Electronic Fetal Monitoring: Guidelines for Interpretation

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Objectives

• Introduction
• Definitions of monitoring components
• Categories
• Management considerations
• Limitations
Introduction

- Electronic fetal monitoring (EFM) is the most common obstetric procedure
- Goal of EFM is to detect fetal hypoxia and signal to the clinician that an intervention is needed to correct the oxygen deficiency
- Use common language to communicate and document findings
How does it work?

• “FHR results from the signal processor, which counts every R-R interval of the ECG from the scalp electrode, converts this interval to rate, and displays every interval (bpm)”

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EFM Guidelines

Electronic fetal heart rate monitoring: Research guidelines for interpretation

National Institute of Child Health and Human Development Research Planning Workshop

NICHD Workshop Research Planning Workshop 1997

Objective: to propose a standardized (and *unambiguous*) set of definitions

Goals:
- more precise interpretation of FHR patterns
- more evidence-based approach to the management of labor
EFM Guidelines

• 2008 National Institute of Child Health and Human Development (NICHD) partnered with ACOG & SMFM

• Goals:
  – Review and update the definitions for FHR pattern categorization from the prior 1997 workshop
  – Assess existing classifications systems for interpreting FHR patterns
  – Recommendations for research priorities for EFM
NICHD EFM Guidelines

• Assumptions:
  – Definitions are for visual interpretation of FHR patterns

• Primarily for intrapartum events, but also applicable to antepartum observations
Breakdown of definitions

- Monitor display
- Normal fetal heart rate tracings
- Contractions tracing
- Abnormal fetal heart rate tracings
The Display

The intervals between the vertical red lines represent one minute.

Fetal heart tracing is displayed in the upper pane.

Uterine activity is displayed in the lower pane.
• Each small vertical square is 10 beats
• Each small horizontal square is 10 seconds
• Each large horizontal square is 1 min
EFM Mantra

• Baseline
• Variability
• Accelerations
• Decelerations
• Contractions
Baseline

• Mean FHR rounded to increments of 5 bpm during a **10-minute segment**

• Excluding:
  – Periodic or episodic changes
  – Periods of marked variability
  – Segments of baseline that differ by more than 25 bpm

• Baseline must be for a minimum of **2 minutes**
Normal Baseline

110 – 160 bpm
Abnormal baseline

- **Tachycardia** > 160 bpm
  - Maternal fever & drugs

- **Bradycardia** < 110 bpm
  - Maternal drugs, hypothyroidism, SLE
  - Fetal heart block

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Bradycardia
Variability

Variability = Amplitude
Variability

Variability represents fetal CNS and cardiac activity

<table>
<thead>
<tr>
<th>Variability Type</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate (normal)</td>
<td>6-25 bpm</td>
</tr>
<tr>
<td>Absent</td>
<td>Undetectable</td>
</tr>
<tr>
<td></td>
<td><em>(flat line)</em></td>
</tr>
<tr>
<td>Minimal</td>
<td>Undetectable – 5 bpm</td>
</tr>
<tr>
<td>Marked</td>
<td>&gt; 25 bpm</td>
</tr>
</tbody>
</table>

As a rule, moderate variability provides reassurance about fetal status and the absence of metabolic acidemia
Absent

Minimal

Moderate

Marked
Changes in Variability

- **Hypoxic causes**
  - Tachysystole
  - Abruption
  - Maternal hypotension

- **Non-hypoxic causes**
  - Sleep cycle
  - Prematurity
  - Cardiac arrhythmias
  - Medications (narcotics)
Acceleration

• Visually apparent abrupt increase in the FHR
  – Onset to peak <30 seconds

• Prolonged acceleration lasts 2-10 minutes, longer than 10 minutes is a baseline change

| > 32 weeks | 15 x 15 |
| < 32 weeks | 10 x 10 |
Fetal heart rate accelerations
EFM Mantra

- Baseline
- Variability
- Accelerations
- Decelerations
- Contractions
Contractions

Normal: 5 contractions or less in a 10 minute window over a 30 minute period
Uterine contractions

- Frequency—beginning to beginning
- Duration—beginning to end
- Strength/Quality/Peak IUP
- Resting tone—relaxation/interval
Uterine Contractions

- External tocodynamometer
  - Frequency and duration of contractions
  - Noninvasive but uncomfortable, difficult to monitor obese patients

- Intrauterine pressure catheter
  - Frequency, duration & *adequacy* of contractions
  - Resting tone between contractions
  - Only when membranes are ruptured; invasive
  - Uncomfortable and limits patient mobility
  - Can be used for intrauterine resuscitation
Montevideo Units

Adequacy of contractions

**IUPC ONLY**

number of ctx in 10 mins X mean amplitude (mm Hg)
Montevideo Units

Calculating MVUs

Contraction forces are usually reported in Montevideo Units (MVUs), which represent the total of the intensity of each contraction in a 10 minute period. MVUs > 200 are adequate for 90% of labors to progress.

With an I UPC, the pressures in mmHG can be quantified, as well as the frequency of contractions.

75 mmhg + 60 mmhg + 50 mmhg + 45 mmhg = 230 MVUs
(Note that the baseline pressure was subtracted from each reading)
Tachysystole

• > 5 contractions in 10 minutes averaged over 30 minute window
• Should also describe the presence or absence of associated decelerations
• Can be used for spontaneous or induced contractions

Tachysystole
Uterine hyperstimulation

• Uterus does not relax between contractions

• Resting uterine tone > 25 mm Hg

• Perfusion of intervillus space is compromised

• FHR decelerations secondary to lack of oxygen

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Decelerations

- Early
- Late
- Variable
- Prolonged
Early Deceleration

• Visually apparent, usually symmetric, gradual decrease and return of the FHR associated with a uterine contraction
  • Onset to nadir >30 seconds
• Nadir of the deceleration occurs at the same time as the peak of the contraction
• Fetal head compression

“mirror image”
Variable Deceleration

• Visually apparent *abrupt* decrease of FHR below baseline
  – less than 30 seconds from onset to nadir

• Decrease must be:
  – $\geq 15$ bpm below baseline
  – duration $\geq 15$ seconds but $< 2$ minutes

• Variable association with contractions

• Cord compression
Variable Deceleration

• Configuration depends upon degree of occlusion

• Partial occlusion
  – occlusion of umbilical vein only
  – reduction of fetal blood return
  – hypotension stimulates baroreceptors with FHR acceleration
Variable Deceleration

• **Complete occlusion**
  
  – occlusion of umbilical vein *and* artery
  
  – fetal *hypertension* resulting in
    
    • baroreceptor mediated decel (first 15-20 sec)
    
    • followed by chemoreceptor mediated decel
      
      (hypoxia, at 30 seconds)
Late Deceleration

• Visually apparent usually symmetric gradual decrease and return of the FHR associated with a uterine contraction
  – > 30 seconds from onset to nadir
• Deceleration is delayed in timing, with the nadir of the deceleration occurring after the peak of the contraction
Late Decelerations

- Fetal hypoxia causes CNS mediated cardiac deceleration reflex
- Myocardial depression secondary to metabolic acidosis
- Placental insufficiency

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FETAL ACCELERATIONS AND DECELERATIONS

"VEAL CHOP"

V - VARIABLE DECELERATION
E - EARLY DECELERATION
A - ACCELERATION
L - LATE DECELERATION
C - CORD COMPRESSION
H - HEAD COMPRESSION
O - OKAY!
P - PLACENTAL INSUFFICIENCY

Legend: VEAL CHOP - FETAL ACCELERATIONS AND DECELERATIONS

Variable decelerations are associated with cord compression (C) and (P).
Early decelerations are associated with head compression. This is generally a temporary event (E) and (H).
Accelerations are associated with unopposed, which occurs when there is no good progesterone (A) and (O).
Late decelerations are associated with placental insufficiency (L) and (P). The goal for this mnemonic is writing it in each column is associated with the correct answer, or the other way around.

SEE ALL MEMORICS AND TIPS AT:
http://nurseslabs.com/nememoris
Prolonged decelerations

• Visually apparent decrease in the FHR below the baseline

• 15 bpm or more, lasting 2 minutes or more but less than 10.

• If a deceleration lasts 10 minutes or longer, it is a baseline change
FHR Decelerations

• Depth and duration should be quantitated

• Recurrent: $\geq 50\%$ of ctx

• Intermittent: $< 50\%$ of ctx

• Deceleration pattern
  – Defines the *nature* of the insult

• Variability
  – Characterizes the ability of fetus to *tolerate* the insult
EFM Mantra

- Baseline
- Variability
- Accelerations
- Decelerations
- Contractions
Interpretation of FHR Patterns

• Patterns reflect the current acid-base status of the fetus
• Tracing patterns will change over time
• Cannot predict the development of cerebral palsy
• Three tier system
  – Category I, II, III
Category I = NORMAL
Category I

- Baseline: 110 – 160 bpm
- Variability: Moderate
- Accelerations: Present or absent
- Early decels: Present or absent
- Late or variable decels: Absent

- Strongly predictive of normal acid-base status
- No action needed

Fetal Metabolic Acidemia

Accelerations present and/or moderate variability

Unlikely risk of acidemia
Category III = BAD!!!
Category III

- Recurrent late decels with absent variability
- Recurrent variable decels with absent variability
- Bradycardia with absent variability
- Sinusoidal pattern

Sinusoidal pattern

- Visually apparent, smooth, sine wave-like undulating pattern in FHR baseline with a cycle frequency of 3-5 per minute which persists for 20 minutes of more
Sinusoidal pattern
Category II = everything else
Category II

• Baseline: - Bradycardia with min/mod variability  
  - Tachycardia

• Variability: - Minimal variability  
  - Absent not accompanied by recurrent decels  
  - Marked variability

• Accelerations: - Absent of induced accels after fetal stimulation

Categories

• Category I
  – Normal/strongly predictive of normal acid-base status
  – No action needed

• Category II
  – Indeterminate
  – Not predictive of abnormal acid-base status
  – Requires evaluation, increased surveillance

• Category III
  – Predictive of abnormal acid-base status
  – Requires *prompt* evaluation and intervention

Algorithm for management of category II fetal heart rate tracings

Moderate variability or accelerations

- Yes
  - Significant decelerations with ≥50% of contractions for 1 hour
    - Yes
      - Cesarean
    - No
      - Active Phase
        - Normal labor progress
          - No
            - Cesarean
          - Yes
            - Observe
        - Second Stage
          - Normal progress
            - No
              - Cesarean or OVD
            - Yes
              - Observe
      - Observe
      - Cesarean or OVD
  - No
    - Observe

- No
  - Significant decelerations with ≥50% of contractions for 30 minutes
    - Yes
      - Observe for 1 hour
    - No
      - Persistent pattern
        - Yes
          - Observe
        - No
          - Manage per algorithm

OVD, operative vaginal delivery.

*aThat have not resolved with appropriate conservative corrective measures, which may include supplemental oxygen, maternal position changes, intravenous fluid administration, correction of hypotension, reduction or discontinuation of uterine stimulation, administration of uterine relaxant, amnioinfusion, and/or changes in second stage breathing and pushing techniques.

Assessment of intrapartum FHR tracing

Category I
- Routine management

Category II*
- Evaluation and surveillance
  - FHR accelerations or moderate FHR variability
    - Continue surveillance + Intrauterine resuscitative measures†
  - Absent FHR accelerations and Absent/minimal FHR variability
    - Intrauterine resuscitative measures†
      - If not improved or FHR tracing progresses to Category III, consider delivery‡

Category III
- Prepare for delivery + Intrauterine resuscitative measures†
  - If not improved, consider prompt delivery‡

*Given the wide variation of FHR tracings in Category II, this algorithm is not meant to represent assessment.
<table>
<thead>
<tr>
<th>Goal</th>
<th>Associated Fetal Heart Rate Abnormality*</th>
<th>Potential Intervention(s)†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promote fetal oxygenation and improve uteroplacental blood flow</td>
<td>Recurrent late decelerations</td>
<td>Initiate lateral positioning (either left or right)</td>
</tr>
<tr>
<td></td>
<td>Prolonged decelerations or bradycardia</td>
<td>Administer maternal oxygen administration</td>
</tr>
<tr>
<td></td>
<td>Minimal or absent fetal heart rate variability</td>
<td>Administer intravenous fluid bolus</td>
</tr>
<tr>
<td>Reduce uterine activity</td>
<td>Tachysystole with Category II or III tracing</td>
<td>Reduce uterine contraction frequency</td>
</tr>
<tr>
<td>Alleviate umbilical cord compression</td>
<td>Recurrent variable decelerations</td>
<td>Discontinue oxytocin or cervical ripening agents</td>
</tr>
<tr>
<td></td>
<td>Prolonged decelerations or bradycardia</td>
<td>Administer tocolytic medication (e.g., terbutaline)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Initiate maternal repositioning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Initiate amniinfusion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If prolapsed umbilical cord is noted, elevate the presenting fetal part while preparations are underway for operative delivery</td>
</tr>
</tbody>
</table>
How often do I have to do this??

Intrapartum

<table>
<thead>
<tr>
<th></th>
<th>First stage of labor: 30 min</th>
<th>Second stage: 15 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncomplicated patient</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complicated Patient</td>
<td>First stage of labor: 15 min</td>
<td>Second stage: 5 min</td>
</tr>
</tbody>
</table>

*Don’t forget to document your findings!*

ACOG PB #106
Limitations of EFM

- Poor interobserver and intraobserver reliability
- Uncertain efficacy
- High false-positive rate
Limitations of EFM

• EFM reduces risk of neonatal seizures
• Increased cesarean and operative vaginal delivery rate
• EFM does not reduce perinatal mortality
• EFM does not reduce the risk of cerebral palsy
Electronic Fetal Monitoring vs Intermittent auscultation

• There is no RCT to document that EFM is superior therefore it is acceptable that an uncomplicated patient could opt for IA

• However, this is hospital and staff dependent, as IA is very “labor intensive”
  – ACOG recommends: q15 min in active phase of latent labor and at least q5 min in second stage
YOU HAVE A 40 HOUR WORK WEEK?

I REMEMBER MY FIRST PART TIME JOB