Situational Awareness In FHR Monitoring

Indications for Action

"Greater experience does not necessarily lead to expertise. One may simply make the same mistakes with greater and greater confidence."

Courtesy of Sarah Cox CNM, author unknown

FETAL HEART RATE MONITORING

Goal:
Reduce variation between providers how they interpret, communicate and respond to FHR Tracings.
The Bottom Line

When nurses, doctors, midwives disagree about their interpretation of the FHR tracing, the plan of care, or how quickly their calls for assistance need to be responded to, patients get harmed.

Interpretive chaos and discord at the bedside, communicates to patients and their families that something is wrong with the clinical care rendered, and the skill of the providers rendering that care.

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1997 A Common Language

...we had to first agree on what we saw...and what we were going to call it.

Committee established neutrality of nomenclature. Emphasized FHR terminology was purely descriptive not diagnostic.

“No a priori assumptions are made of the etiology of the patterns or their relationship to hypoxemia or metabolic acidemia.”

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A Path To Interpretive Consensus

A consistent approach to FHR tracing

- Evaluation
- Communication
- Management
Hierarchy of “Goodness and Badness”

Early
 Variable
 Late
 Bradycardia

Invisible baggage - the background conversation that’s resisting change

End result...

Variability
Decelerations

Weight of the evidence suggest...

Decelerations
Variability
Why Is Ranking Information So Important?

- We are simply not skillful at considering multiple factors. We give some variables too much weight and ignore others.
- We ultimately make each decision using one principle predictor at a time.
- First cue that passes into a provider’s consciousness can disproportionately impact their evaluation and judgment.

**NICHD 2008**

**Three-Tier Fetal Heart Rate Interpretation System**

**Normal**
- FHR 110-160 bpm
- Moderate Variability
- No late or variable decelerations
- ± early deceleration
- ± accelerations

**Indeterminate**

**Abnormal**

**NICHD 2008**

**Category I**
- FHR 110-160 bpm
- Moderate Variability
- No late or variable decelerations
- ± early deceleration
- ± accelerations
NICHD 2008

Category III
Absent variability with recurrent:
- Late decelerations
- Variable decelerations
- Bradycardia
- Sinusoidal pattern

NICHD 2008

Category II Tracings
Everything else
“The Mess In the Middle”

NICHD: Category II Tracings
Not a homogenous group. Includes;
- Variable, late, and prolonged decelerations
- Tachycardia and bradycardia
- FHR patterns with the full spectrum of variability
- Patterns with the full range of association or lack thereof with significant acidemia.
Categories aren’t useful for verbal communication.

Don’t simplify and make clear the framework for how we interpret communicate and manage FHR tracings.

Fetal acidemia and electronic fetal heart rate patterns: Is there evidence of an association?

J. T. Parera a; T. King a; S. Flanders a; M. Fox a; S. J. Kilpatrick b

4 Key Guidelines FHR Monitoring

1. The degree of variability is the most sensitive indicator of the adequacy of oxygen delivery to the fetus at any given moment in time.

2. FHR decelerations as an independent finding are poorly predictive of complicated outcomes.

3. A metabolic acidemia typically develops slowly in association with recurrent decelerations and an evolutionary reduction of FHR variability over time.

4. The deeper the decelerations the > likelihood for developing a significant acidemia.
### A Common Goal

**Desired Goal**
Birth in the absence of a significant acidemia and/or the presence of neonatal vigor:
- Fetal pH > 7.10 (2.5 SD mean CUA 7.26) with
- Fetal BE > -12 mEq/L and/or
- 5 min Apgar score ≥7

**Undesired Goal**
Birth in the presence of a significant acidemia and/or the absence of neonatal vigor:
- Fetal pH < 7.10 (2.5 SD mean CUA 7.26) with
- Fetal BE < -12 mEq/L and/or
- 5 min Apgar score < 7

### A Common Goal

Without undue interventions or iatrogenic complications and the highest degree of patient satisfaction

### Agreement on 7 Important Collaborative Interventions

- Continuous Observation
- Notification
- Bedside Evaluation
- Prepare for birth
- Expedite Birth
- Prepare For Neonatal Resuscitation
- Prepare to Transfer/Transport
Simplify the Framework for Pattern Recognition
Core Premise

1st Key Interpretive Guideline

The degree of baseline variability that accompanies the decelerations is the most sensitive indicator of the adequacy of oxygen delivery to the fetus at any given moment in time.

1st Key Interpretive Guideline

When moderate FHR variability is present, clinicians can presume that the fetus is not suffering deep central cerebral tissue asphyxia at that moment in time.
FHR variability in the moderate range (with or without accelerations) is the visual representation of an intact, i.e. adequately oxygenated fetal neurologic pathway, through the midbrain, the vagus nerve and the cardiac conduction system.

WHY?

NICHD 2008: On Moderate FHR Variability

"Moderate FHR Variability reliably predicts the absence of fetal metabolic acidemia at the time it is observed".


"Given the diverse spectrum of abnormal FHR patterns in Category II The presence of FHR accelerations or moderate FHR variability or both are highly predictive of normal fetal acid-base status and thus may help guide clinical management".

ACOG Practice Bulletin #116 November 2010
FHR decelerations, as an independent finding, are poorly predictive of an inadequacy of fetal oxygenation or the presence of a significant acidemia.

What % of babies with moderate variability and recurrent late decelerations will deliver with a CUA gas at the time of birth pH ≥ 7.1 and a base excess ≤ -12 mEq/L and/or in the presence of neonatal vigor an (Apgar score ≥ 7 at 5 minutes of age)?

a. < 50%  b. < 25%  c. ≥ 99%  d. ≥ 80%

98% of the fetuses with moderate FHR variability, with or without decelerations or second stage bradycardia will be born in the absence of a significant metabolic acidemia, and/or in the presence of neonatal vigor.

When moderate FHR variability is present at the time of birth < 1% of neonates will be born with an Apgar score < 7 at 5 minutes.
Given the low predictive value of late decelerations for acidemia... the presence of accelerations or moderate FHR variability or both may be useful to assess the risk for fetal acidemia.

"Intrauterine Resuscitation"

- Continuous Observation
- Notification
- Bedside Evaluation
- Prepare for birth
- Expedite Birth
- Prepare For Neonatal Resuscitation
- Prepare to Transfer/Transport

**Timing of Interventions: Factors to Consider**

**1 Hour Window of Opportunity ±**

In a fetus with an initially normal FHR pattern, the development of significant acidemia evolves over a period of time, of the order of at least one hour. (60 – 90 minutes)

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Estimated time to delivery

Local realities = Event to delivery time
Case Presentation

Absent and/or minimal FHR variability, accompanied by recurrent decelerations and/or a sustained bradycardia of ≤ 60 bpm, are the FHR patterns most consistently associated with a significant acidemia in the fetus.

NICHD - ACOG Practice Bulletin #116 November 2010

3rd Key Interpretive Guideline

Absent and/or minimal FHR variability, accompanied by recurrent decelerations and/or a sustained bradycardia of ≤ 60 bpm, are the FHR patterns most consistently associated with a significant acidemia in the fetus.

NICHD - ACOG Practice Bulletin #116 November 2010

Continued Minimal FHR Variability (absence of accelerations…) that cannot be explained resolved with resuscitation should be considered as potentially indicative of fetal acidemia and managed accordingly.

NICHD 2010 - ACOG Practice Bulletin #116 November 2010
Category III tracing with Absent FHR Variability “is abnormal and conveys an increased risk of fetal acidemia at the time it is observed”.

NICHD - ACOG Practice Bulletin #116 November 2010

**Case Presentation**

![Images of medical procedures or equipment]

**Case Presentation**

![Images of medical procedures or equipment]
With the exception of acute catastrophic events, a significant metabolic acidemia typically develops slowly in the fetus during labor. Usually over approximately 60-120 minutes in association with typical and observable changes in the FHR tracing.

### 3rd Key Interpretive Guideline

Evolution of Significant Acidemia?

Typical and observable changes in the FHR tracing associated with a increased likelihood for birth in the presence of a significant fetal acidemia?

1. Evolutionary loss of FHR variability
2. In association with recurrent decelerations and/or bradycardia
3. That get deeper over time

### Jagged and Unpredictable

Smooth...Round...Blunted...Flat
Relationship to Significant Acidemia

Based On the Degree of Variability

No No No No Maybe Maybe
Maybe Presumed Presumed

There is a positive relationship between the degree of acidemia and the depth of the decelerations. In the setting of recurrent decelerations or sustained bradycardia the magnitude of the decrease in the FHR appears directly linked to the rapidity with which acidemia may develop.

4th Key Interpretive Guideline

There is a positive relationship between the degree of acidemia and the depth of the decelerations. In the setting of recurrent decelerations or sustained bradycardia the magnitude of the decrease in the FHR appears directly linked to the rapidity with which acidemia may develop.

4th Key Interpretive Guideline

- This “dose-response” relationship appears to be particularly true for FHR tracings with minimal and/or absent baseline variability and recurrent decelerations.
- When absent FHR variability accompanies the decelerations, it can be assumed the association is much higher.
Interrelations between fetal pH, FHR variability, & depth of late decelerations
Paul et al, 1975

- Evaluation of recurrent variable decelerations includes their frequency, depth and duration, uterine contraction pattern, FHR variability.
- Recurrent variable decelerations that progress to greater depth and longer duration are more indicative of impending fetal acidemia.

FHR Pattern Classification
Clinical Management
Categories and Relationship to Significant Acidemia
Category and Clinical Diagnosis

For each of the following FHR tracings identify which NICHD category it belongs in (I, II, III), and its presumptive association with significant acidemia (Yes, No, Maybe).
Within What Time Frame Should birth Occur?

A. Now  B. 15 ≤ min  C. 30 ≤ min  D. ≤ 1 hr.
This patient had a spontaneous vaginal birth 30 minutes later. Apgar Score 7/9. CUA > 7.1 be > -12.
Did those who voted for C/S do the right thing?
Some Things That Trip Us Up In FHR Interpretation and Management

Short term and long term variability
Are they still Relevant?

NICHD-1997 BASIC CLASSES OF FHR VARIABILITY

No distinction is made between short-term variability... and long-term variability because in actual practice they are visually determined as a unit.

Hence the definition of variability is based visually on the amplitude of the complexes, with exclusion of the regular, smooth sinusoidal pattern.
Which side of the tracing is still “jagged and unpredictable?”

Jagged and Unpredictable | Smooth Round Blunted Flat
---|---
Long term variability and Short-term variability | Long term variability with absent Short-term variability

FHR Patterns Associated With Fetal Demise
1. Most have baseline FHR in the upper range of normal i.e. above 150 bpm
2. Dying fetuses always lose their STV
3. No dying fetus had normal LTV, although 18% had either decreased LTV or intermittent periods of LTV
4. Of those fetuses with absent LTV approximately 1/3 have either intermittent sinusoidal patterns or an undulating smooth baseline.

Parer 1983. Handbook of FHR Monitoring
Variability vs. Timing

NICHD 2008

Category 1
- FHR 110-160 bpm
- Moderate Variability
- No late or variable decelerations
  - ± early decelerations
  - ± accelerations

“Normal”
Which Tracing Would You Rather Have and Why?

Tracing 1 because they are early decelerations and they are from head compression.
Tracing 2 because there is moderate variability accompanying the late decelerations.

Timing vs. Shape

What type of decelerations are these?
What type of decelerations are these?

Gradual:
- Onset ≥ 30 seconds
- Nadir

Timing vs. Shape
FHR Pattern Identification?

Shape versus Timing

- Onset ≤ 30 seconds
- Nadir ≤ 30 seconds
Is this patient having contractions?

Do You Need Accelerations During Labor to Presume the Fetus is Not at Risk for a Significant Acidosis?

Category

☐ I    ☐ II    ☐ III

Significant Acidemia

☐ Yes ☐ NO ☐ Maybe
Scalp Stimulation Test-No Periodic Changes

<table>
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<th>Indications Sampling</th>
<th># fetuses</th>
<th># Scalp ph &lt; 7.20</th>
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<tr>
<td>No periodic changes - &quot;Good Variability&quot;</td>
<td></td>
<td></td>
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<tr>
<td>Normal baseline</td>
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<td>Tachycardia</td>
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<td>Diminished Variability</td>
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<td>1</td>
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<tr>
<td>Total</td>
<td>45</td>
<td>2</td>
</tr>
</tbody>
</table>


"The presence of FHR accelerations (either spontaneous or stimulated) reliably predicts the absence of fetal metabolic acidemia. The absence of accelerations does not, however, reliably predict fetal acidemia."

Case Presentation: Shape vs. Timing
FHR Pattern Identification.
Should we start with the baseline first?

Case Presentation: Shape vs. Timing

Summation:
A Simple Interpretive Framework
To see what is in front of one's own nose is a constant struggle" … George Orwell

FHR Patterns Associated With Significant Acidemia

A presumptive diagnosis of a significant fetal acidemia requires two conditions to be met during the intrapartum period:

- Minimal and/or absent variability
- In Association with recurrent decelerations and/or sustained bradycardia.

A Common Language
A Common Goal

Accomplish delivery in the absence of significant acidemia defined

• CUAgas ≥ 7.1 ≥ -12 mEq/L and/or

In the presence of neonatal vigor

• Apgar score ≥ 7 at 5 minutes

Simplify the Framework
4 Key Guidelines FHR Monitoring

1. Core Premise: The degree of variability is the most sensitive indicator of the adequacy of oxygen delivery to the fetus at any given moment in time.

2. FHR decelerations as an independent finding are poorly predictive of complicated outcomes.

3. A metabolic acidemia typically develops slowly in association with recurrent decelerations and an evolutionary reduction of FHR variability over time.

4. The deeper the decelerations the greater likelihood for developing a significant acidemia.
Variability

Decelerations

Uterine Activity

Baseline FHR

Evaluate the Tracing In a Ranked Order

Evidence Based Practice

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Evidence Based Indications For Action

Based on the degree of variability that accompanies the decelerations

Make a presumptive Diagnosis

Significant acidemia?

YES?

NO?

MAYBE?
Based On Your Presumptive Diagnosis

Interdisciplinary Collaborative Interventions
1. Observation
2. Notification
3. Bedside Evaluation
4. Preparation for birth
5. Expedite birth
6. Resuscitation
7. Transfer/Transport

Conservative Measures

7 key Collaborative Interventions

Linked to Collaborative Practice Guidelines

“You must simplify. You must make the complex simple. Then you must make it work”

I.M. Pei
Master Architect
NICHD 3 Tier System Currently Fails to:

• Clearly identify the relationship between FHR patterns and significant acidemia.
• Clarify how our presumptive diagnosis informs the choice and timing of our interventions.

Example: 3 – Tiered System that Integrated Patterns Relationship Acidemia with the Categories

Moderate FHR variability reliably predicts the absence of fetal metabolic acidemia at the time it is observed.

Minimal FHR variability (with decelerations) should be considered as potentially indicative of fetal acidemia and should be managed accordingly.

Absent FHR variability with decelerations… is abnormal and conveys an increased risk of fetal acidemia at the time it is observed.

The Bottom Line

“We must have a system of fetal heart rate monitoring that makes it easy to do things right and hard to do them wrong.”

Adapted from IOM report 1999
References: FHR Monitoring: Indications For Action


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