Introduction

This monograph focuses on new scientific knowledge regarding intrapartum contributing factors for neonatal encephalopathy (NNE) outlined in the Task Force report (ACOG & AAP, 2014). The report is a collaborative resource from the American College of Obstetricians and Gynecologists (ACOG) and the American Academy of Pediatrics (AAP). Task Force members included physicians from multiple countries and specialties. During our case study, we will use the 2008 National Institute of Child Health and Human Development (NICHD) terms and guidelines during electronic fetal monitoring (EFM) interpretation while intervention recommendations are based on the ACOG intrapartum management algorithms (2015). This is part of an EFM Case Study Series.

EFM Standardization: An Overview

The patient care you administer to a fetus today may affect the neurologic health of a newborn for life. Early identification and management of factors that may negatively influence newborn outcomes is critical to patient safety. The Neonatal Encephalopathy & Neurologic Outcomes, second edition, taskforce report is a scientific resource written and endorsed by over 12 national and international organizations (ACOG & AAP, 2014). This report identifies various types of injuries and outlines contributing factors that are consistent with acute peripartum or intrapartum events which may precede neonatal encephalopathy, cerebral palsy, or both.
All perinatal practitioners require knowledge and clinical application of data found in this report to improve early identification and management of intrapartum NNE contributing factors (sentinel events & fetal heart rate (FHR) patterns). After completion of this monograph, learners can identify a fetus at possible risk for NNE during labor and delivery and adjust care accordingly to improve patient safety.

Neonatal Encephalopathy (NNE): What is it? How does a newborn get it?

Neonatal Encephalopathy (NNE)

Case Definition: A clinical syndrome of disturbed neurologic function in the earliest days of life of an infant born beyond 35 weeks gestation; may or may not be a precursor to cerebral palsy.

NICHD Terminology

**FHR Baseline Rate**

*Normal*: 110-160
*Tachycardia*: > 160 for >10 min
*Bradycardia*: < 110 for >10 min
*Indeterminate*: Baseline that is < 2 minutes in any 10-minute segment

**FHR Variability**

*Absent*: Undetectable
*Minimal*: Detectable - 5 bpm
*Moderate*: 6-25 bpm
*Marked*: > 25 bpm
*Sinusoidal*: Sine wave-like undulating pattern of 3-5 cycles/min for > 20 min

**Decelerations**

*Early*: Gradual (> 30 sec) decrease & return of the FHR associated with a UC
*Variable*: Abrupt decrease from the onset to the beginning of the nadir is < 30 sec & return of the FHR associated with a UC
*Late*: Gradual decrease & return of the FHR with the onset, nadir, & recovery typically occurring after the beginning, peak, & ending of the UC
*Prolonged*: > 2 min but < 10 min

**3-Tier FHR Categories**

*Category I*: Normal acid-base status
*Category II*: Indeterminate acid-base status
*Category III*: Abnormal acid-base status

**UC Terminology**

*Frequency*: ≤ 5 UCs/10 min, averaged over 30 min
*Duration*: 50-70 seconds
*Intensity*: 25-75mmHg/IUPC
*Resting Tone*: <20-25mmHg/IUPC
Table 1. Risk Factors for NNE


Intrapartum Contributing Factors

- Sentinel Event
- FHR Patterns

Symptoms
- Subnormal Level of Consciousness
- Difficulty with Initiating & Maintaining Respirations
- Depression of Tone & Reflexes

Antepartum (AP) Risk Factors ONLY: 69%
AP & Intrapartum (IP) Risk Factors: 25%
IP Risk Factors ONLY: 4%
Unknown: 2%
EFM Case Study #4

In this case study, we start with the end. Our case presentation works in reverse finishing with the patient’s presentation. Highlights include new recommendations from the 2014 Task Force on NNE and associated risk management (RM) concerns. RM alerts are provided to offer guidance with potentially risky issues. Critical thinking drills are included to enhance your EFM skill. You may check your responses with the Answer Key provided at the end of the monograph. Let’s begin!

Medical-Legal Outcome (After 6.5 Years of Litigation)

Plaintiff Verdict

- Hospital & primary physician negligent
- Award: $6.5M

Claims

Hospital Negligence:

- Diagnostic/interpretation error of EFM data
- Communication omission to primary practitioner
- Failure to intervene & rescue fetus

Physician Negligence:

- Diagnostic/interpretation error of EFM data
- Miscommunication to perinatal team members
- Failure to intervene & rescue fetus
- Failure to perform a cesarean section in a timely manner

After a diagnosis of cerebral palsy at 11 months of age, the parents of this newborn filed a medical malpractice lawsuit and won. Numerous allegations were made of the hospital nursing staff and the primary physician. For several hours, the labor and delivery nurse failed to recognize and notify the physician of deteriorating fetal conditions. After the physician was aware of the situation, he failed to deliver the fetus in a timely manner. These two primary factors lead to hypoxic-ischemic conditions. Plaintiff experts identified the timing of newborn injury to be intrapartum.
Newborn Outcome:

The term newborn in this case began seizing at 9 hours of life and was discharged on day 22 after experiencing respiratory distress syndrome, cerebral edema, neonatal encephalopathy, and multisystem organ dysfunction. At 11 months, a diagnosis of cerebral palsy was made.

MD Note

Day 4: Electrical seizure from left post quad; EEG reinforces an impression that he suffered an inpatient insult. Dx: MODS- RDS, elevated LFTs, minimal UO & elevated BUN/Creatinine, cerebral edema & seizures. –Dr. S

Day 14: DC home with follow up in Neuro clinic in 7 days; severe neurologic delays.
–Dr. S

[Dx: diagnosis, MODS: multisystem organ failure, LFTs: liver function tests, UO: urinary output]

Documentation Risk:

The physician progress note displayed above is a small sample from the original chart. The line “EEG reinforces an impression that he suffered an inpatient insult” creates unnecessary risk to the hospital and obstetrician. EEG may provide early evidence of the presence and severity of encephalopathy, but cannot identify the underlying cause. Unsupported opinions about causation or the time of injury should not be included in documentation, only objective data. This MD progress note damaged the defense of the hospital and the defendant physician.

NNE Task Force 2014 Recommendation:

ACOG & AAP agree that type and timing of brain injury is best identified with neuroimaging. Magnetic resonance imaging (MRI) is the best modality for delineation of brain injury timing if obtained at 24-96 hours after delivery. A second MRI should be performed 10 days following birth for a full evaluation of the extent of the injury. Precise timing of a hypoxic-ischemic brain injury is not possible.
Neonatal Intensive Care (NICU) Course

After an initial assessment in the Level II nursery, the newborn was transported to the NICU.

Admission Physical Assessment
[@ 1 Hour of Age]

- Weight: 3538 grams/7lbs 8oz
- Pale & lethargic
- Vital signs: stable & O2 saturation: 95% with ventilator support
- Initial Blood Gas @ 17 minutes of life: pH 6.99, CO2 71, BD-17
- Impression:
  - Neonatal depression secondary to perinatal asphyxia; hypoglycemia; unexpected meconium staining
- Plan:
  - NICU, Cardiac monitoring & cultures; start antibiotic

Documentation Risk:
The neonatologist’s impression and plan were documented in the medical record. The line “Neonatal depression secondary to perinatal asphyxia” damaged the defense of this claim by suggesting causation, without any clinical evidence. This note was identified during pretrial discovery and became an important factor in the case.

NNE Task Force 2014 Recommendation:
Asphyxia is defined as marked impairment of gas exchange leading that if prolonged can progress into hypoxemia, hypercapnia, and significant metabolic acidosis. This is a process of varying severity and duration rather than an end point. This term should not be applied to birth events unless specific evidence of markedly impaired intrapartum or immediate postnatal gas exchange can be linked to neurologic illness in the neonate.
Neonatal Resuscitation

Neonatal resuscitation began immediately after birth but cardiopulmonary resuscitation was not started by the primary labor and delivery nurse until 60 seconds after delivery. Two-person resuscitation was started once a second labor and delivery nurse entered the operating room at 90 seconds of life. Positive pressure bag-mask ventilation and chest compressions were performed until the neonatal rapid response team arrived three minutes later.

Interventions

- PPO2 & Chest compressions initiated 60 sec after birth
- ETT tube placed after suctioning; thick meconium below the cords noted
- Heart rate: 100 after 4.5 min of chest compressions & 2 doses of epinephrine
- Time to first gasp: 5 min
- UVC line placed in delivery room

Neonatal Resuscitation Risk:

Any practitioner required to provide immediate stabilization and care to a newborn should become certified and maintain skill in the Neonatal Resuscitation Program (NRP). Every delivery requires 2 providers to care for both mother and infant. One person is solely responsible for newborn stabilization while the second may assist if needed but remain available to care for the mother. This perinatal team did not plan accordingly for this delivery and immediate resources were inadequate. This documented delay in neonatal resuscitation damaged the defense of this case.

On another note, please remember to always use the same clock when documenting in the medical record. Some practitioners use the EFM clock while others use the wall clock. Either is fine but everyone must be consistent. Use of personal wrist watches is not recommended.

NNE Task Force 2014 Recommendation:

Research shows that neonates born after providers receive NRP instruction were more likely to have an Apgar score of 7-10 and less likely to have a 0-3 score regardless of the level of care available at the hospital of birth. The risk of death or a prolonged hospital stay increases 16% for every 30-second delay (up to 6 min) in initiating positive pressure ventilation with bag or mask. Infants with a heart rate of < 60 beats per minute or an Apgar score of less than 4 at 5 minutes, or both, have a 16-fold greater chance of death in the first week of life. Prompt initiation of neonatal resuscitation improves short-term and long-term outcomes.
Apgar Scores: Assisted vs. Unassisted

The newborns Apgar Scores are outlined in Table 1. The newborn was transported to the Level II nursery after 11 minutes of life.

<table>
<thead>
<tr>
<th>Apgar Score</th>
<th>Heart Rate</th>
<th>Respiration</th>
<th>Tone</th>
<th>Reflex</th>
<th>Color</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 min</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>5 min</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
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<td>2</td>
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<tr>
<td>10 min</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

In 2006, ACOG & AAP proposed use of an expanded Apgar score form during resuscitation. An Apgar score that is assigned during resuscitation is termed an “assisted Apgar score” and is not equivalent to one assigned to a spontaneously breathing infant (ACOG & AAP, 2014). Table 2 outlines the additional information required for an “assisted Apgar score”.

<table>
<thead>
<tr>
<th>Minutes</th>
<th>1</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPV/NCPAP</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>ETT</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Chest Compressions</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Epinephrine</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

Source: ACOG & AAP, 2010
Apgar Score Risk:
The perinatal and neonatal resuscitation teams in this case did not use an “assisted Apgar score” form. Therefore, the medical record was not clear on exact timing of resuscitation interventions. The 5-minute Apgar respiration score of 2 is inaccurate; the correct score should have been a 1 resulting in a total score of 5. The medical record showed time to first gasp as 5 minutes but the infant required assisted ventilation until transport to the NICU. This discrepancy was confusing and damaged the defense of this case.

NNE Task Force 2014 Recommendation:
It would be misleading to assign a “2” for respirations to an intubated infant with no spontaneous respirations at 5 minutes of age and who is being ventilated at 30 breaths per minute. Use the proposed expanded Apgar score form during these clinical scenarios. Risk of cerebral palsy increases if the Apgar score is significantly low (0-3) and rises further the longer the score remains low. Therefore, a score of 0-3 at 20 min has a higher relative risk of cerebral palsy.

Decision to Incision
An emergent cesarean section was completed under epidural anesthesia. A live male infant weighing 7lbs 8oz was delivered. The Neonatal Rapid Response Team was not notified until after delivery of the infant.

In the US, once a physician makes the clinical decision to perform an emergent cesarean birth, it is the general consensus that the incision is made within 30 minutes of the announced decision. This guideline has been nationally accepted for decades. In some situations, a fetus may be able to tolerate a longer period of time while others are unable to tolerate less than 30 minutes. Indications that may require a more expedient decision to incision time frame are listed in the next section, entitled Sentinel Events.

A fetus is made to tolerate significant periods of hypoxemia and ischemia from sentinel events (umbilical cord prolapse, placental abruption, uterine rupture, etc.). If a hypoxic-ischemic emergency occurs, a fetus will elicit protective measures, such as redirecting blood flow to vital organs such as the heart, adrenal glands, and brain. Fetal cerebral vascular resistance can decrease up to 50% and still maintain adequate cerebral blood flow (Blackburn, 2013).
A fetus’s high tolerance to hypoxic conditions is based on four characteristics unique to fetal circulation and neurologic development (Blackburn, 2013):

1. Increased oxygen-carrying capacity due to a high concentration of hemoglobin
2. High fetal cardiac output that exceeds that of an adult when based on a volume-per-unit body-weight calculation.
3. Higher fetal hemoglobin saturation; greater than the mother’s at any given point on the oxygen dissociation curve.
4. Faster fetal heart rate that is typically 30 to 50% higher than an adult’s.

Cesarean Birth Risk:
Preparation for a cesarean birth, emergent or otherwise, requires timely notification to the primary physician, anesthesia personnel, OR team, and newborn stabilization team. Poor preparation often leads to inadequate resources and unsafe conditions. An emergent cesarean delivery was performed 37 minutes after the decision was made to do so. The perinatal team was not prepared for the newborn that delivered leading to a delay in NRP. Failure to prepare for and perform an emergent cesarean birth in a timely manner damaged the defense of this case.

NNE Task Force 2014 Recommendation:
Neonates may or may not tolerate hypoxic periods shorter or longer than 30 minutes. Exceeding 30 minutes from decision to incision in many clinical circumstances, which may be categorized as an emergency cesarean delivery, may not be within accepted guidelines. Thirty minutes is a guideline, individual clinical circumstances vary and must be taken into consideration when evaluating NNE causation.

Labor & Delivery: NNE Intrapartum Contributing Factors

Sentinel Event: None in this case study
A maternal-fetal sentinel event may occur prior to or during labor and delivery. Perinatal focal ischemic strokes may present with fetal seizure activity diagnosed with EFM or ultrasound or as neonatal seizures after birth. This phenomenon has strong scientific evidence as a precursor to intrauterine fetal demise, NNE, cerebral palsy, and death (ACOG & AAP, 2014). Additional sentinel events are outlined below. The occurrence of a sentinel hypoxic or ischemic event immediately before or during labor may be an intrapartum contributing factor of NNE.
NNE Task Force 2014 Recommendation:
Type and timing of contributing factors that are consistent with an acute peripartum or intrapartum event include: 1) a sentinel hypoxic or ischemic event occurring immediately before or during labor and delivery, and or 2) Fetal heart rate (FHR) patterns consistent with an acute peripartum or intrapartum event.

<table>
<thead>
<tr>
<th>Maternal Risk Factors</th>
<th>Fetal Risk Factors</th>
<th>4 Perinatal Ischemic Stroke Diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prothrombotic disease</td>
<td>Fetal growth restriction</td>
<td>1. Symptomatic neonatal arterial ischemic stroke</td>
</tr>
<tr>
<td>Primiparity</td>
<td>Placental embolism</td>
<td>2. Symptomatic neonatal cerebral sinovenous thrombosis</td>
</tr>
<tr>
<td>Infertility</td>
<td>Infection</td>
<td>3. Presumed perinatal ischemic stroke</td>
</tr>
<tr>
<td>Preeclampsia</td>
<td>Cardiac disease</td>
<td>4. Periventricular venous infarction</td>
</tr>
<tr>
<td>Prolonged rupture of membranes</td>
<td>Genetic factors</td>
<td></td>
</tr>
<tr>
<td>Chorioamnionitis</td>
<td>Abnormal FHR</td>
<td></td>
</tr>
<tr>
<td>Multiple gestation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prolonged second stage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OVD or emergency C/S</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Maternal Risk Factors:
- Prothrombotic disease
- Primiparity
- Infertility
- Preeclampsia
- Prolonged rupture of membranes
- Chorioamnionitis
- Multiple gestation
- Prolonged second stage
- OVD or emergency C/S

Fetal Risk Factors:
- Fetal growth restriction
- Placental embolism
- Infection
- Cardiac disease
- Genetic factors
- Abnormal FHR

4 Perinatal Ischemic Stroke Diseases:
1. Symptomatic neonatal arterial ischemic stroke
2. Symptomatic neonatal cerebral sinovenous thrombosis
3. Presumed perinatal ischemic stroke
4. Periventricular venous infarction

Images:
- Fetal Stroke
- Placental Abruption
- Uterine Rupture
- Umbilical Cord Prolapse
- Amniotic Fluid Embolus & Maternal ↓↓↓BP
- Maternal Cardiovascular Collapse
- Fetal Exsanguination
FHR Patterns NOT Associated with NNE or HIE

Brain dysfunction caused by low levels of oxygen in the blood (hypoxemia) or poor blood supply due to severe and prolonged low blood pressure (ischemia) is known as hypoxic-ischemic encephalopathy (HIE). This condition may or may not lead to NNE which may or may not lead to cerebral palsy. Understanding that experiencing a severely compromised fetus during patient care is rare but requires immediate action to limit short and long term injury.

What does a fetus who is experiencing an HIE insult look like? As stated earlier, most encounter a sentinel event for which they cannot tolerate. If the event is severe and prolonged, risk of injury increases. The following FHR pattern is not consistent with an acute peripartum or intrapartum event:

- Category I FHR Pattern
- Category II FHR Pattern
- Apgar Score ≥ 7 @ 5 MIN
- Normal Umbilical Cord pH
FHR Patterns Associated with NNE or HIE

As we return back to our case study, we see the first example of a FHR pattern consistent with an acute intrapartum event.

EFM Strip #1 occurs 27 minutes prior to the start of an emergent cesarean birth. The physician was notified via phone 19 minutes prior of this EFM pattern. The labor and delivery nurse notified the charge nurse of the fetal conditions but no preparations for emergent delivery were completed.

**Critical Thinking Drill #1**

1. What interventions are required at this time?
2. Does a RN need a medical order to prepare for a cesarean birth?

**FHR Pattern Risk:**

This Category III FHR pattern persisted for a significant period of time prior to birth with a total period of 22 min of fetal bradycardia. As we will see later in our case, this fetus presented as a Category I FHR pattern that evolved into a Category III during intrapartum. The fetal evolution damaged the defense of this case.

**NNE Task Force 2014 Recommendation:**

The patient who presents with a Category I FHR pattern that converts to Category III as defined by NICHD is suggestive of a hypoxic-ischemic intrapartum event.
EFM strip #2 occurs 92 minutes prior to birth and remains consistent until EFM strip #1 evolves. The physician was not notified of the fetal conditions during second stage. The labor and delivery RN directs the patient in closed-glottis breathing while in the supine position for over 2.5 hours.

EFM Strip #2: Second Stage, 92 min Prior To Birth

Critical Thinking Drill #2

1. What is the FHR baseline rate & variability?
2. What is the likely fetal pH: normal, indeterminate, abnormal?
3. List 2 intervention required at this time?
EFM strip #3 occurs 3 hours prior to birth. The patient received an epidural for pain relief 2 hours prior and oxytocin is infusing at 18 mU/minute. Cervical exam revealed: C/7-8/0.

**Critical Thinking Drill #3**

1. What Category is this FHR pattern?
2. Are there any FHR decelerations present? If so, what type?
3. List 2 intervention required at this time?
EFM strip #4 occurs 90 minutes earlier. Oxytocin is infusing at 10 mU/minute.

**Critical Thinking Drill #4**

1. What is the FHR baseline rate?
2. What types of FHR decelerations are present? Are they episodic or periodic?
3. Is the UC pattern normal or abnormal? If abnormal, define.
EFM strip #5 occurs 8 hours prior to birth. The 11-minute bradycardia episode was not reported to the physician. When the physician arrived at the bedside to assess the patient 60 minutes later, he did not review the prior EFM strip. A fetal scalp electrode was placed in the middle of this tracing by the labor and delivery RN. Oxytocin was discontinued during the bradycardia and was restarted 5 minutes after this strip.

**EFM Strip #5: 11 Min of Bradycardia, 8 Hours Prior to Birth**

**Critical Thinking Drill #5**

1. Would you have restarted the oxytocin infusion 5 min after this tracing, why or why not?
EFM strip #6 occurs 9 minutes prior to EFM strip #5. Oxytocin is infusing at 24mU/min and the patient is in a semi-recumbent position. The patient complained of moderate pain with contractions. The labor and delivery RN enters the patient’s room 2 minutes after this tracing.

**Critical Thinking Drill #6**

1. What is the FHR baseline rate and variability prior to the prolonged deceleration?
2. List at least 2 interventions required at this time.

**Maternal Antepartum NNE Risk Factors:**

- Bleeding
- Trauma
- Coagulation and autoimmune disorders
- Infection
- Thyroid Disorders
EFM strip #7 is the fetal admission strip that occurs over 18 hours prior to birth. The patient was admitted for an elective induction at 39 2/7 weeks gestation. The initial cervical exam revealed: 50%/1-2/-3 vertex presentation.

**EFM Strip #7: Admission Strip – 18 Hours Prior to Birth**

Critical Thinking Drill #7

1. What are the four characteristics of a Category I FHR pattern?

**Admission FHR Pattern Risk:**

This fetus displayed characteristics of a Category I FHR pattern at admission that evolved into a Category III pattern during intrapartum. This was a significant factor when determining causation and negligence by the hospital and primary practitioner. This significantly damaged the defense of this claim when the trial court determined causation.

**NNE Task Force 2014 Recommendation:**

Additional fetal heart rate patterns that develop after a Category I FHR pattern on presentation, which may suggest intrapartum timing of a hypoxic-ischemic event, include tachycardia with recurrent decelerations and persistent minimal variability with recurrent decelerations.
This case study outlined key aspects of intrapartum contributing factors in the development of neonatal encephalopathy. Our overview of recommendations from the second edition NNE Task Force report was brief so please access the resource in its entirety from either the ACOG or AAP websites; see our QUICK LINK provided in the reference list. Apply this scientific evidence into your clinical practice.

A new and important addition to the NNE Task Force report is a review of patient safety efforts directed at preventing neonatal encephalopathy. The report includes two templates specific to NNE for data collection and quality improvement (ACOG & AAP, 2014):

- Data Collection Guidelines for Infants Delivered at 35 Weeks of Gestation or More with Risk of Neonatal Encephalopathy
- Data Collection Guideline for Neonatologists & Pediatricians Who Manage Infants with Neonatal Encephalopathy

**NNE Recommendations:**

- Identify & manage NNE symptoms early
- Identify & manage intrapartum FHR patterns & sentinel events swiftly
- Incorporate ACOG & AAP NNE Task Force recommendations into hospital policy, procedures, and protocols, as well as, clinical practice.

**EFM CS #4: Critical Thinking Answer Key**

**22 Min Prior To Birth (EFM Strip #1)**

1. **What interventions are required at this time?**

   **Answer:** ACOG algorithm for Category III FHR pattern management: Intrauterine resuscitation maneuvers and deliver by the most expeditious route. Prepare for an emergent cesarean birth, notify the primary physician, OR team, anesthesia personnel, and neonatal stabilization team.

2. **Does a RN need a medical order to prepare for a cesarean section?**

   **Answer:** Notification to appropriate personnel should an emergent delivery be required does not require a medical order and improves patient safety. It is recommended that non-invasive (transporting the patient) and low-tech procedures (PIV or Foley Catheter) be outlined in an “Emergent Delivery” standing order set with OB department approval for initiation by RNs during certain clinical conditions (ACOG & AAP sentinel events or FHR patterns consistent with peripartum or intrapartum event).
Second Stage: 92 Min Prior To Birth (EFM Strip #2)

1. What is the FHR baseline rate & variability?
   
   **Answer:** 170, absent

2. What is the fetal pH: normal, indeterminate, abnormal?
   
   **Answer:** abnormal

3. List 2 interventions required at this time.
   
   **Answer:** Notify primary practitioner, reposition laterally, increase IVF if not contraindicated, assess & correct maternal blood pressure, oxygen therapy, discontinue active pushing.

3 Hours Prior To Birth (EFM Strip #3)

1. What category is this FHR pattern?
   
   **Answer:** three

2. Are there any FHR decelerations present? If so, what type?
   
   **Answer:** Yes: variable & late.

3. List 2 interventions required at this time.
   
   **Answer:** Discontinue oxytocin infusion, reposition laterally, increase IVF if not contraindicated, apply FSE if not already done so, assess maternal blood pressure, notify primary practitioner, prepare for delivery, and notify neonatal resuscitation team.

4.5 Hours Prior To Birth (EFM Strip #4)

1. What is the FHR baseline rate?
   
   **Answer:** 145

2. What types of FHR decelerations are present? Are they episodic or periodic?
   
   **Answer:** Periodic variable decelerations

3. Is the UC pattern normal or abnormal? If abnormal, define.
   
   **Answer:** Appears to be abnormal, tachysystole; more information required.
11 Min Bradycardia, 8 Hrs Prior To Birth (EFM Strip #5)

1. Would you have restarted the oxytocin infusion 5 min after this tracing, why or why not?

   Answer: No, a normal baseline rate should be reestablished prior to restarting a uterine stimulant medication. A minimum of 10 minutes are required to establish a baseline rate.

Beginning Of Bradycardia (EFM Strip #6)

1. What is the FHR baseline rate and variability prior to the prolonged deceleration?

   Answer: 145, moderate

2. List at least 2 interventions required at this time.

   Answer: Discontinue oxytocin infusion, reposition laterally, increase IVF if not contraindicated, assess maternal blood pressure, notify primary practitioner, oxygen therapy, and administer tocolytic if appropriate.

Admission Strip (EFM Strip #7)

1. What are the four characteristics of a Category I FHR pattern?

   Answer:

   i. Normal baseline rate: 110-160

   ii. Moderate variability

   iii. Absence of decelerations: variable, late, prolonged

   iv. Absence or presence of accelerations or early decelerations

This educational material is not intended to substitute for individualized clinical judgment. It does not dictate an exclusive method of care, and it is not applicable to all circumstances and all patients.
Bibliography: EFM Case Study Series #4: Neonatal Encephalopathy

Note: Web links can change over time. If link no longer works, web-search the article by title.

Quick Links

  [http://www.acog.org/Search?Keyword=neonatal+encephalopathy+and+neurologic+outcomes [free to members; may be purchased by non-members]]


  [http://www.acog.org/Search?Keyword=FHR+intrapartum+management+116]

References


