

# Electronic Fetal Monitoring Study Guide

## EXAM OUTLINE

This is an outline of topics and areas which may be included in the Electronic Fetal Monitoring examination. Percentages identified for the topic areas represent a range of the number of test questions assigned to each content area and therefore might total more or less than 100 percent.

### The Electronic Monitoring Equipment (<5%)

1. Fetal heart rate monitoring
  - a. Internal
  - b. External
2. Uterine monitoring
  - a. External
  - b. IUPC
3. Equipment failure and troubleshooting
4. Artifact Detection
5. Patient Education

### Physiology (5-10%)

1. Uteroplacental
  - a. Uteroplacental circulation
  - b. Fetal circulation
  - c. Fetal heart regulation
2. Uterine activity
  - a. Resting tone
  - b. Contractions
    - i. Frequency
    - ii. Duration
    - iii. Intensity
3. Factors affecting fetal oxygenation
  - a. Uterine activity
  - b. Maternal factors
  - c. Anesthesia
  - d. Drugs (Therapeutic & Recreational)
  - e. Placental factors
  - f. Umbilical blood flow
  - g. Acid base and cord blood gases
  - g. Effects of maternal drugs on the fetus

### Pattern Recognition, Interpretation and Intervention (60-70%)

1. Baseline heart rate
  - a. Bradycardia
  - b. Tachycardia
  - c. Variability
  - d. Sinusoidal
2. Fetal heart rate patterns
  - a. Accelerations
  - b. Decelerations
    - i. Early
    - ii. Variable
    - iii. Late
    - iv. Prolonged

**Electronic Fetal Monitoring**  
**Study Guide**

3. Response to tachysystole
4. Dysrhythmias and other variant patterns
  - a. Supraventricular tachycardia
  - b. Congenital heart block
  - c. Ectopic beats
5. Common Complications
  - a. Preterm Labor
  - b. Hypertension
    - i. Gestational hypertension
    - ii. Preeclampsia- eclampsia
    - iii. HELLP syndrome
    - iv. Chronic (essential)
  - c. Postdates Pregnancy
  - d. Diabetes (Gestational, Type 1, Type 2)
  - e. Placental disorders (Previa, abruption)
  - f. Uterine rupture/scar dehiscence
  - g. Infections
  - h. Multiple gestations
  - i. Maternal Obesity

**Adjunct Fetal Assessment (5-10%)**

1. Auscultation
2. Fetal movement counting
3. Nonstress testing
4. Fetal acid base interpretation
5. Biophysical profile
6. Fetal Acoustic Stimulation

**Professional Issues (<5%)**

1. Evidence-Based Practice
2. Professional/Legal
3. Ethical Principles
4. Patient Safety

## Electronic Fetal Monitoring Study Guide

### SELF-ASSESSMENT

#### **1. The Electronic Monitoring Equipment (<5%)**

- a. Setup
  - i. What is the paper speed?
  - ii. How do you read the fetal strip paper scale?
  - iii. Where is the optimal placement of external monitor for fetal heart rate and uterine activity?
  
- b. Technology (Define and list characteristics of each term below)
  - i. What is autocorrelation?
  - ii. How does the ultrasound transducer detect the fetal heart rate?
  - iii. How does the FSE detect the fetal heart rate?
  - iv. Can the fetal ECG pickup the signal of the maternal heart rate? Explain?
  - v. How does the tocotransducer detect uterine activity?
  - vi. How does the IUPC detect uterine activity?
  
- c. Uses and limitations
  - i. What are the advantages and limitations of the ultrasound transducer and fetal scalp electrode?
  - ii. What are the advantages and limitations of the tocotransducer and internal pressure catheter (IUPC)?
  - iii. Why does the IUPC require it to be zeroed?
  - iv. Your patient is being monitored for contractions. When do you use palpation of the fundus to determine the strength of a contraction?

**Electronic Fetal Monitoring**  
**Study Guide**

- v. How effective is EFM with monitoring multiples (i.e. twins, triplets)?
  
- vi. What are the challenges with maternal size and EFM?
  
- vii. What are some examples of contraindications for using internal fetal monitoring (FSE and IUPC)?
  
  
  
  
  
  
  
  
  
  
- d. Terminology (Define the following terms and can you recognize them on the fetal strip. What causes this to occur?)
  - i. FHR Doubling and Halving
  
  
  
  - ii. Artifact
  
  
  
  - iii. Dysrhythmias
  
  
  
  
  
  
  
  
  
  
- e. How do you differentiate artifact from dysrhythmia?

**2. Physiology (5 - 10%)**

- a. Uteroplacental circulation
  - i. Terminology (Define the following terms and role in uteroplacental circulation)
    - 1. Uterine arteries and veins
  
  
  
    - 2. Spiral arteries
  
  
  
    - 3. Intervillous space
  
  
  
    - 4. Chorionic villi
  
  
  
    - 5. Umbilical vein and arteries

**Electronic Fetal Monitoring**  
**Study Guide**

- ii. Fetal Circulation – Describe the following:
  - 1. Pathway for oxygen-rich and nutrient-rich blood
  
  - 2. Pathway for oxygen-poor and waste product-rich blood
  
  - 3. Anatomical shunts that permit fetal blood to bypass the liver and the lungs
  
- iii. Describe the fetal oxygenation pathway from the environment to the fetus and examples of conditions that may interfere with oxygen transfer.
  - 1. Lungs
  
  - 2. Heart
  
  - 3. Vasculature
  
  - 4. Uterus
  
  - 5. Placenta
  
  - 6. Umbilical cord
  
- iv. Describe the fetal physiologic response to interruptions of the “oxygen pathway.”
  
- v. Describe how the maternal blood delivers oxygen to the fetus. Include the following in your response:
  - 1. Which maternal arteries carry blood to the placenta?
  
  - 2. Where do oxygen, nutrient, and waste exchange occur in the placenta?
  
  - 3. Describe the mechanisms of transport across the placenta for each of the following:
    - a. Oxygen, carbon dioxide
  
    - b. Glucose
  
    - c. Amino acids

**Electronic Fetal Monitoring**  
**Study Guide**

- d. Water and dissolved electrolytes
  - e. Immunoglobulins, serum proteins
  - f. Fetal Rh-positive cells
4. What is the difference between passive diffusion and facilitated diffusion?
5. Why is it consequential when fetal cells enter the maternal system?
6. What happens in the placenta during a contraction?
7. How does the fetus maintain oxygenation during a contraction?
8. Which maternal conditions decrease uteroplacental function (Include respiratory, circulatory, and cardiac)?
- b. How do the following factors affect (Physiologic Effects) uterine blood flow and fetal oxygenation?
- i. Regional Anesthesia
  - ii. Drugs (therapeutic and recreational)
  - iii. Umbilical blood flow
  - iv. Placental factors
- c. Uterine activity (Define each terminology below and criteria used to evaluate the fetal tracing)
- i. Resting tone
  - ii. Contractions
    - 1. Frequency
    - 2. Duration
    - 3. Intensity
  - iii. Hypertonus
  - iv. Tachysystole

**Electronic Fetal Monitoring**  
**Study Guide**

- d. Fetal anatomy and physiology
  - i. How does oxygenated blood enter the fetal circulation (via which vessel?)
  - ii. How does oxygenated blood get to the heart, brain, lungs, and body (via which vessels)
  - iii. How does deoxygenated blood return to the maternal circulation (via which vessels)?
  - iv. Terminology
    - 1. What are chemoreceptors and what triggers them?
    - 2. What are baroreceptors and what triggers them?
    - 3. What response occurs in the body when chemoreceptors and baroreceptors are stimulated?
    - 4. What is the difference between hypoxia and hypoxemia?
    - 5. What is the difference between acidemia and acidosis?
  - v. Cord Gas Interpretation
    - 1. What is the normal pH, CO<sub>2</sub>, O<sub>2</sub>, and base excess (BE) in the umbilical vein and arteries?
    - 2. Is the cord pH above or below 7.25 when acidosis (respiratory or metabolic) is present?
    - 3. Is the O<sub>2</sub> higher in the umbilical arteries or the vein? Why?
    - 4. Is the CO<sub>2</sub> higher in the umbilical arteries or the vein? Why?
    - 5. Is the cord CO<sub>2</sub> above or below 60 when respiratory acidosis is present?
    - 6. Is the cord O<sub>2</sub> above or below 20 when metabolic acidosis is present?
    - 7. Why does the body need a buffer?
    - 8. Is the base excess above or below -11 when metabolic acidosis is present?

**Electronic Fetal Monitoring**  
**Study Guide**

**3. Pattern Recognition, Interpretation and Intervention (60 - 70%)**

Recognition, interpretation, and interventions of the FHR pattern using **NICHD Definitions**

**a. Baseline FHR**

1. What is the normal range?
2. What part of the nervous system regulates the FHR?
3. What happens to the nervous system as the fetus matures and how does this affect the fetal heart rate?
4. What is the difference between fetal bradycardia and tachycardia?
5. How do you assess variability?
6. What is the significance of absent, minimal, moderate, and marked variability?
7. How does fetal sleep, sedatives, narcotics, fever, dysrhythmia and prematurity affect variability?
8. What is a sinusoidal pattern?
9. Can you determine the baseline FHR and variability of sinusoidal pattern?
10. What causes a sinusoidal pattern?
11. Can a sinusoidal pattern resolve? If so, describe.

**b. NICHD Definitions**

1. What is the criterion for acceleration? Is acceleration a reassuring pattern?
2. What is the difference between early and late deceleration?
3. What is the difference between prolonged deceleration and bradycardia?
4. What are the possible causes of prolonged deceleration?
5. What is a variable deceleration?
6. Are early and late decelerations abrupt (< 30 seconds) or gradual ( $\geq$  30 seconds) from the onset to beginning of lowest point (nadir)?



**Electronic Fetal Monitoring**  
**Study Guide**

7. Do shoulders and overshoot occur with early, late, or variable decelerations?
8. What is the significance of shoulders and overshoot?
9. What is a lambda pattern?
10. Can you determine early and late decelerations without uterine contractions?
11. Which decelerations usually fall  $\geq 15$  bpm from the baseline, last  $\geq 15$  seconds and  $< 2$  minutes from onset to return to baseline?
12. Which fetal heart rate pattern is attributed to cord compression?
13. Define terminal bradycardia?
14. Which fetal heart rate pattern is attributed to head compression?
15. Which fetal heart rate pattern is attributed to uteroplacental insufficiency or problems?
16. What interventions are appropriate for early, late, and variable decelerations?
17. If there are concerns about the fetal well-being in labor, what actions may be taken to assess fetal acid-base status?
18. If there are concerns about the fetal well-being in labor, what action may be taken to ensure an accurate tracing?
19. If there are concerns about the fetal well-being in labor, what actions may be taken to ensure fetal oxygenation?
20. What are the appropriate steps for intrauterine resuscitation?

**Electronic Fetal Monitoring**  
**Study Guide**

- c. Conditions that affect fetal heart rate patterns
  - 1. Define uterine hypertonus? What are the criteria?
  - 2. Define uterine tachysystole? What are the criteria?
  - 3. What interventions are appropriate for tachysystole?
  - 4. What type of fetal heart rate pattern is likely to occur with the following medical conditions:
    - a. Preterm labor
    - b. Hypertension in pregnancy
      - i. Chronic Hypertension
      - ii. Gestational Hypertension
      - iii. Pre-eclampsia
      - iv. Eclampsia
    - c. Postdates pregnancy
    - d. Diabetes mellitus
      - i. Gestational (A1, A2)
      - ii. Pregestational (Type 1, Type 2)
    - e. Placental disorders (previa, abruption)
    - f. Uterine rupture/scar dehiscence (VBAC)
    - g. Cord prolapse
    - h. Infections
    - i. Multiple gestations
    - j. Illicit drug use
    - k. Intrauterine growth restricted (IUGR)
  - 5. Dysrhythmias and other variant patterns
    - a. List the characteristics of the fetal heart patterns below and appropriate interventions.
      - 1. Supraventricular tachycardia
      - 2. Congenital heart block
      - 3. Ectopic beats
      - 4. Dropped Beats

**Electronic Fetal Monitoring**  
**Study Guide**

**4. Adjunct Fetal Assessment (5 - 10%)**

- i. WHAT IS THE GOAL? How does fetal surveillance help to achieve this GOAL?
- ii. What are the criteria used to evaluate each procedure and management?
  1. Auscultation
  2. Fetal movement counting
  3. Nonstress testing
  4. Fetal Acoustic Stimulation
  5. Contraction stress testing
  6. Biophysical Profile (Score of 8 – 10; score of 6; score 0-4)
  7. Scalp stimulation
  8. Amnioinfusion
  9. Fetal Acid Base Testing

**5. Legal Aspects of electronic Fetal Monitoring (<5%)**

- a. Documentation requirements for first stage and second stage labor
  - i. Low risk
  - ii. High risk
- b. Documentation requirements for intermittent auscultation (low risk)?
- c. How do you assess fetal heart rate using intermittent auscultation (procedure)?
- d. Which intrapartum events require documentation of the fetal heart rate before and/or after the event?

## Electronic Fetal Monitoring Study Guide

- e. When is the chain of command implemented?
  
- f. What is meant by "**Decision to Incision**"? What are the implications for patient safety?
  
- g. Ethical Principles - Give an example of each principle relevant to Fetal Monitoring.
  - i. **Non-maleficence** - do no harm, is directly tied to the nurse's duty to protect the patient's safety. Born out of the Hippocratic Oath, this principle dictates that we do not cause injury to our patients. We ask ourselves, and then patients and families ask us, "Can this harm the patient?" Focus is on **avoidance of harm or hurt**; core of medical oath and nursing ethics.
  - ii. **Beneficence**- is at the heart of everyday nursing practice. The 3 forms of beneficence require taking action by helping--preventing harm, removing harm and promoting good. Focus is on compassion; taking positive action to help others; **desire to do good**; core principle of our patient advocacy.
  - iii. **Paternalism**- Healthcare professionals **make decisions about diagnosis, therapy, and prognosis for the patient**. Based upon the health care professional's belief about what is in the best interest of the patient, he/she chooses to reveal or withhold patient information in these three important arenas.
  - iv. **Autonomy**— means that individuals have a right to self-determination, that is, to make decisions about their lives without interference from others. Focus is on agreement to **respect another's right to self-determine** a course of action; support of independent decision making.
  - v. **Justice**- means giving each person or group what he/she or they are due. It can be "measured" in terms of fairness, equality, need or any other criterion that is material to the justice decision. In nursing, justice often focuses on equitable access to care and on equitable scarce resource allocation. This principle refers to an **equal and fair distribution of resources**, based on analysis of benefits and burdens of decision.
  - vi. **Privacy and Confidentiality** - Privacy belongs to each person and, as such, it cannot be taken away from that person unless he/she wishes to share it. Confidentiality, on the other hand, means that the information shared with other persons will not be spread abroad and will be used only for the purposes intended. A patient's sharing of private information imposes a duty of confidentiality on health care providers. That duty means providers will share information only on a need-to-know basis.
  - vii. **Fidelity**- This principle requires loyalty, fairness, **truthfulness**, advocacy, and dedication to our patients.

**Electronic Fetal Monitoring**  
**Study Guide**

- h. Legal Issues
  - i. Documentation
  - ii. Informed Consent
  - iii. Liability
  
- i. Patient Safety
  - i. Standard Terminology
  - ii. Team Communication