Antenatal Fetal Heart Rate (FHR) Monitoring

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1. Purpose of guideline

The purpose of this guideline is to provide guidance for Auckland DHB clinicians undertaking fetal heart assessment including cardiotocograph (CTG) in the antenatal period. This includes the situations where computerised CTG is indicated and how to interpret the Dawes Redman Criteria (DR criteria).

2. Guideline management principles

- The aim of antenatal fetal surveillance is to identify the fetus at risk of intrauterine hypoxia and acidaemia. Timely, appropriate intervention may avoid neurological damage or death.
- There is no evidence to show that manual fetal manipulation, maternal glucose administration or icy drinks reduce the incidence of a non-reactive CTG.
- Computerised CTG analysis aids pregnancy management. It is not a diagnostic tool.
- Maternal wishes and concerns should be discussed and recorded.
- There is no evidence to support the routine antenatal use of CTG for fetal assessment in women with an uncomplicated pregnancy.
- For women at increased risk of pregnancy complications current evidence has not identified differences in outcomes with the use of CTG during pregnancy, but more studies are needed (Grivell et al, 2015).
- There is no clear evidence that antenatal CTG improves perinatal outcomes or caesarean section rates. However, a comparison of computerised CTG analysis versus traditional CTG showed a significant reduction in perinatal mortality with computerised CTG analysis (Grivell et al, 2015).

3. Abbreviations / definitions

Term	Definition
CTG	cardiograph
Dawes Redman criteria	DR criteria. A database of 100,000 traces; acts as an expert assistant for CTG interpretation and accurate interpretation criteria.
EFM	Electronic fetal monitoring
FGR	Fetal growth restriction
FHR	Fetal heart rate
Intermittent auscultation	Listening and counting method and the fetal heart rate should be documented as a single number instead of a range.
SGA	Small for gestational age

4. Gestational age and electronic fetal monitoring (EFM)

- < 26 weeks gestation: Intermittent auscultation of the fetal heart, CTG is only undertaken on written instruction by a senior medical officer (SMO).
- 26-27+6 week's gestation: due to an immature fetal autonomic nervous system, the patterns of the FHR that may be expected at later gestation are not present. CTG should be interpreted with caution.
- ≥ 28+0 weeks gestation: a CTG should be performed as part of any assessment where there is reason to be concerned about the fetal well-being.

5. Elective Caesarean sections

- The fetal heart should be auscultated for a full minute prior to the women entering theatre for an elective caesarean section. If there are any concerns with the rate, or a deceleration is heard, a CTG must immediately be performed. The fetal heart rate must be documented in the clinical records.
- The fetal heart rate must again be auscultated following insertion of a regional anaesthetic and any concerns communicated directly to the surgeon and documented in the women clinical records.

6. Indications for performing an antenatal CTG.

- The following list is presented as a guide only. The relevant guideline for individual conditions should be accessed to provide further information, and senior obstetric opinion requested if unsure.
- There is no evidence to support the use of routine antenatal CTG in women with uncomplicated pregnancies.
- A well pregnant women reporting normal fetal movements does not require a CTG at every outpatient assessment.

Maternal pre-existing	**Maternal - gestational**	**Fetal**
• Severe maternal disease e.g. Systemic lupus erythematosus, cyanotic heart disease, pulmonary disease, severe anaemia, vascular disease, renal disease, hyperthyroid.	• Hypertensive disorders in pregnancy-Pre-eclampsia and hypertension • Diabetes requiring medication or poorly controlled • Antepartum haemorrhage • Abdominal trauma • Suspected preterm labour • Undiagnosed abdominal pain • Pre-term rupture of membranes • Prolonged pregnancy (>	• Decreased fetal movements • Confirmed SGA/FGR • Multiple pregnancy • Oligohydramnios • Fetal arrhythmias • Abnormal doppler umbilical artery velocimetry • FHR abnormal on auscultation • Rhesus isoimmunisation • Previous abnormal antenatal CTG.

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Maternal pre-existing	Maternal - gestational	Fetal
	=41+0 weeks gestation) • Maternal infection • Term pre labour rupture of membranes • Prior to and following any external cephalic version.	

7. Before commencing CTG

Ensure that:

- An abdominal palpation has been performed and the fetal position has been clearly assessed and documented, that the procedure has been explained and consent gained.
- The date and time on the CTG machine is correct.
- CTG machine is set to a paper speed of 1 centimetre (cm) per minute.
- The following information is identified on the CTG paper:
  - Maternal name and National Health Index (NHI) number
  - Date and time of starting CTG
  - Maternal pulse
  - Indication for CTG
  - Risk factors
  - Any event, which may affect the FHR e.g. vaginal examination, change of position.
  - If an opinion is sought, then the signature of that person is recorded on the CTG paper and the opinion recorded in the clinical records.
  - Date, time and signature of person discontinuing the CTG together with the reason for discontinuation.

8. Antenatal CTG interpretation sticker and management

For women having an antenatal CTG, a documented systematic assessment should take place when reviewing the trace. The CTG trace should be classified as NORMAL or ABNORMAL. An abnormal CTG should be continued and immediate obstetric registrar review requested. The antenatal CTG Interpretation sticker should be used to assist with assessment.

The CTG sticker will be completed:

- 20 minutes after a CTG has initially been applied
- When the CTG is identified as abnormal
- On discontinuing the CTG
- More frequently if a change in the appearance from the previous review
- Hourly if continuous CTG requested
- The sticker will be completed contemporaneously and fixed into the women's clinical records.

In all cases when the CTG trace is assessed as **abnormal** the midwife and then the reviewing obstetric registrar must document a plan on a CTG sticker.

The midwife must notify the abnormal CTG to a senior midwifery colleague i.e. Clinical Charge Midwife (CCM), Charge Midwife (CM) while waiting for obstetric registrar review.

The Obstetric Registrar's written plan could include the following:

- Repeat CTG at a later time - midwife to escalate to obstetric registrar if again abnormal
- Escalate to obstetric SMO
- Continue CTG with a time stated for next review by obstetric registrar. The CTG trace will be initialled as evidence of the review.

For women receiving continuous CTG there should be consideration to transfer women to Labour and Birth suite for one on one care. If this is not possible, then one on one care should be provided in an alternative setting. In situations where one on one care can not be provided due to staffing levels and/or acuity, then the CTG must be reviewed every 20 minutes and an Antenatal CTG sticker completed and fixed into the women clinical records on each occasion. A datix should be completed if one to one care to unable to be provided.

9. CTG interpretation-Non Huntleigh

- A CTG should be no less than 20 minutes in duration
- If the CTG continues for longer than 20 minutes duration due to not meeting the definition of normal, the CTG should never be left unattended for longer than a period of 20 minutes.
- A normal CTG includes the following features as described in The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG), 2019 guideline:
  - A baseline FHR of 110-160bpm
  - Baseline FHR variability of 6-25bpm
  - The presence of accelerations – transient increases in FHR of 15bpm above the baseline and lasting 15 seconds at the baseline. Accelerations in the preterm fetus may be of lesser amplitude and shorter duration The significance of no accelerations on an otherwise normal CTG is unclear
  - No decelerations – transient decreases of the FHR below the baseline lasting at least 15 seconds, conforming to one of the patterns below. See Appendix 1 for descriptions of early, variable, complicated variable, prolonged, late decelerations and bradycardia.

All other CTGs by this definition are abnormal and require further evaluation taking into account the full clinical picture.

10. Computerised CTG using Dawes Redman criteria (Huntleigh CTG Monitor)

- Staff should ensure that each CTG strip generated from a machine with Dawes Redman capability has the analysis activated and viewed.
- Do not delay undertaking a CTG when a CTG machine with Dawes Redman criteria is not available.
- Studies show an improvement in terms of perinatal outcome, caesarean sections rates and number of diagnostic interventions with computerised CTG analysis compared to traditional CTG (Kouskouti, 2018).

- Short-term variation (STV) is a useful measure of fetal condition. However, it is only valid if measured after 60 minutes of recording and is only one aspect of fetal condition.
- The final clinical judgement should be based on the entire clinical assessment with CTG forming a part of this holistic approach to pregnancy management.

The Dawes Redman (DR) CTG analysis can be used for **antenatal** CTG. It is valid for any gestation over 26 weeks but is **not** suitable for intrapartum CTG analysis. Gestations below 32 weeks may take longer to achieve criteria due to immature central nervous system.

10.1 Performing computerized CTG

- Start the CTG, turn 'analysis' on
- Enter the gestational age in weeks and days (the analysis will not start unless the gestation is entered)
- Turn the printing on
- After 10 minutes if the DR criteria is met, this will be displayed on the bottom of the screen (with a tick).
- If the DR criteria is not met then continue to record the CTG.

10.2 Applying the Dawes Redman criteria

The first result is after 10 minutes and is updated every two minutes up to a maximum of 60 minutes. There are two possible outcomes:

- Criteria met
- Criteria not met.

10.3 Criteria are met

This can be met in as little as 10 minutes. The CTG can be stopped subject to visual assessments 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.

10.4 Criteria not met before or at 60 minutes

This simply indicates that the criteria has not YET been met and normality has not been demonstrated. There are many reasons for this including uncertain basal rate determination and fetal behavioural state (e.g. sleep state). Unless there are clear pathological features, or any cause for concern, continue the trace until the criteria are met.

10.5 Criteria not met after 60 minutes

- This is an ABNORMAL outcome
- A visual review of the CTG, the reasons for failure and the overall clinical picture must be reviewed by an obstetric registrar/SMO.
- See Appendix 2 for a list of codes why the criteria not met.

- Check the short-term variation (STV) (ms): STV values <4msecs is low, <3msecs is abnormal and <2msecs highly abnormal.

1.6 STV must NOT be used in isolation as an indicator of fetal condition – you can have a normal STV with a severely compromised fetus particularly where the fetus is affected by infection or anaemia.

1.7 **Do not rely on the analysis in isolation**. It may not always identify abnormal patterns that may be more obvious from visual interpretation with a holistic expert assessment of the whole clinical scenario.

11. Responsibilities

11.1 All clinicians in maternity

Who complete an assessment of fetal wellbeing are responsible for ensuring they undertake a holistic assessment of maternal and fetal health and risk factors. This must be clearly documented with an action plan in the clinical records.

11.2 Role of the midwife

The midwife is responsible for:

- Acting as an effective advocate for the women.
- Providing evidence based information about fetal wellbeing assessment to the women and her family.
- Check that the chosen method for fetal heart rate monitoring is appropriate for gestation and there is a documented action plan to follow.
- Respond and attend in a timely manner when requested to provide a fresh-eyes review for a colleague
- Ensure that any clinical concerns about fetal wellbeing are appropriately escalated until a comprehensive review with appropriate action plan and follow-up plan is completed and clearly documented.

11.3 Role of the O&G Medical staff/Obstetrician

The obstetrician is responsible for:

- Providing evidence based information about fetal wellbeing assessment to the women and her family.
- On admission ensure that the chosen method for fetal heart rate monitoring is appropriate for gestation with a documented action plan and follow up. The method of fetal heart monitoring may change due increasing gestation.
- Respond and attend in a timely manner when requested to provide a fresh-eyes review
- Attending in a timely manner when requested to review an abnormal CTG.
- Providing a further review of an abnormal CTG at hourly intervals or earlier if requested. Documenting a plan at each review.
- Refer to Intrapartum Fetal Surveillance Policy once labour commences for management of abnormal CTG.

12. Education and training

All midwifery and obstetric staff and lead maternity carers (LMC) access holders must attend regular mandatory fetal surveillance education. This must include CTG interpretation, and the use of fetal lactate assessment, and regular multidisciplinary clinical review.

At Auckland DHB, mandatory education consists of attending the RANZCOG Fetal Surveillance Programme (FSEP) face-to-face training (with formal assessment) every four years. In addition, at least every two years the Fetal Surveillance Education Program (FSEP) online learning programme should be completed, in conjunction with a total of four hour in-house case-based multidisciplinary CTG learning (either a single four-hour workshop or several shorter CTG review sessions).

13. Supporting evidence

- Grivell, R. M., Alfirevic, Z., Gyte, G. M., & Devane, D. (2015). Antenatal cardiotocography for fetal assessment. *Cochrane Database of Systematic Reviews*, (9).
- The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG), Intrapartum Fetal surveillance, Clinical Guideline – Fourth Edition 2019. Available from: https://ranzcog.edu.au
- Redman, C. W. G., & Moulden, M. (2014). Avoiding CTG misinterpretation: A review of the latest Dawes-Redman CTG analysis. *British Journal of Midwifery*, *22*(1), 2-5.
- Kouskouti, C. 2018. Short Term Fetal Heart Rate Variation in Intrauterine Growth Restriction: development of reference values for a new computational algorithm. Retrieved from: https://edoc.ub.uni-muenchen.de/22939/1/Kouskouti_Christina.pdf

Other

- Bwrdd lechyd Prifysol Hywel Dda University, National Health Service, Wales. (2019). Antenatal Electronic Fetal Monitoring Guideline.
- Women and Newborn Health Service, King Edward Memorial Hospital. (2016). Antepartum Fetal Heart Rate Monitoring.
- Northern Devon Healthcare. (2018). Fetal wellbeing and Monitoring Guideline Antenatal Cardiotocography (CTG) and Dawes Redman Analysis (2019): Royal Cornwall Hospitals NHS Trust.

14. Associated documents

- Intrapartum Fetal Surveillance Policy
- Decreased (Reduced) Fetal Movements
- Caesarean Section (CS) – Pre, Peri & Post-Op Care

Other

- Fetal Surveillance Education Program
  (Available from: https://fsep.ranzcog.edu.au/what-we-offer/online-program)

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15. Disclaimer

No guideline can cover all variations required for specific circumstances. It is the responsibility of the health care practitioners using this Auckland DHB guideline to adapt it for safe use within their own institution, recognise the need for specialist help, and call for it without delay, when an individual patient falls outside of the boundaries of this guideline.

16. Corrections and amendments

The next scheduled review of this document is as per the document classification table (page 1). However, if the reader notices any errors or believes that the document should be reviewed ***before*** the scheduled date, they should contact the owner or Document Control without delay.

Appendix 1: Intrapartum fetal surveillance definitions

Term	Definition
Baseline fetal heart rate	The mean level of the fetal heart rate when this is stable, excluding accelerations and decelerations and contractions. It is typically determined over a time period of 5 or 10 minutes and expressed in bpm. Preterm fetuses tend to have values towards the upper end of this range. A progressive rise in the baseline is important as well as the absolute values.
Normal Baseline	FHR 110-160 bpm
Baseline Bradycardia	<110 bpm
Baseline Tachycardia	>160 bpm
Baseline variability:	The minor fluctuations around the baseline FHR. It is assessed by estimating the difference in beats per minute between the highest peak and lowest trough of fluctuation in one minute segments of the trace between contractions.
Normal baseline variability:	6 – 25 bpm at the baseline fetal heart rate
Reduced baseline variability	3 – 5 bpm
Absent baseline variability	<3 bpm
Increased baseline variability	> 25 bpm
Sinusoidal:	A regular oscillation of the baseline FHR resembling a sine wave. This smooth, undulating pattern is persistent, has a relatively fixed period of 2 – 5 cycles per minute and an amplitude of 5 –15 bpm above and below the baseline. Baseline variability is absent and there are no accelerations.

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Accelerations	Transient increases in FHR of 15 bpm or more above the baseline and lasting 15 seconds at the baseline. Accelerations in the preterm fetus may be of lesser amplitude and shorter duration. The significance of no accelerations on an otherwise normal CTG is unclear.
Decelerations	Transient decreases of the FHR below the baseline lasting at least 15 seconds, conforming to one of the patterns below:
Early decelerations	Uniform, repetitive decrease of FHR with slow onset early in the contraction and slow return to baseline by the end of the contraction.
Variable decelerations	Repetitive or intermittent decreasing of FHR with rapid onset and recovery. Time relationships with contraction cycle may be variable but most commonly occur simultaneously with contractions.
Complicated variable decelerations	The following additional features increase the likelihood of fetal hypoxia: • Rising baseline rate or fetal tachycardia. • Reducing baseline variability. • Slow return to baseline FHR after the end of the contraction. • Large amplitude (by 60 bpm or to 60 bpm) and/or long duration (60 seconds). • Presence of smooth post deceleration overshoots (temporary smooth increase in FHR above baseline).
Prolonged decelerations	A fall in the baseline fetal heart rate for more than 90 seconds and up to 5 minutes
Bradycardia	A fall in the baseline fetal heart rate for more than 5 minutes
Late decelerations	Uniform, repetitive decreasing of FHR with, usually, slow onset mid to end of the contraction and nadir more than 20 seconds after the peak of the contraction and ending.

Source: The Royal Australian and New Zealand College of Obstetricians and Gynaecologists.

Appendix 2: Reasons for Dawes Redman Criteria NOT being met

Reasons for Dawes Redman Criteria NOT Being Met	
Code	
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 (STV) <3
7	Possible error at the end of the recording
8	Deceleration at the end of the recording
9	High frequency sinusoidal rhythm
10	Suspected sinusoidal rhythm
11	Long-term variation (LTV) in high episodes below acceptable level
12	No accelerations

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