The Aim of Intrapartum Surveillance

- To detect potential fetal decompensation and to allow timely and effective intervention to prevent perinatal / neonatal morbidity or mortality.

Fetal Well Being During Labour

Definitions

- Hypoxemia - decreased oxygen content in blood
- Hypoxia - decreased oxygen content in tissues
- Acidemia - increased H+ content in blood
- Acidosis - increased H+ content in tissues
- Asphyxia - hypoxia with metabolic acidosis

Do not use fetal distress

Hypoxia is Normal During Labour

80% of all labours have some periods of atypical or abnormal EFM

<table>
<thead>
<tr>
<th>Healthy Fetus</th>
<th>Fetus with Limited Reserve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transient fetal hypoxia</td>
<td>Limited reserves = limited fetal oxygenation</td>
</tr>
<tr>
<td>Physiological ↓ in pH</td>
<td>Potential for metabolic acidosis &amp; cardiovascular decompensating</td>
</tr>
<tr>
<td>Well tolerated</td>
<td></td>
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</tbody>
</table>

Fetal Asphyxia with Hypoxic Ischemic Encephalopathy (HIE)

- If hypoxia continues over time → metabolic acidosis
- Metabolic acidosis + continued hypoxia → asphyxia
- Severity / duration of asphyxia affects the outcome

Cerebral Palsy

- Chronic motor disorder of cerebral origin
- Due to the increased survival of babies < 1500 gm, CP increased in that population
- Overall rates are stable (2 – 3 per 1000)
Intrapartum events account for less than 20% of neurological deficits in children.

Criteria to Define an Acute Intrapartum Hypoxic Event as Sufficient to Cause Cerebral Palsy

Essential Criteria (must meet all four)
1. pH < 7.00 and base deficit ≥ 12 mmol/L
2. Early onset of severe or moderate neonatal encephalopathy in infants ≥ 34 wks
3. Cerebral palsy of the spastic quadriplegic or dyskinetic type
4. Exclusion of other etiologies (e.g. trauma, coagulation, infection, genetic)

Criteria that Suggest Intrapartum Timing
1. A sentinel hypoxic event occurring immediately before or during labour
2. Sudden sustained bradycardia or absence of variability + persistent, late or variable decelerations, usually after the hypoxic sentinel event when previously normal FHR
3. Apgar scores 0 – 3 beyond 5 minutes
4. Multisystem involvement within 72 hours of birth
5. Early imaging study showing acute nonfocal cerebral abnormality

Factors Affecting Fetal Oxygenation Maternal
- ↓ maternal arterial oxygen tension
- ↓ maternal oxygen carrying capability
- ↓ uterine blood flow
- Chronic maternal conditions

Factors Affecting Fetal Oxygenation
- Maternal
- Uteroplacental
- Fetal
Factors Affecting Fetal Oxygenation

Uteroplacental
- Excessive uterine activity
- Uteroplacental dysfunction

Fetal
- Cord compression
- ↓ fetal oxygen carrying capability

Interpretation of Fetal Surveillance

Must look at total clinical picture including:
- Maternal risk factors
- Fetal risk factors
- Progress of labour
- FHR characteristics and uterine activity
- Changes or trends over time

Methods of Intrapartum Fetal Surveillance

Intermittent Auscultation (IA)
and
Electronic Fetal Monitoring (EFM)

Guidelines for Fetal Heart Rate Assessment

- Practitioners with the knowledge, skills & ability of IA and EFM
- One to one care recommended regardless of IA or EFM
- Institutional policy for technique and frequency
- Defined interventions for atypical and abnormal FHR patterns

Definitions of FHR (IA and EFM)
Normal range 110 – 160
- FHR < 110 – bradycardia
- FHR > 160 - tachycardia
Characteristics of Normal Contractions

- **Frequency:** ≤ 5 in 10 min (avg over 30 min)
- **Duration:** < 90 sec
- **Configuration:** regular, symmetrical
- **Intensity:** mild moderate or strong by palpation 25 – 90 mm/Hg by IUPC or
- **Resting tone:** soft, < 15 mmHg for ≥ 30 sec

Characteristics of Excessive Uterine Activity

- **Tachysystole** - > than 5 contractions in 10 min averaged over 30 min (spont and stimulated labour) including a fetal heart rate interpretation
- **Resting tone between contractions** < 30 seconds
- **Contraction length** 90 sec

IA Components

- **Uterine activity by palpation**
  - Frequency, duration, intensity, resting tone
- **FHR**
  - Baseline – between contractions for 60 sec.
  - Post contraction – immediately post contraction for 30 – 60 sec
  - Increase or decrease in FHR
  - Rhythm
  - Changes for trends or over time

IA cannot:

- Assess baseline variability
- Classify the type of deceleration

Normal vs Abnormal IA

<table>
<thead>
<tr>
<th>Normal</th>
<th>Abnormal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Bpm</td>
<td>110 – 160</td>
</tr>
<tr>
<td>Rhythm</td>
<td>Regular</td>
</tr>
<tr>
<td>Change in FHR</td>
<td>Accelerations</td>
</tr>
<tr>
<td>Action</td>
<td>Continue IA</td>
</tr>
<tr>
<td></td>
<td>Provide comfort &amp; supportive care</td>
</tr>
<tr>
<td></td>
<td>Fetal oxygenation</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Pain Management and IA

- IA may be used with Epidural (incl. PCEA) & normal maternal vitals with frequent IA at initiation & top-ups (q 5min for 30 min)
- For PCA, use EFM
Fetal Well Being During Labour

**EFM – Components**

**FHR**
- Baseline fetal heart rate
- Variability
- Accelerations or decelerations
- Changes or trends over time

**Uterine Activity**
- Frequency, duration, intensity, resting tone

**Baseline Fetal Heart Rate**
- Need 2 minutes of identifiable baseline in a 10 minute segment
- Approximate mean, rounded to increments of 5 bpm
- Excludes periodic or episodic changes and periods of marked variability (> 25 bpm)

**Fetal Heart Rate Variability**
- Range or amplitude of the fluctuations from baseline
- Determined by assessing a one minute period free from accelerations and decelerations
  - absent undetectable
  - minimal undetectable to ≤ 5 bpm
  - moderate 6 – 25 bpm
  - marked > 25 bpm

- Is dependent on an intact CNS
- Is primarily a result of alterations in vagal tone
- Presence suggests that fetal acid base status is acceptable
- Absence does not necessarily indicate abnormal fetal acid base status

**Acceleration**
- Abrupt increase in FHR above baseline (onset to peak < 30 seconds)
  - ≥ 15 bpm for ≥ 15 seconds from onset to return
  - < 32 wks: ≥ 10 bpm for ≥ 10 seconds
- If ≥ 2 but < 10 minutes = prolonged acceleration
- If ≥ 10 minutes = baseline change

- Absent or decreased with:
  - acidosis
  - fetal sleep cycles
  - medications – narcotics, sedatives, betamethasone, Mg bolus, etc.
  - preterm infants
  - fetal tachycardia
  - congenital anomalies
Fetal Well Being During Labour

**Periodic Changes: Early Decelerations**
- Gradual decrease (onset to nadir \( \geq 30 \) sec) & return to baseline coincident with contraction
- Nadir at contraction peak
- Head compression causing increased vagal tone - benign

**Variable Decelerations**
- Abrupt (onset to nadir < 30 seconds)
- \( \geq 15 \) bpm for \( \geq 15 \) seconds
- May have ‘shoulders’
- Cord compression
  - baroreceptors
  - abrupt FHR change

**Complicated Variable Decelerations**
- Deceleration < 70 bpm or > 60 sec.
- Loss of variability of baseline
- Biphasic deceleration
- Overshoot (20 bpm increase for 20 seconds)
Fetal Well Being During Labour

Complicated Variable Decelerations
Slow return to baseline

Baseline rate lower after the deceleration

Complicated Variable Decelerations
Baseline Tachycardia or Bradycardia

Late Decelerations
• Gradual decrease in FHR
• Onset, nadir and recovery after beginning, peak and end of contraction
• May be
  – subtle
  – associated with baseline tachycardia
• When persistent and repetitive (≥ 50%) → action
• Acidosis less likely if moderate variability present

Late Decelerations
• May be due to hypoxia
• Chemoreceptor response
  – reflex showing

Mechanism
- head compression
- cord compression
- hypoxia
- complicated variable
  - cord compression & hypoxia
- uterine pressure

Direct vagal stimulation
Baroreceptor vagal response
Chemoreceptor vagal response +/- direct myocardial depression
EFM Interpretation

<table>
<thead>
<tr>
<th></th>
<th>Normal</th>
<th>Atypical</th>
<th>Abnormal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Bpm</td>
<td>110 – 160</td>
<td>100 – 110</td>
<td>&lt; 100 &gt; 160 &gt; 80 min</td>
</tr>
<tr>
<td></td>
<td></td>
<td>rising</td>
<td>Rising baseline erratic baseline</td>
</tr>
<tr>
<td>Variability</td>
<td>Moderate</td>
<td>Minimal/absent ≤ 5 bpm 40-60 min</td>
<td>Minimal/absent ≤ 5 bpm &gt; 80 min ≥ 25 bpm &gt; 10 min sinusoidal</td>
</tr>
<tr>
<td></td>
<td>Minimal/absent ≤ 5 bpm &lt; 40 min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deceleration</td>
<td>None</td>
<td>Repetitive (≥ 3) Uncomplicated variables</td>
<td>Repetitive (≥ 3) Complicated variables</td>
</tr>
<tr>
<td></td>
<td>Occasional</td>
<td>Occasional late decels Single prolonged &gt; 2 &lt; 3 min</td>
<td>Late decels &gt; 50% of contractions Prolonged &gt; 3 min</td>
</tr>
<tr>
<td></td>
<td>Uncomplicated variables Early decels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acceleration</td>
<td>Spontaneous or with scalp stim</td>
<td>Absent with scalp stim</td>
<td>Usually absent</td>
</tr>
</tbody>
</table>

Classification of EFM Tracings

<table>
<thead>
<tr>
<th>Previous</th>
<th>Reassuring</th>
<th>Non-reassuring</th>
</tr>
</thead>
<tbody>
<tr>
<td>New</td>
<td>Normal Tracing</td>
<td>Atypical Tracing</td>
</tr>
<tr>
<td>Action</td>
<td>EFM may be interrupted for 30 min if maternal-fetal condition stable +/- or oxytocin rate stable</td>
<td>Further vigilant assessment, especially when combined features present</td>
</tr>
</tbody>
</table>

Response to Atypical / Abnormal FHR Pattern
- Intrauterine resuscitation
- Institute or continue EFM
- Consider fetal scalp stimulation for atypical
- Consider fetal scalp sampling
- If abnormal findings persist and alternative tests are unavailable or abnormal → expedited delivery

Intrauterine Resuscitation
- Get help
- Lateral position
- Fluid load
- Stop oxytocin
- Exam/rule out cord prolapse
- Consider oxygen by mask
- Consider amnioinfusion, or tocolytics in selected cases
- Maternal O2 only in cases of maternal hypoxia or hypovolemia

Additional Tests of Fetal Well Being
- Scalp stimulation
- Fetal scalp blood sampling
- Cord gases

Digital Fetal Scalp Stimulation
- Provides indirect assessment of acid-base status
  - Avoid during a deceleration
  - Gentle stimulation for 15 seconds
  - Prolonged pressure may produce a vagal response → fetal bradycardia
  - NOT to be used as a resuscitative measure
Digital Fetal Scalp Stimulation

- Recommended with atypical EFM
  \( \sqrt{ } \) acceleration usually = pH > 7.20
- No acceleratory response may not be a problem but consider:
  - fetal scalp blood sampling where available
  - when unable to perform, consider prompt delivery

Fetal Scalp Blood Sampling – pH

- Indicated with atypical / abnormal fetal HR pattern
- Delivery not imminent
  - pH \( \geq 7.25 \) → repeat if fetal status persists
  - pH ≤ 7.20 → delivery indicated
  - Intermediate pH → repeat in 30 min or deliver if rapid ↓ pH since last sample

Fetal Scalp Blood Sampling – Lactate

- Indicated with atypical / abnormal fetal HR pattern
- Point of care testing requiring 1 drop of blood
- Fewer scalp incisions, faster results
- More successful sampling – 99% vs 79%
- Strong negative predictive value for fetal acidemia

Cord Blood Sampling

- Recommended after each delivery
- Arterial and venous
- Delayed cord clamping
  - ↓ arterial pH
  - document length of delay

<table>
<thead>
<tr>
<th>Type of acidosis</th>
<th>pH</th>
<th>pCO2</th>
<th>HCO3</th>
<th>Base Deficit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory</td>
<td>↓</td>
<td>↑</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>Metabolic</td>
<td>↓</td>
<td>Normal</td>
<td>↓</td>
<td>↑</td>
</tr>
<tr>
<td>Mixed</td>
<td>↓</td>
<td>↑</td>
<td>↓</td>
<td>↑</td>
</tr>
</tbody>
</table>

How Should the Fetus be Monitored in Labour?

Intermittent Auscultation (IA)

VS

Electronic Fetal Monitoring (EFM)
Effect of EFM Versus IA in Labour

<table>
<thead>
<tr>
<th>Outcome</th>
<th>RR</th>
<th>(95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caesarean delivery</td>
<td>1.63</td>
<td>(1.29,2.07)</td>
</tr>
<tr>
<td>Assisted vaginal birth</td>
<td>1.15</td>
<td>(1.0,1.3)</td>
</tr>
<tr>
<td>NICU admission</td>
<td>1.01</td>
<td>(0.9,1.0)</td>
</tr>
<tr>
<td>Perinatal death</td>
<td>0.86</td>
<td>(0.0,1.0)</td>
</tr>
<tr>
<td>Neonatal seizures</td>
<td>0.50</td>
<td>(0.3,0.8)</td>
</tr>
<tr>
<td>Cerebral Palsy</td>
<td>1.75</td>
<td>(0.0,3.0)</td>
</tr>
</tbody>
</table>

Relative Risk (95% Confidence Interval)

Alfirevic Z, Cochrane Library
9 trials, Issue 5, 2013

SOGC Recommendations

- Intermittent auscultation following an established protocol is the preferred method in low risk pregnancies
- EFM following an established protocol is recommended for women and fetuses with risk factors

Frequency of FHR Assessment (IA or EFM)

- Limited evidence for timing in the latent phase
- Every 15 – 30 min in the active phase
- Every 15 min in the second stage before pushing
- Every 5 min in the second stage when pushing

Unsupported Technologies

- Fetal pulse oximetry

New Technologies

- Fetal ECG analysis (ST)

Admission Fetal Heart Tracings

- NOT recommended for healthy, term women with absence of risk factors
  - ↑ intervention with no difference in outcome (epidural analgesia, EFM, fetal blood sampling)
- Not used to diagnose labour
- Recommended with risk factors
Conclusions

- CP rates are still 2 – 3/1,000 live births
- Most documented asphyxia does not result in CP
- All women in labour should have the continuous presence of an appropriately trained person
- IA is preferred in healthy term pregnancies
- IA and EFM criteria, standards and multidisciplinary education must be developed and maintained

Conclusions

- Limitations of fetal surveillance must be recognized in order to reduce interventions driven by false-positive results
- Use fetal scalp stimulation/sampling when indicated
- Perform routine cord blood gas sampling