4	Jan 2017	Clinical Effectiveness Midwife	Archived	Updated from NICE review Nov 2016 CTG classification
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7.0	May 2021	S. Thompson, Fetal Wellbeing Practitioner N. Maguire & S. Das, Labour Ward Consultants	Archived	NHS England: Saving Babies' Lives Care Bundle - SBLCB part 4 Huntleigh Diagnositics: Dawes-Redman CTG Analysis
8.0	October 2022	H. Close & N. Jarvis Fetal Well Being Midwives	Archived	Review by Fetal Wellbeing Midwives. Amendments made to include 26/40 CTG, IIA, TREND and escalation pathway

8.1	March 2023	H.Close & N.Jarvis Fetal Wellbeing Midwives	Archived	6.0 - Deviations from normal in community setting to be referred in to labour ward. 6.1- Addition to Dawes Redman Criteria Use during Induction of Labour. New flow chart
8.2	January 2024	CE Team, H. Close, N. Jarvis Fetal Wellbeing Midwives	LIVE	Amended to align with NICE NG229 Fetal Monitoring

The interpretation and application of clinical guidelines will remain the responsibility of the individual clinician. If in doubt contact a senior colleague or expert.

Contents

Fetal Heart Monitoring Guideline

1.0 Introduction

To provide evidence-based guidance for Midwives and Obstetricians during the antenatal and intrapartum period with regard to:

- Intermittent Auscultation (including an introduction to Intelligent intermittent auscultation)
- Continuous Electronic Fetal Monitoring
- Fetal blood sampling
- Cord blood sampling

The indications for and the method of fetal monitoring should always be discussed with the pregnant woman and person as they have the right to make informed choices regarding their care or treatment. These choices should be recognised as an integral part of the decision making process.

The woman and person's decision about fetal monitoring during labour should be supported. Birthing companion(s) should be included in these discussions if appropriate, and if that is what the woman/person wants. These discussions and decisions should be documented on MIS.

Confirm with the woman and person which method of fetal monitoring has already been advised antenatally.

Prior to any form of fetal heart rate monitoring, the pregnant woman and person's pulse should be palpated for 1 minute in order to differentiate between pregnant woman and person's and baby's, and then documented on MIS. The assessment of fetal wellbeing is only one component of intrapartum care. It is an important area where due consideration must be given to pregnant woman and person's preference and priorities in the light of potential risk factors to both pregnant woman and person and baby.

2.0 Scope

This guideline applies to:

- Midwives
- Obstetricians

3.0 Roles & responsibilities

Midwives & Obstetricians:

- To access, read, understand and follow this guidance.
- To use their professional judgement in application of this guideline.

Management:

- To ensure the guideline is reviewed as required in line with Trust and National recommendations.
- To ensure the guideline is accessible to all relevant staff.

4.0 Definitions and abbreviations used in this guideline

BPM Beats Per Minute	**FSE** Fetal Scalp Electrode
FHR Fetal Heart Rate	**CTG** Cardiotocograph
IA Intermittent Auscultation	**CEFM** Continuous Electronic Fetal Monitoring
RCT Randomized Control Trials	**FBS** Fetal Blood Sampling
CS Caesarean Section	**IIA** Intelligent Intermittent Auscultation
MIS Maternity Information System	**FH** Fetal Heart
ADAU Antenatal Day Assessment Unit	**CLS** Central Labour Suite
IOL Induction of Labour	**RFM** Reduced Fetal Movements
SGA Small for Gestational Age	**STV** Short Term Variability

5.0 Types of fetal monitoring

Intermittent Auscultation (IA) - is a systematic method of listening to fetal heart tones with a Pinards stethoscope or a hand-held Doppler, paying attention to Baseline rate, and recording accelerations and decelerations if heard (In line with NICE guidance)

Intelligent Intermittent Auscultation (IIA) – This method uses the same principles as Intermittent Auscultation however includes a holistic approach to maternal and birthing parent and fetal well-being, to include recognition of clinical findings and risk factors (chandaharan 2010) The aim of Intelligent Intermittent Auscultation is to detect deviations from the norm that may suggest a possible fetal compromise or identify a fetus requiring a more intensive assessment (Lewis and Downe 2015).

Continuous Electronic Fetal Monitoring (CEFM) – Cardiotocography (CTG) records changes in the fetal heart rate and their relationship to uterine contractions. CTGs are to be performed from 26 weeks gestation. CEFM is a screening tool for hypoxia and does not replace the need for accurate clinical observations on which decisions should be made in conjunction with the CTG.

Computerised CTG (cCTG) – allows an analysis of different patterns to be graded in a standardised and consistent way. It uses the computerised numerical analysis of the CTG drawing on experience from archived records applying the Dawes Redman criteria. It can eliminate the problems associated with individual visual interpretation. However the final clinical judgements should be based on the entire clinical assessment with computerised CTG forming a part of this holistic approach to pregnancy management.

6.0 Antenatal fetal heart monitoring

Although antenatal auscultation of the fetal heart (FH) is not routinely clinically indicated, it can support confirmation of fetal wellbeing and reassure the mother and birthing parent. It can be offered from 16 weeks at antenatal appointments, and failure to hear the FH should be followed up by an ultrasound scan at the earliest opportunity. Any abnormalities detected in a community setting during auscultation should be referred into ADAU/Delivery Suite. Oral fluids to improve the fetal heart rate are not recommended.

Where CTG monitoring is required during the antenatal period or prior to established labour, the antenatal CTG assessment should be completed and referral made according to outcome findings. A computerised assessment to include Dawes-Redman analysis should be used for all antenatal CTG's unless contraindicated – see 6.2

If a CTG is visibly abnormal, classified as abnormal or does not meet Dawes-Redman criteria then it must be reviewed by the obstetric team. If a woman and person has a CTG that is classified as abnormal in any area other than labour ward they must be transferred to ADAU/labour ward for continuous CTG and review.

6.1 Dawes Redman Criteria

The Dawes Redman Criteria for normality is based on over 100,000 CTG traces, linked to outcomes and can be used for antenatal traces where the fetal gestation is between 26+0 weeks and term and is associated with a significant reduction in perinatal mortality compared with clinical CTG interpretation (Appendix 1). Dawes-Redman analysis can be used for gestations from 26 weeks, however although the analysis is valid it is not as precise as when carried out at later gestations. (Redman et al 2022)

- **If the CTG meets the Dawes Redman Criteria:** It can be discontinued as long as the clinician has assessed the CTG and clinical picture as a whole**.** Unless there are other clinical concerns, for example maternal and birthing parent systemic illness, ongoing bleeding or uterine pain, the CTG can be stopped. Ensure the correct button is pressed in order for the printer to produce a report of the analysis. A single midwife/clinician can sign and date the print out when the Dawes Redman Criteria are met.
- **Duration of Dawes-Redman criteria**: If CTG is normal and the criteria met, this can be stopped after 10 minutes.
- **If the Dawes Redman Criteria is not met by 10 minutes:** The CTG should continue for up to the maximum record length of 60 minutes. Between 10-60 minutes, once it meets the criteria it can be stopped. If the CTG is classified as abnormal on an antenatal sticker the CTG should be continued and escalated to an obstetrician.
- **If the criteria have not met by 60 minutes:** Obstetric review and discussion with consultant regarding plan of care, this may include a repeat CTG depending on the individual clinical picture. Please see Appendix 4 for management guidance when criteria not met.
- **Induction of Labour.** Dawes-Redman analysis can be used during induction of labour as long as there is no palpable or reported uterine activity, i.e. before and after insertion of a cervical ripening balloon and before and after insertion of

dinoprostone (Prostin or Propess). It is not to be used after spontaneous/artificial rupture of membranes.

6.2 Contraindications to CTG

- Gestation <26 weeks
- Latent phase of labour
- Ongoing Induction of labour after administration of prostaglandins

7.0 Equipment

- For intermittent auscultation a Pinard's stethoscope is preferred or a handheld fetal Doppler could be used. There is evidence that the Pinard's stethoscope reduces the potential for confusing maternal and fetal heart rates and for this reason its use is recommended before starting IA/IIA or CEFM. It can continue to be used for IA/IIA as appropriate. The operator must be trained in its use.
- For continuous electronic fetal monitoring a CTG monitor should be used. The operator must be trained in its use.
- When starting a CTG, the operator must check that it is set to print at 1cm/minute and also show the correct date and time (See section 10.1).
- Do not rely solely on the CTG trace for fetal wellbeing and be aware of its limitations and artefacts, such as double maternal and birthing parent heart rate being displayed. The maternal and birthing parent pulse rate should be recorded at least hourly. **As well as palpating the maternal and birthing parent pulse it may be helpful to use the pulse oximetry to record maternal and birthing parent pulse, especially at the start of the CTG. If there are any concerns with erroneous recording of the maternal and birthing parent heart rate a maternal birthing parent pulse oximeter should be used. Remember that by the time confusion is considered we may have been monitoring the maternal and birthing parent heart rate for some time.**
- Confirm fetal heart rate using independent means, Pinard or hand held doppler; if there is any clinical uncertainty refer to an obstetrician and consider an ultrasound scan.

8.0 Labour fetal heart monitoring following low risk pregnancy Intelligent Intermittent Auscultation

(See appendix 4)
For a pregnant woman and person who is healthy and has had an otherwise uncomplicated pregnancy, intelligent intermittent auscultation should be offered as the recommended way to monitor fetal wellbeing. This should be clearly recorded on MIS.

Initial auscultation of the fetal heart is recommended at first contact in the latent phase of labour and at each further assessment undertaken. To date there are no studies to assess the optimal frequency for IIA in low risk labours, in any birth setting but it should detect potential concerns about fetal wellbeing and the possible need to transfer to CEFM.

However, the literature suggests in the **active stage of labour**, intelligent intermittent auscultation should be performed immediately after a contraction by palpating the abdomen (so not to miss a late deceleration), for at least 60 seconds and at least:

- Every 15 minutes in the first stage, or more often if any cause for concern or signs of the second stage.
- Every 5 minutes in the passive **and** active second stage.
  NICE CG190 (updated 2014)

The clinician should listen after a contraction and the heart rate should be recorded as a single figure on the partogram in beats per minute so that the baseline can by observed overtime. Listening before, during and after a contraction is not recommended as routine practice as it is more important assessing how the baby copes after the contraction. Women and people need to be able to move freely during a contraction and to have interruptions minimised. We should only consider listening in this way if we have concerns about the baby's heart rate over-accelerating following a contraction (tachycardic overshoot) which shows that the baby is having to use extra resources to recover its heart rate to its baseline following the contraction.

If the fetal heart gives rise for concern, such as an increase in the fetal heart rate (as plotted on the partogram) of 20 beats a minute or more from the start of labour, or a deceleration is heard, auscultate the fetal heart after three consecutive contractions. Carry out a full review, taking into account the whole clinical picture including antenatal and existing or new intrapartum risk factors, maternal and birthing parent observations, contraction frequency (including hypertonus) and the progress of labour.

If concerns persist escalate to the coordinator and commence a CTG should be commenced following discussion with the pregnant woman and person and their partner. This change should then be documented on MIS.

The pregnant woman and person's pulse should be palpated at least hourly to differentiate between the pregnant woman and person's and fetal heart rates and should be documented on the partogram. If there is a suspected fetal heart rate pattern abnormality, the pulse rate should be palpated sooner and documented with a plan of care.

Following commencement of CEFM, the partogram must be used.

8.1 Maternal and birthing parent request for CTG in low risk pregnancy

Explain the woman and person that if there are no identified risk factors for fetal compromise:

- There is a risk of increased interventions with continuous CTG monitoring compared with intermittent auscultation, which may outweigh the benefits AND
- Advice given by their midwife or obstetrician on the method of fetal heart rate monitoring will take into account the whole clinical picture.

9.0 Indications for the use of continuous intrapartum electronic fetal monitoring

9.1 The following table gives indications for continuous CEFM in labour:

This list is not exhaustive and an individualised risk assessment must be made in each case. Multiple 'minor' risk factors for fetal compromise should be considered an indication for CEFM.
Consider continuous CTG monitoring if, based on clinical assessment and multidisciplinary review, there are concerns about other antenatal factors not listed below that may lead to fetal compromise.
Be aware that intrapartum risk factors may increase the risk of fetal compromise, and that intrapartum risk factors that develop as labour progresses are particularly concerning.

CEFM Required
• Antepartum haemorrhage. • Breech presentation. • Contractions that last longer than 60 seconds (hypertonus), or more than 5 contractions in 10 minutes (tachysystole). • A reading of 2+ of protein on urinalysis and a single reading of either raised systolic blood pressure (140 mmHg or more) or raised diastolic blood pressure (90 mmHg or more). • Hypertension: either systolic blood pressure of 140 mmHg or more or diastolic blood pressure of 90 mmHg or more on 2 consecutive readings taken 30 minutes apart, measured between contractions. • Severe hypertension: a Single reading of either systolic blood pressure of 160 mmHg or more or diastolic blood pressure of 110 mmHg or more, measured between contractions. • Diabetes (pre-existing and/or on medication). • During establishment of epidural analgesia for at least 30 minutes, be recommenced for a further 30 minutes following a bolus of ≥10mls. • Fetal Growth Restriction or any other fetal risk factors or concerns. • Reduced fetal movements before the onset of contractions. • Induction of labour for maternal or fetal risk factors and concerns. • Maternal and birthing parent medical disease e.g. essential hypertension, cholestasis. • Multiple pregnancy. • Oligohydramnios. • Oxytocin use. • Pain reported by the pregnant woman and person that differs from the pain normally associated with contractions. • Previous CS. Birth after Caesarean section (BAC) Guideline • Prematurity (under 37 weeks). • Pregnancy over 42 weeks. • Meconium stained liquor (If meconium present carry out full risk assessment and discuss with the woman and birthing parent risks and benefits of CEFM). • Suspected chorioamnionitis or sepsis.

Consider CEFM
Reasons for transfer from IA to CEFM in labour
• Abnormal FHR (less than 100 bpm, greater than 160 bpm or any deceleration after a contraction. • Increase in baseline rate >20bpm • Maternal and birthing parent pyrexia (defined as 38.0 °C once or 37.5 °C on two occasions 1 hour apart). • Maternal and birthing parent pulse over 120 beats/minute on 2 occasions, 30 minutes apart or earlier if any other risks. • Fresh bleeding developing in labour. • The pregnant woman and person's request.
• Prolonged rupture of membranes over 24 hours. • Induction for post maturity. • Confirmed delay in the first or second stage of labour.

Explanation must be given as to why this is being offered. If the trace is normal after 20 minutes, return to intermittent auscultation unless the pregnant woman and person asks to stay on CEFM.

If the woman and person is on the Birth Centre and there are concerns with the fetal heart, the CTG can be performed on the Birth Centre in the expectation that it will be able to be discontinued in 20 minutes, and normal care resumed. However if concerns persist, obstetric review and transfer to CLS are indicated.

Offer telemetry to any pregnant woman/person who needs CEFM during labour when available and applicable. If telemetry not available, document discussion of risks with the woman and birthing person if CEFM is declined on MIS.

9.2 CEFM with epidural analgesia - including patient controlled epidural analgesia

Offer CEFM to all women and people on insertion of regional analgesia (for example, an epidural) for at least 30 minutes during establishment of a regional analgesia. If the CTG is normal this can be discontinued and IA used unless there are other risk factors that indication CEFM throughout labour or the woman and person wishes to continue with CEFM. CEFM must be recommenced for a further 30 minutes following a bolus of 10mls or more, if no concerns are highlighted, then IA can be resumed. (NICE 2022)

10.0 CEFM and record keeping

10.1 Information to be recorded at start of the CTG

Record the following information at the start of the CTG (using a CTG commencement sticker):

- Name
- Hospital number
- Date and time of commencement (Check CTG set time as pre-programmed and adjust the clock on the wall to match)
- Clinical indication for CTG (for example IOL, RFM)
- Maternal and birthing parent pulse
- Fetal heart rate as auscultated by handheld fetal doppler or pinard.
- Printed name of clinician
- Connect CTG to Sonic Centrale system and input patient details, once discontinued discharge patient from system

10.2 Documentation requirements during labour CTG monitoring

Any intrapartum events that may affect the fetal heart should be noted at the time, on the CTG using the pre-set buttons, and then signed, with the date and time noted on MIS (for example, vaginal examination, FBS or insertion of an epidural).

Any member of staff who is asked to provide an opinion on a trace should categorise the tracing according to NICE (normal, non-reassuring or abnormal) and document their findings on MIS.

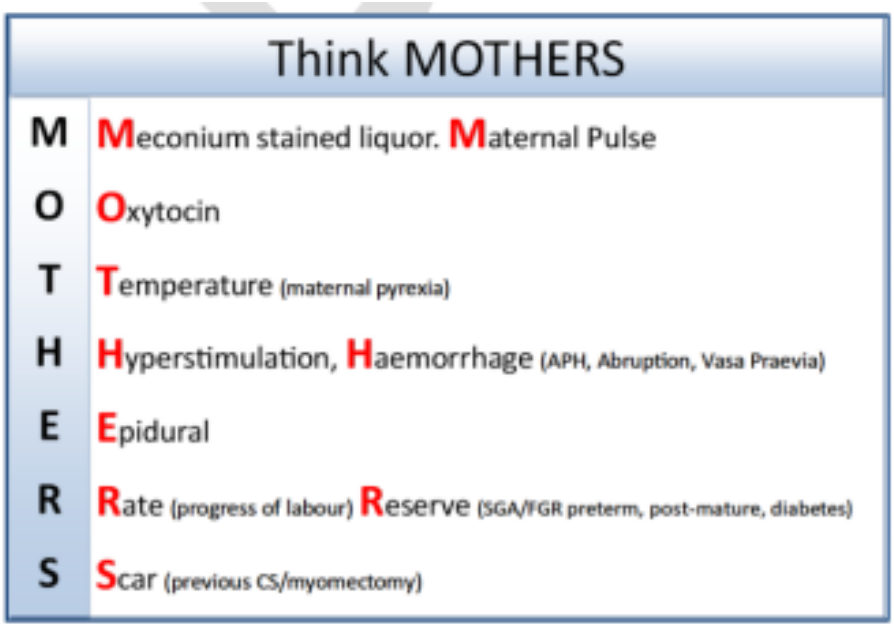
All CTGs both antenatal and intrapartum need to be connected to the Sonic Centrale system and once discontinued the patient must be discharged.

10.3 Information to be recorded at end of labour CTG

Following birth, the healthcare professional should sign and note the date, time and mode of birth on the CTG trace, (using the end CTG sticker).

10.4 Documentation requirements when changed from IA to CEFM

In cases where fetal monitoring in labour changes from intermittent auscultation the reason for the change should be documented on MIS.



10.5 TREND Analysis Function in labour

This is available with all CTG machines for use as an aid to CTG classification in the first stage of labour. It measures the fetal heart rate parameters at regular intervals and describes the trace in a quantitative way. The use of TREND DOES NOT replace the need for skilled interpretation of the trace or second signature and Fresh eyes review. It is intended to assist in assessing the quantitative changes over a period of time in labour.

Trend measurements are performed at 15 minutes, and every 15 minutes thereafter. It fits a baseline using the last 60 minutes of fetal heart data collected, then calculates the following parameters:

- Baseline heart rate (bpm) for the last 60 minutes
- Baseline heart rate (bpm) for the last 15 minutes
- Deceleration size (beats) for the last 60 minutes
- Deceleration size (beats) for the last 15 minutes
- Short term variation (ms) for the last 60 minutes.

A confidence indicator is shown as High, Medium or Low. If the confidence indicator is medium or high, the results reliably reflect the fetal heart rate pattern. If the confidence indicator is Low, interpret the results in relation to the appearance of the trace (Huntleigh 2016)

11.0 Risk management

Following birth, the CTG printed recording should be safely stored in an approved CTG envelope and the date and time recorded on the front of the envelope.

FHR traces should be kept for 25 years. In cases of concern or investigation FHR traces should be photocopied and stored. FHR traces should remain with the medical notes at all times.

12.0 Interpretation and classification of EFM

12.1 Human Factors relating to CTG interpretation

There are many variables which make CTG interpretation challenging. Gordon Dupont's Dirty Dozen encapsulates the human factors that can affect CTG interpretation concisely):

1	Lack of communication
2	Complacency
3	Lack of knowledge
4	Distraction
5	Lack of team work
6	Fatigue
7	Lack of resources
8	Pressure
9	Lack of assertiveness
10	Stress
11	Lack of awareness
12	Norms

When reviewing Electronic Fetal Heart Rate monitoring Healthcare professionals must take into account the full picture. Including the mother and birthing parent's history, stage and progress in labour, any antenatal and intrapartum risk factors and any other signs the baby may not be coping with labour. CTGs should not be viewed as a stand-alone investigation (EachBaby Counts 2015).

It is well recognised that Human Factors impact CTG misinterpretation or mismanagement, this highlights the importance of maintaining situational awareness and considering the whole clinical picture.

The need to be able to interpret a fetal heart rate correctly is as crucial as empowering all staff to professionally question the interpretation of others when required. Effective communication requires both sharing concerns and listening within the team with the absence of boundaries creative by hierarchy and differing roles. This can be demonstrated through robust escalation management planning and documentation. Clinical staff should be empowered to seek advice from a colleague who can give an unbiased perspective. Decision making is more difficult when staff feel stressed and tired. A difference perspective improves the chance of making a safe decision (RCOG 2018). Refer to Appendix 5: Escalation of concerns

12.2 Interpretation of CTG including 'Fresh Eyes'

In established labour, the CTG should be reviewed at least hourly using the CTG review on MIS and peer reviewed by 2 clinicians (junior staff should have a more senior member of staff review with them). This should include a reassessment of fetal/maternal and birthing parent risk factors to ensure fetal wellbeing, and as well as an assessment of the CTG. The findings, including classification, must be documented on the CTG review on MIS. Use the annotation on the CTG machine where available. If writing on the trace, take care not to cover any printing on the paper.

Any loss of contact should be recorded on MIS, such as a change of position or when the trace is on hold due to going to the toilet etc. If there is persistent loss of contact, consider the use of FSE if not contraindicated.

This interpretation of the trace is guided by the NICE interpretation which includes baseline rate, baseline rate variability, accelerations and decelerations.

During episodes of abnormal FHR patterns when the pregnant woman and person is lying supine they should be advised to adopt the left-lateral position.

Any CTG abnormality in labour must not be interpreted in isolation but with all clinical features of the case considered. All changes to the progress of labour, volume and colour of liquor, general condition and any medication administered should be documented on MIS.

With regard to the use of pregnant woman and person facial oxygen therapy for fetal compromise, prolonged use maybe harmful to the fetus (baby) and should be avoided; however there is no research evidence evaluating the benefits or risks associated with its short-term use.

IV fluid boluses for CTG abnormalities should be avoided unless there is evidence of maternal and birthing parent hypotension and/or dehydration. There is limited evidence to support the use of repeated fluid boluses. There remains an increased risk of maternal and birthing parent fluid overload leading to hyponatremia (see CG21009 Maternity Fluid Management as an In-patient or During Labour Guideline)

Clinicians should take into account the time that it will take to achieve birth by both instrumental vaginal birth and caesarean birth when making decisions regarding concern over fetal wellbeing during labour.

12.3 Second stage of labour considerations and CTGs

During 2nd stage (including both passive and active stages) the CTG should be monitored more closely, review with fresh eyes every half hour and timely referral made in the case of any abnormality.

Take into account that interpretation of CTG traces in the second stage of labour is more challenging than in the first stage of labour. Have a lower threshold for seeking a second opinion or assistance.

Ensure the fetal heart rate is differentiated from the maternal and heart rate at least once every 5 minutes.

If fetal heart rate accelerations are recorded, be aware these are most likely to be maternal and birthing parent pulse. Consider monitoring the baby with a fetal scalp electrode if there is concern about confusing the heart rates, but if this cannot be achieved expedite birth.

If fetal heart rate decelerations are recorded, look for other signs of hypoxia (for example, a rise in the baseline fetal heart rate or a reduction in variability).

Take into account that onset of hypoxia is both more common and more rapid in the active second stage of labour. Take an increase in the baseline fetal heart rate of 20 beats a minute or more as a red feature in active second stage labour.

If CTG concerns arise in the active second stage of labour:

- Obtain an obstetric review.
- Consider discouraging pushing and stopping any oxytocin infusion to allow the baby to recover, unless birth is imminent.
- Agree and document a clear plan with time limits for the next review.

12.4 Full Description of cardiotocograph trace features and management

NICE (NICE 2022) recommendations for interpretation of intrapartum FHR features are as follows:

Overall care

- Use CTG review on MIS along with a systematic assessment of the condition of the pregnant woman and person and unborn baby, by the midwife caring for them and a second practitioner for "fresh eyes" rotating who this is to support objectivity.
- Every hour in the first stage and 30 mins in the second stage or more frequently if there are concerns.
- Do not make any decision about a pregnant woman and person's care in labour on the basis of CTG findings alone.
- Take into account the pregnant woman and person's preferences, parity, any antenatal and intrapartum risk factors, the current wellbeing of the pregnant woman and person and unborn baby and the progress of labour.
- Ensure that the focus of care remains on the pregnant woman and person rather than the CTG trace.
- Remain with the pregnant woman and person in order to continue providing one-to-one support.
- Talk to the pregnant woman and person and their birth companion(s) about what is happening and take their preferences into account.

Principles for intrapartum CTG trace interpretation

- When reviewing the CTG trace, assess and document contractions and all 4 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 hypoxia is lower. NB Consider gestational age for baseline rate variations.
- If it is difficult to categorise or interpret a CTG trace, obtain a review by a senior midwife or a senior obstetrician.

Rising Baseline Rate

- Normal baseline rate is between 110-160bpm, however a change in baseline rate of more than 20bpm warrants further consideration. Note a **rising baseline rate** even within normal range may be **of concern** if other non-reassuring /abnormal features exist.

- It is important to consider the trend overtime. For example a FHR of 150bpm may be within the normal range, but an increase from a baseline rate of 110bpm from the beginning of the CTG to 150bpm needs to be taken seriously to exclude evolving hypoxia and infection.
- Compare baseline rates of previous CTGs

Variability

Cycling is a sign of fetal wellbeing. It signifies normal fetal physiology and is a reassuring feature.

If there is an absence of variability, carry out a review of the whole clinical picture with a low threshold for expedited birth, as this is a very concerning feature.

Accelerations

- Transient increases in fetal heart rate of 15 beats a minute or more, lasting 15 seconds or more.
- The presence of fetal heart rate accelerations, even with reduced baseline variability, is generally a sign that the baby is healthy.
- Accelerations that coincide with the contractions especially in the second stage of labour should be investigated as possible erroneous recording of the maternal and birthing parent pulse and a maternal and birthing parent pulse oximeter used.

Decelerations

Transient episodes when the fetal heart rate slows to below the baseline level by more than 15 beats a minute, with each episode lasting 15 seconds or more. An exception to this is that in a trace with reduced variability, decelerations may be ‘shallow’.

Description	Feature		
	Baseline (beats/ minute)	**Baseline variability (beats/ minute)**	**Decelerations**
White	110 to 160	5 to 25	None or early. Variable decelerations with no concerning characteristics
Amber	100 to 109†	Less than 5 for 30 to 50 minutes	
	Rise in Baseline >20bpm from start of CTG Unable to determine baseline	**OR** More than 25 for 10 minutes	**OR** Repetitive Variable decelerations with any concerning features < 30mins **OR** Variable decelerations with any concerning features > 30mins **OR** Repetitive Late decelerations for <30 minutes
Red	Below 100 OR Above 160	Less than 5 for more than 50 minutes **OR** More than 25 for more than 10 minutes **OR** Sinusoidal	Repetitive Variable decelerations with any concerning features> 30mins **OR** Repetitive late decelerations >30 minutes **OR** Acute bradycardia, or a single prolonged deceleration lasting 3 minutes or more.

Abbreviation: CTG, cardiotocograph.
* Regard the following as concerning characteristics of variable decelerations: lasting more than 60 seconds; reduced baseline variability within the deceleration; failure to return to baseline; biphasic (W) shape; 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.

Management based on interpretation of CTG trace:

Category	Definition	Management
Normal	All features are white	• Continue CTG (unless it was started because of concerns arising from intermittent auscultation and there are no ongoing risk factors) and usual care. • Talk to the pregnant woman/person and her birth companion(s) about what is happening.
Suspicious	1 amber feature **AND** 2 white features	• Correct any underlying causes, such as hypotension or uterine hyperstimulation. • Perform a full set of maternal observations. • Start 1 or more conservative measures*. • Inform an obstetrician or a senior midwife. • Document a plan for reviewing the whole clinical picture and the CTG findings. • Talk to the pregnant woman/person and their birth companion(s) about what is happening and take their preferences into account.
Pathological	1 red feature **OR** 2 amber features	• Obtain a review by an obstetrician and a senior midwife. • Exclude acute events (for example, cord prolapse, suspected placental abruption or suspected uterine rupture). • Correct any underlying causes, such as hypotension or uterine hyperstimulation. • Start 1 or more conservative measures*.

		• Talk to the pregnant woman and person and their birth companion(s) about what is happening and take their preferences into account. • If the CTG trace is still pathological after implementing conservative measures. • Obtain a further review by an obstetrician and a senior midwife. • Offer digital fetal scalp stimulation and document the outcome. • If the CTG trace is still pathological after fetal scalp stimulation. • Consider fetal blood sampling. • Consider expediting the birth. • Take the pregnant woman and person's preferences into account.
Need for urgent intervention	Acute bradycardia, or a single prolonged deceleration for 3 minutes or more.	• Urgently seek obstetric help. • If there has been an acute event (for example, cord prolapse, suspected placental abruption or suspected uterine rupture), expedite birth. • Correct any underlying causes, such as hypotension or uterine hyperstimulation. • Start 1 or more conservative measures*. • Make preparations for an urgent birth. • Talk to the pregnant woman and person and their birth companion(s) about what is happening and take her preferences into account. • Expedite the birth if the acute bradycardia persists for 9 minutes. • If the fetal heart rate recovers at any time up to 9 minutes, reassess any decision to expedite the birth, in discussion with the pregnant woman and person.

Describe decelerations as 'early', 'variable' or 'late'. Do not use the terms 'typical' and 'atypical' because they can cause confusion.
Abbreviation: CTG - cardiotocography.
***** If there are any concerns about the baby's wellbeing, be aware of the possible underlying causes and start one or more of the following **conservative measures** based on an assessment of the most likely cause(s):

- Encourage the pregnant woman and person to mobilise or adopt an alternative position (and to avoid being supine).
- If the pregnant woman and person is hypotensive offer intravenous fluids between 250-500mls.
- Reduce contraction frequency by reducing or stopping oxytocin if it is being used and/or offering a tocolytic drug, (a suggested regimen is subcutaneous terbutaline 0.25 mg).

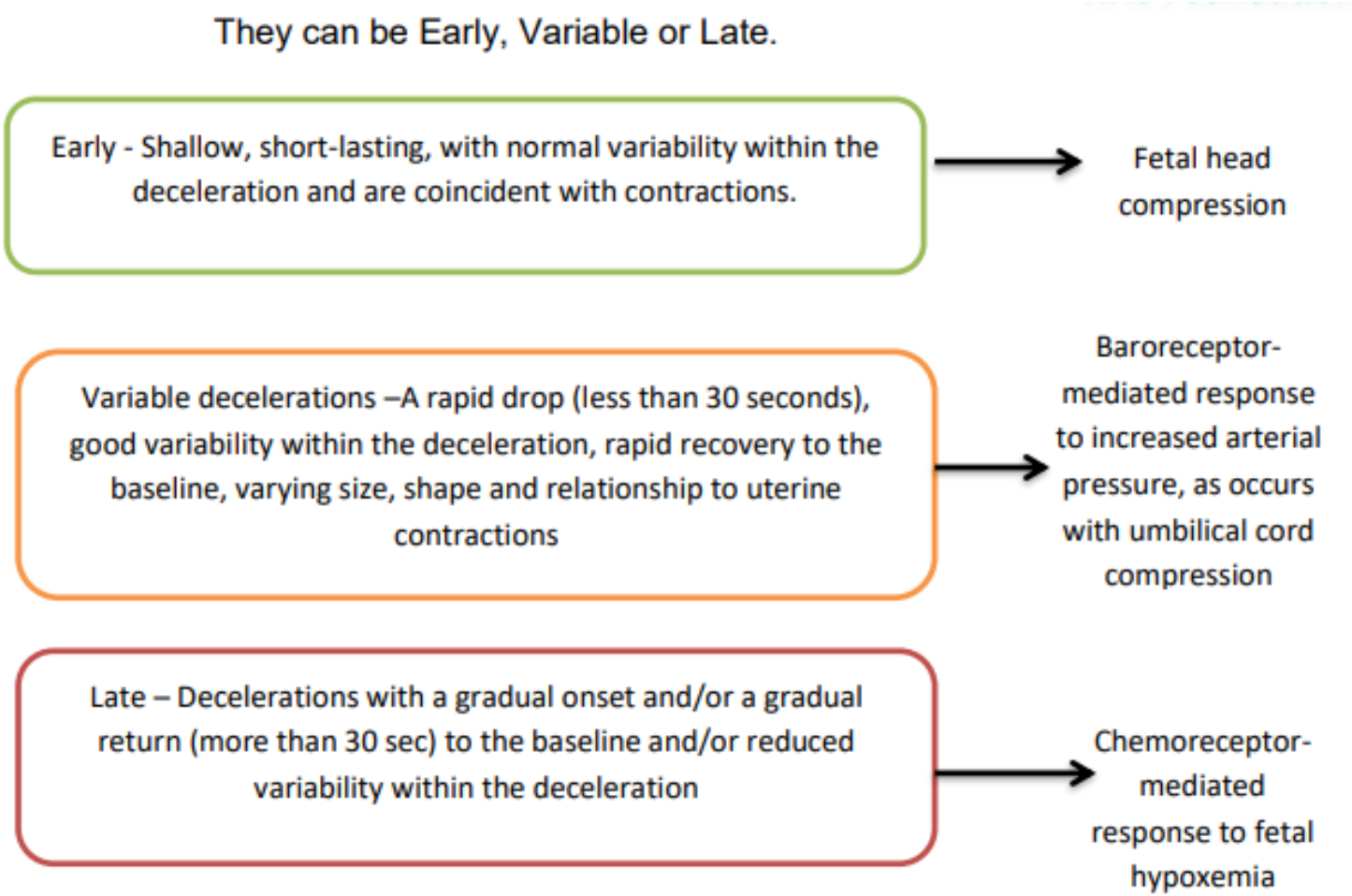
If variable decelerations with no concerning characteristics are observed:

- Be aware that these are very common, can be a normal feature in an otherwise uncomplicated labour and birth, and are usually a result of cord compression.
- Ask the pregnant woman/person to change position or mobilise.

Based on the individual features of the heart rate trace, baseline, variability, accelerations and decelerations the overall classification of tracing should be classified as:

Category	Definition
Normal	**All four features** are classified as white
Suspicious	**One feature classified as amber**
Pathological	**Two or more features classified as amber** or one or more classified as red

Types of Decelerations:



12.5 Clinical response to classification of CEFM

When a CTG is defined as **normal** where there is continuous fetal monitoring, there should be evidence of Registrar review at least every 4 hours documented on MIS (remember these pregnant women and people are under Consultant led care.)

When a CTG is classified as **suspicious,** this should trigger a labour ward coordinator / Obstetrician review. Following the review a plan should be documented on MIS.

When a CTG is classified as **pathological,** the on-call Obstetric Registrar (or Consultant if Registrar is unavailable) must be informed and review the pregnant woman and person in order to make an assessment to decide on the appropriate action needed.

This may include increased frequency of observation, Fetal scalp stimulation FBS or emergency delivery if indicated. This review should be documented on MIS with a clear management plan to include time of next review.

12.6 Escalation of concerns

In the analysis of Each Baby Counts 2017, at least one reviewer felt that 'failure to escalate/act upon risk/transfer appropriately' occurred in 36% of reports. This was considered to be as a result of either a lack of awareness of deterioration and the need to escalate, or a breakdown in the process of attempted escalation.

All members of the multidisciplinary team must feel psychologically safe and empowered to challenge a decision that they feel is incorrect. Where there is disagreement, a third party should be called to provide another opinion and fresh perspective.

If any member of the team feels that they disagree with the classification of a CTG then they should feel confident to escalate. (Appendix 5: Escalation of Concerns). If a difference of opinion, is documented on MIS, this should be the MDT discussion and the opinions of each member of staff to include the midwife looking after the birthing woman and person, the Coordinator, Obstetric Registrar and Consultant on call as well as the preference of the birthing woman and person.

13.0 Poor CTG quality

Possible cause	Actions required
Poor contact from abdominal transducer	Perform an abdominal palpation and listen to FHR with Pinards stethoscope or hand held Doppler and re-position transducer. If not successful apply fetal scalp electrode (FSE).
FSE not working or detached	Listen with transducer, check position of FSE. Consider changing machine to a Teams 3 intrapartum (newer model)
Telemetry – loss of contact	Check that both transducers are fully charged. Ensure antenna is in line of sight with the pregnant woman/ person. If in the pool move the machine closer to the pool for better signal. If this does not resolve the loss of contact, assist woman and person out of the pool and switch to wired transducers from telemetry.

14.0 Fetal blood sampling (FBS)

(See Appendix 3: FBS Flowchart)

- In the presence of a pathological CTG, FBS may be appropriate to determine if it is safe to continue with the labour.
- In all situations the woman and person's preferences and the whole clinical picture should be considered before deciding to proceed.
- **The consultant on call should be consulted if a third FBS is being considered.**

14.1 Criteria for considering fetal blood sampling

- Pathological CTG.
- No contraindications to FBS (examples below).
- Conservative measures and fetal scalp stimulation have been unsuccessful.

14.2 Contraindications

- **FBS should not be performed in any situation where the overall clinical picture suggests that expediting birth is required.**
- **Caution: where meconium is present there is risk of contamination and false reassurance. Discuss with on call consultant.**

Examples of situations where FBS **SHOULD NOT** be performed:

- Suspicion of acute maternal or fetal compromise, for instance:
  - Bradycardia (over 3 minutes).
  - Cord prolapse.
  - Uterine rupture.
  - Placental abruption or other evidence of acute haemorrhage.
  - Sinusoidal trace (or other suggestion of fetal haemorrhage).
  - Immediately after recovery from prolonged deceleration.

- Evidence of maternal and birthing parent sepsis
  - Persistent maternal and birthing parent or fetal tachycardia without a reversible or known cause should promote a high suspicion of sepsis.
- Maternal and birthing parent infection with risk of materno-fetal transmission (E.g. HIV with high titres, Hepatitis, herpes simplex).
- Risk of fetal bleeding disorders/ heritable bleeding disorders in mother and birthing parent (including low platelets).
- Prematurity <34/40.

The FBS procedure may take up to 15 to 20 minutes. If a woman and person is in the second stage of labour, expediting birth by instrumental birth may reduce further delay and is usually considered first line.

14.3 Procedure

- FBS should only be performed by staff who are trained and competent to perform FBS.
- Obtain consent. The woman and person must understand the possible outcomes and subsequent actions that may be recommended (See table below).
- Check that the gas analyser is ready to receive samples.
- Ensure that all equipment is ready and staff are available to process the samples immediately (delay can lead the gas analyser rejecting the specimen).
- Position in left lateral where possible.
- Ensure privacy and avoid unnecessary exposure.

FETAL BLOOD SAMPLE RESULT	ACTION
NORMAL	
FBS result: • pH 7.25 or greater • Lactate 4.1 or below **OR** NO RESULT OBTAINED but good fetal response to stimulation during procedure with improvement in CTG.	Continuing labour may be considered. If CTG abnormality persists then consider repeat FBS: • Within 60minutes in the first stage • Within 30 minutes in the second stage
BORDERLINE	
FBS result: • pH 7.21 – 7.24 • Lactate 4.2 – 4.8	• Consider expediting birth if delivery is not expected within 30 minutes. • If labour is continued, a repeat sample should be performed within 30 minutes.
ABNORMAL	
FBS result: • pH 7.20 or less • Lactate 4.9 or above **OR** NO RESULT OBTAINED with minimal/no fetal response to scalp stimulation during procedure and no improvement in CTG. **OR** Woman declines FBS	• Recommend expediting delivery • Inform neonatal team • Neonatal team should be present at birth

15.0 Paired cord sampling

- Paired cord blood gases do not need to be taken routinely. They should be taken when there has been concern about the baby either in labour or immediately following birth. Take for all babies on SGA/FGR pathway irrespective of condition at birth.
- If it has been necessary to do a FBS sample during labour paired umbilical cord samples should be taken.
- Paired cord sample results must documented on MIS and the print out must be filed in the CTG envelope within the notes.

Ideally, sampling and analysis of cord blood should be performed as soon as possible after birth. However, if absolutely necessary, clamped cord segments can be left for up to 60 minutes without significant changes in pH and C02. Care must be taken to avoid the introduction of air into the blood gas analyser as this may cause unreliable readings.

15.1 Procedure for taking cord blood

- Procedure should be explained to the parents and consent obtained.
- The need to take paired cord blood samples does not prevent optimal cord clamping for up to 60 seconds.
- Following birth and before placental separation a segment of cord of at least 6 inches, where possible, should be isolated between 2 sets of clamps. The segment of cord is then excised for immediate sampling, placed in a receiver and given to a midwife/support worker trained in cord sampling and analysis.
- Using universal precautions, the cord should be wiped clean of blood and amniotic fluid with a dry swab. Using 2 heparinised syringes with 21 gauge needles, blood is withdrawn first from the umbilical artery and then from the vein. (The distended vein stabilises the artery and makes access easier). The needle should be inserted almost parallel to the vessels. As an aid to sample identification, a larger quantity of blood should be taken from the vein.
- Any air bubbles should be expelled from the syringes and both samples analysed (artery first)
- Input pregnant woman and person's details and input the sample details into gas analyser.

If for any reason cord blood samples are unable to be taken, this should be recorded on MIS.

In relation to cord blood results, clinically well babies require a paediatric opinion when the pH is more than 7 or base excess -16 or lower.

The cord gas results should be documented on MIS.

16.0 Training

All midwives and obstetricians involved in intrapartum care will attend the fetal monitoring training day yearly. Staff are expected to complete yearly training via K2 and pass their assessment for continuous electronic fetal monitoring before assessing CTGs, and should be trained in escalation protocol. This is evidenced in the Maternity Education Strategy. Staff not in date with their K2 training must not perform or interpret any fetal heart rate monitoring (including IIA and CTG monitoring)

17.0 Monitoring

Fresh eyes Audit – this will be collected by a retrospective data collection and Live audit reviews of 12 labour cases each site monthly.

Intermittent Auscultation audit (Intelligent Intermittent Auscultation (IIA)) – this will be collected by retrospective data collection and live audit 8 labour cases each site monthly

The fetal wellbeing lead midwives will be responsible for this.

The processes for audit and monitoring of the guideline are contained within:

- For training standards – the Maternity Education Strategy

References

ALSO (2003) Intrapartum Fetal Surveillance: Section E. 2003 4th Edition. Advanced Life Support in Obstetrics Provider Manual

Chandraharan E (2010) Rationale approach to electronic fetal monitoring during labour in 'all' resource settings. Sri Lanka Journal of Obstetrics and Gynaecology. 32 pp77-84

Dawes, C & Moulden, M (2020) Avoiding CTG misinterpretation: A review of the latest DawesRedman CTG analysis

Grivell RM et al. Antenatal cardiotocography for fetal assessment Review The Cochrane Library 2012, Issue 12

K2 (2002) Plymouth Fetal Monitoring Training System. K2 Medical Systems

NHS SEC 'Fresh Eyes' Maternal Death Report 2009

Medical Devices Alert: Ref MDA/2010/054 Adverse outcomes are still being reported in the presence of CTG traces that appear normal.

National Institute for Health and Clinical Excellence. (2008) Antenatal Care: Routine care for the healthy pregnant woman. London. NICE

NICE guideline CG190 (2014 updated 2017) Intrapartum care for healthy women and babies (nice.org.uk)

National Institute for Health and Clinical Excellence. NG229 (2022) Fetal monitoring in labour. London. NICE

Obianuju Nzelu, Edwin Chandrahharan, and Susana Pereira (2018) Human Factors: The Dirty Dozen in CTG misinterpretation Global Journal of Reporductive Medicine 6(2)

Royal College of Anaesthetists, Royal College of Midwives, Royal College of Obstetricians and Gynaecologists, Royal College of Paediatrics and Child Health. (2007). Safer Childbirth: Minimum Standards for the Organisation and Delivery of Care in Labour. London: RCOG Press. Available at: www.rcog.org.uk

Appendix 1: Dawes Redman Criteria

The CTG is compared with the database of over 100,000 CTG traces linked to outcomes where the fetal gestation is between 26 weeks and term and to satisfy the criteria for normality the trace should have:

- An episode of high variation above the first centile for the gestational age.
- No decelerations >20 lost beats or >100 lost beats on records longer than 30 minutes.
- Basal heart rate between 110 and 160 bpm.
- At least one fetal movement or three accelerations.
- No evidence of a sinusoidal fetal heart rate rhythm.
- Short Term Variation of 3ms or greater.

  Short term variability (STV) is an important index of fetal wellbeing, but by no means the only one. STV is, however, measurable by the external Doppler detection systems that are universally used around the world. A low STV is most commonly encountered with growth retarded, chronically stressed fetuses. A value of <4msecs is low, <3msecs is abnormal and <2msecs highly abnormal.

  These thresholds are only valid when measured over the full period of 60 minutes. It may happen that an operator gets concerned about a low STV and stops the record prematurely. This is a mistake—such a trace maybe that of a baby having a long quiet period who may wake up and show normal reactivity before the full hour when criteria can be said to be not met.

  However the strength of the Dawes Redman system is that the criteria encompass several different aspects of fetal health.

- Either an acceleration or variability in high episodes >tenth centile and > 20 fetal movements.
- No errors or decelerations at the end of the record.

Appendix 2: Dawes Redman Criteria - reasons for criteria not met codes and management

1	Basal Heart Rate outside normal range (110-160bpm)	• Discuss with senior obstetrician (SpR or consultant), further assessment of fetal wellbeing or delivery depending on clinical picture. • Inform senior midwife/co-ordinator.
2	Large decelerations	• If the trace is otherwise normal and has one or two isolated decelerations, repeat the trace in 2-4 hours. • For recurrent decelerations inform senior obstetrician (SpR or consultant). • Inform senior midwife/co-ordinator. • Consider delivery.
3	No episodes of high variation**	• If STV is normal and there are accelerations, CTG can be discontinued and repeated within 4 hours. • Absence of an episode of high variation is strongly linked to development of metabolic academia. This should be acted upon in the same way as a reduced STV.
4	No movements and fewer than 3 accelerations	• Requires obstetric review. • Inform senior midwife/co-ordinator. • Repeat CTG within 4 hours.
5	Baseline fitting is uncertain	• If all else is fine and the baseline falls within normal parameters then this can be ignored. **or** • If concerned repeat within 4 hours.
6	Short term variation is less than 3	• Inform senior obstetrician (SpR or consultant). • Inform senior midwife/co-ordinator. • Consider delivery.
7	Possible error at the end of record	• Continue CTG. • Repeat CTG within 4 hours.
8	Deceleration at the end of the record	• Inform senior obstetrician (SpR or consultant). • Inform senior midwife/co-ordinator. • Consider delivery or appropriate action based on clinical picture. • Continue or repeat CTG as required.
9	**High-frequency sinusoidal rhythm**	• Discuss with senior obstetrician (SpR or consultant). • Inform senior midwife/co-ordinator. • Consider immediate delivery.
10	**Suspected sinusoidal rhythm***	• Maternal blood for Kleihauer to test for degree of feto-maternal haemorrhage and consider risk of fetal anaemia • Inform senior obstetrician (SpR or consultant). • Inform senior midwife/co-ordinator. • Consider delivery. Differentiate from pseudo sinusoidal rhythm, if sinusoidal, alert neonatal paediatricians
11	**Long term variations in high episodes below acceptable levels****	• Discuss management plan with senior obstetrician (SpR or consultant). • Inform senior midwife/co-ordinator. • Repeat CTG in 4 hours. Absence of an episode of high variation is strongly linked to development of metabolic academia. This should be acted upon in the same way as a reduced STV.
12	**No accelerations**	• Review by SPR/consultant. • Inform senior midwife/co-ordinator. • Continue CTG or repeat within 4 hours.

Appendix 2 continued: Huntleigh Diagnostics Quick User Guide

This guide provides an overview guide to the use of the Care Analysis feature in the FM800E range of fetal monitors. It MUST be used in conjunction with the full FM800E Instructions for Use & users must be fully trained in its use & on local protocols relating to its use & application.

NB: This analysis is not for use in established labour & is a guide only – it is NOT a diagnosis. Users must read & understand the full "Intended Use Statement" in the Instructions for Use.

1. Check the Care analysis function is on.
   (Enabled via the set-up menu – refer to Instructions for Use)
2. Enter gestational age.
3. Start the trace (refer to Instructions for Use).
4. 10 minutes of good quality data is required before the first analysis result is available.
5. A new analysis result will then be available after every additional
   2 mins, upto max 60 mins.
6. The live analysis status is shown on the display (refer to Instructions for Use).
7. The latest analysis result details can be viewed on the display via the set-up menu.

When the trace (printer) is stopped, the latest analysis result will be printed at the end of the trace print-out. **If stopped before 10 mins, no analysis will be performed.**

Analysis Outcomes:

1. **Dawes/Redman Criteria Met**
   Indicates criteria for normality have been met and the trace can be stopped (subject to local protocols).

2. **Dawes/Redman Criteria Not Met** (at <60 mins)
   Indicates trace has not **YET** met criteria for normality. Reason codes will be shown – see below. Unless clearly pathological, continue the trace until the criteria are met.

3. **Dawes/Redman Criteria Not Met** (at 60 mins)
   This is an abnormal outcome & appropriate clinical review / action must be taken. Reason codes will be shown – see below.

Code	Reason
1	Basal heart rate outside normal range
2	Large decelerations
3	No episodes of high variation
4	No movements and fewer than 3 accelerations
5	Baseline fitting is uncertain
6	Short-term variation is less than 3ms
7	Possible error at the end of the record
8	Deceleration at the end of the record
9	High-frequency sinusoidal rhythm

10	Suspected sinusoidal rhythm
11	Long-term variation in high episodes below acceptable level
12	No accelerations

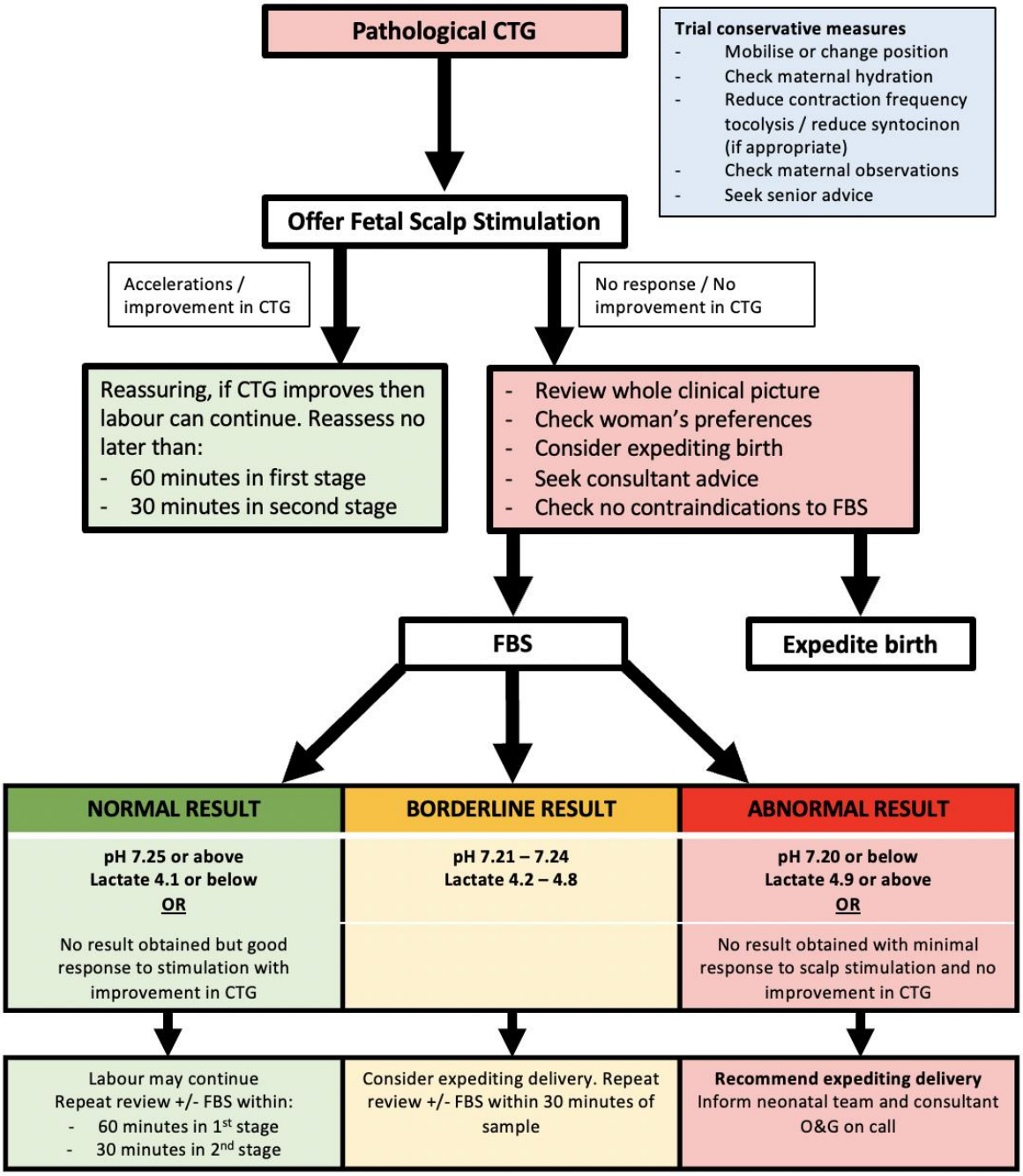
Care Analysis - A user's guide to terminology

Signal loss (%)	The percentage of the trace for which there was no fetal heart rate recorded. Signal loss is usually due to poor transducer positioning or fetal movement. Reposition the transducer to get the best possible signal, ensuring plenty of gel is used. If the signal loss is >50% during accels or large decels, these will not be included in the analysis results.
Contractions	The software registers a contraction if there is a rise of 16% or more, lasting for 30 seconds or more, from the resting 'zero' line.
Movements	Simply counts fetal movements recorded by the mother. Note that this will always be shown as zero for twins monitoring, as it is not possible to tell which fetus is moving.
Basal Heart Rate (bpm)	This is the average rate measured normally during periods of low variation. On very reactive traces it is assessed by a 'best fit' method. It is similar to visually assessed baseline rate but may differ with some trace patterns (eg. very reactive, large decels, etc.). Users should always visually assess baseline rate independly from the analysis.
Accelerations	A rise from baseline rate of 10bpm or more, lasting 15 seconds or more. Research has shown that a small percentage (5-8%) of traces without accelerations are in fact normal. It is not therefore essential to have accelerations present for the trace to be interpreted as normal. This is particularly true pre-30 weeks gestation.
Decelerations	A decrease from baseline of at least 10bpm, lasting 60s or more, with >5 'lost beats', or a decrease of 20bpm lasting 30 seconds or more, with >5 'lost beats'. See below for definition of 'lost beats'.
High minutes (mins)	This is a measure of how reactive the trace is. Rather than relying on accelerations (see above), this measures the amount of time the change from one beat to the next exceeds a certain level. For a full definition of this, refer to the user manual, but in essence, it can be interpreted as the period of time, during the trace, over which the FHR was highly reactive.
Most lost beats	'Lost beats' are a measure of the area or 'size' of the deceleration. To understand this, consider a trace with a baseline rate of 120bpm with a 1 minute deceleration. If the heart rate had stayed at the baseline rate for this period, instead of decelerating, there would have been 120 heart beats in the one minute. Because of the deceleration, the FHR slowed down and there were actually only, say, 80 beats during the one minute. This means it 'lost' (120-80 =) 40 beats – this is how Care Analysis measures decelerations, in

	'Lost beats'. Most lost beats is simply the 'size' of the largest deceleration.
Short Term Variation (ms)	This is a form of 'variability' or 'baseline variation'. Traditionally, variability is assessed visually as the difference between the highest & lowest rates in a 1 minute period during a quiescent period (ie. no accels or decels). Short Term Variation (STV) is essentially the same, but measured over a much shorter time period than can be done visually (3.75s). It is measured in milliseconds rather than bpm. This is the time between beats, rather than the number of beats per minute – just a different way of measuring heart beats. In non-reactive traces, STV has been shown to correlate highly with the development of metabolic hypoxaemia and intrauterine death. If there is a consistent downward trend in STV towards or below 3ms over period of days or weeks, delivery may need to be expedited.

For a more complete understanding of Care Analysis, refer to the FM800E Instructions for Use and our website: www.huntleigh-diagnostics.com

Appendix 3: FBS flowchart



Appendix 4: How to perform IIA Intelligent Intermittent Auscultation

An understanding of how hypoxia evolves is crucial to assessing how the baby is coping with labour and when escalation of care is required. Traditionally midwives listened before, during and after a contraction but this is not recommended in the majority of cases now because it is more relevant how the baby responds after the contraction. Therefore the key time to listen is IMMEDIATELY after the contraction as this tells us how the baby has coped with it.

The technique is to count for at least a minute – counting in continuous 15 second blocks. The numbers that are achieved will enable similarities and variations to be identified which will enable the baseline rate to be worked out

For example if you counted in 15 second blocks for the traditional 60 seconds you may get numbers such as: 29 28 35 39 = 131bpm

If you listened for longer **29 28** 35 39 **31 28** = 116bpm

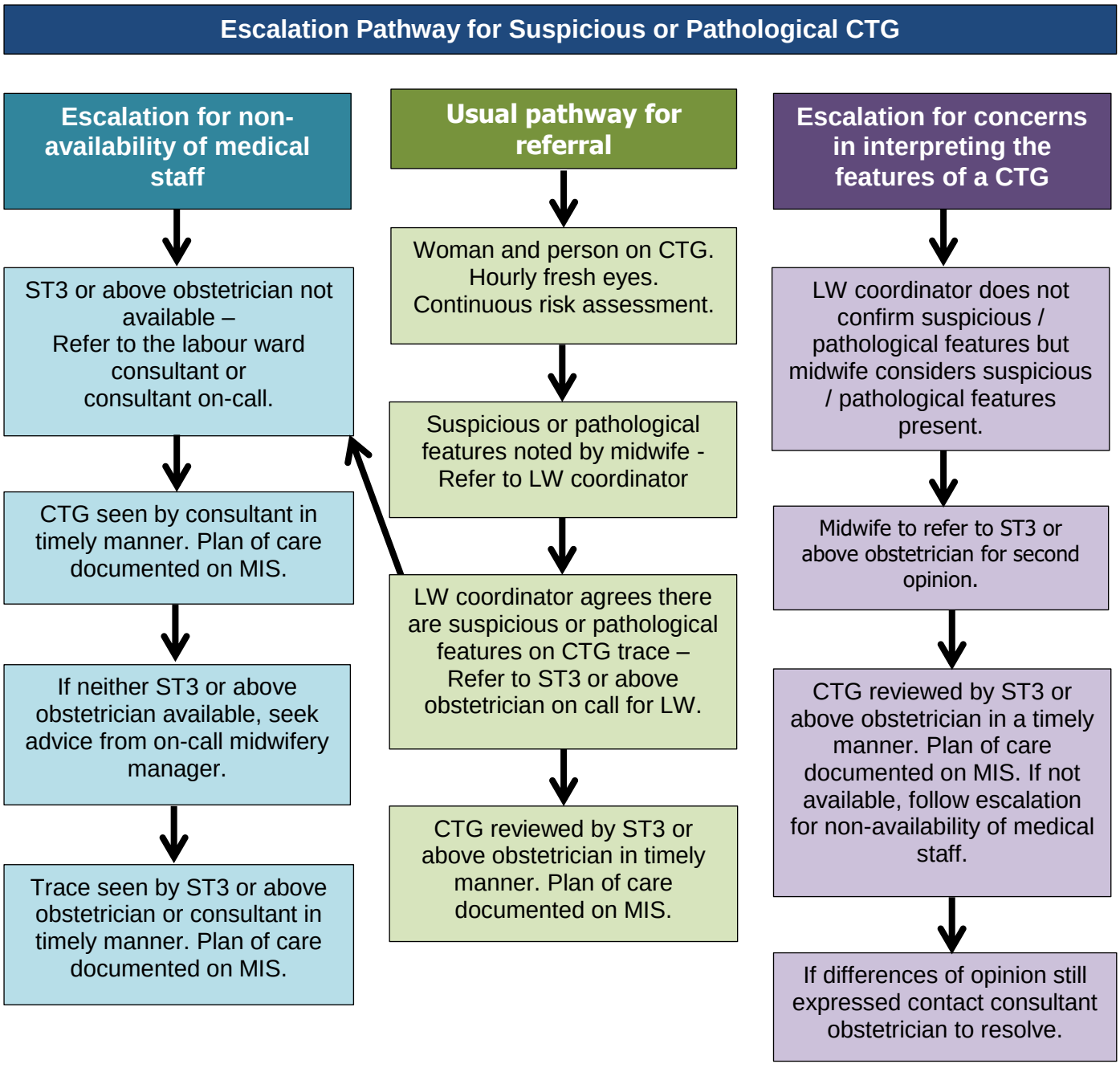
With a slight variation in numbers of 1 to 2 beats per minute the 4 numbers that are similar would add up to equal the baseline with the higher numbers in the middle indicating an acceleration. In the majority of cases in labour the loss of accelerations are common therefore for most counting in 15 second blocks for 60 seconds will be sufficient to achieve the baseline rate.

If there are large variance in the numbers 28 30 38 44 at 60 seconds would = 140bpm. This would suggest that there could be a wide variance in the actual steady baseline – a late deceleration at the beginning of the count or an acceleration at the end therefore counting for longer would be indicated. This is essential to ascertain if the baseline has risen to pick up on the physiology of evolving hypoxia.

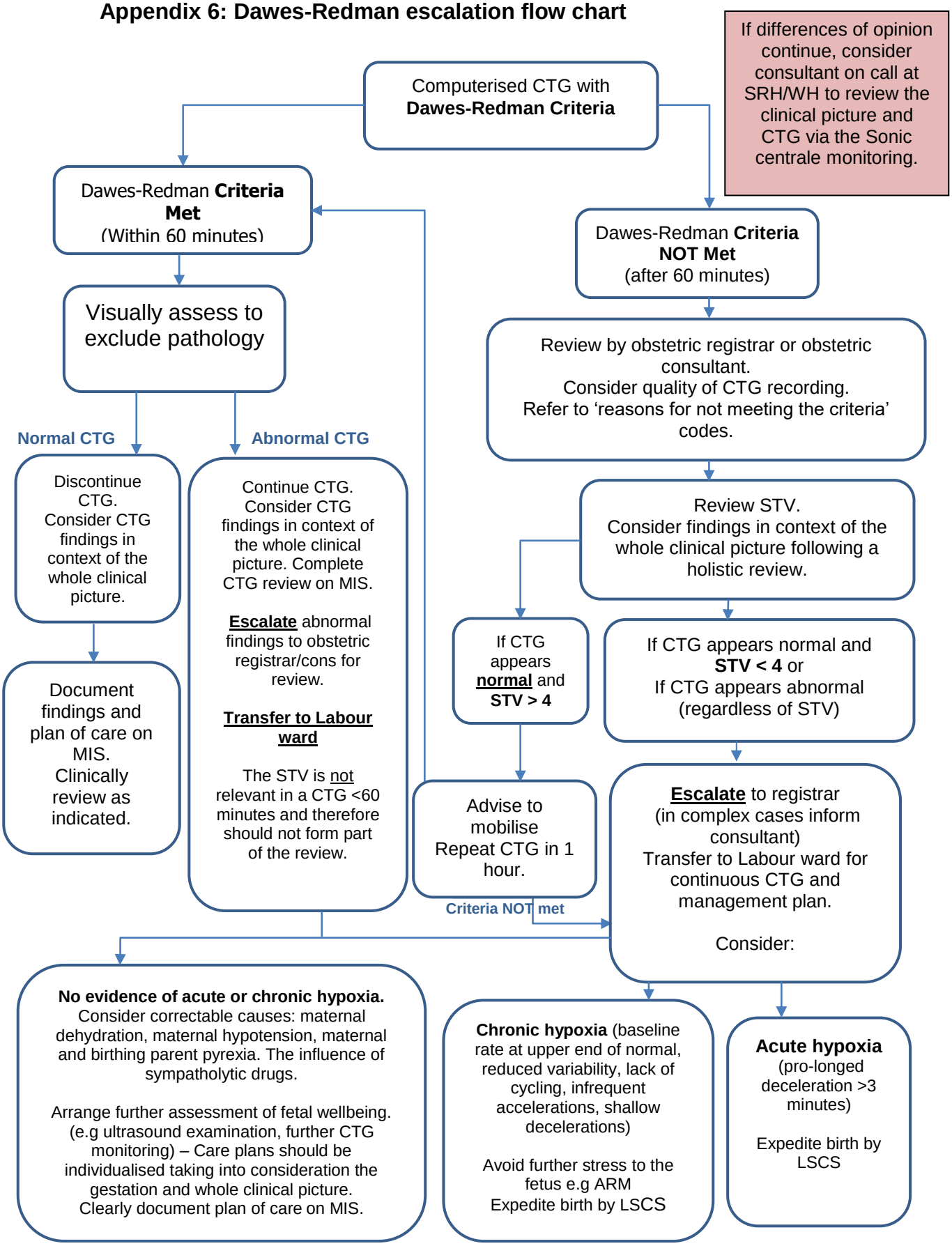
For documentation it is acceptable to write the individual numbers in the free text of the notes to identify that IIA is being used and then added up and plotted as a single number on the partogram as the baseline rate.

Please refer to ELearning for Health and the Intelligent Intermittent Auscultation training package

Appendix 5: Escalation of concerns



Appendix 6: Dawes-Redman escalation flow chart



Appendix 7: Recommendation regarding use of Dawes Redman

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Use of the Dawes Redman computerised CTG analysis system (DR-CTG)
In labour, latent labour or induction of labour or after a 'Stretch and Sweep' procedure

The Dawes-Redman system was not designed for use in labour. A separate system is being built which we hope will be reliable in that context but it is not yet ready for use.

This leaves the frontier between non-labour and labour as undefined territory.
An obvious difficulty is the definition of when labour begins. All professionals can find this difficult to assess at least in some cases.

Given the uncertainty, we recommend that Dawes Redman should not be used in this context, including the latent phase of labour. We have not studied the issue in detail and the relationship between computerised FHR patterns and outcome is not clearly defined, as it is when the woman is certainly not in labour.

If it is used like this and the outcome is unexpectedly poor we cannot say that this is a malfunction of the analysis because we have not designed it for this purpose.

In relation to the use of prostin gels and in the general context of Induction of Labour:

1. DR-CTG can be used before the first prostin is given providing there is no uterine activity. A post-prostin DR-CTG can be performed provided there is NO uterine activity of any description.
2. It can be used before or after a 'stretch and sweep' procedure provided there are no signs of latent or early labour. This also applies to mechanical (non-pharmacological) methods of cervical dilatation e.g. Foley catheters or Dilapan.
3. DR-CTG is particularly useful during induction of labour, in association with fetal growth restriction subject to the caveats above.

But remember that DR-CTG is not valid in the latent phase of labour.

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Specialist Midwife for Dawes-Redman CTG monitoring
Lead for Dawes-Redman Education

24/10/2022

CR/ MV/ BA v5 10/11/2022

Appendix 8: Labour CTG assessment sticker for use in downtime

Please do not print from guideline

Situation	Background	Assessment- *Always consider: is the baby coping?*				Recommendation
Date:	Define Risks:	Baseline rate at start of CTG:		Current baseline rate:		**Classification Agreed?** Yes / No
Time:		*Please circle*	**White**	**Amber**	**Red**	
Gestation:		**Contractions**	<5:10	>5:10		**Escalated to:** Coordinator YES / NO Registrar YES / NO Consultant YES / NO
Maternal Pulse:		**Baseline rate**	110-160bpm	100-109bpm Rise in Baseline >20 bpm from start of CTG Unable to determine baseline	<100 or >160bpm Rise in Baseline >20bpm in active second stage	**Plan:**
Contractions: : 10 Mild Moderate Strong		**Variability**	5-25bpm	<5bpm for 30-50 mins >25bpm for 10 mins	<5 for >50mins >25 for >10mins Sinusoidal	
	New risks since last assessment:	**Accelerations**	Present	In Labour: Absence of accelerations in a normal CTG is of unknown significance		
Membranes: Intact Clear Blood stained Meconium		**Decelerations** Concerning features of decelerations include: • Lasting >60s • Reduced variability in the deceleration • Failure or slow to return to baseline • Biphasic (W) shape • No shouldering	None Early or Variable decelerations with no concerning features	Repetitive Variable decelerations with any concerning features <30mins Variable decelerations with any concerning features >30mins Repetitive Late decelerations for <30mins	Repetitive Variable decelerations with any concerning features >30mins Repetitive Late decelerations for >30mins Acute bradycardia or Single prolonged deceleration >3mins	Time next review due:
Last VE cm		**Classification**	NORMAL	SUSPICIOUS	PATHOLOGICAL	Discussed with woman/birthing person? Care plan agreed Yes / No
Midwife Signature Designation & Stamp			**"Fresh eyes" signature** Designation & Stamp			

Appendix 9: Antenatal CTG assessment sticker for use in downtime

Please do not print from guideline

Antenatal CTG Assessment	**Reason for CTG:**	**Maternal Pulse:**	**Fetal Movements:**
Date:	**Gestation:**	**Membranes Ruptured Y / N** Date & time:	**Liquor colour:**
Time:	**Reassuring**	**Non-Reassuring**	
Baseline Rate (bpm)	110-160 **Rate:**	Less than 110 **Rate:**	
		More than 161 **Rate:**	
N.B. A changing baseline rate even within the normal range may be of concern			
Variability	5 bpm or more	Less than 5 bpm for more than 40 mins	
Accelerations	Present	None for 40 mins	
Decelerations	None	Unprovoked deceleration(s)	
		Decelerations related to contractions (not in labour)	
Opinion	**NORMAL CTG** (all-4 features reassuring)	**ABNORMAL CTG** (1 or more non-reassuring feature)	
ACTION: (An abnormal CTG requires prompt review by experienced obstetrician/senior midwife)			
1st Name, signature and designation:			
2nd Name, signature and designation or Dawes/Redman Criteria Met.:			