South Australian Perinatal Practice Guidelines

Assessment of Fetal Acid Base Balance

Introduction

- Intrapartum fetal surveillance frequently involves the use of a cardiotocograph (CTG).
- The CTG is 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). In nearly half of all CTG tracings, an abnormal fetal heart rate is observed, but only a small proportion of these fetuses are actually hypoxic (Wiberg-Itzel et al. 2008)
    - The use of fetal blood sampling (either pH or lactate) in such cases may reduce intervention rates (e.g. caesarean section) associated with the use of cardiotocography alone (RANZCOG 2006)
- If fetal blood sampling is performed, the scalp pH or lactate result should be interpreted taking into account any previous measurement, the rate of progress in labour and other clinical circumstances (RANZCOG 2006)
- Metabolic acidaemia occurs in 2 % of all births. Over 90 % of these infants will not develop cerebral palsy (RCOG 2001)

Fetal scalp pH and lactate levels

- A randomised, controlled multicentre trial showed pH analysis and lactate analysis of fetal blood have comparable results in the management of intrapartum fetal compromise (Wiberg-Itzel et al. 2008)
- The average fetal scalp blood pH is 7.33 in normal labour
    - pH > 7.25 and lactate < 4.1 mmol / L is considered normal
    - pH < 7.25 and > 7.20 and lactate ≥ 4.1 to 4.7 mmol / L are borderline
    - pH < 7.20 and lactate > 4.7 mmol / L indicative of fetal acidemia requiring intervention
    - pH < 7.00, or base deficit ≥ 12 mmol / L and lactate > 5.8 mmol / L indicates pathologic fetal acidaemia (Andres et al. 1999; Freeman et al. 2003)
- The mean umbilical artery pH after uncomplicated pregnancy and labour ranges from 7.25 to 7.31 in different studies (Vandenbussche et al. 1999)

Indications

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- Factors including clinical history, parity, evolution of the FHR pattern, stage and rate of progress in labour influence the decision for fetal blood sampling (FBS)
- Fetal scalp blood estimation may be of value in the following circumstances:
    - Bradycardia
    - Complicated tachycardia
    - Recurrent decelerations
    - Prolonged episodes of bradycardia or undefined deceleration patterns
    - Prolonged loss of variability which does not spontaneously correct with fetal stimulation.
    - Miscellaneous e.g. non specific concerns about fetal wellbeing

Contraindications

- Maternal Hepatitis B, C and HIV
- Suspicion of bleeding tendencies in the fetus
- Clear evidence on EFM of serious, sustained fetal compromise
- Face presentation
- FBS is not generally recommended in pregnancies at less than 34^{+6} weeks of gestation because delivery may be inappropriately delayed in a small “at risk” fetus that may sustain damage earlier than would be expected in a term fetus (RANZCOG 2006)

Management

- In tertiary centres, fetal blood sampling should be considered part of routine care for the management team when indicated, and a competency the resident medical officer or registrar should be able to fulfil

Procedure for fetal blood sampling

Position:

- The preferred maternal position is left-lateral position with hips well flexed and the lower leg extended. The upper leg should be flexed (held by an assistant or positioned in a stirrup) with the buttocks extending over the edge of the bed to allow the clinician to be positioned below the level of the maternal vagina
- If lithotomy position is used, ensure a lateral wedge is used to prevent aortocaval compression

Procedure:

- Attach the fetal scalp blade (depth of 2 mm) to an introducer
- Under direct vision, insert amnioscope with light source into the posterior fornix

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- The clinician obtaining the scalp sample should aim to angle the amnioscope downward below the horizontal plane
- Once past the anterior lip of the cervix, angle the cone anteriorly into the cervix to visualise the presenting part
- Clean the fetal scalp surface with chlorhexidine / alcohol-soaked gauze
- Apply sterile liquid paraffin to the fetal scalp (forms a non wettable surface and encourages beading of fetal scalp blood)
- Make a quick stab with the fetal scalp blade / introducer to achieve a clean incision on the fetal scalp
- As the fetal blood appears, insert the heparinised capillary tube to touch the drop of blood, and keeping the tube angled downward, the blood is allowed to flow by gravity
    - **FBS for pH:** Let the tube fill with at least 2 cm of blood (without air bubbles or liquor)
    - **FBS for lactate:** A minimum of 5 microlitres of blood is required (without air bubbles or liquor)
- Immediately pass the sample to an assistant for processing
- Obtain two samples
- Apply pressure with a swab to the fetal scalp over the next two contractions and observe to ensure the bleeding has stopped

Note: refer to individual midwifery standard for further information

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Results

Fetal blood sampling

Lactate < 4.1 mmol / L or pH ≥ 7.25:

- Repeat FBS if there is continuing concern about fetal wellbeing (or if cardiotocographic tracing does not return to normal)

Lactate 4.1- 4.7 mmol / L or pH 7.21 – 7.24:

- Notify obstetrician on call to consider mode of delivery if rapid fall since last sample, or repeat FBS within 30 minutes

Lactate > 4.7 mmol / L or pH ≤ 7.20:

- Delivery indicated
- Rapid deterioration in features of fetal compromise requires obstetric review of timing and mode of delivery
- Consider the woman's complete history (e.g. presence of meconium, progress, fetal scalp pH value) when assessing need for caesarean section (category 1)

Lactate of ≥ 5.8 mmol / L or pH < 7.00:

- Requires an urgent assisted vaginal delivery if possible or a category 1 caesarean section to be called

If FBS inappropriate or cannot be performed:

- Expedite delivery
- Notify anaesthetist and paediatrician
- Urgency of delivery should take into account the severity of fetal compromise and relevant maternal factors

No sample or one contaminated with liquor or inadequate volume sample obtained:

- Review indication for FBS and current CTG
- Consider need for delivery

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Categorisation of urgency for emergency caesarean section

- Categorisation of emergency Caesarean section facilitates communication and reduces misunderstanding between health care professionals (RCOG 2004).

Suggested categories include:

1. Immediate threat to the life of the woman or fetus (category 1)
2. Maternal or fetal compromise not immediately life-threatening (category 2)
3. No maternal or fetal compromise but needs early delivery (category 3)
4. Delivery time to suit woman or staff (category 4)

- In major tertiary centres where staff and theatre facilities are available, delivery within 30 minutes is a debated standard for category 1 emergency Caesarean sections
- A RCOG (2004) review of decision to delivery times found maternal and neonatal outcomes do not change for decision to delivery intervals of up to 75 minutes. However, delays to delivery of > 75 minutes were associated with poorer outcomes; the effect greater with pre-existing maternal or fetal compromise

Cord blood gases

- Fetal arterial and venous cord gases (pH and base excess) are not required for uncomplicated term spontaneous vaginal births
- Obtain fetal arterial and venous cord gases (pH and base excess) at time of birth where
  - Fetal scalp bloods have been taken
  - Operative vaginal delivery or caesarean section is required
  - Baby is less than 37^{+0} weeks of gestation
  - Multiple pregnancy
  - Breech vaginal birth
  - Baby's condition is poor at birth
  - Meconium stained liquor is present
- It is generally accepted that arterial and venous pH should differ by 0.03 to be sure that the artery has been sampled (Vandenbussche et al. 1999)

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Abbreviations

cm	Centimetre(s)
CTG	Cardiotocograph
EFM	External fetal monitoring
e.g.	For example
et al.	And others
FBS	Fetal blood sampling
FHR	Fetal heart rate
pH	A measure of the acidity or basicity of a solution, numerically equal to 7 for neutral solutions, increasing with increasing alkalinity
HIV	Human immunodeficiency virus
mmol/L	Millimoles per litre
mm	Millimetre(s)
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	18 Mar 04	23 Oct 07	Original version
2.0	23 Oct 07	22 Nov 11	Review
3.0	22 Nov 11	current	

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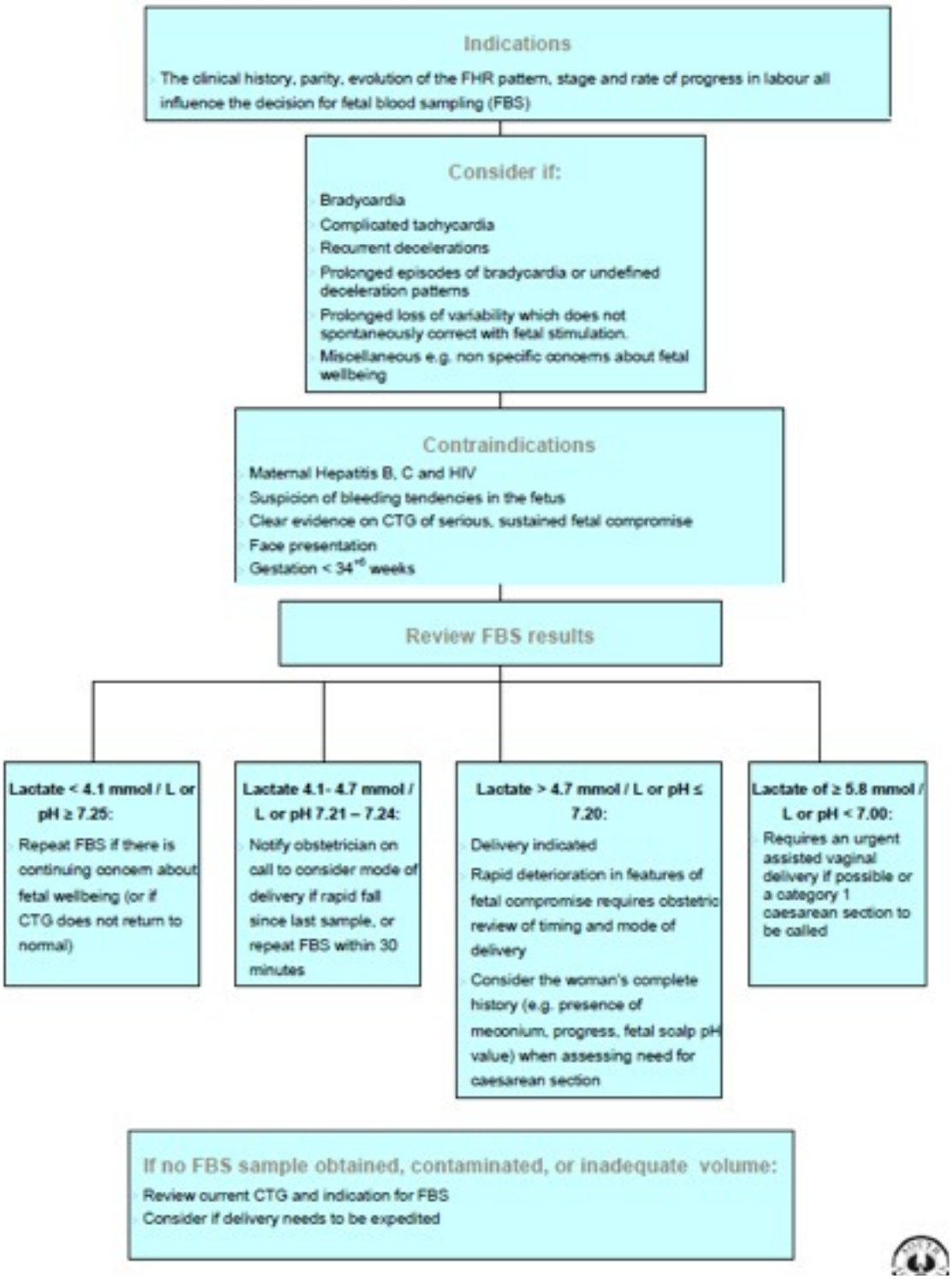
Fetal blood sampling flow chart



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