Clinical Guideline
Cardiotocography

Policy developed by: SA Maternal & Neonatal Clinical Network
Approved SA Health Safety & Quality Strategic Governance Committee on:
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Summary
Clinical practice guideline on cardiotocography.

Keywords
CTG, cardiotocography, fetal monitoring fetal compromise, FHR, fetal heart rate, fetal surveillance, baseline, bradycardia, accelerations, decelerations, variable decelerations, cardiotocography clinical guideline

Policy history
Is this a new policy? N
Does this policy amend or update an existing policy? Y v4.0
Does this policy replace an existing policy? N
If so, which policies?

Applies to
All Health Networks
CALHN, SALHN, NALHN, CHSALHN, WCHN, SAAS

Staff impact
All Staff, Management, Admin, Students, Volunteers
All Clinical, Medical, Nursing, Allied Health, Emergency, Dental, Mental Health, Pathology

PDS reference
CG212

Version control and change history

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Note

This guideline provides advice of a general nature. This statewide guideline has been prepared to promote and facilitate standardisation and consistency of practice, using a multidisciplinary approach. The guideline is based on a review of published evidence and expert opinion.

Information in this statewide guideline is current at the time of publication.

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Health practitioners in the South Australian public health sector are expected to review specific details of each patient and professionally assess the applicability of the relevant guideline to that clinical situation.

If for good clinical reasons, a decision is made to depart from the guideline, the responsible clinician must document in the patient’s medical record, the decision made, by whom, and detailed reasons for the departure from the guideline.

This statewide guideline does not address all the elements of clinical practice and assumes that the individual clinicians are responsible for discussing care with consumers in an environment that is culturally appropriate and which enables respectful confidential discussion. This includes:

- The use of interpreter services where necessary,
- Advising consumers of their choice and ensuring informed consent is obtained,
- Providing care within scope of practice, meeting all legislative requirements and maintaining standards of professional conduct, and
- Documenting all care in accordance with mandatory and local requirements

Explanation of the aboriginal artwork:
The aboriginal artwork used symbolises the connection to country and the circle shape shows the strong relationships amongst families and the aboriginal culture. The horse shoe shape design shown prior to the generic statement symbolises a woman and those enclosing a smaller horse shoe shape depicts a pregnant woman. The smaller horse shoe shape in this instance represents the unborn child. The artwork shown before the specific statements within the document symbolises a footprint and demonstrates the need to move forward together in unison.

Australian Aboriginal Culture is the oldest living culture in the world yet we experience the worst health outcomes in comparison. Our Aboriginal women are 2-5 times more likely to die in childbirth and our babies are 2-3 times more likely to be low birth weight. Despite these unacceptable statistics the birth of an Aboriginal baby is an important Cultural event and diverse protocols during the birthing journey may apply.
Cardiotocography

> An electronic method of simultaneously recording fetal heart rate (FHR), fetal movements and uterine contractions as a method of assessing fetal well-being, predominantly in pregnancies with increased risk of complications.

> Intrapartum continuous CTG monitoring with appropriate management reduces the incidence of neonatal convulsions; however neonatal convulsions alone are poor predictors of adverse long-term neonatal outcome.

> Perinatal death, cerebral palsy and neurodevelopmental disability are important adverse outcomes of fetal hypoxia.

> In interpreting CTGs, features of fetal compromise represent markers for the detection of fetal hypoxia and/or acidosis.

> Moderate FHR variability (6-25 bpm) is strongly associated (98%) with an umbilical pH > 7.15 or newborn vigour (5 minute apgar score ≥ 7).

> Undetectable or minimal FHR variability (< 3 bpm) in the presence of late or variable decelerations is the most consistent predictor of newborn acidemia (23%).

> There is a positive relationship between the degree of acidemia and the depth of decelerations or bradycardia.

> Except for sudden profound bradycardia, newborn acidemia with decreasing FHR variability in combination with decelerations develops over a period of time approximating one hour.

> The percentage of FHR patterns with features of fetal compromise that can be attributed to fetal acidosis is presented in figure 2.1.

> Poor standardisation in the interpretation of CTGs and disagreement about appropriate interventions have resulted in a lack of reliable and valid data to demonstrate the efficacy of CTG monitoring.

Cardiotocograph (CTG) practice recommendations

There are no internationally agreed practice recommendations. However, various authorities such as ACOG, RCOG, NICE and RANZCOG have published guidelines. RANZCOG (2014) recommends:

> CTG paper speed at 1cm / minute.

> Sensitivity displays at 20 beats per minute / cm.

> Set FHR range display at 50 – 210 bpm.

> Ensure date and time are correct on commencement of CTG.

> Date and time settings on CTG tracings are validated whenever used.

> Label CTGs with the mother’s name, date, time commenced, hospital record number and include the maternal observations.

> Intrapartum events that may affect the FHR (e.g. starting or changing oxytocin regimen, vaginal examination, obtaining fetal blood sample or insertion / siting an epidural) should be noted contemporaneously both on the CTG and in the maternal case notes, including date, time and signature.

> Health professionals should be aware that machines from different manufacturers use different vertical axis scales, and this can change the perception of fetal heart rate variability.
In addition, medical expert consensus recommends:

> Midwives should not undertake continuous CTG monitoring in the absence of medical supervision
> On commencement of CTG monitoring, women should be advised, in general terms, how to read their tracing
> Where central monitoring is in use, the woman should be able to recognise the significance of the alarm light if it activates, so that staff can be summoned if they do not react to the alarm

### CTG competency assessment

> There are wide variations in the interpretation of CTGs, even among experts
> Failure to act on signs of fetal compromise jeopardizes the efficacy of CTG monitoring
> RANZCOG (2014) recommends that all clinicians using and interpreting CTGs should have current knowledge of:
  > Fetal physiological responses to hypoxia
  > Good pattern recognition skills
  > The ability to integrate this knowledge with each clinical situation
> Continuing professional development in the application and interpretation of fetal monitoring (based on RANZCOG 2014 recommendations) should be completed by all clinicians using and interpreting CTG’s
> This may be met through following the SAPPG clinical guidelines on fetal surveillance in the Antenatal and Intrapartum periods (based on RANZCOG 2014 recommendations) and, depending on local resources, successful completion of a recognised education package such as:
  > RANZCOG Online Fetal Surveillance Education Program (OFSEP). Available from URL: [www.fsep.edu.au](http://www.fsep.edu.au)

### Description of CTG fetal heart rate patterns

> Interpret and report on CTG tracings in descriptive rather than diagnostic terms
> Document a description of the features evident in the CTG tracing as described below
> Where the features indicate fetal compromise, continue tracing, document in descriptive terms and seek medical review
> The CTG should be interpreted in combination with the woman’s complete history
### Term | Definition
--- | ---
**Baseline FHR:**  
> The mean of the FHR when this is stable, excluding accelerations and decelerations and contractions  
> It is expected that the fetal heart rate of preterm fetuses may be in the upper range  
> A FHR within the normal baseline with accelerations or normal baseline variability (and without decelerations) is not associated with hypoxia  
> The baseline FHR should be determined over 5 to 10 minutes and expressed in bpm

<table>
<thead>
<tr>
<th>Normal baseline</th>
<th>110-160 bpm</th>
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<tr>
<td><strong>Baseline bradycardia</strong></td>
<td>Less than 110 bpm</td>
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<tr>
<td><strong>Baseline tachycardia</strong></td>
<td>More than 160 bpm</td>
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**Baseline variability:**  
> The minor baseline FHR fluctuations measured by gauging the difference in bpm between the highest peak and lowest trough of fluctuation in 1 minute segments of the trace between contractions

<table>
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<tr>
<th>Normal baseline variability</th>
<th>6-25 bpm at the baseline fetal heart rate</th>
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| **Reduced baseline variability** | 3-5 bpm  
*Caution should be exercised in interpreting variability in the presence of an external transducer  
Reduced variability of less than 5 bpm may be normal in a term fetus if seen as part of sleep phase of ‘cycling’ (up to 20 to 40 minutes duration and occasional slight rise in baseline). However, it may also reflect hypoxia or occur secondary to drugs such as pethidine.  
**Absent baseline variability** | Less than 3 bpm |
| **Increased baseline variability** | More than 25 bpm  
A saltatory fetal heart rate pattern is defined as fetal heart amplitude changes of more than 25 beats per minute with an oscillatory frequency of more than 6 per minute for a minimum duration of 1 minute. This may occur in a rapidly evolving hypoxia, especially in the second stage of labour. |
| **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 amplitude of 5-15 bpm above and below the baseline. Baseline variability is absent and there are no accelerations |
| **Accelerations** | > Transient increases in FHR of 15 bpm or more above the baseline and lasting 15 seconds  
> 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 episodes of decrease of FHR below the baseline of more than 15 bpm 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  
Vagal in origin, medical experts suggest variable decelerations result from stimuli such as cord or head compression |
| **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 secs)  
Presence of smooth post deceleration overshoots (temporary smooth increase in FHR above baseline) |
| **Prolonged decelerations** | Decrease of FHR below the baseline of more than 15 bpm for longer than 90 seconds but less than five minutes |
Late decelerations

| 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 after the contraction. In the presence of a non-accelerative trace with baseline variability less than 5 bpm, the definition would include decelerations of less than 15 bpm. |

NB: The definitions published by RANZCOG (2014 p. 61) have been used as the basis of these recommendations.

Fetal compromise

> Detection enables appropriate and timely intervention, thereby reducing the incidence of adverse outcomes.
> Institute continuous CTG monitoring when risk factors for fetal compromise are detected antenatally, at the onset of labour, or if any intrapartum risk factor develops.
> Where risk factors for fetal compromise are detected antenatally so that continuous CTG monitoring is indicated, the woman should be advised to give birth where continuous CTG monitoring is possible.
> Fetal compromise may be due to placental insufficiency, uterine hyperstimulation, maternal hypotension, cord compression and placental abruption.
  > In particular, where uterine hypertonus is associated with abnormal fetal heart rate patterns (hyperstimulation), acute tocolysis has been shown to be useful. For more information refer to ‘tocolysis for uterine hypercontractility’ in the A to Z index at www.sahealth.sa.gov.au/perinatal.
> In clinical situations where the fetal heart rate pattern is considered abnormal, immediate management includes:
  > Identification of any reversible cause of the abnormality and initiation of appropriate action (e.g. maternal repositioning, correction of maternal hypotension, rehydration with intravenous fluid, reduction or cessation of oxytocin and/or tocolysis for excessive uterine activity).
  > Initiation or maintenance of continuous EFM.
  > Consideration of further fetal evaluation or delivery if a significant abnormality persists.
  > Escalation of care if necessary to a more experienced practitioner.
The normal CTG is associated with a low probability of fetal compromise and has the following features:

- Baseline rate 110-160 bpm
- Baseline variability of 6-25 bpm
- Accelerations of 15 bpm for 15 seconds
- No decelerations

All other CTGs are by this definition are abnormal and require further evaluation along with the full clinical picture.

The following features are unlikely to be associated with fetal compromise when occurring in isolation:

- Baseline rate 100-109 bpm
- Absence of accelerations
- Early decelerations
- Variable decelerations without complicating features

The following features may be associated with significant fetal compromise and require further action. For further information, see “fetal compromise” below:

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

The following features are likely to be associated with significant fetal compromise and require immediate management, which may include urgent delivery:

- Prolonged bradycardia (<100 bpm for > 5 minutes)
- Absent baseline variability (< 3 bpm)
- Sinusoidal pattern
- Complicated variable decelerations with reduced or absent baseline variability
- Late decelerations with reduced or absent baseline variability
Figure 2.1 significance of FHR traces relative to pH

Adapted from Beard et al. by Murray in Allan. Obstetrics and Gynaecology Grand Rounds: The neurologically impaired infant. United Journal 2001; 3:15

> On the left side, Figure 2.1 demonstrates the percentage of fetal acidosis identified in the presence of CTG features indicating fetal compromise

> The percentage of normal pH in relation to CTGs that have markers for fetal compromise (on right side) reinforces the importance of interpreting CTGs in combination with the woman’s complete history

Storage of CTG tracings

> File all CTG tracings in the woman’s case record with the appropriate hospital report or archive, including details that link with the woman’s case record

> If notes are to be microfilmed, provision should be made for the storage of CTG traces. For example, short traces may need to be microfilmed whilst long traces may need to be stored in their original format in heat protected envelopes (not plastic sleeves). Consider electronic storage of traces. e.g. optical disc

> CTG recordings should be stored for the same period of time as medical records (33 years)

> CTGs from centrally monitored systems (e.g. Tracevue) may be initially stored on the hard disc of the server and subsequently archived to a permanent medium
Communication and consultation

> Women with confirmed abnormal FHR patterns should be referred to an Obstetrician

> Local facilities should establish clear communication channels that enable midwives / medical officers to inform or seek advice from an Obstetrician. This may include consultation with an Obstetrician at another facility if required

> Considerations should be given to improving the way CTG recordings are transmitted to obstetricians who are supervising labour from outside the hospital e.g. faxing the CTG to the location of the obstetrician OR where possible, scanning the CTG and emailing directly to their mobile phone if the obstetrician is outside the hospital (where a prior arrangement is in place)

> Details of the CTG transmitted to the Obstetrician must be documented in the woman’s case notes, including the date and time, and a description of the features of the CTG AND

> The medical officer / midwife must follow up by telephoning the Obstetrician within a short timeframe (within 10 minutes) of sending the CTG recording to confirm the CTG has been reviewed and receive advice on further management

Review of external CTGs

> The SA Perinatal Advice Line has an Obstetrician and Neonatologist rostered from a major public maternity unit available 24 hours for clinical advice. Refer to ‘Perinatal advice and emergency transport’ at www.sahealth.sa.gov.au/perinatal in the A to Z index for further information

> Medical officers from country hospitals may directly contact referral hospitals for a second opinion / review of CTG tracings if they detect abnormal features that may require a management plan

> The medical officer should first phone the referring hospital and ask to speak to the obstetric medical officer on-call

> The case in question should be discussed with the obstetric medical officer at the referral hospital

> When CTGs are faxed to a referral hospital for review by specialist staff, the fax should include the following:

> Indications for referral

> Clinical details

> Demographic details

> Contact details of the referring doctor

> Review should be by the on-call registrar (obstetric medical officer) in consultation with the obstetrician on-call

> If transfer is considered, the obstetric medical officer will discuss a management plan with the obstetrician on-call

> The referring medical officer will be notified via phone of the review and suggested management plan as soon as possible. If no communication has occurred within 30 minutes, the referring medical officer should contact the referral hospital and discuss with the on-call registrar (obstetric medical officer)
Case notes specific to the information and advice given by the obstetric medical officer on-call should be created so that a permanent record exists.

The referring medical officer must also document in the woman’s case notes, details of the CTG transmitted to the obstetric medical officer at the referring hospital, including the date and time, a description of the features of the CTG, name of the obstetric medical officer on-call they liaised with and management plan.

References


### Abbreviations

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<tr>
<td>ACOG</td>
<td>American College of Obstetricians and Gynaecologists</td>
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<tr>
<td>bpm</td>
<td>Beats per minute</td>
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<td>cm</td>
<td>Centimetre</td>
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<td>CTG</td>
<td>Cardiotocography</td>
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<td>EFM</td>
<td>External fetal monitoring</td>
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<td>FHR</td>
<td>Fetal heart rate</td>
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<td>NICE</td>
<td>National Institute for Clinical Excellence</td>
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<td>RANZCOG</td>
<td>Royal Australian and New Zealand College of Obstetricians and Gynaecologists</td>
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<tr>
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<td>Royal College of Obstetricians and Gynaecologists</td>
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