Fetal Heart Rate Monitoring:
The Category II Conundrum

Tekoa L. King CNM, MPH
October 26, 2016

Objectives

- A quick history
- The Category II chasm
  - Current recommended management algorithms
- Research findings: The relationship between FHR patterns and newborn acidemia
- Proposed solution for Category II interpretation and management

Interpreting Fetal Heart Rate Patterns is a Classic “Blind Men and Elephant” Problem

The relationship between FHR patterns and fetal oxygenation status is indirect and only one variable in a complex interplay of physiologic variables

Disclosure

- I have no financial disclosures related to this presentation
NICHD 2008 FHR Categories

- Category I (normal)
  - FHR patterns that are “normal”: Associated with fetal well-being
  - Present in 99.5% of tracings

- Category II (indeterminate)
  - FHR patterns that are “indeterminate”: Inconsistently associated with fetal acidemia
  - Present in 84.1% of tracings

- Category III (abnormal)
  - FHR patterns that are “abnormal”: Consistently associated with fetal acidemia
  - Present in 0.1% of tracings

Macones et al 2008, Jackson MJ 2011

Category I, “Normal”

- Includes all of the following:
  - Baseline rate: 110-160 bpm
  - FHR variability: moderate
  - No late or variable decelerations
  - Early decelerations: present or absent
  - Accelerations: present or absent

Category II

Includes all FHR patterns not categorized as normal or abnormal

Category III “Abnormal”

- Absent baseline FHR variability and:
  - Recurrent late decelerations or,
  - Recurrent variable decelerations or,
  - Bradycardia

- Sinusoidal pattern

Parer et al 2006, Macones et al 2008
What is the Problem?

1. There are more than 40 different FHR patterns in Category II
2. These are also the FHR patterns seen most frequently in clinical practice
   - 22% of time in first stage
   - 40-75% of time in second stage

Sheiner E 2001, Jackson MJ 2011

What is the Problem?

3. The FHR patterns in Category II are heterogeneous in that they reflect varying risks for fetal acidemia
4. Any clinical setting that uses the NICHD 3-tier system has to grapple with how to manage Category II tracings

Jackson M 2011

How Did The NICHD Guidelines Start Being Implemented?

2010: ACOG Practice Bulletin: 4 Categories
2010: ACOG Practice Bulletin: 4 Categories

- Reliance on accelerations is misleading: Spontaneous accelerations are not a necessary sign of fetal well-being during labor
- To be successful, the algorithm needs to include all members of the team. This means including information the nurse at the bedside needs which is when to notify a clinician
- Category II does not include absent variability

Miller and Miller 2011: 5 Categories

- This algorithm incorporates thinking about FHR patterns physiologically but it is a complex version of standard practice and as such, it layers a complex set of mental steps over what we already do.
<table>
<thead>
<tr>
<th>FHR pattern</th>
<th>Recommended Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mod variability without recurrent decels</td>
<td>Observe</td>
</tr>
<tr>
<td>2. Mod variability with recurrent decelations for 1 hr in latent phase</td>
<td>Cesarean section</td>
</tr>
<tr>
<td>3. Mod variability with recurrent decelations for 1 hr in active phase and normal labor progress</td>
<td>Observe</td>
</tr>
<tr>
<td>4. Mod variability with recurrent decelations for 1 hr in active phase and abnormal labor progress</td>
<td>Cesarean section</td>
</tr>
<tr>
<td>5. Mod variability with recurrent decelations for 1 hr in second stage and normal progress</td>
<td>Observe</td>
</tr>
<tr>
<td>6. Mod variability with recurrent decelations for 1 hr in second stage with abnormal progress</td>
<td>Cesarean section or OVD</td>
</tr>
<tr>
<td>7. Minimal or absent variability without recurrent decelations for 30 minutes</td>
<td>Observe for one hour, if persistent Cesarean or OVD</td>
</tr>
<tr>
<td>8. Minimal or absent variability with recurrent decelations for 30 minutes</td>
<td>Cesarean section or OVD</td>
</tr>
</tbody>
</table>

**Parer-Ikeda 5-tier System**

Number of non-reassuring FHR categories in professional guidelines
FHR Management Algorithms: Summary

- All split Category II into 2 or 3 subcategories
- They all base the subdivisions on the degree of variability and presence or absence of accelerations
- This is a good start (!) but these algorithms do not take into account two critical factors
  - 1. Change over time
  - 2. Role of depth and duration of decelerations

Objectives

- A quick history
- The Category II chasm
  - Current recommended management algorithms
- Research findings: The relationship between FHR patterns and newborn acidemia
- Proposed solution for Category II interpretation and management

Current Research on FHR Categories and Management

- Category I and Category III are well correlated with acid/base status at birth
  - Category I: Normal acid-base status
  - Category III: Significant risk of metabolic acidemia that is associated with adverse neurologic outcomes
- 5-tier system that has 3 intermediate categories correlates better with acid-base status at birth than does the 3-tier system or 2-tier systems

The Relationship Between FHR Patterns and Newborn Acidemia

1. Newborn acidemia with decreasing FHR variability and recurrent decelerations develops over a period of time approximating one hour: (PATTERN EVOLUTION)
2. There is a positive relationship between the depth and severity of deceleration or bradycardia and the degree of acidemia: (AREA UNDER THE CURVE)

2. Pattern of Developing Acidemia over Time

- Recurrent variable or late decelerations
- Decelerations get deeper and spontaneous accelerations no longer present
- Compensatory tachycardia +/-
- Variability diminishes
- Ultimately a terminal bradycardia


3. Role of Depth and Duration

- The best predictor of newborn acidosis is:
  - “the area under the curve” which integrates depth and duration of bradycardic rate
  - Calculated area under the curve is translated into minutes per bpm

4. The Problem of Minimal vs Absent Variability

- The NICHD arbitrarily defined absent variability as the key component of Category III

- However, the studies that identified the FHR patterns subsequently placed in Category III analyzed FHR tracings with:
  - “minimal/absent” variability (Williams KP 2003)
  - “decreased variability” (Paul 1995)
  - “Less than 5 bpm change in rate” (Beard 1974)

4. Example: Problem of Minimal vs Absent Variability

- Williams et al 2002
  - N=488 term births
  - FHR pattern 1 hour before birth correlated to UA cord pH and BD
  - Minimal/absent variability with recurrent late decelerations for 1 hr before birth:
    - 32% had BD <-12
    - 24% had pH <7.0
  - Similar findings for minimal/absent variability with recurrent variable decelerations

Summary: Lingering Problems

- Current FHR management algorithms:
  - Static without accounting for duration (pattern evolution over time) or depth of decelerations
  - Artificial distinction between minimal and absent variability when the focus should be on diminishing variability
  - Algorithms that use “accelerations or moderate variability” may artificially elevate the role of accelerations in labor

Objectives

- A quick history
- The Category II chasm
  - Current recommended management algorithms
- Research findings: The relationship between FHR patterns and newborn acidemia

Proposed solution for Category II interpretation and management
**Category II Management**

1. Recurrent decelerations and moderate variability
   - AND
2. Decelerations deeper and/or persistent, OR variability decreasing OR tachycardia appears
   - AND
3. Variability decreasing further, AND/OR tachycardia present
   - Plan delivery within short period of time

**FHR Pattern Evolution over Time and Management**

- **Category I**
  - 1. Recurrent decelerations w moderate variability
- **Category II**
  - 1. Recurrent decelerations w moderate variability
    - AND
  - 2. Decelerations Deeper OR Persistent OR Variability Diminishing OR Tachycardia
    - AND
  - 3. Variability decreasing and decelerations getting deeper AND/OR Tachycardia
    - Plan delivery within short period of time
- **Category III**
  - 1. Recurrent decelerations and moderate variability
  - AND
  - 2. Decelerations deeper and/or persistent, OR variability decreasing OR tachycardia appears
  - AND
  - 3. Variability decreasing further, AND/OR tachycardia present
  - Plan delivery within short period of time

**In Conclusion...**

- Current NICHD Category II has limited clinical utility
- Algorithms promoted to solve this problem all split Category II into 2 or 3 interpretation/management subdivisions
  - Remarkable consistency in the FHR patterns placed in institutionally-devised subcategories
- 5-tier system is well-correlated with acid-base status at birth but.....>>>
Thank You

Tekoa L. King CNM, MPH
tking@acnm.org