

Fetal Heart Rate Monitoring Update: The Good, the Bad, and the Atypical

Graham Gaylord Ashmead, MD, FACOG

Intrapartum fetal heart rate monitoring is the most common obstetric procedure performed in the United States.

In 2002, 85% of the approximately 4 million live births in the United States were evaluated with electronic fetal monitoring (EFM). Fetal heart rate (FHR) is controlled by a balance between the fetal sympathetic and parasympathetic nervous system, and EFM is used by clinicians to assess fetal oxygenation.¹

Despite the widespread use of EFM, there has been no decrease in cerebral palsy. Although intrapartum EFM abnormalities correlate with umbilical cord base excess and neonatal seizures, a meta-analysis of randomized control trials has shown that EFM has no effect in perinatal mortality or

TABLE 1. Fetal Heart Rate (FHR) Pattern Definitions

Accelerations	<ul style="list-style-type: none"> • Abrupt increase in FHR (onset to peak <30 sec) • Duration is <2 min • 32 weeks: <ul style="list-style-type: none"> – Peak of 15 bpm above baseline, 15 sec duration • <32 weeks: <ul style="list-style-type: none"> – Peak of 10 bpm, 10 sec duration • Prolonged acceleration lasts 2 to 10 min • Acceleration of 10 min is a change in baseline
Baseline	<ul style="list-style-type: none"> • Mean FHR rounded to increments of 5 bpm during 10-min segment • Minimum of 2 min in a 10-min period • Excludes periodic or episodic changes or periods of marked variability • Normal: <ul style="list-style-type: none"> –110 to 160 bpm (tachycardia >160 bpm; bradycardia <110 bpm)
Bradycardia	<ul style="list-style-type: none"> • FHR baseline is <110 bpm
Early decelerations	<ul style="list-style-type: none"> • Onset, nadir, and recovery of FHR usually coincide with beginning, peak, and ending of the contraction (onset to nadir \geq30 sec)
Late decelerations	<ul style="list-style-type: none"> • Symmetrical decrease of FHR associated with contraction • Nadir of FHR deceleration occurs after peak of contraction (onset to nadir \geq30 sec)
Prolonged deceleration	<ul style="list-style-type: none"> • Decrease in FHR below baseline 15 bpm • Lasts 2 to 10 min • Deceleration >10 min is a change in baseline
Recurrent	<ul style="list-style-type: none"> • Decelerations are recurrent if they occur with at least half of contractions
Sinusoidal	<ul style="list-style-type: none"> • Smooth “sine wave” in FHR 3 to 5 per min over 20 min
Variability	<ul style="list-style-type: none"> • Irregular fluctuations in FHR amplitude and frequency: <ul style="list-style-type: none"> – Absent: amplitude range undetectable – Minimal: detectable but <5 bpm – Moderate (normal): 6 to 25 bpm – Marked: >25 bpm
Variable decelerations	<ul style="list-style-type: none"> • Abrupt FHR decrease from onset to nadir of <30 sec • At least 15 bpm, lasting >15 sec but <2 min

pediatric neurologic morbidity.² However, EFM is associated with an increase in the rate of operative vaginal and cesarean deliveries.¹

CONFLICTING INTERPRETATION

There is considerable inter and intra variability in the interpretation of EFM. Clinicians disagree with each other in their eval-

uation of FHR about 80% of the time. Even when reviewing the same FHR pattern several months later, a clinician disagrees with his or her own initial interpretation about 20% of the time.¹

One study by Chauhan et al had 5 clinicians evaluate the FHR patterns of 100 parturients using the traditional intrapartum evaluation (reassuring vs nonreassuring). Forty-six percent of these patients had an emergent cesarean delivery, and 2% had a fetal pH less than 7.0. The study found that not only was there poor agreement among

Graham Gaylor Ashmead, MD, FACOG, is Maternal-Fetal Medicine Subspecialist, Department of ObGyn, St. Luke's-Roosevelt Hospital, New York, NY.

TABLE 2. Category Definitions

Category I: Normal or “Good”	<i>Present:</i>	<ul style="list-style-type: none"> – Baseline FHR 110 to 160 bpm – Moderate baseline variability (6-25 bpm)
	<i>Absent:</i>	<ul style="list-style-type: none"> – Variable decelerations – Late decelerations
	<i>Present or Absent:</i>	<ul style="list-style-type: none"> – Accelerations – Early decelerations
Category II: Indeterminate or “Atypical”		FHR patterns that are not category I or III
		Absence of induced accelerations after fetal stimulation
Category III: Abnormal or “Bad”	<i>Present (either):</i>	<ul style="list-style-type: none"> – Sinusoidal FHR pattern OR – Absent baseline FHR variability AND ANY: <ul style="list-style-type: none"> – Recurrent late decelerations – Bradycardia – Recurrent variable decelerations

clinicians, but they could not even predict which parturients had an emergent cesarean delivery or low fetal pH.³ Fetal metabolic acidosis and hypoxic-ischemic encephalopathy are also associated with significant increases in EFM abnormalities, but EFM predictive ability to identify these conditions is low.⁴

Although intermittent fetal auscultation may be a theoretical option in low-risk patients, nursing staffing limitations make this impractical in a busy labor and delivery suite. Finally, regardless of the medical merits of intrapartum FHR monitoring, intermittent or continuous, auscultation or electronic, there is a medicolegal expectation in the United States of some form of fetal monitoring in labor.

DEFINING CHARACTERISTICS

In 2008, the National Institute of Child Health and Human Development (NICHD) Workshop Report on EFM set forth recommendations for defining FHR characteristics to improve predictive value of EFM and facilitate evidence-based clinical management of fetal compromise. The NICHD definitions were created for visual interpretation of FHR patterns, with the understanding that the definitions should be adaptable to future computer interpretation.^{5,6} The FHR defi-

nitions are intended for evaluation of intrapartum patterns but may be used antepartum. A 3-Tier FHR Interpretation System was developed, defining a category I FHR tracing as normal, category III as abnormal, and the remaining category II as atypical or indeterminate.⁵ The 3 categories could be considered respectively: “good,” “bad,” and “atypical.”

While there can be controversy about the need for yet another system to evaluate FHR patterns, defining some FHR patterns as clearly good or normal (category I) and some as clearly bad or abnormal (category III) is a step forward. The remaining atypical or indeterminate FHR patterns (category II) will always be with us and able to generate debate. See Table 1 (FHR definitions) and Table 2 (category definitions). Figures 1, 2, 3A, and 3B demonstrate samples of category I, II, and III FHR patterns.

EVALUATION BASED ON CATEGORY

How should the current classification of FHR categories be used?

Category I, or good, FHR patterns are normal and require no specific action. Category I FHR patterns should reassure both patients and their clinicians. Category II, or indeterminate, FHR patterns are *not* predictive of abnormal fetal acid-base status

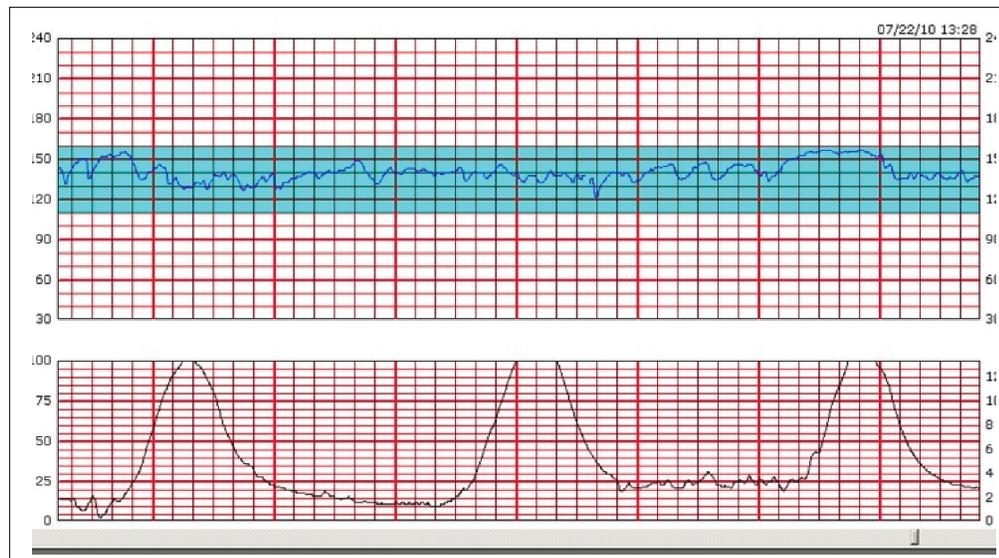


FIGURE 1. Category I, inpartum (moderate variability with accelerations).
Outcome: normal spontaneous vaginal delivery at term with APGAR scores 9/9 (1 and 5 min).

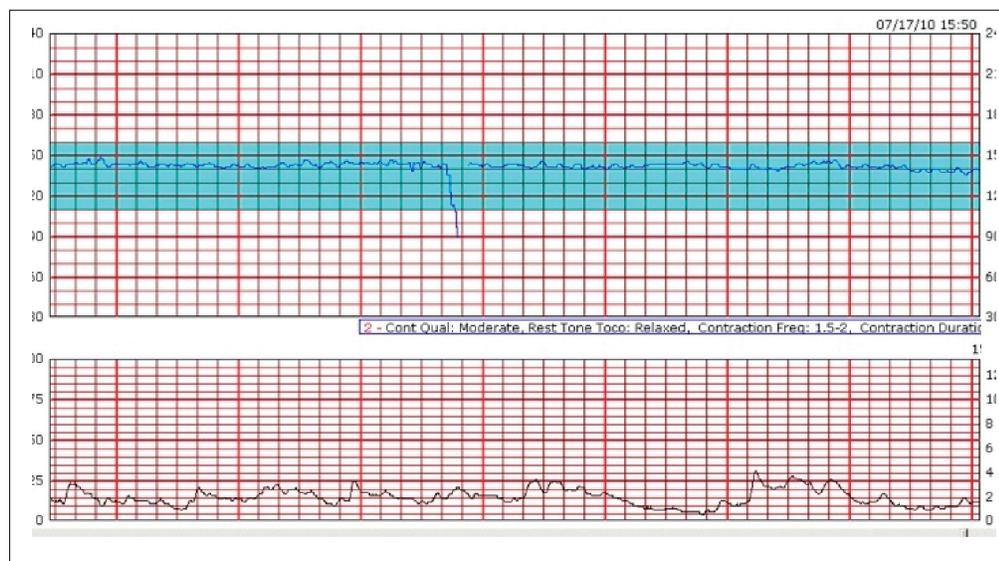


FIGURE 2. Category II, inpartum (minimal variability, abrupt deceleration >15 sec duration).
Outcome: normal spontaneous vaginal delivery at term with APGAR scores 7/8 (1 and 5 min).

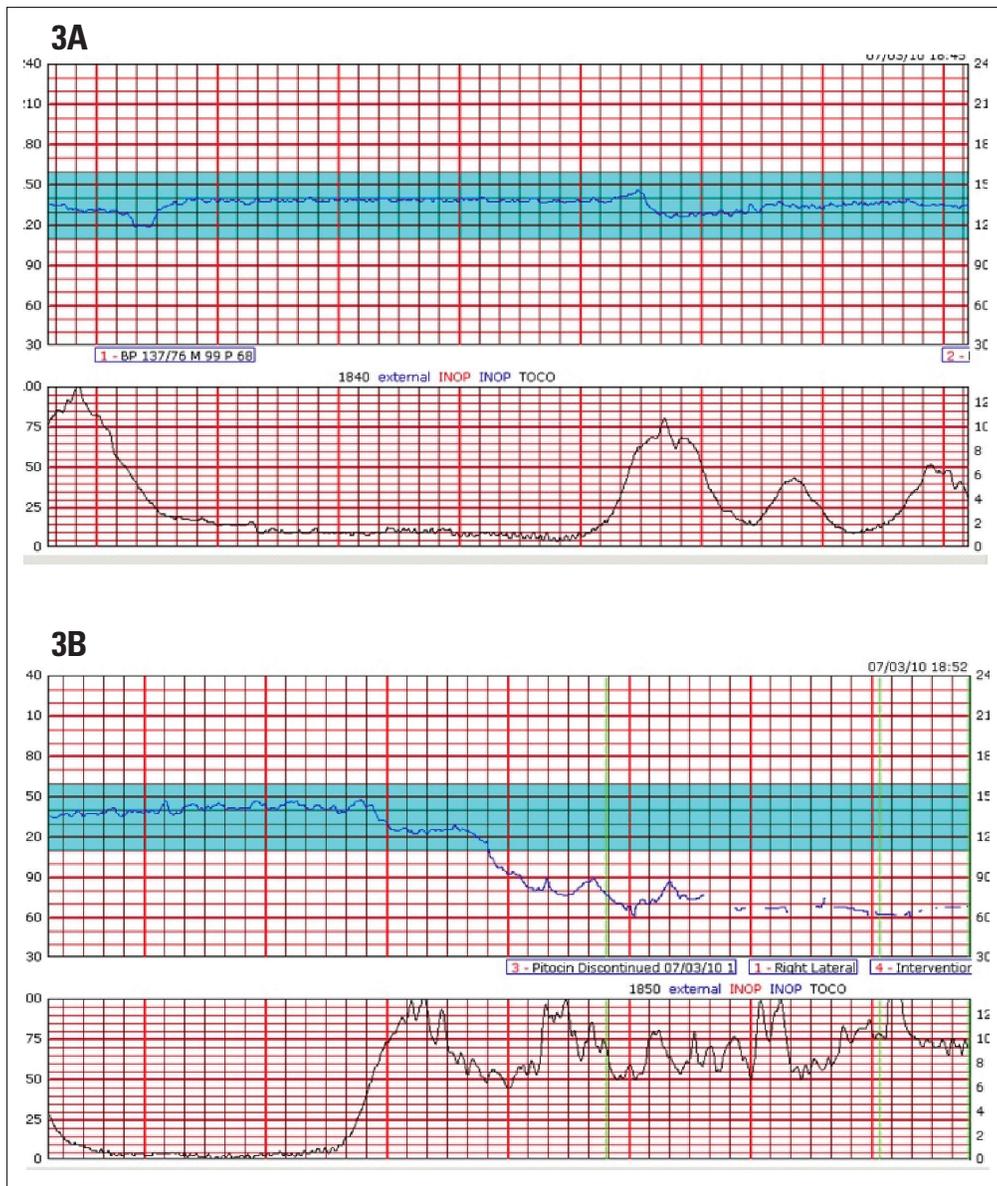
and require evaluation in terms of overall clinical condition, reevaluation, and continued surveillance.^{1,5,7}

Category III, or bad, FHR patterns are predictive of abnormal fetal acid-base status at the time of observation. Category III FHR tracings that require immediate action include an absent baseline FHR variability with recurrent late or variable decelerations, bradycardia, or a sinusoidal

pattern.⁷ If possible, the cause of the nonreassuring FHR should be addressed. These can include poor fetal oxygenation, uteroplacental perfusion, or umbilical cord compression. Some interventions include:

- Maternal oxygenation (100% O₂ 10 L/min nonrebreather face mask)
- Change in maternal position (right or left lateral positioning)

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FIGURES 3A and 3B. Category III, intrapartum (absent variability and bradycardia) in patient with known treated congenital syphilis. Outcome: primary cesarean delivery at term with APGAR scores 2/6/8 (1, 5, and 10 min) and delivery cord pH 6.96 arterial and 7.0 venous.

(continued from page 18)

- If prolapsed umbilical cord is noted, elevate the presenting fetal part while preparations are made for operative delivery
- Discontinuation of labor stimulation (stopping uterotonic agents)
- Tocolytic therapy for tachysystole (eg, terbutaline)
- Treatment of maternal hypotension
- Intravenous fluid boluses (1,000 mL).^{1,5,7,8}

If the Category III patterns persist and acidosis cannot be excluded, then appropriate management is expeditious delivery.

CONCLUSION

Future research should be directed towards the category II indeterminate or atypical patterns and their relationship to clinical outcome. Computer analysis of FHR tracings may eventually further simplify and

improve intrapartum care and management. In any case, the current classification and suggested management of FHR tracings will hopefully result in a more beautiful future—avoiding both fetal acidosis and unnecessary intervention, while improving patient care.

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