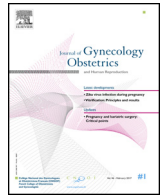




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Original Article

Inter-observer reliability of 4 fetal heart rate classifications

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ABSTRACT

Objective. – Different classification of fetal heart rate (FHR) pattern have been proposed: FHR classified as either “reassuring” or “non-reassuring”, the National Institute of Child Health and Human Development (NICHD) published in 2008 a 3-tier system, the French College of Gynecology and Obstetrics (CNGOF) recommended in 2013 a 5-tier system and recently in 2015, the Federation International of Gynecology and Obstetrics (FIGO) proposed a new classification based on a 3-tier system. Our objective was to assess the inter-observer reliability of these 4 existing classifications.

Study design. – Four observers reviewed 100 FHR without clinical information. FHR were obtained from term singleton pregnancies. Fetal heart rate patterns were classified by one 2-tier (“reassuring vs. non-reassuring”), two 3-tier (NICHD 2008 and FIGO 2015), and one 5-tier (CNGOF 2013) fetal heart classifications.

Results. – The global agreement between observers was moderate for each classification: 0.58 (0.40–0.74) for the 2-tier, 0.48 (0.37–0.58) for the NICHD 2008, 0.58 (0.53–0.63) for the CNGOF 2013 and 0.59 (0.49–0.67) for the FIGO 2015 classification. When FHR was classified as reassuring, it was classified as normal in 85.5% for the NICHD 2008 and in 94.5% for the FIGO 2015. For the CNGOF 2013, 65.0% were classified as normal and 32.5% as quasi normal. There was strong concordance between FIGO category I and “reassuring” FHR ($\kappa = 0.95$).

Conclusion. – Inter-observer agreement of FHR interpretation is moderate whatever the classification used. To evaluate the superior interest of one classification, it will be interesting to compare their impact on need of second line techniques and on neonatal outcome.

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Introduction

The use of cardiotocography (CTG) for obstetrical monitoring during labour is the standard of care in many countries [1]. But it has well-documented limitations. In low-risk pregnancies, the routine use of CTG during labor has been associated with an increase in caesarean delivery rates and meta-analysis comparing continuous fetal heart rate (FHR) monitoring versus intermittent auscultation during labour have failed to demonstrate an advantage of continuous cardiotocography to improve perinatal outcomes [2,3]. It has been well demonstrated that CTG analysis is subject to considerable intra- and inter-observer disagreement, even when experienced clinicians use widely accepted guidelines [4–7]. The main aspects that are prone to observer disagreement

are mainly in the evaluation of variability, the identification and classification of decelerations and finally the classification of tracings as suspicious and pathological [4,8,9]. The subjectivity of observer analysis has also been demonstrated in retrospective audit of tracings, where CTG features are frequently assessed to be more abnormal in cases with known adverse neonatal outcome [10,11]. This disagreement can be responsible of an augmentation of invasive procedures, such as fetal blood sample or cesarean section, and of different practice in a same team.

In order to reduce inter-observer disagreement and propose standards care, different colleges have proposed classifications. The older classification system rated fetal heart tracings as either “reassuring” or “non-reassuring” [12]. The National Institute of Child Health and Human Development (NICHD) classification was published in 2008 and is a 3-tier system [13]. The French College of Gynecology and Obstetrics (CNGOF) classification was recommended in 2013 and is a 5-tier system [14]. Recently in 2015, the Federation International of Gynecology and Obstetrics (FIGO)

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proposed a new classification based on a 3-tier system [15]. Rei et al. has evaluated the new classification and found a good inter-observer agreement in evaluation of most CTG features and in overall tracing classification [16]. But none study has previously compared the inter-observer agreement of the different classifications. So, our objective was to assess the inter-observer reliability of those 4 Fetal Heart Rate classifications.

Material and methods

A computerized perinatal database was used to randomly select 100 FHR tracings. Inclusion criteria were a singleton pregnancy at more 37 weeks of gestation with more than 2 hours of labour before birth. The analysis of the FHR was on the last 60 minutes prior to pushing efforts.

Four observers were asked to participate in the study and independently reviewed the FHR tracings without clinical information (archived version viewed on a computer screen) and without neonatal outcome information. All were obstetricians who achieved their last year of residency formations. They had no recent formations on CTG analysis and there was no interactive training session performed prior to FHR tracing review. Each observer was given a detailed set of instructions and description of the classifications.

For each case, the observers were asked to classify the FHR as “reassuring” or “non-reassuring” (2-tier system) and then according to 3 fetal heart classifications during the 60 min of FHR [12–15]. The first one was the NICHD (2008) with 3 categories: normal, indeterminate and abnormal. The second one is the CNGOF 5-tier (2013): normal, quasi normal, intermediate, pathological and pre-terminal. The last one was the new FIGO 3-tier (2015): normal, suspicious and abnormal (Table 1).

Statistical analysis was performed with SAS software package, release 9.4 (SAS Institute, Cary, NC). We assess the overall inter-observer agreement in CTG classifications using Krippendorff’s Alpha (simple for the 2-tier system or weighted coefficients for other ordinal classifications) [17]. Then each observer was compared to the others for each classification. The pairwise agreement was assessed using simple or weighted Cohen’s Kappa coefficient and we calculated the average Kappa values for each observer [18]. Finally, we evaluated the concordance between a fetal heart classified as normal in the 2-tier classification and normal (category I) in NICHD and FIGO classification, and normal or quasi normal (category I and II) of the CNGOF classification by calculating simple Kappa coefficients.

Predefined criteria for agreement were used: 0.0–0.20 (poor), 0.21–0.40 (fair), 0.41–0.6 (moderate), 0.61–0.8 (substantial), and 0.81–1.0 (almost perfect).

Table 1
Fetal heart rate classifications.

| | Normal | Suspicious or indeterminate | Pathological |
|-------------------|--|--|--|
| NICHD 2008 | | | |
| Baseline rate | 110–160 beats per minute (bpm) | Bradycardia not accompanied by absent baseline variability Tachycardia | Absent baseline FHR variability and any of the following: Recurrent late decelerations; Recurrent variable decelerations; Bradycardia Sinusoidal pattern |
| Variability | Moderate | Minimal baseline variability Absent baseline variability not accompanied by recurrent decelerations Marked baseline variability | |
| Decelerations | Late or variable decelerations: absent Early decelerations: present or absent | Recurrent variable decelerations accompanied by minimal or moderate baseline variability Prolonged deceleration > 2 min but < 10 min Recurrent late decelerations with moderate baseline variability Variable decelerations with other characteristics, such as slow return to baseline, “overshoots,” or “shoulders” | |
| Accelerations | Present or absent | Absence of induced accelerations after fetal stimulation | |
| FIGO 2015 | | | |
| Baseline rate | 110–160 bpm | Lacking at least one characteristic of normality, but with no pathological features | < 100 bpm |
| Variability | 5–25 bpm | | Reduced variability, increased variability, or sinusoidal pattern |
| Decelerations | No repetitive | | Repetitive late or prolonged decelerations during > 30 min or 20 min if reduced variability, or one prolonged deceleration with > 5 min |
| Accelerations | – | | – |
| CNGOF 2013 | | | |
| Baseline rate | Normal (I) 110–160 bpm Quasi normal (II) 160–180 bpm 100–110 bpm | Intermediate (III) > 180 bpm isolated 90–100 bpm | Pathologic (IV) > 180 bpm and other criteria < 90 bpm Pre-terminal (V) No variability (< 3 bpm) and no reactivity with or without decelerations or bradycardia |
| Variability | 6–25 bpm | 3–5 bpm > 40 min > 25 bpm | 3–5 bpm > 60 min Sinusoidal |
| Decelerations | None | Non-repetitive late Variables (< 60 sec and > 60 bpm) Prolonged > 3 min | Repetitive late Variables > 60 sec or severe Repetitive prolonged > 3 min |
| Accelerations | Presents | Presents or absents | Presents or absents |

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