WOMEN'S HEALTH AND PAEDIATRICS

MATERNITY UNIT

Antenatal Cardiotocography

Amendments			
Version	**Date**	**Comments**	**Approved by**
1	May 2020	Introduction of Antenatal Cardiotocography Guideline	Perinatal Governance Group

Compiled by: Miss Sian McDonnell – Consultant Obstetrician

In consultation with: Perinatal Governance Group

Ratified by: Perinatal Governance Group

Date ratified: **May 2020**

Next review date: **May 2023,** or if legislation, national guidance or lessons learnt indicate an earlier review

Target audience: All health professionals within the maternity services

Equality impact assessment: Perinatal Governance Group

Comments on this document to: Perinatal Governance Guideline Group

Contents

Flow Chart for commencing cCTG

Confirm the rationale for CTG.

Is there a maternal or fetal condition or disease that will negatively impact fetal development?

No → CTG **NOT** Indicated

↓

Is the pregnancy beyond 26^{+0} weeks?

CTG's between 26 – 28 weeks require senior obstetrician decision

No → CTG **NOT** indicated.

Auscultate with Pinards stethoscope or sonicaid

Yes ↓

Commence Dawes Redman recording
(The first result is available at 10 minutes and every 2 minutes thereafter until a maximum of 60 minutes)

There must be no deceleration or artefact at the end of the recording

CRITERIA MET
Visually review and classify the CTG. If this is normal and there are no other ongoing clinical concerns, the analysis can be **stopped**.
This can be with as little as 10 minutes recording time.
The printer will produce a report of the analysis results.

Do not review the numeric data as the CTG has been classified as normal and this data is, therefore, insignificant

CRITERIA NOT MET BEFORE 60 MINUTES
Unless there are clear abnormal features, or any cause for concern, continue the recording until the criteria are met.
Short-term variation (STV) is uninterpretable prior to 60 minutes; do not review the numeric data.

DO NOT prematurely stop the recording. If the analysis has been stopped before criteria are met and before 60 minutes IT IS NOT VALID

CRITERIA NOT MET AFTER 60 MINUTES OF ANALYSIS
Indicates that normality has not been demonstrated
In the context of antenatal CTG classification, this is an abnormal outcome.
A senior obstetric review must take place and an individualised plan made based on reasons for failure, visual trace review and holistic review of the pregnancy.

The STV should be taken into account and the trend reviewed if previous analysis has been performed. It has a predictive value for fetuses at risk of metabolic acidaemia and IUD.
STV cannot be assessed visually. It can only be analysed with a full 60 minutes.
STV MUST NOT be used in isolation as an indicator of fetal condition
STV Values:
≥4 ms is normal <4 ms is low
<3 ms is abnormal
<2 ms is highly abnormal

DO NOT act on the basis of the CTG analysis alone, which is an aid to pregnancy management, not a diagnostic tool

Antenatal Cardiotocography

1.0 Introduction

Cardiotocography (CTG) is a widely used tool for fetal assessment in the antenatal period. At present antenatal CTG is not thought to be useful as a method of routine fetal assessment in low risk pregnancies and its use in the antenatal period implies that a risk factor has been identified.

The most recent systematic review on Antenatal Cardiotocography for fetal assessment in high risk pregnancies (Cochrane 2015) concluded that:

- Comparison of traditional CTG versus no CTG showed no significant difference identified in perinatal mortality or potentially preventable deaths.
- Similarly, there was no significant difference identified in caesarean sections.
- However, comparison of computerised CTG versus traditional CTG showed a significant reduction in perinatal mortality with computerised CTG.

A normal CTG (traditional or computerised) is only a clinical diagnostic tool and cannot be used as a predictive or screening test. It only indicates current fetal state and it cannot predict catastrophes such as sudden abruption.

2.0 Antenatal Cardiotocography

Fetal monitoring may be carried out antepartum either on an in-patient or outpatient basis for on-going surveillance of the fetus. All women who present with an antepartum problem should have at least auscultation of the fetal heart at any gestation. If there is clinical indication then computerised electronic fetal monitoring should be performed.

CTG should only be performed in the antenatal period for fetal surveillance as per clinical indications. *All Women will be offered computerised CTG if a CTG is indicated in the antenatal period.* This includes the CTG prior to commencing IOL but following Propess, Prostin or ARM, traditional CTG should be used (see Intrapartum fetal heart rate monitoring).

Exceptions can be made on an individual basis by the obstetric consultant. CTG carried out before 28 weeks gestation should be performed and interpreted with caution.

2.1 Documentation and CTG Storage

- Rationale for antenatal CTG documented in maternal notes.
- At the start of the CTG, enter the woman's name, date of birth, NHS number, hospital number, maternal pulse and indication and legible name, designation and signature of the midwife
- Add the Maternal pulse at the start of the CTG
- Check printing speed 1cm/min
- At the end of the CTG, the above classification is documented with the date, time and legible staff name, signature and designation.

- Antenatal CTG paper print outs must be stored in the CTG envelope and be stored within the purple files until after delivery when they will be uploaded to Evolve.
- The envelope must be identified with the patient's name, NHS number and hospital number; include the date, reason for CTG and legible name, designation and signature of the midwife.

2.2 Documentation of an Antenatal CTG

Documentation of the antenatal CTG should follow the DR Q BRAVADO pattern:

Define **R**isk

Quality

Baseline **R**ate

Variability

Accelerations

Decelerations

Overall view

Fresh eyes (Band 5 midwives must Fresh Eyes with a Band 6 or above)

Plan

2.3 Action related to traditional Antenatal CTGs

A **Normal** CTG may be discontinued once 'Fresh eyed'

A **Suspicious** CTG should continue and be reviewed by an experienced obstetrician ASAP (within 30 mins). The CTG classification and any action taken should be documented in the notes.

A **Pathological** CTG should continue and be reviewed, without delay, by an experienced Obstetrician. If there is going to be a delay, then the CTG should be taken to the doctor for review.

2.4 Computerised CTG (cCTG)

Computerised CTG is an objective analysis of CTG. It eliminates the problems associated with highly subjective interpretation based on visual interpretation and is reproducible and consistent. It uses the computerised numerical analysis of the CTG, which is derived from the world's largest CTG database linked to outcomes and is known as Dawes Redman CTG analysis. It works in a 2-stage process where it derives a dataset similar to the traditional interpretation process and then applies the Dawes Redman criteria to this dataset. The final clinical judgement should be based on the entire clinical assessment with computerised CTG forming a part of this holistic approach to pregnancy management.

2.4.1 The Dawes Redman criteria are derived from the following dataset:

1) **Signal Loss:** Percentage of the trace length for which there is no FHR data.
2) **Movements:** As per traditional technique based on movements perceived by the patient. This is not used in monitoring twin pregnancies as movements cannot be attributed to a particular fetus.

3) **Basal heart rate:** This is different from baseline heart rate and is calculated by the software. It may deviate significantly from the visual assessment of baseline heart rate particularly during periods of prolonged high or low rates.
4) **Contractions:** Are recorded as per the traditional technique.
5) **Accelerations:** Same as conventional CTG definition but are quantified and presented in 2 groups (amplitude >10bpm and amplitude >15bpm).
6) **Decelerations:** The number of decelerations is defined as per conventional CTG but additionally, they are quantified in terms of ">20 Lost Beats"- a measure of the depth and duration of the deceleration.
7) **Reactivity of fetal heart beat**: Fetal heart rate variation has been shown to be the most useful computerised CTG indicator of antepartum fetal well-being. Two normal sources of FHR variation are gestational maturity and episodic changes in fetal behavioural states after 28 weeks gestation. The system was designed to take into account the episodic changes in fetal heart rate and fetal movement's characteristic of sleep states. Even in the absence of acceleration in a normal fetus, there is at least one episode of high FHR variation from 28 weeks onwards.
    - **Long term variation (LTV)** is in the form of high and low episodes in minutes. Variation in the pulse interval or rate from the baseline gives a measure of LTV. Periods for which LTV or beat-to-beat variation is >32 milliseconds for five or six consecutive minutes are described as high episodes and when the LTV is low the period is described as low episodes.
    - Short **term variation (STV):** Is similar to baseline variability, and LTV, but measured over a much smaller interval of just 3.75s (typically 7 to 10 beats). A significant benefit is that it is independent of baseline rate. The mean STV increases as gestational age advances.
    - Overall the thresholds of abnormal STV are as below:

      < 4ms: Low
      < 3ms: Abnormal
      < 2ms: Highly abnormal.

STV CANNOT be assessed visually from looking at the trace. It is NOT the same as beat-to-beat variability. It MUST NOT be used in isolation as an indicator of fetal condition – you can have normal STV with a severely compromised fetus. It is only significant as part of a full 60-minute analysis

2.5 On-going outpatient monitoring:

For women who require regular outpatient monitoring, an individual plan will be made.

2.6 Inpatient Monitoring

Women who are inpatients on the antenatal wards should have at least daily assessment of the fetal heart using computerised CTG. Conventional monitoring should be used once the woman either goes into labour spontaneously or following prostaglandin administration / ARM if induction of labour.

2.7 Gestational age and CTG

26-30 weeks: At early gestations, the fetal autonomic nervous system is not mature and therefore the patterns of fetal heart rate (FHR) which may be expected at later gestations may not be present. Also there is increased possibility of signal loss and poor quality in CTG's at earlier gestations. Traces should always be compared with previous FHR tracings and suspicious features may include any change in baseline rate, variability and/or presence of decelerations. If a 26-30 week CTG trace does not fall into the Normal category the women should be reviewed by a Registrar/Consultant

3.0 Performing computerised CTG (cCTG):

Huntleigh CTG machines in the Day Assessment Unit, Triage and Joan Booker Ward are able to perform Dawes Redman CTG analysis. See Appendix 1.

1. Start the CTG, turn 'analysis on'
2. Enter the gestational age in weeks and days.
3. Turn the printing on.
4. After 10 minutes if the Dawes Redman criteria is met, this will be displayed on the bottom of the screen (with a tick). If you want to review press menu and then press "review". If you want to generate the report then stop the recording and press print (Do not turn off the CTG machine until it has completed printing).
5. If the Dawes Redman criteria are not met then continue to record the CTG.

3.1 Applying the Dawes Redman criteria:

The computer software assesses the above mentioned dataset and creates a report. The first result is after 10 minutes and is updated every 2 mins up to max of 60 mins.

There are 2 possible outcomes:

- Criteria met
- Criteria not met

3.1.1 What to do when Criteria are met:

This can be met after as little as 10 minutes (i.e. after the first analysis). It indicates a normal trace. The CTG can be stopped subject to visual assessment and clinical judgement. Do not rely on the analysis in isolation. It may not always identify unusual or pathological patterns that may be more obvious from visual interpretation, holistic assessment of, and knowledge of, the whole clinical scenario.

In some clinical scenarios such as the monitoring as severely growth restricted fetuses, analysis may need to continue for an hour, EVEN IF the criteria are met. This will be on an individual patient basis.

3.1.2 What to do when Criteria not met BEFORE 60 minutes:

This simply indicates that the criteria have not YET been met and normality has not been demonstrated. There are many reasons why a trace may not meet the criteria for a while, including uncertain basal rate determination and fetal behavioural state (e.g. sleep state). Reasons for failure

to meet the criteria are shown as reason codes. Unless there are clear pathological features, or any cause for concern, continue the trace until the criteria are met.

3.1.3 What to do when Criteria are not met AT 60 minutes:

In the context of the antenatal CTG test, this must be considered a "Pathological" outcome and appropriate case review and action must be taken, based on the reasons for failure, visual trace review, and an holistic assessment of the pregnancy, in accordance with local / international guidelines & protocols. The review should be performed by a Registrar/Consultant to plan further management. Do NOT act on the basis of the CTG analysis alone, as it is an aid to pregnancy management, not a diagnostic tool.

The reasons why the trace did not meet the criteria are highlighted as coded numbers alongside the CRITERIA NOT MET message

Below are descriptions of each CRITERIA NOT MET CODES and may help to advise further management but THIS DOES NOT REPLACE AN INDIVIDUAL RISK ASSESSMENT AND CLINICAL REVIEW.

Dawes Redman CRITERIA NOT MET codes:

1. Basal Heart Rate outside normal range (110 – 160)
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 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

- **1. Basal Heart Rate outside normal range (110-160)**

It is agreed in the NICE guidelines that an acceptable rate for a term fetus is 110 – 160 beats per minute (recent NICE 2017 suggests 100 is acceptable for a lower limit) but for extremely pre-term fetuses under 28 weeks gestation, baseline rates under 140 are unusual and in this event further assessments of fetal wellbeing should be discussed with the on call Obstetric Consultant.

- **2. Large decelerations**

If the trace is otherwise normal this can be noted as an unprovoked variable deceleration but does not require immediate action and the trace should be repeated later.

- **3. No episodes of high variation**

This is different to baseline variability. Important evidence of normality is the episodic variation in the baseline heart rate. In deep sleep the fetal heart rate is relatively constant with lower short-term variation but this should not normally exceed 50 minutes. In this event, if the short-term variation is normal and/or there are any accelerations the trace may be discontinued and repeated in 4 – 8 hours

- **4. No movements and fewer than 3 accelerations**

This is significant and requires review by the obstetric team.

- **5. Baseline fitting is uncertain**

If all else is fine, and the baseline falls within normal parameters, then this can be ignored.

- **6. Short-term variation (STV) is less than 3ms**

Short-term variation is a computerized measure of the micro fluctuations of the fetal heart that are much shorter than the macro fluctuations. It is inversely proportional to the fetal heart rate and does not depend on the baseline.

The absence of an episode of high variation (a non-reactive trace) is strongly linked to the development of metabolic acidaemia and impending intrauterine death

STV (ms)	**<2.6**	**2.6-3.0**	**>3.0**
Metabolic acidaemia	4.0%	2.7%	
IUD	24.1%	4.3%	0.0%

- **7. Possible error at end of the record**

This occurs when the machine detects a possible abnormality at the end of the trace which would otherwise be passed as CRITERIA MET.

In this event the trace may be continued or, if the clinical evaluation is that it is significantly abnormal, for example prolonged deceleration, then action should be taken as appropriate.

- **8. Deceleration at the end of the record**

In this event the trace should be continued and action taken as appropriate.

- **9. High frequency sinusoidal rhythm**

Sinusoidal FHR patterns are associated with either severe fetal anemia or severe/prolonged fetal hypoxia with acidosis and are associated with poor fetal outcomes.

These traces can be easily missed clinically and the analysis of the Dawes Redman system should be **acted on immediately** probable delivery – **should be discussed with Consultant on call**.

- **10. Suspected sinusoidal rhythm**

Sinusoidal FHR patterns are associated with either severe fetal anaemia or severe/prolonged fetal hypoxia with acidosis and are associated with poor fetal outcomes.

Sinusoidal FHR needs to be distinguished from a Pseudosinusoidal FHR which, while it closely resembles a sinusoidal pattern, is usually transient, resolves spontaneously and is associated with a good fetal outcome.

Distinguishing between Sinusoidal and Pseudosinusoidal FHR Patterns)

Where a diagnosis of Sinusoidal FHR pattern is made, immediate intervention is required with probable delivery if intrauterine resuscitation is not appropriate.

The CTG should be continued and the mother informed of the seriousness of the situation.

Maternal blood should be taken for an urgent Kleihauer test to assess the degree of any feto-maternal haemorrhage.

The Neonatal Paediatricians should be alerted and the Obstetric Consultant and Obstetric Anaesthetic Consultant informed of possible need for emergency delivery.

- **11. Long-term variation in high episodes below acceptable level**

This should be acted upon in the same way as STV.

- **12. No accelerations**

In this event the CTG trace should be **continued but should be reviewed by Obstetric Registrar ST3 and above or Obstetric Consultant**.

3.2 Frequency of computerised CTG in high-risk pregnancies:

The STV can deteriorate very quickly especially at less than 32 weeks gestation in cases where there is either maternal disease such as pre-eclampsia with fluctuations of maternal blood pressure and in cases of severe growth restriction with abnormal blood flow through the placenta. This may necessitate the need for the cCTG to be repeated more than once daily - a plan needs to be made by a Senior Obstetrician regarding frequency.

3.3 Computerised CTG in relation to gestational age

The Dawes/Redman criteria are based upon the normal distribution at 32 weeks. Gestations below 32 weeks may take longer to achieve criteria due to immature central nervous system.

4.0 Training Plan

All Obstetric and midwifery staff are required attend at an annual CTG update to ensure they are compliant with current guidance in relation to interpretation and assessment of the fetal heart rate. This can be achieved as by attending the training as part of their induction day, PROMPT training day and weekly CTG meetings.

References

Guideline CG 55 Intrapartum Care December 2014

FIGO Guidelines for the Use of Fetal Monitoring 1987

RCOG, RCM, RC of Anaesthetists, RC of Paediatricians (2007). Safer Childbirth: Minimum Standards for the Organisation and delivery of Care in Labour

Fitzpatrick T, Holt L (2008) 'A 'buddy' approach to CTG'. The Royal College of Midwives Journal, Oct/Nov: 40-41

National Institute for Health and Clinical Excellence (NICE). (2004). Caesarean Section. London: NICE.

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.

Royal College of Obstetricians & Gynaecologists. (2007). Birth After Previous Caesarean Section. London: RCOG. Available at: www.rcog.org.uk

Simon A.G. et al (2006) 'An exploratory mixed-methods study of Scottish midwives' understandings and perceptions of clinical near misses in maternity care'. Midwifery, ***22****(2): 125-136*

Dawes GS, Moulden M, Redman CW. Improvements in computerised fetal heart rate pattern analysis antepartum. *J Perinat Med*; 1996;24:25-36

Federation Internationale de Gynaecologie et d'Obstetrique (FIGO). 1987 Guidelines for the use of fetal monitoring**.** *Int J. Gyn Obs*;1987 25:159-167

Gibb D., Arulkumaran S. Fetal Monitoring in Practice**.** 1992. Butterworth Heinemann: London

National Collaborating Centre for women's and children's health. 2014. Intrapartum care: care of healthy women and their babies during childbirth. NICE clinical guideline 190.

Royal college of obstetricians and gynaecologist Green-top guideline No. 31. 2nd edition. The Investigation and Management of the Small-for-Gestational-Age Fetus. *RCOG*;2014

Serra V, Bellver J. Moulden M, Redman CW. Computerized analysis of normal fetal heart rate pattern throughout gestation. *Ultrasound Obstet Gynecol* 2009:34:74-9

Street P., Dawes GS, Moulden M, Redman CWG. Short term variation in abnormal fetal heart rate records. *Am J Obstet Gynecol*;1991;80:673-678

Steer PJ. Commentary on 'Antenatal cardiotocogram quality and interpretation using computers'. *BJOG*;2014;121 (Suppl. 7):9-13Grivell RM1, Alfirevic Z, Gyte GM, Devane D., Antenatal cardiotocography for fetal assessment Cochrane Database Syst Rev. 2015 Sep 12;(9)

SonicaidFetalCare ANTEPARTUM ANALYSIS, Issue 1.3 (c) 2005 Huntleigh Healthcare Ltd

Roberts D, Kumar B, Tincello D, Walkinshaw S "Computerised antenatal fetal heart rate recordings between 24 and 28 weeks of gestation." British Journal of Obstetrics & Gynaecology, August 2001, 108(8):858-862.

Tincello D, White S, Walkinshaw S "Computerised analysis of fetal heart rate recordings in maternal type I diabetes mellitus." British Journal of Obstetrics & Gynaecology, August 2001, 108(8):853-857.

Appendix 1

HOW TO SET UP THE HUNTLEIGH COMPUTERISED CTG

Place belts and transducers as conventional CTG.

DO NOT start printing.

Give the patient the fetal event marker and explain how to use,

Press SETUP (Bottom right)

Press ANTEPARTUM ANALYSIS

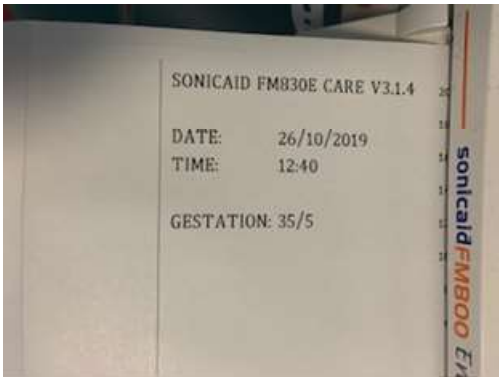
Press GESTATION

USE buttons to enter EXACT gestational age (weeks and days). This affects the interpretation so MUST be correct.

Press EXIT

Press ANALYSIS to ON. Press EXIT.

Press the PRINT button (top left of lower panel of buttons)



The CTG will now start to print. The gestation will print – orange light will be on.

If the Gestation does not print, you have gone wrong. If you do not turn off the machine to start again, it will not start analysis.

You can also see analysis is happening

A in a circle (I in circle means no analysis is being done).

? – criteria not yet met

Numbers on right – number of minutes analysis being done.

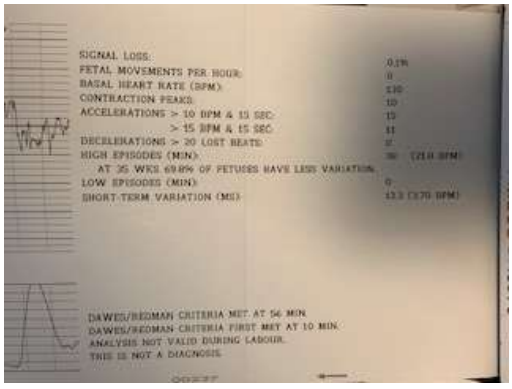
This CTG has been running for 4 minutes and the analysis has not been met.

The STV can be reviewed during the CTG by pressing Setup > Antepartum analysis > Ult 1 or 2 (depending which port transducer is in)

On this CTG, the criteria have been met and that analysis has been running for 56 minutes.

Press the top left PRINT button. Orange light will turn off.

LEAVE MACHINE TO PRINT ANALYSIS OR THE RESULTS WILL BE LOST.



A breakdown of the analysis can be seen.

If criteria are not met, reason codes will also be printed.

Audit/Monitoring

Element to be monitored	Lead	Method	Frequency	Reporting arrangements
Documentation at start and end of CTG as per guideline recommendation	Speciality Lead for Obstetrics or designated person	Clinical audit Audit proforma to be held by Lead/Audit centre Sample: 1% or 10 sets, whichever is the greater of health records of women who have delivered Sample: 1% or 10 sets, whichever is the greater of health records of women who have delivered in whom the tracing was assessed as suspicious or pathological over a one year period	Annual	Reported annually to the Delivery Suite Forum Lead will oversee action planning and ensure that progress of action plan implementation is reported to the Delivery Suite Forum and other groups as required
CTG carried out appropriately as per guideline (e.g. correct gestation, not in labour)				
Computerised CTG commenced and discontinued appropriately as per guideline recommendations				
Computerised CTGs not meeting criteria managed appropriately as per guideline recommendations				
Clear plan documented for timing of repeat CTGs as per guideline recommendations				
CTGs stored appropriately as per guideline recommendations				
Monitor compliance with the identified training for CTG interpretation	Practice Development Midwives	Allocation and completion of training has achieved 75% as set out in the TNA	Monthly reports from Fetal Wellbeing Midwife and CPE Team Quarterly	Quarterly report to the Perinatal Governance Group. Required actions will be agreed at the meeting, along with lead staff for each action and timescales. Minutes of will be circulated to relevant staff groups who have been tasked with completing the action plan. Lead will oversee action planning and ensure that progress of action plan implementation is reported to the maternity training group and other groups as required