**GOAL: Maximize maternal-fetal oxygenation**

EFM assesses fetal hypoxemia in real time

**Benefits:**
- Non-invasive options
- Universal use
- Assess fetal hypoxemia in real time
- Reduces risk of neonatal seizures
- Intermittent auscultation or EFM has comparable results

**Limitations include:**
- Poor inter- and intra-observer reliability
- Associated with increased rate of OVD and C/S for abnormal FHR patterns or acidosis or both
- Does not reduce the risk of CP or perinatal mortality
  - High false-positive rate for CP: >99%

**General EFM Principles**

- Fetal oxygenation and intrauterine conditions are influenced by several internal and external factors
- Fetal tolerance to pregnancy, labor, and birth varies with each fetus
- Fetal oxygen reserves decline over the course of labor
- Identifying FHR trends indicative of evolving fetal hypoxemia is key to early intervention
- Administering interventions prior to the development of fetal hypoxemia may limit morbidity or mortality
- Intrauterine resuscitation measures (IURM) are interventions administered to improve oxygen delivery to mother and fetus
- IURM may be administered by various members of the perinatal team based on competency and credentials
- Non-invasive interventions should be administered prior to invasive options when clinically possible
- IURM may have a single or cumulative effect on EFM data; hence one intervention may resolve several abnormal UA and or FHR components
- Most UA and/or FHR patterns may be resolved with 2 or less IURM
- IURM are administered based on underlying pathophysiology
- An EFM Algorithm is a step-by-step procedure that outlines administration of IURM for specific clinical conditions
- There is not one single course of action for any UA/FHR pattern
- Specific individualized clinical conditions and maternal-fetal response will guide selection and sequence of IURMs
- IURM may not resolve all abnormal UA or FHR components or patterns
- When IURMs are unsuccessful, delivery may be indicated

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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### General UC Characteristics

- **Frequency**: ≤ 5 UCs in 10 minutes, averaged over a 30-minute period
- **Duration**: 50-70 seconds
- **Intensity**: 25-75 mmHg via IUPC
- **Resting Tone**: < 20-25 mmHg via IUPC

### General FHR Characteristics

May apply to fetal heart rate accelerations or decelerations

### Episodic

- Associated without UCs

### Periodic

- Associated with UCs

### Peak

- Highest point

### Nadir

- Lowest point

### Abrupt

- Onset to peak or nadir is less than 30 seconds

### Gradual

- Onset to nadir of deceleration is ≥ 30 seconds

### Prolonged

- > 2 minutes but < 10 minutes

### Intermittent

- Occur with < 50% of UCs in any 20-minute window

### Recurrent

- Occur with ≥ 50% of UCs in any 20-minute window
<table>
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<tr>
<th>Uterine Dysfunction:</th>
<th>Tachysystole</th>
<th>Hypertonus</th>
<th>Tachysystole/Hypertonus-IURM (intrauterine resuscitation measures) for abnormal UA Activity:</th>
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<tr>
<td><strong>Term</strong></td>
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<td><strong>Pathophysiology</strong></td>
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| Uterine Dysfunction: | >5 contractions in 10 minutes, averaged over a 30-minute period; applied to both spontaneous and stimulated labor. Should always be qualified as to the presence or absence of associated FHR decelerations.  
- Spontaneous or medication induced | ✓ Uterine Dysfunction:  
- Fibroids or prior uterine surgery  
- Over Distension: polyhydramnios, multiple gestation, large for gestational age (LGA)  
- Hypertonus: Cephalopelvic disproportion (CPD) or occiput posterior (OP) presentation  
- Muscular exhaustion (overstimulation or prolonged labor/endogenous vs exogenous) | ✓ Lateral Positioning  
- Decompress Vena Cava |
| Tachysystole | ✓ Vena Cava Compression  
- Supine in term pregnancy  
- Obesity  
- Multiple gestation | ✓ Increase IV Fluids  
- Maternal hydration improves uterine function  
- ↑250cc vs 125cc/hr if not contraindicated |
| Hypertonus | ✓ Dehydration  
- NPO status may lead to maternal dehydration, limit uterine muscle function | ✓ Excessive cervical ripening or labor stimulation  
- Cervidil or oxytocin-adjust dose | ✓ Cervical Exam  
- Assess labor progression |
| | ✓ Medications:  
- Cocaine | ✓ Medications:  
- Decrease or discontinue labor stimulation agents  
- Remove cervical ripening agents  
- Administer tocolytic prn | ✓ Medication(s) |
| | ✓ OB Clinical conditions:  
- Preterm labor  
- Placental Abruption  
- Uterine Rupture  
- Post Term | ✓ OB Clinical conditions:  
- Preterm labor  
- Placental Abruption  
- Uterine Rupture  
- Post Term | ✓ See ACOG Tachysystole Algorithm |
| | ✓ OB Clinical conditions:  
- Preterm labor  
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| | ✓ OB Clinical conditions:  
- Preterm labor  
- Placental Abruption  
- Uterine Rupture  
- Post Term | | |
| Acceleration | Visually apparent *abrupt* increase in the FHR; if lasts 10 minutes or >, it is a baseline change  
| | ≥ 32 weeks GA: acceleration has a peak of 15 bpm or > above baseline, with a duration of 15 seconds or > but < 2 minutes from onset to return  
| | < 32 weeks GA: acceleration has a peak of 10 bpm or > above baseline, with a duration of 10 seconds or > but < 2 minutes from onset to return. | Catecholamine induced cardiac stimulation typically caused by fetal movement and directly influenced by gestational age; reliably predicts the absence of fetal metabolic acidemia at the time of observation  
| | o Prolonged acceleration:  
| | o Excessive catecholamine exposure  
| | o Medications that may decrease occurrence include:  
| | o Parenteral narcotics  
| | o MgSO4  
| | o Betamethasone | *Persistent prolonged accelerations may evolve into a baseline change; continued surveillance is required* |

| Decelerations: | Visually apparent usually symmetrical *gradual* decrease and return of the FHR associated with a uterine contraction  
| | o FHR decrease is calculated from the onset to the nadir of the deceleration  
| | o *Nadir* of the deceleration occurs at the same time as the peak of the contraction  
| | o In most cases, the onset, nadir, and recovery of the deceleration are coincident with the beginning, peak, and ending of the contraction, respectively | Fetal head compression stimulating parasympathetic response leading to cardiac slowing; decel typically found late in labor process but may evolve into variable deceleration if observed early in labor process-if so may be associated with:  
| | o CPD, cervical examination, forcep application | ❖ *Continued Surveillance* |

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| Late | Visually apparent usually symmetrical **gradual** decrease and return of the FHR associated with a uterine contraction  
  - FHR decrease is calculated from the onset to the nadir of the deceleration  
  - Deceleration is delayed in timing, with the nadir of the deceleration occurring **after** the peak of the contraction  
  - In most cases, the onset, nadir, and recovery of the deceleration **occur after** the beginning, peak, and ending of the contraction, respectively | Direct causes may include:  
  - Maternal reflex response due to supine positioning  
  - Uteroplacental insufficiency (UPI): inadequate amount of oxygen to meet fetal demands leading to cardiac depression; if prolonged may lead to fetal hypoxemia  
  - If accelerations or moderate variability absent, hypoxemia may be present | Maternal Supine position etiology:  
  - **Lateral Positioning**  
    - Decompress Vena Cava  
    - Stabilize maternal blood pressure  
  
UPI/Hypoxemia etiology:  
  - **RX Fetal Hypoxemia** |
| Variable | Visually **apparent** abrupt decrease in FHR below the baseline calculated from the onset of the deceleration to the beginning of the FHR nadir of less than 30 seconds  
  - FHR decrease is > 15 bpm, lasting > 15 seconds, but < 2 minutes  
  - When associated with UCs, the onset, nadir, and recovery of the deceleration **commonly vary with successive UCs** | Umbilical cord compression, entanglement, or stretch leading to partial or complete occlusion of the 2 arteries and 1 vein; depending on severity may lead to fetal hypertension, fetal hypotension, +/-hypoxemia  
  - More frequent in preterm fetuses  
  - If accelerations or moderate variability absent, hypoxemia may be present | Umbilical cord compression etiology:  
  - **Lateral Positioning**  
    - May releases umbilical cord  
  - **Amnioinfusion**  
    - IV solution may decompress umbilical cord |
|  |  | Umbilical cord compression etiology + hypoxemia:  
  - **RX Fetal Hypoxemia**  
  - **Review ACOG IP FHR Algorithm** |
NICHD Guidelines

- Definitions are primarily developed for visual interpretation of FHR patterns, but should be adaptable to computerized systems of interpretation.
- Definitions should be applied to intrapartum patterns, but also are applicable to antepartum observations.
- Definitions apply to the interpretation of patterns produced from either a direct fetal electrode or external Doppler device detecting the fetal heart events with use of the autocorrelation technique.
- Most common paper speed is 3 cm per minute on the horizontal axis and 30 beats per cm of paper for the FHR on the vertical axis.
- No distinction between STV and LTV as these FHR characteristics are visually assessed as a unit.
- EFM strip must have data of good quality for full and complete assessment.
- Several FHR components are gestational age (GA) dependent, so GA must be considered in the full description of the pattern.
- FHR tracings are evaluated in the context of the maternal medical condition, prior results of fetal assessment, medications, and other factors.
- The biological and clinical significance of FHR patterns is commonly considered to be related to the quantitative variation from the “normal” (Category I) range.
- The individual components of the FHR patterns that are defined do not occur alone and generally evolve over time. Therefore, a full description of an FHR tracing requires a qualitative and quantitative description of: baseline rate, baseline variability, presence of accelerations, periodic or episodic decelerations, and changes or trends over time.
- Laboring women with high-risk conditions (eg, suspected fetal growth restriction, preeclampsia, type I diabetes, or cardiac disease) should be monitored with continuous EFM.

<table>
<thead>
<tr>
<th>FHR 3 Tier Category System</th>
<th>All are required:</th>
<th>Strongly predictive of normal fetal acid-base status at time of observation</th>
<th>Routine Management</th>
<th>Depending on clinical situation, efforts to expeditiously resolve the abnormal FHR pattern may</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category I</td>
<td>Baseline rate: 110-160</td>
<td>Baseline variability: Moderate</td>
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<tr>
<td></td>
<td>Late or variable decels: absent</td>
<td>Early decel or accels: absent or present</td>
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<tr>
<td></td>
<td>May include any of the following:</td>
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<td></td>
<td>Absent baseline variability plus:</td>
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<tr>
<td></td>
<td>Recurrent late decelerations</td>
<td>Recurrent variable decels</td>
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<tr>
<td></td>
<td>Associated with abnormal fetal acid-base status at time of observation</td>
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<tr>
<td></td>
<td>Routine Management</td>
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<table>
<thead>
<tr>
<th>Category II</th>
<th>Indeterminate acid-base status at time of observation; FHR components or patterns that may signal evolving hypoxemia in the fetus:</th>
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</thead>
<tbody>
<tr>
<td>o Bradycardia</td>
<td><em>Increased frequency, duration, and/or intensity of decelerations (LD or VD)</em></td>
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<tr>
<td>• Sinusoidal pattern</td>
<td><em>Increase or decrease in baseline rate accompanied by recurrent decelerations</em></td>
</tr>
<tr>
<td>All other patterns not included in Cat I or Cat III</td>
<td>*Marked or minimal variability accompanied by recurrent decelerations (LD or VD) lasting ≥ 60-90min</td>
</tr>
</tbody>
</table>

References: