Intrapartum monitoring

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The following cardiotocograph (1cm/min) was performed in the active phase of the Labour in a primigravid woman at term. A) The risk of fetal acidaemia at this time is?  B) The risk of fetal acidaemia within 2 hours is?

The cardiotocograph (1cm/min) was performed in the first stage of labour in a primigravid woman at 40 weeks. The decelerations observed are best described as:-

Fetal Monitoring - History
- 17th century – LeGaust described 'fetal heart beats'
- 1818 – Mayor heard the fetal heart with ear to abdomen
- 1833 - Kennedy wrote first book on observations of the fetal heart rate
- 1903 – Seitz collated full descriptions of fetal heart rate decelerations and their causation

Fetal monitoring - history
- 1960 – Direct fetal electrode
- 1964 – Doppler detection of fetal heart rate
- EFM developed
  - Antenatal
  - Intrapartum
Intrapartum Fetal Monitoring

- Both auscultation and EFM were introduced before full evaluation of their clinical effectiveness
- What causes fetal cerebral damage/death?
- Is there evidence for a role for heart rate monitoring of the fetus in labour?

Fetal Monitoring

- What kills/damages the fetus
  - Oxygen?
  - pH?
  - Carbon dioxide?
  - Lactate?

Lactate

- Vasoconstriction in the brain
  - Increased glutamate
  - Increased prostaglandins
  - Increased hypoxanthine
    - Increased oxygen radical formation on reperfusion
  - Levels above 6.1 mmol/l
    - In the human results in prolonged neonatal morbidity
    - In the sheep results in white matter damage
  - Kjellmer, JAM

Perinatal Asphyxia

- Cerebral palsy
  - Vs
  - Hypoxic Ischaemic Encephalopathy

Hypoxic Ischaemic Encephalopathy

- By definition involves
  - Fetal metabolic acidaemia associated with depression at birth and multiorgan damage in the absence of infection and metabolic anomalies and fetal malformations
  - Grade 2,3 has up to 65% long-term neurological anomaly
  - Occurs in 4/1000 deliveries

Is Intrapartum Monitoring Any Good??

- Data comes from meta-analysis of studies of Intermittent Auscultation (IA)
  - vs
  - Electronic fetal monitoring (EFM)

  Some monitoring vs no monitoring data is hard to find but anecdote suggests that no monitoring is associated with a 4-10x increase in perinatal mortality.
**IA vs EFM**

- Data complex due to study problems:
  - Differing subjects
  - Differing methodologies and CTG definitions
  - Change to EFM in the IA group
  - Differing definitions of seizures
  - Post hoc analysis especially of hypoxic deaths
  - Variable scalp blood analysis
  - Size too small to detect significance differences in outcomes especially perinatal mortality

RCOG Guidelines, [www.rcog.org.uk](http://www.rcog.org.uk), 2001

**IA vs EFM**

- EFM is significantly more likely to detect fetal metabolic and respiratory acidaemia and reduce the risk of neonatal seizures, at the expense of raising the rate of operative intervention.
- Risk of acidaemia/seizures in the IA group was in the higher risk category of prolonged labour and oxytocin use.

- RCOG guidelines

**RCOG Guidelines (2001)**

- Continuous EFM
  - ...offered and recommended for high-risk pregnancies where there is an increased risk of perinatal death, cerebral palsy or neonatal encephalopathy
  - ...should be used where oxytocin is being used for induction or augmentation of labour
  - For other pregnancies...

**IA monitoring as alternative**

- In the active stages of labour IA should occur after a contraction, for a minimum of 60 seconds and at least
  - Every 15 minutes in the 1st stage
  - Every 5 minutes in the 2nd stage
  - IA should be changed to EFM for FHR anomaly or change in labour risk factor, (? Midwife unable to give are as above?)

**Electronic Fetal Monitoring**

- Despite guidelines, there is continued ‘Bad press’ about EFM and the ability to detect fetus at risk of hypoxic damage

**Reasons for poor outcomes with EFM**

- Definitions not standardised
- Inappropriate interpretation of FHR patterns
- Poor intraobserver and interobserver agreement
- No understanding of relationship between FHR and Acid-base status

Electronic Fetal Monitoring

- Parer and King:-
  Any evidence that CTGs are badly interpreted...

  or is their paper just the last gasp from the protagonists??

Electronic Fetal Monitoring

- How good are we at using EFM to prevent the fetal morbidity associated with fetal acidaemia?
  - Acidaemia rate 2.2 – 2.8% with 50% in the low risk group.

Electronic Fetal Monitoring

- Medicolegal evidence
Electronic Fetal Monitoring

- MRANZCOG exams

Electronic Fetal Monitoring

- Literature
  - Neonatal ischaemic encephalopathy
    - 50% cases unavoidable
    - Other 50% (11/23), low risk, without PET, no breech
      - All had suboptimal CTG/heart rate monitoring and/or assessment

Electronic Fetal Monitoring – British experience

- Formal appraisal of CTG assessment vs acid-base balance in Obstetric workers showed correct correlation in 50%
  - Rises with Practice improvement projects.
- Up to 70% practitioners did not see need for FBS in intrapartum monitoring.
  - Greene KI, RCOG, 1994

Electronic Fetal Monitoring

- Clear need for
  - the use of a consistent teaching programme,
  - the use of standard guidelines,
  - an understanding of the fetal physiology behind the guidelines
  - R2 system of CTG teaching developed

Guidelines

- www.rcog.org.uk
- www.ranzcog.edu.au
Electronic Fetal Monitoring

To understand CTG interpretation and the need for Fetal Blood Sampling one must understand the fetal physiology.
**HEAD COMPRESSION**

- Heart
- Aorta
- Pulmonary artery

To Head

- Head pressure
- Blood pressure
- Heart rate

**Cord Compression**

- Heart
- Aorta
- Pulmonary artery

To Cord

- Pressure in aorta
- Baroreceptor activity
- Heart rate

**Placental blood flow – resting state**

- Normal placental function

  \[ pO_2 = 2.0 \text{ – } 4.0 \text{ kPa} \]

**Placental blood flow - During contraction**

- Normal placental function

  \[ pO_2 = 1.8 \text{ – } 2.5 \text{ kPa} \]
Late decelerations
- with placental insufficiency

Placental blood flow – resting state
Placental insufficiency
$pO_2 = 1.8 - 2.5 \text{ kPa}$

Placental blood flow – during a contraction
Placental insufficiency
$pO_2 < 1.5 \text{ kPa}$
$pO_2 = 1.5 - 1.8 \text{ kPa}$
$pO_2 = 1.8 - 2.5 \text{ kPa}$

Placental blood flow – after a contraction
Placental insufficiency
$pO_2 < 1.5 \text{ kPa}$
$pO_2 = 1.8 - 2.5 \text{ kPa}$

Heart
Aorta
Pulmonary artery
To Cord
Carotid sinus
IVC
Electronic Fetal Monitoring
- What can be diagnosed?
  - pH2 changes
  - Changes in afterload
  - Changes in intracranial pressure
  - Adrenaline rise
  - Intact cerebral synaptic activity
  - Intact myocardial conduction

Not fetal lactate levels

The Intrapartum CTG
- Is there a relationship with fetal acidaemia?
The Intrapartum CTG

- Is there a relationship with fetal acidaemia?
  - Yes
    - But it is statistical only

Fetal Blood Sampling

- pH?
- Base excess?
- Lactate?

Fetal Blood Sampling

- pH
  - Intermediate: 7.18 – 7.25
  - Deliver: < 7.18
- Base deficit
  - Intermediate: 8 – 10 mmol/L
  - Deliver: > 10 mmol/L
- Lactate
  - Intermediate: 4.8 – 5 mmol/L
  - Deliver: > 5mmol/L

Electronic Fetal Monitoring

- EFM is a screening tool
- It has a high sensitivity for a condition of low prevalence
- It has high false positive rate
- It must be used with another technology to improve the positive predicative value
Electronic Fetal Monitoring + FBS
- How good?
  - RCOG guidelines + FBS
  - HIE rates as low as 1/7000
  - No intrapartum deaths

RANZCOG Guidelines
- On 2nd edition
- “Still in process of evolution”
- Developed after RCOG guidelines

Antenatal education
Clinical competence
CTG settings

The Admission CTG
Intermittant auscultation
Vs CTG

CTG should be used if any risk detected

Management of Abnormal CTG

Which CTG changes denote fetal compromise?

“Low probability”
“Unlikely risk”
“May be associated”
“Very likely”
Guideline 12
Delivery should be expected when:
- Significant fetal distress is suspected.
- There is clear evidence of severe fetal compromise (FHR should not be monitored).
- FHR abnormalities are at a degree requiring further assessment, but FHR is misclassified, clinically inappropriate or not recorded.

Guideline 11
Delivery should be expected when:
- FHR is abnormal.
- There is clear evidence of severe fetal compromise (FHR should not be monitored).
- FHR abnormalities are at a degree requiring further assessment, but FHR is misclassified, clinically inappropriate or not recorded.

Good Practice Note
- HIV is a concern and is recommended that the woman be in the left lateral position or lying on her back. 
- Continued adherence to HIV test.
- Clear evidence of severe fetal compromise.
- Most bleeding disorders (e.g., severe thrombocytopenia).
- Fetal presentation.
- Anomalous infection (e.g., HIV, hepatitis B, hepatitis C, and syphilis). 
- Fetal presentation.
- HIV is not generally recommended in pregnancy at any time. 
- It is recommended that antenatal care should be referred to at the time of delivery in cases where it is known to have been performed appropriately.
- Testing for congenital heart defects does not predict HIV.

Guideline 13
Maintaining standards and practice review
Guideline 13
All health professionals involved in caring for primary care with pregnant and breastfeeding women should be involved in an audit of their institution. 

Good Practice Note
- The guideline summary above emphasizes the following practices in assisting with clinical audit and education:
- Regular OBs review meetings
- Periodical and systematic audit and feedback analysis following abnormal FHR patterns, severe depression, low birth weight, and fetal deaths in cases where it has been performed appropriately.
- Review of the use of FHR when available.