Clinical Application of Cardiotocography

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Antepartum
1. Non-stress test (NST)
2. Contraction stress test (CST)
   Oxytocin challenge test (OCT)
3. Admission test

Intrapartum
1. Intermittent CTG - usually at onset, mid-active phase, second stage
2. Continuous CTG
Admission Test (1)

Objectives:
• to identify the already compromised or likely to become compromised fetus of an apparently normal / low-risk pregnancy upon admission

Procedure:
• immediately upon admission, run a short trace (5 - 30 min), may include both the components of NST and CST
Admission Test (2)

Value:

• good predictor of fetal condition at the time of admission and for the next 4 - 6 hours of labour in term low-risk fetus

* Any one with a suspicious Admission Test (AT) should have continuous CTG from early in labour
Fetal Heart Monitoring - Placement of Abdominal Transducer

(A) Identifying landmarks
(B) Placement of transducer
CTG Procedure (1)

• Confirm fetal heart beat
• secure transducer over the loudest spot - remember position of fetal heart descends with descent of fetal head
• check date and time on tracing
• check paper speed - 1cm / min standard
  \[3cm / min\] special circumstances
• Label strip
CTG Procedure (2)

- ensure a good trace is obtained for 5 minutes before leaving the patient
- return within 15 minutes to double check the tracing
- consider scalp clip if attempts at good trace failed
- fetal stimulation should be considered if no reactivity is seen within 30 minutes
- mark events on the paper
Reading the CTG (1)

• Baseline heart rate - line drawn through the midpoint of the peaks and troughs excluding accelerations and decelerations

• Baseline variability - horizontally lines drawn at the level of the highest point of the peaks and lowest point of the troughs in a 1 cm (1 minutes) segment during active phase
Reading the CTG (2)

• Rest (Sleep) / Activity (Wake) cycles -
  Rest phase : up to 40 minutes, decreased variability, no accelerations
• Active phase : accelerations, increased variability
Intrapartum (1)

- Scalp electrode with “picket fence” artifact
  - due to poor contact of scalp electrode with fetal tissue or poor contact of the reference electrode with maternal tissue
- Confluent accelerations
  - identified by fetal movement markers and normal variability at true baseline and higher rates
Intrapartum (2)

- Compare with previous trace
- If baseline tachycardia with decelerations - normal will have decreased variability at trough and rapid return to baseline
- Gradual and progressive shift in baseline is an abnormal feature and should alert one to the presence of fetal stress, need to anticipate appearance of fetal compromise
FIGO Fetal Heart Rate Pattern Classification (1)

Antepartum
• Normal
• Suspicious
• Pathological

Intrapartum
• Normal
• Suspicious
• Pathological
FIGO Fetal Heart Rate Pattern Classification (2)

- **Normal** means fetal health
- **Suspicious** means
  - continue observation
  - additional tests
- **Pathological** means
  - additional test
  - intervention
FIGO CTG Pattern (1)

A. Normal -
(1) Baseline 110-150 bpm
(2) Baseline variability 5-25 bpm
(3) No decelerations / sporadic mild deceleration of short duration
(4) ≥ 2 accelerations during a 10 minutes period
FIGO CTG Pattern (2)

B. Suspicious -

(1) Baseline 150-170 or 110-100 bpm
(2) Variability 5-10 bpm for > 40 min
(3) Variability > 25 bpm
(4) No accelerations > 40 min
(5) Sporadic mild decelerations of any type
(6) Variable decelerations

Antepartum - (1) - (5) any one / combination
Intrapartum - (1) - (4) & (6) any one / combination
FIGO CTG Pattern (3)

C. Pathological:

Antepartum

(1) Baseline < 100 or > 170 bpm
(2) Variability < 5 bpm for > 40 min
(3) Recurring and repeated decelerations of any type
(4) Sporadic noncurrent severe variable, prolonged or late decelerations
(5) Sinusoidal pattern

Any one or in combination
Abnormal Patterns

The following alone and in combination signify developing hypoxia and acidosis

- Absence of accelerations
- $\uparrow$ baseline FHR
- $\downarrow$ baseline variability
- Late decelerations
- Variable decelerations with abnormal features
- Early decelerations with abnormal features
Effect of Clinical Conditions on FHR Patterns and their Interpretation
Malpresentation and Malposition (1)

- OP / OT position - early onset of early deceleration
- Brow presentation - early and variable decelerations
- Healthy fetus - no pathological features
- Any pathological features in addition - fetus is compromised
Malpresentation and Malposition (2)

• Repeated early deceleration in the case of malposition / malpresentation before definite onset of labour / strong contractions and / or engagement of the head suggest a distressed fetus
Oxytocin Effect of FHR Tracing (1)

Can cause - Excessive contractions
- Hypertonic contractions
- Tetanic contractions

Can results in - Baseline shift
- prolonged bradycardia
- tachycardia
- late decelerations
- variable decelerations
Oxytocin Effect of FHR Tracing (2)

Management

• Run a strip before commencement of oxytocin
• Stop oxytocin / ↓ dose by half
• Turn patient to side
• Fluid loading
• Oxygen via mask nasal connulae
• IV / IM tocolytics
Oxytocin Effect of FHR Tracing (3)

* Note time taken after stopping oxytocin till FHR returned to normal. Allow same time afterwards before restarting oxytocin

* If abnormal FHR patterns appear after restarting on oxytocin and delivery is not imminent → for C/S
Effect of medications on FHR patterns (1)

**Pethidine** -
- \( \downarrow \) baseline variability, abolish accelerations, effect may be prolonged beyond the normal rest phase
- If no decelerations or \( \uparrow \) baseline FHR \( \rightarrow \) not hypoxic

**Beta sympathomimetics** -
- baseline tachycardia, accelerations and variability preserved
Effect of medications on FHR patterns (2)

Beta-Blockers
• ↓ baseline variability and accelerations despite fetal movements / contractions

Aldomet
• ↓ baseline variability and accelerations, despite fetal movements / contractions
Effect of medications on FHR patterns (3)

Indirect Effects of drugs

- Acts by ↓ placental perfusion, which is secondary to maternal haemodynamic changes e.g. peripheral vasodilatation, or ↑ uterine contraction e.g. oxytocin

Multiple drug effect

- can change baseline heart rate and reactivity
Second Stage of Labour (1)

- Head compression leads to early decelerations → ↑ with features of variable decelerations. As long as there is normal baseline and variability in between contractions, the fetus is healthy.
Second Stage of Labour (2)

Signs of hypoxia:

• tachycardia
• ↓ variability between and during decelerations
• late decelerations
• failure to return to baseline (or > 100 bpm) after decelerations
• prolonged bradycardia

* Delay of 20 min → asphyxiated infant
Management of Prolonged Bradycardia

- Identify risk factors
- Adjust maternal position – left lateral is not always the best
- Improve hydration
- Stop oxytocin
- Vaginal examination
- IV / IM betamimetic (in-utero resuscitation)
Management of Prolonged Bradycardia

• Scalp blood sampling should **NOT** be done because it can only lead to delay in delivery if delivery is warranted, and it cannot help in the diagnosis of underlying condition.

• Arrange delivery if risk factors identified or no recovery by 9 min.
Effect of Obstetric Complications (1)

Placental abruption

• Uterine irritability shown by frequent contractions of low amplitude

• FHR trace - initially tachycardia ± decelerations, no accelerations, ↓ variability. Bradycardia is a late and danger sign of severe asphyxia
Effect of Obstetric Complications (2)

Chorioamnionitis / Fetal infection

• If maternal infection only (with/without fever) - tachycardia with normal variability and reactivity
• Preserved baseline variability and reactivity suggest healthy fetus
• If fetal infection occurs - ↓ variability ± decelerations (often variable decelerations)
• Maternal illness + preterm meconium suggest listeriosis
Effect of Obstetric Complications (3)

Fetal abnormality

- CNS abnormality $\rightarrow \downarrow$ baseline variability and low baseline rate

Discrepancy between CTG (abnormal) and biophysical profile (within normal) suggest chromosomal abnormalities, especially if bony measurements are reduced / slight IUGR
Effect of Obstetric Complications (4)

Fetal heart block

- Persistent bradycardia / double counting
- No responding to stimulation

Dying fetus

- Acute / subacute insult : decelerations / tachycardia / lack of accelerations → ↓ variability → bradycardia
Effect of Obstetric Complications (5)

- Chronic / longstanding hypoxia: FHR within normal range but no accelerations and no / shallow decelerations and no baseline variability (silent pattern) → terminal pattern, may have brain death

* Intervention for fetal wellbeing at the stage of bradycardia or terminal pattern is usually not indicated because of the very poor prognosis
Effect of Obstetric Complications (6)
Uterine rupture in Trial of Scar

- Scar rupture + loss of normal intrauterine pressure
  + tonic contraction + interrupt perfusion

- FHR trace can be normal if placental perfusion not disturbed

- Can mimic placental abruption
Effect of Obstetric Complications (6)  
Uterine rupture in Trial of Scar

- Should suspect scar rupture / uterine rupture if severed prolonged bradycardia, ↓ variability with repeated early or late decelerations, or loss of signal
Effect of Obstetric Complications (7)

Pre-eclampsia
• $\uparrow$ risk of growth retardation and placental insufficiency, oligohydramnios, abruption
• Effect of medications e.g. Aldomet, beta-blockers
• Effect of prematurity
Effect of Obstetric Complications (8)

Breech Presentation

- Cord compression and prolapse, especially flexed or footling breech
- Compression of skull above the orbits by uterine fundus can lead to variability decelerations
- After rupture of membranes, more likely to be decreased liquor volume with cord compression
- Other underlying problems which have been missed e.g. prematurity
Effect of Obstetric Complications (9)

PROM

• ↑ risk of cord compression
• ↑ risk of intrauterine infection
• Need to establish fetal wellbeing before induction of labour
• ↑ risk of dysfunctional labour and failed induction
• Preterm PROM - ↑ risk of placental abruption and fetal distress. Effect of prematurity
Effect of Obstetric Complications (10)

Twin Pregnancy

- ↑ risk of growth retardation in one or both fetuses
- ↑ risk of other complications
- Need to ensure wellbeing of both fetuses
- Continuous monitoring of the second twin is important during labour and delivery
- Effect of prematurity