FETAL HEART MONITORING

DEFINITION

The aim of fetal heart monitoring is to prevent adverse perinatal outcomes by identifying fetuses with metabolic acidosis / cerebral hypoxia at a point when the process is reversible by appropriate intervention.

Fetal heart rate monitoring can be performed by regular auscultation with a fetoscope, Pinard or hand-held Doppler (Intermittent Auscultation (IA)) or by continuous electronic fetal monitoring (EFM) by cardiotocograph (CTG)

ANTENATAL ELECTRONIC FETAL MONITORING

There is no evidence to support the routine antenatal use of EFM for fetal assessment in women with an uncomplicated pregnancy.¹

For women at increased risk of pregnancy complications current evidence has not identified differences in outcomes with the use of EFM during pregnancy, but more studies are needed.¹

There is no evidence to support EFM prior to 28 weeks gestation. Any decision to perform this level of monitoring at earlier gestation should be discussed with the Obstetric consultant and justification documented.

Any decision to perform EFM to assess fetal wellbeing between 28-37 weeks of gestation will be based on clinical indication and should be discussed with the Obstetric team.

EFM is not appropriate in any case of suspected intrauterine fetal demise, ultrasound scan is recommended as the initial investigation.

Interpretation of antenatal EFM is the same as intrapartum with the added considerations of:

- An isolated small variable deceleration is not usually significant on an antenatal CTG if the remainder of the CTG is normal. However, all decelerations on an antenatal CTG require obstetric review.
- Most decreased baseline variability is due to normal fetal sleep. If decreased variability continues for more than 40 minutes, in spite of manoeuvres to encourage fetal movements, obstetric review is required.
- During electronic fetal monitoring it is recommended the hand held patient event marker is used by the woman to clearly determine fetal movements. The automatic fetal
movement detector (FMD or Actogram) is not a reliable method for detecting fetal movement as it can be triggered by low velocity movement.

Use of antenatal EFM in a primary unit

Primary units offering antenatal EFM for rural women, provide this service for the following:

- Reduced fetal movements
- As indicated by the obstetric team following consultation with Christchurch Women’s Maternity Outpatient Department. Any concerns please fax to Day Assessment Unit (DAU) at 03 3644271.

INTERMITTENT INDICATIONS FOR EFM

The basic principle of EFM is to detect developing fetal hypoxia / acidaemia with the aim of preventing cell damage or cell death. It should not be used in isolation when assessing the clinical presentation. The interpretation of a fetal heart rate (FHR) trace should take into consideration:

- the stage of labour
- progress in labour
- maternal and fetal condition
- prior or additional risk factors.

EFM should not be used for women experiencing uncomplicated labour as it increases maternal intervention rates without improvement in perinatal outcome. The RANZCOG Intrapartum fetal surveillance guidelines (2009) indicate that there is insufficient evidence for routine admission CTGs and that this is left to the discretion of individual hospitals. The CDHB do not support admission CTGs for women without risk factors, these women should be monitored by intermittent auscultation (IA).

Continuous EFM should be considered and discussed when risk factors for intrapartum hypoxia are present. Women should be informed that continuous EFM will restrict their mobility and consideration should be given to maternal preference and priorities. There is a lack of high-level evidence that the use of continuous EFM improves perinatal outcomes in many instances.

Use of intrapartum EFM in a primary unit

- This is not recommended or supported.
(Refer to algorithm in Appendix 1 for suitability for intermittent auscultation)

Intermittent auscultation is a listening and counting method and the fetal heart rate should be documented as a single number (like documentation of maternal pulse rate) instead of a range. The terminology used around IA is different from that used for CTG’s as there is not a printed trace to interpret\(^3\).

When using the ultrasound sensor/transducer for 1A do not use the print function on the CTG.

Initial assessment to include \(^3\):

- **Risk factors** for increased fetal compromise (refer to Appendix 1)
- **Abdominal palpation** to assess lie, presentation, position, descent, growth and liquor volume, including plotting fundal height on a customised G.R.O.W. chart
- Usual pattern of **fetal movements**
- Assessment of **uterine activity** – frequency, length, strength, resting tone, uterine irritability and tenderness
- **Average fetal heart rate** – determined by listening between contractions, in the absence of fetal movements, and counting for 30-60 seconds on several occasions.
- **Maternal pulse** – recorded to distinguish from fetal heart
- **Fetal heart increases** – determined by listening during a fetal movement
- **Fetal heart decreases** – these should not be audible when auscultation is performed immediately after a contraction for 60 seconds

Ongoing monitoring using IA:

**First stage of labour:**

- **Frequency** every 15-30 minutes
- **Timing** from the end of a contraction
- **Duration** count for 30-60 seconds

**Second stage of labour:**

- **Frequency** at least every 5 minutes or after each contraction
- **Timing** from the end of a contraction
- **Duration** count for 30-60 seconds
IA interpretation:

**Normal findings:**
- Average fetal heart rate between 110-160 bpm
- Fetal heart increases above the average
- No fetal heart decreases below the average
- Regular rhythm

**Abnormal findings:**
- Tachycardia (> 160 bpm)
- Bradycardia (< 110 bpm)
- Gradual or abrupt decreases in fetal heart
- Changes to rhythm (irregular)

**CONTINUOUS EFM**

A number of antenatal and intrapartum risk factors have been shown to be associated with adverse perinatal outcomes (see algorithm Appendix 1). In the presence of any of these risk factors, continuous EFM should be recommended.

Where continuous EFM is required for the substantial part of labour, and if the EFM to date is considered normal, monitoring may be interrupted for short periods of up to 15 minutes to allow for personal care (e.g. toilet or shower). Such interruptions should be infrequent and not occur following any intervention that might be expected to alter the fetal heart rate (e.g. medication administration, rupture of membranes). The RANZCOG Intrapartum fetal surveillance guidelines (2009) suggest EFM may be used continuously or intermittently. The CDHB do not support intermittent EFM.

Intrapartum fetal surveillance and its interpretation is a complex task which requires a sound understanding of fetal physiological responses to hypoxia, good pattern recognition skills and the ability to integrate this knowledge with each clinical situation. Health professionals involved in intrapartum care have a responsibility to access regular training in intrapartum fetal surveillance (see below for training recommendations). The summary of fetal heart rate patterns provided below is to be used in addition to, rather than instead of, an understanding of fundamental physiology.

**Normal CTG**

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 5-25 bpm
- Accelerations 15 bpm for 15 seconds
- No decelerations

**Abnormal CTG**

All other CTGs are by this definition abnormal and require further evaluation taking into account the full clinical picture.
The following features are *unlikely* to be associated with significant 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 including consultation*:

- Fetal tachycardia > 160 bpm
- Reduced baseline variability 3-5 bpm
- Complicated variable decelerations
- Late decelerations
- Prolonged decelerations

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

- Prolonged bradycardia (< 100 bpm for > 5 mins)
- Absent baseline variability
- Sinusoidal pattern
- Complicated variable deceleration with reduced baseline variability
- Late decelerations with reduced baseline variability

**CORDLESS FETAL TRANSDUCERS**

EFM can be performed using cordless transducers via radio wave telemetry giving women freedom of movement while being monitored. In the event of technical issues with the wireless signal reception, standard wired monitoring should be resumed.

The following requirements should be met prior to making the decision for cordless monitoring:

- Health professionals using this equipment must be familiar with instructions for use (DVD and booklet available from Birthing Suite Clinical Co-ordinators or Midwifery Educators)
- Use of cordless monitoring will generally be most appropriate for women birthing after a caesarean section and will be decided on a case by case basis as discussed with birthing suite clinical co-ordinator or obstetric team
- A minimum period of standard wired EFM is required to confirm fetal well being before commencement of cordless EFM, including maternal pulse oximetry, to ensure accurate cordless monitoring
• If a woman is mobilising during EFM, the chance of losing the signal or detecting the maternal heart rate is higher than for standard wired EFM, and requires extra vigilance from health professionals around regular checking of maternal heart rate and position of transducers
• Cordless transducers may be used while woman is in shower, but in order to prolong lifespan of this equipment, please do not use in birthing pools.
• During cordless EFM the woman will need to stay within range of the base unit i.e. in the same corridor as her room
• Responsibility for the transducers will remain with the operator from the time of sign out until they are returned and signed back in. Each of the three required transducers for each woman costs in the order of $3700 and any loss or damage will remain the responsibility of the midwife who has signed the equipment out.

**MANAGEMENT OF ABNORMAL FETAL HEART RATE**

In clinical situations where the fetal heart rate pattern is considered abnormal, whether using IA or continuous EFM, correct action includes:

• Checking maternal pulse
• Checking positioning of CTG transducer
• Maternal position change to increase utero-placental perfusion and/or alleviate cord compression
• Continuing or commencing continuous EFM
• Identification of any reversible cause of the abnormality and initiation of appropriate action (e.g. correction of maternal hypotension, cessation of oxytocin infusion* and/or acute tocolysis for excessive uterine activity)
• Consideration of fetal blood sampling

*Note: In certain circumstances, oxytocin infusion may be reduced rather than discontinued, in order to maintain dose sufficient for continuing augmentation of labour but without overstimulation. If CTG is abnormal but unlikely to be associated with fetal compromise, the trace must be reviewed by the obstetric team prior to decision is made on continuing dose of oxytocin for augmentation.

**FETAL BLOOD SAMPLING**

The increased intervention rate associated with EFM can be reduced with the use of fetal blood sampling (FBS)³.

**Fetal blood lactate sampling is easier to perform as it requires a smaller sample size. In addition to testing fetal blood lactate** it is recommended that pH is tested if sufficient blood sample is available. Lactate level gives a more direct measure of metabolic acidosis
than pH, as it measures a metabolite of anaerobic metabolism. The following are recommended actions according to lactate level and pH level\(^9\).

<table>
<thead>
<tr>
<th>LACTATE</th>
<th>Ph</th>
<th>CLASSIFICATION</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 4.1</td>
<td>≥ 7.25</td>
<td>Normal</td>
<td>Repeat FBS only required if continued concerns about fetal wellbeing (or if CTG does not return to normal)</td>
</tr>
<tr>
<td>≥ 4.1-4.7</td>
<td>&gt;7.21-7.24</td>
<td>Borderline</td>
<td>Repeat FBS 20-30 minutes</td>
</tr>
<tr>
<td>&gt;4.7</td>
<td>7.01-7.20</td>
<td>Indicative of fetal acidaemia</td>
<td>Delivery indicated by Category 2 caesarean section unless assisted vaginal birth possible or spontaneous vaginal birth imminent.</td>
</tr>
<tr>
<td>≥ 5.8</td>
<td>&lt; 7.0</td>
<td>Abnormal</td>
<td>Requires urgent assisted vaginal delivery if possible or a category 1 caesarean section.</td>
</tr>
</tbody>
</table>

As an adjunct to CTG monitoring in the active phase of labour, fetal blood sampling (FBS) for scalp pH and/or lactate should be considered in all circumstances where the CTG is non-reassuring.

**Indications to perform FBS include:**

- Persistent variable or late decelerations
- Unexplained decrease in variability
- Unexplained tachycardia
- Sinusoidal pattern
- Prior to trial of assisted delivery where the CTG is suspicious or pathological (see comments below regarding fetal blood sampling at full dilatation).

Caution with FBS should be exercised with:

- Maternal Pyrexia
- Evidence of maternal sepsis
- Full dilatation

In the presence of infection fetal condition can change rapidly. Fetal blood sampling may be of less value in the presence of pyrexia, as it assesses hypoxia / acidaemia and not sepsis. Therefore the results of fetal blood sampling, if reassuring, should be interpreted with caution.

In general it is reasonable to perform fetal blood sampling in the *passive* phase of second stage. In the *active* phase of the second stage maternal lactate rises by 2mmol/l for every 30 minutes of active pushing\(^5\). The fetal lactate rises correspondingly, and may be difficult to interpret. FBS may be appropriate before a “trial” of instrumental delivery, but if delivery is assured at a low station with OA presentation, then proceeding direct to assisted delivery without FBS may be expedient.
If 2 FBS results, obtained at the same time (within 30 minutes) have different classifications, (one is normal, one is abnormal) a third sample must be obtained. If this is not possible, then the highest value lactate should be actioned.

Contra-indications to FBS:

- Clear evidence of serious fetal compromise e.g. prolonged fetal bradycardia where urgent birth is required
- Significant fetal compromise in second stage of labour where assisted vaginal birth is appropriate
- Known maternal infection e.g. HIV, hepatitis B & C viruses, active herpes simplex virus or evidence of intrauterine sepsis. Group B Streptococcus carrier status does not preclude FBS
- Prematurity < 34 weeks
- Face or uncertain presentation
- Bleeding disorder such as suspected haemophilia or known maternal autoimmune thrombocytopenia.

The threshold for FBS should be reduced in the presence of other risk factors such as meconium, known IUGR or oligohydramnios. Scalp pH results should be interpreted taking into account any prior pH measurement, the rate of progress in labour and any other risk factors.

After a normal FBS result, sampling should be repeated at an interval of 40 to 60 minutes if the CTG remains non-reassuring or sooner if there are new abnormalities.

After a borderline FBS result, sampling should be repeated at an interval of 20 to 30 minutes if the CTG remains non-reassuring or sooner if there are new abnormalities.

If the CTG remains unchanged and the FBS result is unchanged at the second test, a further sample may be deferred unless additional abnormalities develop on the trace.

Where FBS sampling is considered necessary for a third separate occasion, a consultant/specialist obstetric opinion should be sought prior.

Following any labour where FBS has been performed, paired cord samples should be taken at birth to confirm acid-base status of the baby.

**DOCUMENTATION**

Both IA and continuous EFM require careful documentation. All staff asked to review a CTG must record their findings.

When using IA, the fetal heart rate is documented as a single number i.e. 136bpm and not as a range of numbers. The timing and duration are documented as well as the equipment used to listen to the fetal heart.
Use of the partogram is recommended during EFM and it may be useful during IA as it may provide visual clues to changes in the fetal heart rate such as a rising baseline.

**When commencing a CTG always:**

- Attach the woman’s identification label to the CTG paper.
- Check the time and date stamp and paper speed and sign as correct on CTG paper.
- Document in the clinical record the time and date of commencement of CTG.
- Document the maternal pulse on the CTG paper.

**While CTG is in progress:**

- Record significant events on the CTG paper e.g. vaginal examinations, insertion of epidural, episodes of vomiting or hypotension, fetal blood sampling
- Document maternal pulse on the CTG paper if there is a break in recording or if there is a sudden change in baseline rate. Use continuous maternal pulse rate monitoring where available with CTG.
- Ensure that any member of staff who is asked to provide an opinion signs the trace and documents in the woman’s clinical record the plan of care along with the date, time and signature.
- A documented systematic assessment should be undertaken every hour or as required.
- Where there is a concern about fetal wellbeing all midwifery staff should complete the CTG sticker tool to assess the CTG features prior to requesting a review by the senior midwife, preferably in the first instance, or medical staff.
- A CTG sticker should be used by medical and midwifery staff when documenting in the clinical record:

```
| CARDIOTOCOGRAPH (CTG) |          |          |          |          |"
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Date:</td>
<td>Time:</td>
<td>Maternal Pulse:</td>
<td>Distress:</td>
<td>Fetal movements:</td>
</tr>
<tr>
<td>Determination/Rate:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contractions:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline Rate:</td>
<td>110-160</td>
<td>130-160</td>
<td>&gt;160</td>
<td>&lt;100 bpm for &gt;6 mins</td>
</tr>
<tr>
<td>Variability:</td>
<td>5-25 bpm</td>
<td>Reduced</td>
<td>(3-5 bpm)</td>
<td>Absent</td>
</tr>
<tr>
<td>Accelerations:</td>
<td>Present</td>
<td>Absent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decelerations:</td>
<td>1. None</td>
<td>1. Early</td>
<td>3. Variable without</td>
<td>4. Late</td>
</tr>
<tr>
<td>Overall assessment:</td>
<td>Low</td>
<td>Late</td>
<td>without complications</td>
<td></td>
</tr>
<tr>
<td>Action:</td>
<td>No action</td>
<td>Current reversible causes</td>
<td>Current reversible causes</td>
<td>Referred to senior colleague</td>
</tr>
<tr>
<td>Plan:</td>
<td>(e.g. OB, transfer, continue CTG)</td>
<td></td>
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</tbody>
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**NOTE:**

* CTG sticker should be used in conjunction with this guideline and training programme as described below, (e.g. indications for CTG listed in Appendix 1, action for correction of reversible causes summarised above in “Management of Abnormal Fetal Heart Rate”)
At completion of CTG:

- Following birth, sign the CTG paper and note the date, time and mode of birth.
- Store CTG paper securely with the woman’s clinical record at the end of the monitoring process.
- Multiple CTG’s need to be numbered in chronological order.

EDUCATION AND TRAINING

It is acknowledged that these guidelines need to be complemented by a comprehensive and ongoing education and training programme. CDHB have provided the K2 online fetal monitoring programme since May 2007 and, from 2012 have also provided access to training as part of the RANZCOG fetal surveillance education programme (FSEP). The current CDHB version of the K2 fetal monitoring programme is in line with RANZCOG fetal monitoring recommendations (from January 2013).

Fetal monitoring training is mandatory for all CDHB health professionals undertaking any aspect of EFM, and is a strong recommendation for all self-employed Lead Maternity Carers (LMC’s).

The training consists of:

- Completion of K2 fetal monitoring package or RANZCOG online FSEP programme (contact O&G education supervisors or midwifery educators for most appropriate option)
- RANZCOG FSEP Full day
- RANZCOG FSEP Half day refresher

The cycle is repeated every 3 years, in any order but with the full day workshop being completed prior to the half day refresher. A CDHB staff member with a score below 55% in their FSEP assessment requires an individual learning/ supervision plan developed with their line manager and/or educator training supervisor within 3 months and re-assessment within 6 months.

All midwives performing IA must have up-to-date knowledge and skills to competently perform this method of fetal heart monitoring (provided as part of the Midwifery Technical Skills Workshop).
REFERENCES


APPENDIX 1

Intrapartum Fetal Heart Monitoring
Clinical Guidelines - Algorithm

ASK THE QUESTION!
Are there any identifiable antenatal risk factors?

NO

Normal

Intermittent auscultation using a hand held Doppler

EFM for 30 minutes

Normal

Abnormal

ASK THE QUESTION!
Has an intrapartum risk factor developed?

NO

YES

Antenatal risk factors

- Increased risk of fetal compromise, including:
  - Abnormal antenatal CTG
  - Abnormal Doppler umbilical artery velocimetry
  - Suspected or confirmed intrauterine growth restriction
  - Oligohydramnios or polyhydramnios
  - Prolonged pregnancy > 42 weeks
  - Multiple pregnancy
  - Breech presentation
  - Antepartum haemorrhage
  - Known fetal abnormality which requires monitoring
  - Prior uterine scar/caesarean section
  - Pre-eclampsia
  - Diabetes (on insulin or poorly controlled or with fetal macrosomia)
  - Other current or previous obstetric or medical conditions which constitute a significant risk of fetal compromise

Abnormal

Continuous EFM

Intrapartum risk factors

- Induction of labour with prostaglandin/ oxytocin
- Abnormal auscultation or CTG
- Oxytocin augmentation
- Epidural analgesia
- Abnormal vaginal bleeding in labour
- Maternal pyrexia 38°C
- Meconium or blood stained liquor
- Absent liquor following amniocentesis
- For nulliparous women: active second stage of labour > 2 hours when birth is not imminent
- For multiparous women: active second stage of labour > 1 hour when birth is not imminent
- Pre-term labour less than 37 completed weeks
### DESCRIPTIONS OF FETAL HEART RATE (FHR) PATTERNS

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
</table>
| **Baseline fetal heart rate:** | The mean level of the FHR when this is stable, excluding accelerations and decelerations. It is determined over a time period of 5 or 10 minutes and expressed in bpm. Preterm foetuses tend to have values towards the upper end of this range. A trend to progressive rise in baseline is important as well as the absolute values.  
Normal Baseline:  
Bradycardia:  
Tachycardia:  
FHR 110-160 bpm  
<110 bpm  
>160 bpm |
| **Baseline variability**    | The minor fluctuations in baseline FHR. It is assessed by estimating the difference in beats per minute between highest peak and lowest trough of fluctuation in one minute segments of the trace.  
Normal baseline variability:  
Reduced baseline variability:  
Absent baseline variability:  
Increased baseline variability:  
Sinusoidal:  
5-25 bpm between contractions  
3-5 bpm  
<3 bpm  
>25 bpm  
A regular oscillation of baseline FHR resembling a sine wave. This smooth, undulating pattern is persistent, has 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. |
| **Accelerations**           | Transient increases in FHR of 15 bpm or more above the baseline and lasting 15 seconds. Accelerations in preterm fetus may be of lesser amplitude and shorter duration. The significance of no accelerations on an otherwise normal CTG is unclear. |
### DESCRIPTIONS OF FETAL HEART RATE (FHR) PATTERNS CONT...

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Decelerations</strong></td>
<td>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:</td>
</tr>
<tr>
<td>Early decelerations:</td>
<td>Uniform, repetitive decrease in FHR with rapid onset early in the contraction and slow return to baseline by the end of the contraction.</td>
</tr>
<tr>
<td>Variable decelerations:</td>
<td>Repetitive or intermittent decreasing of FHR with rapid onset to recovery. Time relationships with contraction cycle may be variable but most commonly occur simultaneously with contractions.</td>
</tr>
<tr>
<td>Atypical/complicated</td>
<td>The following additional features increase the likelihood of fetal hypoxia.</td>
</tr>
<tr>
<td>variable decelerations:</td>
<td>● Rising baseline rate or fetal tachycardia</td>
</tr>
<tr>
<td></td>
<td>● Reducing baseline variability</td>
</tr>
<tr>
<td></td>
<td>● Slow return to baseline FHR after the end of the contraction.</td>
</tr>
<tr>
<td></td>
<td>● Large amplitude (by 60 bpm or to 60 bpm) and/or long duration (60 secs).</td>
</tr>
<tr>
<td></td>
<td>● Loss of pre and post deceleration shouldering (abrupt brief increases in FHR baseline)</td>
</tr>
<tr>
<td></td>
<td>● Presence of post deceleration smooth overshoots (temporary increase in FHR above baseline)</td>
</tr>
<tr>
<td>Prolonged decelerations:</td>
<td>Decrease of FHR below the baseline of more than 15 bpm for longer than 90 seconds but less than 5 minutes.</td>
</tr>
<tr>
<td>Late decelerations:</td>
<td>Uniform, repetitive decreasing of FHR with, usually, slow onset mid to end of the contraction and more than 20 seconds after the peak of the contraction and ending after the contraction. In the presence of non-accelerative trace with baseline variability &lt;5 bpm, the definition would include decelerations &lt;15 bpm.</td>
</tr>
</tbody>
</table>