South Australian Perinatal Practice Guidelines

Cardiotography

Cardiotocography

- An electronic method of simultaneously recording fetal heart rate (FHR), fetal movements and uterine contractions to identify the probability of fetal hypoxia (Pattison and McCowan 2006)
- Continuous CTG monitoring reduces the incidence of neonatal convulsions; however neonatal convulsions alone are poor predictors of adverse long-term neonatal outcome (MacLennan 1999)
- Perinatal death, cerebral palsy and neurodevelopmental disability are important adverse outcomes of fetal hypoxia (MacLennan 1999)
- 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 (Parer et al. 2006)
- The percentage of FHR patterns with features of fetal compromise that can be attributed to fetal acidosis is presented in figure 2.1 (Beard in Murray 2001)
- When fetal scalp blood sampling is used in combination with CTG monitoring, both false positive and false negative prediction of poor fetal outcome using CTGs are reduced (Mires et al. 2001; RCOG 2001)
- 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 (Alfirevic et al. 2006)

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 (2006) 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
- Check that date and time settings on CTG tracings are regularly validated
- Label CTGs with the mother's name, date, time commenced and hospital record number
- Intrapartum events that may affect the FHR (e.g. starting or changing Syntocinon®) regimen, vaginal examination, obtaining fetal blood sample or insertion / siting an

ISBN number: UNKNOWN
Endorsed by: SA Maternal & Neonatal Clinical Network
Contact: South Australian Perinatal Practice Guidelines workgroup at: cywhs.perinatalprotocol@health.sa.gov.au

Government of South Australia
SA Health

epidural) should be noted contemporaneously both on the CTG and in the maternal case notes, including date, time and signature

- *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 (2002) 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
- Regular education and assessment of competency should be completed by all clinicians using and interpreting CTG's
- e.g. Successful completion of a recognised education package such as:
  - *EFM Master Tutor. A practical approach to the interpretation of CTG. Version 6.0 (Morris 2006).* Available from URL: http://www.response-education.com.au/
  - RANZCOG Online Fetal Surveillance Education Program (OFSEP). Available from URL: http://www.ranzcog.edu.au/fsep/index.shtml

CTG reporting

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 review
- The CTG should be interpreted in combination with the woman's complete history
- In the clinical setting the following description of FHR patterns are recommended

Baseline FHR:	Normal 110 – 160 bpm Bradycardia <110 bpm Tachycardia >160 bpm

Government of South Australia
SA Health

ISBN number: UNKNOWN
Endorsed by: SA Maternal & Neonatal Clinical Network
Contact: South Australian Perinatal Practice Guidelines workgroup at: cywhs.perinatalprotocol@health.sa.gov.au

The mean of the FHR when this is stable, excluding accelerations and decelerations.

The *baseline FHR* should be *determined over 5 to 10 minutes and expressed in bpm*

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

- Baseline variability:

Increased > 25 bpm

Normal 5 – 25 bpm
Reduced 3 – 5 bpm
Absent < 3 bpm

Baseline variability: minor baseline FHR fluctuations measured by gauging the difference in bpm between the highest peak and lowest trough of fluctuation over a 1 minute period

- Accelerations:

Transient increases in FHR of 15 bpm or more above the baseline and lasting seconds or more

The significance of no accelerations on an otherwise normal FHR recording is not known

- Decelerations

Transient episodes of slowing of FHR below the baseline of more than 15 bpm lasting at least 15 seconds, conforming to one of the patterns described as Early, Variable, Complicated Variable, Prolonged or Late

Variable decelerations

Intermittent periodic slowing of FHR with rapid onset and recovery. The time relationship with contractions is variable but they most commonly occur in association with contractions *Vagal* in origin, medical experts suggest variable decelerations result from stimuli

Government of South Australia
SA Health

ISBN number: UNKNOWN
Endorsed by: SA Maternal & Neonatal Clinical Network
Contact: South Australian Perinatal Practice Guidelines workgroup at: cywhs.perinatalprotocol@health.sa.gov.au

	such as *cord or head compression (Morris* 2002)
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) > Loss of pre and post deceleration shouldering (abrupt brief increases in FHR baseline) > Presence of post deceleration smooth overshoots (temporary increase in FHR above baseline)
Prolonged decelerations	Decrease of FHR below the baseline of more than 15 bpm for longer than 90 seconds but less than 5 minutes
Late decelerations	Uniform, repetitive, decreasing of FHR with, usually, slow onset mid to end of the contraction, 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 < 5 bpm, the definition would include decelerations < 15 bpm
Early decelerations	Uniform, repetitive, periodic decreases of FHR with onset early in the contraction and return to baseline at the end of the contraction

NB: The definitions published by RANZCOG (2006 p. 25) 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

Government of South Australia
SA Health

ISBN number: UNKNOWN
Endorsed by: SA Maternal & Neonatal Clinical Network
Contact: South Australian Perinatal Practice Guidelines workgroup at: cywhs.perinatalprotocol@health.sa.gov.au

- 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 hypercontractility (either hypertonus or tachsystole), maternal hypotension, cord compression and placental abruption
- Immediate management of fetal compromise includes:
    - Identification of any reversible cause of the abnormality and initiation of appropriate action (e.g. correction of maternal hypotension, 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
    - Maternal repositioning may alleviate maternal hypotension or cord compression and improve fetal condition
- The normal CTG is associated with a low probability of fetal compromise and has the following features
    - Baseline rate 110 – 160
    - Baseline variability of 5 – 25 bpm
    - Accelerations 15 bpm for 15 seconds
    - No decelerations
- All other CTGs by this definition are abnormal and require further evaluation taking into account the full clinical picture
- The following features are unlikely to be associated with significant fetal compromise when occurring in isolation:
    - Baseline rate 100 – 109
    - Absence of accelerations
    - Early decelerations (see figure 2.1)
    - Variable decelerations without complicating features (see figure 2.1)
- The following features may be associated with significant fetal compromise and require further action:
    - Fetal tachycardia (see figure 2.1)
    - Reduced baseline variability (see figure 2.1)
    - Complicated variable decelerations
    - Late decelerations
    - Prolonged decelerations
- The following features are very 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
    - Sinusoidal pattern
    - Complicated variable decelerations with reduced baseline variability
    - Late decelerations with reduced variability

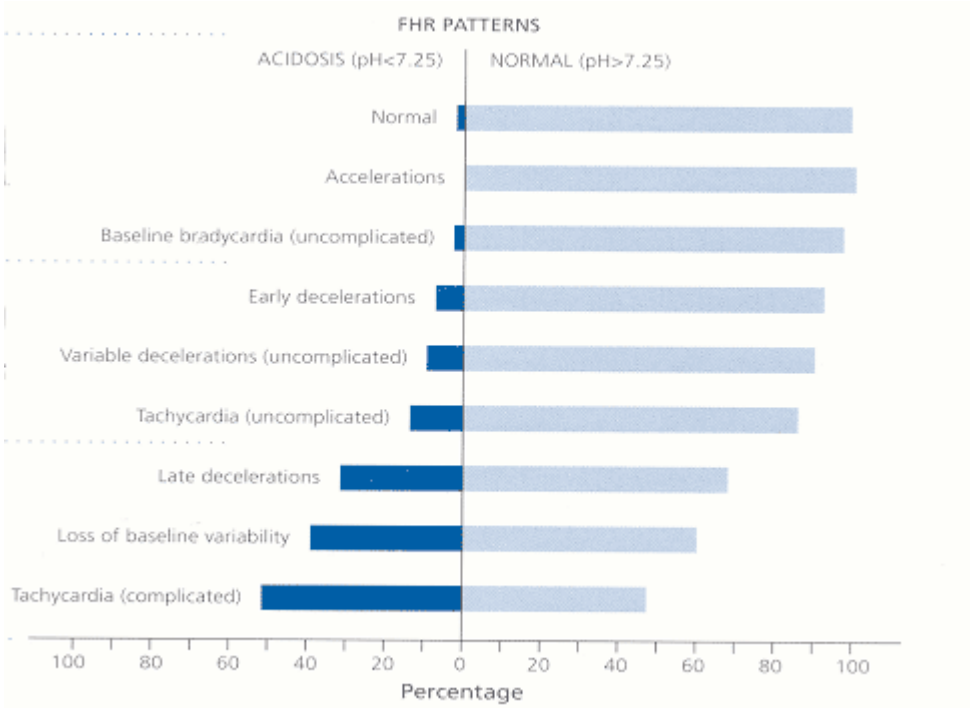
Government of South Australia
SA Health

ISBN number: UNKNOWN
Endorsed by: SA Maternal & Neonatal Clinical Network
Contact: South Australian Perinatal Practice Guidelines workgroup at: cywhs.perinatalprotocol@health.sa.gov.au

- Complicated tachycardia

NB: The good practice notes on fetal compromise published by RANZCOG (2006 p. 9) have been used as the basis of these recommendations

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)

ISBN number: UNKNOWN
Endorsed by: SA Maternal & Neonatal Clinical Network
Contact: South Australian Perinatal Practice Guidelines workgroup at: cywhs.perinatalprotocol@health.sa.gov.au

- 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

Review of external CTGs

Medical officers from country hospitals may contact referral hospitals for a second opinion / review of CTG tracings if they suspect features of fetal compromise 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 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
- Case notes specific to the information and advice given by the medical officer should be created so that a permanent record exists

Government of South Australia
SA Health

ISBN number: UNKNOWN
Endorsed by: SA Maternal & Neonatal Clinical Network
Contact: South Australian Perinatal Practice Guidelines workgroup at:
cywhs.perinatalprotocol@health.sa.gov.au

References

1. Pattison N and McCowan L. Cardiotocography for antepartum fetal assessment (Cochrane Review). In: *The Cochrane Library,* Issue 3, 2006. Oxford: Update Software (Level I). Available at URL: http://www.mrw.interscience.wiley.com/cochrane/clsysrev/articles/CD001068/frame.html
2. MacLennan A. A template for defining a causal relation between acute intrapartum events and cerebral palsy: international consensus statement. BMJ 1999; 319: 1054-59.
3. Beard RW, Filshie GM, Knight CA, Roberts GM. The significance of the changes in the continuous fetal heart rate in the first stage of labour. J Obstet Gynaecol Br Commonw 1971; 78(10):865-81 (Level III-3).
4. Murray H. In: T. Allen. Obstetrics and Gynaecology Grand Rounds: The neurologically impaired infant. United Journal 2001; 3:14-16.
5. Parer JT, King T, Flanders S, Fox M, Kilpatrick SJ. Fetal academia and electronic fetal heart rate patterns: Is there evidence of an association? J Maternal-Fetal and Neonatal Med 2006; 19: 289-294.
6. Mires G, Williams F, Howie P. Randomised controlled trial of cardiotocography versus Doppler auscultation of fetal heart at admission in labour in low risk obstetric population. BMJ 2001; 322:1457-62. (Level I).
7. Royal College of Obstetricians and Gynaecologists (RCOG). The Use of Electronic Fetal Monitoring, Evidence-based Clinical Guideline Number 8. RCOG Clinical Effectiveness Support Unit, London: RCOG Press; 2001. Available at URL: http://www.rcog.org.uk
8. Alfirevic Z, Devane D, Gyte GML. Continuous cardiotocography (CTG) as a form of electronic fetal monitoring (EFM) for fetal assessment during labour. *Cochrane Database of Systematic Reviews* 2006, Issue 3. Art. No.: CD006066. DOI: 10.1002/14651858.CD006066 (Level I). Available at URL: http://www.mrw.interscience.wiley.com/cochrane/clsysrev/articles/CD006066/frame.html
9. The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG): Intrapartum Fetal Surveillance. Clinical Guidelines – Second Edition; 2006 (Level IV). Available at URL: http://www.ranzcog.edu.au
10. Morris D. EFM Master Tutor. A practical approach to the interpretation of CTG; 2006. Version 6.0. Available at URL: http://www.response-education.com.au/

Government of South Australia
SA Health

ISBN number: UNKNOWN
Endorsed by: SA Maternal & Neonatal Clinical Network
Contact: South Australian Perinatal Practice Guidelines workgroup at: cywhs.perinatalprotocol@health.sa.gov.au

Abbreviations

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

Version control and change history

PDS reference: OCE use only

Version	Date from	Date to	Amendment
1.0	20 April 04	03 Oct 06	Original version
2.0	03 Oct 06	23 Nov 10	Reviewed
3.0	23 Nov 10	current	

Government of South Australia
SA Health

ISBN number: UNKNOWN
Endorsed by: SA Maternal & Neonatal Clinical Network
Contact: South Australian Perinatal Practice Guidelines workgroup at:
cywhs.perinatalprotocol@health.sa.gov.au