Assessment of Fetal Well-Being

Amie Hollard, MD
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<table>
<thead>
<tr>
<th><strong>Learning Objectives</strong></th>
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<tbody>
<tr>
<td><strong>Discuss</strong></td>
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<tr>
<td>Discuss advantages and disadvantages of external versus internal fetal monitoring</td>
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<tr>
<td><strong>Interpret</strong></td>
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<tr>
<td>Be able to interpret fetal heart tracing</td>
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<tr>
<td>- Baseline, variability, accelerations, decelerations</td>
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<tr>
<td><strong>Interpret</strong></td>
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<tr>
<td>Be able to interpret contraction patterns</td>
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<tr>
<td><strong>Classify</strong></td>
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<tr>
<td>Be able to classify fetal heart rate tracings into one of three categories</td>
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<tr>
<td><strong>Discuss</strong></td>
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<td>Discuss common modes of antenatal surveillance</td>
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<tr>
<td>- NST, BPP, Modified BPP</td>
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What will be covered

- Ways to Monitor
- The Basics
- Fetal Tachycardia and Bradycardia
- Variability
- Accelerations and Decelerations
- Sinusoidal Pattern

- Uterine Contractions
- Categorization of FHR Tracings
- Antenatal Surveillance: Non-Stress Test and Biophysical Profile
- Guidelines for Reviewing FHR Monitoring
- Examples of Tracings
Ways to Monitor
Ways to Monitor: External

Uterine contractions
Fetal heart rate (FHR)

Benefits
- Non-invasive
- Can be used with intact membranes

Disadvantages
- Sometimes not able to adequately trace heart rate or contractions
- Detects frequency of contractions but says nothing about their strength
Ways to Monitor: Internal

Uterine contractions
Fetal heart rate (FHR)

Benefits
- Ability to trace regardless of maternal habitus or position
- Able to quantify strength of contractions

Disadvantages
- More invasive
- Only used with ruptured membranes
- Caution with patients who have HIV, hepatitis B/C
- Rare complications with placement
The Basics
The Basics

Fetal heart rate

Each dark line represents one-minute intervals

Contractions

BPM

MVU s
Features to Describe

FHTs
- Baseline
- Variability
- Accelerations
- Decelerations
- Interpret into 1 of 3 categories

Contractions
- Frequency
- Amplitude (if IUPC)
Baseline

Mean fetal heart rate
- Rounded to increments of 5
- During a 10-minute period
- Excluding accelerations and decelerations

Normal baseline
- 110-160 BPM
Baseline
Baseline

Bradycardia
<110 BPM
Tachycardia
>160 BPM
Indeterminate

- less than 2 minutes of baseline is present
Fetal Tachycardia/Bradycardia
Fetal Tachycardia

- Normal variant
  - prematurity
- Intra-amniotic infection
- Response to maternal condition (fever, dehydration, etc.)
- Fetal anemia
- Fetal cardiac arrhythmia (SVT)
- Fetal hypoxia
- Thyrotoxicosis
Fetal Tachycardia
Fetal Bradycardia
Variability
Variability

Fluctuations in FHR

- Beat-to-beat variation

Descriptors are:

- **Absent**: undetectable amplitude range
- **Minimal**: Up to 5 BPM
- **Moderate**: amplitude range 6 to 25 BPM
  - Reassuring
- **Marked**: amplitude range greater than 25 BPM
Marked Variability
Accelerations/Decelerations
Accelerations

Abrupt increase in FHR
- Gestational age $\geq$ 32 weeks
  - At least 15 BPM above baseline
  - Must last at least 15 seconds
  - (15x15s)
- Gestational age <32 weeks
  - 10x10s unless previously demonstrated 15x15s

Prolonged accelerations
- Last at least 2 minutes but fewer than ten minutes

Baseline change
- Last 10 minutes or longer
Acceleration

Acme of 15 bpm above baseline with duration > 15 secs but < 2 min

Baseline

Begining

End

Acme

Duration > 15 secs

Acme > 15 bpm above baseline
Accelerations
Decelerations

Decrease of FHR below baseline

3 Types
- Early
- Variable
- Late

Recurrent if occurring with >50% contractions
- Otherwise intermittent

Prolonged if >2 minutes
Baseline change if >10 minutes
Deceleration
Early Deceleration

- Symmetrical to contraction
- Mirror image of contraction
- Gradual decrease in FHR
  - 30 secs or more from onset to nadir
- Represent vagal response to head compression
- Not concerning
EARLY DECELERATION

- Gradual FHR decrease
- Onset to nadir 30 seconds or more
- Nadir of deceleration occurs with peak of contraction
- Mirror contraction

Onset to nadir > 30 secs
Late Decelerations

Deceleration is delayed in timing
- Nadir following the peak of the contraction
A gradual FHR decrease
- Onset to nadir > 30 second
Represents uteroplacental insufficiency
Non-reassuring
Late Decelerations
Variable Decelerations

- Abrupt decrease in fetal heart rate
  - Onset to nadir less than 30 seconds
- Decrease in FHR
- May or may not be associated with contractions
- Represent cord compression
  - More likely with oligohydramnios
  - Amnioinfusion
- Common during labor
- Can be concerning if recurrent
Variable Decelerations
Prolonged Deceleration
Sinusoidal Pattern
Sinusoidal Pattern

- Smooth sine-wave pattern
- Cycle frequency 3-5 per minute
- Persists for 20 minutes or longer
- Non-reassuring
  - Fetal anemia
  - Pseudosinusoidal pattern can occur after IV narcotic administration during labor
Sinusoidal Pattern
Uterine Contractions
Uterine Contractions

Number of contractions in 10 minutes
  - averaged over thirty minutes

Components to note
  - **Frequency**
  - **Intensity**
  - **Duration**
  - **Relaxation**
    - time between contractions
Monitoring of Contractions

DURATION: beginning to end of one contraction

FREQUENCY: beginning of one contraction to the beginning of the next contraction.

These contractions are coming every 5 minutes and lasting for 60 seconds.
Uterine Contraction
Tachysystole

>5 contractions in 10 minutes
- Averaged over 30 minutes

If sustained, could lead to fetal distress
Contraction Intensity

Can only be assessed with IUPC

- Look at 10-minute window of contractions
- For each contraction
  - Subtract nadir from peak of contraction
- Add up these values, which represent contraction strength
- Measured in MVUs (Montevideo units)
- 200 MVUs or greater is considered an adequate contraction pattern that should in theory be enough to promote cervical change
Montevideo units are calculated by subtracting the baseline uterine pressure from the peak contraction pressure for each contraction in a 10-minute window and adding the pressures generated by each contraction. In the example shown, there were five contractions, producing pressure changes of 52, 50, 47, 44, and 49 mm Hg, respectively. The sum of these five contractions is 242 Montevideo units.
Categorization of FHR Tracings
Categorization of FHR Tracings

Recommendation of three-tiered system

- April 2008
- More standardized interpretation

Concept: Interpretation of an FHR monitor strip is a dynamic process, with determination of whether a particular strip is reassuring and what action plans should be taken... and then to evaluate at a later time
Categorization of FHR Patterns

An evaluation of the fetus at a particular point in time
Categories I, II, and III
### TABLE 2. Category Definitions

<table>
<thead>
<tr>
<th>Category I: Normal or &quot;Good&quot;</th>
<th>Present:</th>
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<tbody>
<tr>
<td></td>
<td>- Baseline FHR 110 to 160 bpm</td>
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<td></td>
<td>- Moderate baseline variability (6-25 bpm)</td>
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<td>Absent:</td>
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<tr>
<td></td>
<td>- Variable decelerations</td>
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<tr>
<td></td>
<td>- Late decelerations</td>
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<tr>
<td>Present or Absent:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Accelerations</td>
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<tr>
<td></td>
<td>- Early decelerations</td>
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<thead>
<tr>
<th>Category II: Indeterminate or &quot;Atypical&quot;</th>
<th>FHR patterns that are not category I or III</th>
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<tr>
<td>Absence of induced accelerations after fetal stimulation</td>
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<tr>
<th>Category III: Abnormal or &quot;Bad&quot;</th>
<th>Present (either):</th>
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<tbody>
<tr>
<td></td>
<td>- Sinusoidal FHR pattern OR</td>
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<td></td>
<td>- Absent baseline FHR variability AND ANY:</td>
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<tr>
<td></td>
<td>- Recurrent late decelerations</td>
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<td></td>
<td>- Bradycardia</td>
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<tr>
<td></td>
<td>- Recurrent variable decelerations</td>
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Category I

Normal baseline
  ▪ 110-160 BPM
FHR Variability
  ▪ moderate
Late or Variable decelerations
  ▪ none
Category II

Not enough evidence to place into either Category I or III

Various extremes of category II

- Reactive tracing with one variable deceleration
- Minimal variability with recurrent late decelerations
Category III

- Abnormal tracing
- Predictive of abnormal fetal acid-base status
- Requires prompt intervention
The ABCD’s of Fetal Monitoring

- Confirm FHR and uterine activity
- FHR Category?
  - I
    - Is the patient low-risk?
      - Yes: Routine Surveillance
        - Every 30 min in the 1st stage of labor
        - Every 15 min in the 2nd stage of labor
      - No: Heightened Surveillance
        - Every 15 min in the 1st stage of labor
        - Every 5 min in the 2nd stage of labor
  - II or III
    - "ABCD"
      - "A" - Assess oxygen pathway
      - "B" - Begin corrective measures
      - FHR Category?
        - I
          - Presence of moderate variability or accelerations
            - Yes: Expedite Delivery
              - Is vaginal delivery likely before the onset of metabolic acidemia and potential injury?
                - Yes: Expedite Delivery
                - No: Heightened Surveillance
          - Absence of clinically significant decelerations
            - No/unsure: "C" - Clear obstacles to rapid delivery
            - "D" - Determine decision to delivery time
              - Is vaginal delivery likely before the onset of metabolic acidemia and potential injury?
                - Yes: Expedite Delivery
                - No: Heightened Surveillance
Intrauterine Resuscitation

- Oxygen
- IV fluids
- Reposition the mother (left side, etc.)
- Assess maternal blood pressure
  - Especially if shortly after epidural placement
- Check cervix
  - Delivery imminent?
  - Cord prolapse?
- Stop the Pitocin if this agent is being used
- Terbutaline can be given to space out contractions, especially if tachysystole is a concern
Antenatal Surveillance: Non-stress test, biophysical profile and modified biophysical profile
Common Methods of Antenatal Surveillance

- Non-stress test (NST)
- Biophysical profile (BPP)
- Modified BPP (NST/AFI)
Non-Stress Test

Monitor fetal heart rate at least 20 minutes in the absence of contractions
- With contractions, technically contraction stress test
False negative (i.e. reassuring test with fetal demise within one week)
- 2/1000
Higher false positives
- Fetal sleep-wake cycles
- Maternal narcotics

Outcomes
- Reactive
  - 2 accelerations/20 minutes
- Non-reactive
  - Less than 2 accelerations/20 minutes
Reactive NST
Biophysical Profile (BPP)

- NST + ultrasound markers
- Score linearly correlated with fetal pH
- Risk of fetal death within one week of normal BPP is 0.8/1000
Biophysical Profile

• Performed during a 30-minute timeframe but can be extended
• Zero or 2 points for each (all or none)
  • NST (sometimes not performed)
    • 2 accelerations/20 minutes
  • Fetal breathing
    • >30 seconds
  • Fetal gross body movements
    • 3 distinct movements
  • Fetal tone
    • 1 episode of flexion with return to extension
  • Amniotic fluid volume
    • Deepest vertical pocket at least 2 cm
Biophysical Profile

In the absence of oligohydramnios

- Scores of 10/10, 8/8 (no NST) and 8/10 all reassuring
- 6/8 is NOT a score!
  - Get NST
- 6/10 requires further evaluation
- 4/10, 2/10, 0/10 or oligohydramnios not reassuring
Modified Biophysical Profile

Combination of NST/AFI
- NST represents acute fetal well being
- AFI represents chronic fetal well being
0 or 2 points
  - NST: 0 if non-reactive, 2 if reactive
  - AFI: 0 if oligohydramnios; 2 if not
Score of 4/4 as reassuring as full BPP
  - False negative 0.8/1000
Score of 2/4 requires full BPP
Score of 0/4 requires further evaluation
Guidelines for Reviewing
Guidelines for Reviewing FHR Monitoring

Normal patient
- Reviewed every 30 minutes in the first stage of labor
- Every 15 minutes in the second stage

Complicated patients
- Every 15 minutes in first stage
- Every 5 minutes in second stage
Examples of Tracings
26 weeks
pre-eclampsia
Apgars 3-5-4
ph 7.10 PCO2 68 Bicarb 20
BD 7.9 PO2 60

09/14/10 19:35
At 6:50 pm, oxytocin is discontinued, the attending obstetrician is called and intracranial resuscitation is begun; pt. moved to OR at 6:57 pm.