Reliability and diagnostic accuracy of cardiotocography in term infants with and without neonatal encephalopathy

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Declarations of interest

- No commercial conflicts of interest

Background

- Cardiotocographs (CTGs) are used as a screening tool in labour to detect at risk fetuses so that delivery can be expedited
- The PMMRC Neonatal Encephalopathy Working Group reports on all term babies with neonatal encephalopathy
- 50% of deaths associated with hypoxic ischaemic encephalopathy (HIE) are potentially avoidable (PMMRC 6th and 10th Reports)
  - 2010 – 50% potentially avoidable
  - 2014 – 40% potentially avoidable

Objective

To determine whether CTG abnormalities of babies born with HIE could be detected and lead to plans to expedite delivery

Neonatal Encephalopathy Definition

A clinically defined syndrome of disturbed neurological function within the first week of life in the term (≥37 weeks) infant, manifested by difficulty in initiating and maintaining respiration, depression of tone and reflexes, subnormal level of consciousness and often seizures.

Hypoxic ischaemic encephalopathy is a subset of NE associated with hypoxia

Methods

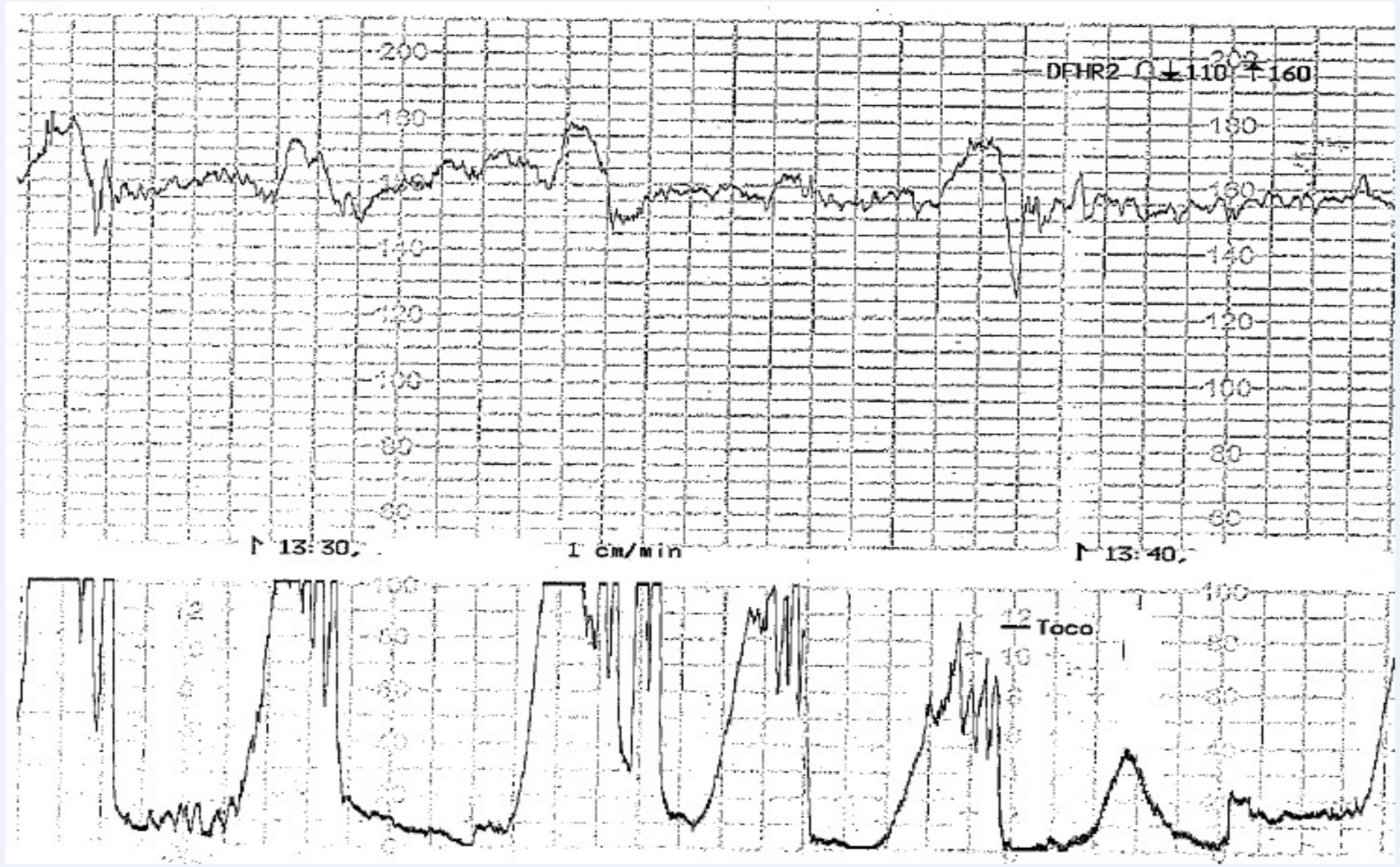
- Ten practicing clinicians were asked to review CTGs from babies with and without HIE
- The perinatal outcome for each case was not disclosed to the clinician
- Each clinician had to have completed the RANZCOG FSEP training in 2 years prior to taking part in the study
- An online survey was developed of the clinical details and CTGs of 35 cases and 105 control babies
- The cases were randomly placed among the controls
- Clinicians were asked to score the CTG for the penultimate hour prior to delivery
- The RANZCOG CTG tool was used and they were asked to recommend an action plan

Inclusion criteria for the cases and contolrs

- The cases were identified from a national review of NE cases believed to be associated with hypoxia in labour where CTG was available for the penultimate hour prior to delivery
  - Excluded acute intrapartum events such as placental abruption or cord prolapse
- The controls were identified from a cohort of babies with normal cord lactate levels and where CTG was available for the penultimate hour prior to delivery

Random example

- **Age**: 24 years old. **Obstetric history:** P2 - 2 NVDs at term. **Gestation:** 41+4/40
- **Antenatal history:** Low risk, uncomplicated
- **Labour:** Induction of labour for post-maturity. ARM 4 hours ago, syntocinon infusion recently commenced. Contracting irregularly 3:10.
- **Presentation and lie:** Cephalic, longitudinal
- **VE findings:** 8cm dilated, vertex at spines, thick meconium noted.
- **Maternal observations:** BP 120/78, pulse 86, T36.6°C
- **Pain relief:** Nitrous oxide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Analysis

- Inter-rater agreement of the CTG abnormality for sensitivity for cases and controls and for each of the reviewers' action plans
- Reviewer data were excluded from further analysis if the inter-assessor agreement on plan for "immediate action" was less than 80 %

RANZCOG CTG Tool

CTG finding	Normal	Suspicious	Abnormal
Baseline rate	110-160	100-109	<100 or >160
Variability	5 bpm or more	<5 bpm for 40-90 mins	<5 bpm for ≥90 mins
Accelerations	present	none	none
Decelerations	none	Early decelerations OR single variable deceleration up to 3 mins	Repeated variable or late decelerations OR prolonged deceleration lasting > 3 mins
Overall opinion	ALL four features normal	ONE suspicious feature	TWO or more suspicious features or ONE or more abnormal features

Plan for what to do next

* *12. Please indicate your plan from the list below*

- ○ Discontinue CTG and commence intermittent auscultation
- ○ Continue to monitor with continuous CTG and review CTG after short interval +/- other measures as indicated e.g. reposition woman, IV fluids, stop syntocinon, IV antibiotics
- ○ Fetal blood sample and clinical plan dependent on result
- ○ Category 1 (Immediate) delivery either by caesarean or instrumental delivery dependant on your clinical findings
- ○ Category 2 (Urgent) delivery by caesarean or instrumental delivery dependant on your clinical findings

Prev Next

Maternal and intrapartum characteristics

Characteristic	Cases (n=35)	Controls (n=105)	P-value
Maternal age * (y)	28.9 (5.8)	27.5 (5.3)	0.21
Parity = 0 (%)	28.6%	44.6%	0.10
Gestational age (wk)*	40 (1.4)	39.4 (1.2)	0.015
Induction of labour (%)	37.1%	42%	0.61
Vaginal birth after caesarean (%)	8.6%	10.5%	0.74
Meconium (%)	43.3%	28%	0.16
Obesity (BMI ≥30kg/m^2) (%)	24.2%	46.7%	0.015
Smoker (%)	28.6%	16.8%	0.13
Small for gestational age (%)	2.9%	8.6%	0.017
Large for gestational age (%)	2.9%	14.0%	
9 cm or fully dilated in penultimate hour (%)	45.7%	46.7%	0.92

*Mean±SD

Proportion of abnormal CTGs detected and (urgently) acted on by case status

	Immediate action based on CT	
Scorer	Cases assessed abnormal (Sensitivity) %	Controls assessed abnormal (1-specificity) %
2	69	29
3	80	38
4	63	35
5	80	43
9	91	47
10	71	23
Average	76	29

Summary of results

Clinicians identified an abnormal CTG at least one hour prior to delivery in 76% of NE cases and 29% of control cases

Action plan included either FBS or category 1 CS in 36% of cases and 7% of controls

Conclusion

Intrapartum CTGs are an imperfect screening tool for the detection of hypoxia in labour leading to HIE

The level of sensitivity for detection of abnormal CTGs among trained clinicians highlights the need for mandatory annual recertification

Further development of better screening tools would be welcome

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Perinatal and Maternal Mortality Review Committee

He matenga ohorere, he wairua uiui, wairua mutunga-kore

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