Objectives

1. Understanding the NCC Examination - Preparing for the Exam - Reference Review - Suggested resources and How-to-study-guide

2. Construct a study plan for the exam based on understanding the blueprint and domains of practice covered utilizing suggested resources.

3. Identify common mistakes and pitfalls that are made during studying and testing for the exam - Recall the core components covered in the exam through didactic supplementation and practice test questions
NCC Exam Information

- Inpatient OB exam: 175 questions, 25 pretest questions
- EFM review: 125 questions, 25 practice questions
- Continuing education hours
- Modules
  - Competency Assessment Exam

Level of care
- Years of experience
- Variety in practice

Experience
- Birthing Center
- Regional Perinatal Center
- Travel nurse
### Resource Review: Textbooks

<table>
<thead>
<tr>
<th><strong>Pro’s</strong></th>
<th><strong>Con’s</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• One book may encompass all subjects covered</td>
<td>• Can be expensive because of how much content is included</td>
</tr>
<tr>
<td>• Very detailed explanations, rationales on difficult content</td>
<td>• Not updates as often</td>
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<tr>
<td>• Textbooks can be highlighted, can reference later, you can make study cards with e-books</td>
<td>• Time consuming</td>
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<tr>
<td></td>
<td>• Can be difficult to focus on only what is needed for the exam</td>
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<td></td>
<td>• Adult learner remembers 10% of what they read</td>
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**Textbooks**

**Study Guides**

**Test Prep Review**
Doppler Ultrasound

- Multiple piezoelectric crystals within the transducer generate sound waves that are transmitted toward the fetal heart and receive US waves reflected back from the fetal heart movements.
- The sound waves returning from moving structures are altered in frequency from those sound waves originally transmitted toward the moving structure.
- This frequency shift, called the “Doppler shift,” is detected and amplified to produce the waveform, which is then interpreted by the computer in the fetal monitor. The monitor then produces an audible sound and tracing to reflect the detected FHR.
Tocodynamometer (Toco)

- The toco detects abdominal pressure or contour changes resulting from uterine contractions.
- The pressure sensor should be placed over the uterine fundus at the point of maximal contraction intensity.
- Computer technology translates the degree of pressure detected by the sensor into an electrical signal that is displayed numerically on the monitor.
- The uterine activity (UA) resting tone should be adjusted to 15 to 20 mm Hg between contractions.
Intrauterine Pressure Catheter

- The IUPC allows for greater quantitative measurement of uterine contraction frequency, duration, intensity or peak intrauterine pressure, and resting tone.
- The decision to use an IUPC should be based on the clinical need for additional uterine activity information (i.e., obesity or uterine overdistention inhibits the ability to assess uterine activity).
- **Additional reasons for use:** (1) need for amnioinfusion, (2) oxytocin induction or augmentation when external methods of assessing uterine activity are not producing an interpretable uterine activity tracing, and (3) lack of progress of labor when quantitative analysis of uterine activity is indicated for clinical decision making.

Artifact vs. Arrythmia

Irregular variations or absence of the FHR on the FHM resulting from mechanical limitations of the monitor, electrical interferences, or weak signal (appearing as gaps or dots), AWHONN/FHMPP, 2015.

Artifact with FSE may appear in the form of irregular lines varying with varying length, unlike the regular lines seen with some arrhythmias.

Artifact can present because of half-counting, double-counting, and or recording MHR.
SIGNAL AMBIGUITY
MHR/FHR

PHYSIOLOGY (11%)

Uteroplacental
- Circulation
- Fetal circulation
- Fetal heart regulation

Factors affecting fetal oxygenation
- Uterine activity
- Maternal factors
- Anesthesia
- Drugs
- Placental factors
- Umbilical blood flow
**EXTRINSIC FACTORS**

- External environment
- Maternal lungs
- Maternal blood
- Maternal heart
- Maternal Vasculature
- Uterus
- Placenta
  - Placenta structure
  - Placental blood flow
  - Placenta in the oxygen pathway

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**Placenta**

- It is primarily a fetal structure responsible for the physiologic exchanges of gases, nutrients, and substances between the mother and developing fetus
- Other major functions
  - Metabolism
  - Endocrine secretions
  - Immunologic protection from pathogens Barrier to maternal blood and bacteria

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**PHYSIOLOGIC BASIS OF EXTRINSIC INFLUENCES ON THE FHR**
FHR Control mechanisms

- Brainstem – a normal FHR pattern reflects an intact, oxygenated brainstem, autonomic nervous system, and heart.
- Baroreceptors and Chemoreceptors
- Anaerobic Metabolism
  - Metabolic acidosis and lactate
  - Lactic acid
- Fetal Circulation and the Redistribution of Blood
  - Shunting

MATERNAL OXYGEN TRANSPORT PHYSIOLOGY

Fetus depends on constant supply of well-oxygenated maternal blood to maintain aerobic metabolism

Oxygen transport physiology involves four basic components:

<table>
<thead>
<tr>
<th>Oxygen content</th>
<th>Oxygen affinity</th>
<th>Oxygen delivery</th>
<th>Oxygen consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>total amount of oxygen in the maternal arterial blood</td>
<td>the affinity of hemoglobin for oxygen is the means by which hemoglobin readily acquires and releases oxygen molecules</td>
<td>quantity of O2 delivered to the tissues</td>
<td>quantity of oxygen consumed by the tissues each minute</td>
</tr>
<tr>
<td><strong>Influence</strong></td>
<td><strong>Action</strong></td>
<td><strong>FHR Effect</strong></td>
<td></td>
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<tr>
<td>----------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Parasympathetic Branch</strong></td>
<td>Pathway for transmission of variability</td>
<td>↓FHR</td>
<td></td>
</tr>
<tr>
<td>Originates in medulla oblongata</td>
<td></td>
<td>Slow, gradual ↓FHR with ↑gestational age (28 weeks and term)</td>
<td></td>
</tr>
<tr>
<td>Vagus nerve</td>
<td></td>
<td>Modulates baseline FHR with sympathetic</td>
<td></td>
</tr>
<tr>
<td><strong>Sympathetic Branch</strong></td>
<td>* Stimulation releases catecholamines</td>
<td>↑FHR</td>
<td></td>
</tr>
<tr>
<td>At term, nerve fibers widely</td>
<td>* Reserve mechanism to improve heart’s pumping ability during intermittent</td>
<td>Modulates baseline FHR with parasympathetic nervous system</td>
<td></td>
</tr>
<tr>
<td>distributed throughout myocardium</td>
<td>stress</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Baroreceptors:</strong></td>
<td>When ↑ arterial BP, the baroreceptors quickly detect amount of stretch,</td>
<td>Abrupt ↓FHR</td>
<td></td>
</tr>
<tr>
<td>Protective stretch receptors</td>
<td>sending impulses via vagus nerve to midbrain</td>
<td>Abrupt ↓CO</td>
<td></td>
</tr>
<tr>
<td><strong>Chemoreceptors</strong></td>
<td>Central- reflex tachycardia</td>
<td>Abrupt ↓BP</td>
<td></td>
</tr>
<tr>
<td>Central – located medulla oblongata</td>
<td>Peripheral - bradycardia</td>
<td>Variable decels with moderate variability are baroreceptor influenced</td>
<td></td>
</tr>
<tr>
<td></td>
<td>When blood flow is below threshold for normal respiratory gas exchange,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>↑PCO2 stimulates</td>
<td></td>
<td></td>
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</tbody>
</table>
Factors Affecting Uteroplacental Perfusion

- Excessive uterine contractions or tachysystole
- Abruptio placenta
- Drug stimulant (e.g., oxytocin, misoprostol, Cervidil)
- Maternal hypotension
- Supine hypotension
- Sympathetic blockade (e.g., regional anesthetic)
- Hypovolemic shock
- Maternal Conditions
  - Chronic hypertension
  - Hypertensive disorders of pregnancy
- Physical or emotional stress
- Placental changes
- Decreased surface area (e.g., abruptio placenta)
- Degenerative (e.g., hypertension, prolonged pregnancy, diabetes)
- Calcifications (e.g., smoking)
- Infarcts (e.g., abruptio placenta, prolonged pregnancy)
- Infection (e.g., chorioamnionitis)
- Edema (e.g., erythroblastosis fetalis)
- Vasoconstriction

Fetal Well-being

- How is fetal well being assessed?
  - Kick Counts
  - Non-stress Test (NST)
  - Contraction Stress Test (CST)
  - Biophysical Profile (BPP)
    - Modified Biophysical Profile
Example of a reactive nonstress test (NST). Accelerations of 15 beats per minute lasting 15 seconds with each fetal movement (FM). Top of strip shows FHR; bottom of strip shows uterine activity tracing. Note that FHR increases (above the baseline) at least 15 beats and remains at that rate for at least 15 seconds before returning to the former baseline.

Example of a nonreactive NST. There are no accelerations of FHR with FM. Baseline FHR is 130 beats per minute. The tracing of uterine activity is on the bottom of the strip.
Contraction Stress Test

- CST is a fetal well being test to determine how the fetus will respond to hypoxia during contractions.
- Contractions are stimulated either through nipple stimulation or the administration of oxytocin.
- This test more sensitive to fetal oxygen reserves than the NST.
- Low false-negative

Example of a positive contraction stress test (CST). Repetitive late decelerations occur with each contraction. Note that there are no accelerations of FHR with three fetal movements (FM). The baseline FHR is 120 beats per minute. Uterine contractions (bottom half of the strip) occurred four times in 12 minutes.
Vibroacoustic Stimulation Test

- This test will evaluate fetal status by observing accelerations of the FHR following acoustic stimulation.
- Procedure
  - Stimulus can be applied over the abdomen for 1 second x2. Then apply stimulus for 2 seconds; wait 1 minute.
- Interpretation
  - Reactive – Two accelerations in 10 minutes 15 x 15
  - Acoustic stimulation of the nonacidotic fetus may elicit FHR accelerations that appear to be valid in the prediction of fetal well-being
  - Such stimulation offers advantage of reducing overall testing time and reducing false negative testing
When the maternal-uterine-placental exchange system is interrupted, potential exists for fetal acidosis, which can lead to permanent damage or death.

The body and all living cells are sensitive changes in acidity and alkalinity. An alteration of the pH of blood affects the functioning of the cells. Blood has buffers to keep pH constant.

Alkalosis and acidosis can cause permanent damage to organs or progress to a fatal condition if not quickly restored.
### Understanding acid-base

- **Acidemia**: the buildup of acid in the blood.
- **Acidosis**: the buildup in the tissues (reduced pH).
- **Base deficit**: amount of bases used in attempt to normalize the pH, the more base used to normalize the pH, the larger the number becomes and the greater the deficit.
- **Hyponxia**: reduction of oxygen in the blood.
- **Hypoxia**: reduction of O2 in the tissues.
- **pH**: a representation of the H ion concentration.
- **PCO2**: quantity of CO2 in the blood.
- **PO2**: the quantity of O2 in the blood.

### Fetal Acid Base: Respiratory

- There is not a production or accumulation lactic acid.
- CO₂ is not effectively removed.
- Accumulated free hydrogen ions in the blood cause a decrease in pH.
- Respiratory acidosis occurs quickly and has potential for rapid recovery.
- Resolves quickly with PPV
  - Or intrauterine resuscitation
- A healthy fetus can easily excrete excess CO₂ once blood flow returns to normal.
- Fetus with respiratory acidosis may have rise in FHR baseline, minimal or loss of accels and variability.
Fetal Acid Base: Metabolic

- Oxygen supply that is decreased over time, which leads to increase in lactic acid.
- If O² levels fails to return to normal, peripheral tissues shift into anaerobic metabolism
- O² reserves are totally depleted
- The buffer base becomes depleted causing pH to fall as fetus becomes hypoxic.
- Cardiac output decreases greatly
- Brain O² consumption decreases

<table>
<thead>
<tr>
<th></th>
<th>Normal Values</th>
<th>Metabolic Acidemia</th>
<th>Respiratory Acidemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>≥ 7.10</td>
<td>&lt; 7.10</td>
<td>&lt; 7.10</td>
</tr>
<tr>
<td>Po2 (mm Hg)</td>
<td>≥ &gt; 20</td>
<td>&lt; 20</td>
<td>variable</td>
</tr>
<tr>
<td>PCO2 (mm Hg)</td>
<td>&lt; 60</td>
<td>&lt; 60</td>
<td>&gt; 60</td>
</tr>
<tr>
<td>Bicarbonate (mEq/L)</td>
<td>&gt; 22</td>
<td>&lt; 22</td>
<td>≥ 22</td>
</tr>
<tr>
<td>Base deficit</td>
<td>≤ 12</td>
<td>&gt; 12</td>
<td>&lt; 12</td>
</tr>
<tr>
<td>Base excess</td>
<td>≥ - 12</td>
<td>&lt; - 12</td>
<td>&gt; - 12</td>
</tr>
</tbody>
</table>

Normal and Abnormal Umbilical Cord Blood Acid-Base Values
Fetal Response to Interrupted Oxygen Transfer

- Essential Criteria that Define an Acute Intrapartum Event Sufficient to Cause Cerebral Palsy

1. Umbilical cord arterial blood pH <7 and base deficit ≥ 12
2. Early onset of severe or moderate neonatal encephalopathy in infants born at 34 or more weeks of gestation
3. Cerebral palsy of the spastic quadriplegic or dyskinetic type
4. Exclusion of other identifiable etiologies such as: trauma, coagulation disorders, infectious conditions, or genetic disorders

<table>
<thead>
<tr>
<th>Category I</th>
<th>Category II</th>
<th>Category III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline rate: 110-160</td>
<td>Baseline rate: Bradycardia not accompanied by absent baseline variability, Tachycardia Variability: minimal, absent with no recurrent decelerations, marked Accelerations: absent or induced after fetal stimulation Periodic or episodic decelerations: Recurrent variable decels accompanied by minimal or moderate variability, Prolonged decels more than 2 minutes but less than 10 minutes, recurrent late with moderate variability</td>
<td>Absent baseline FHR variability and any of the following: Recurrent late decelerations Recurrent variable decelerations Bradycardia Sinusoidal pattern</td>
</tr>
</tbody>
</table>
A true sinusoidal FHR pattern is a visually apparent, smooth, sine wave–like undulating pattern in the FHR baseline with cycle frequency of 3 to 5 per min that persists for 20 minutes or longer and classified as a category III pattern.

Associated with severe fetal anemia, massive fetomaternal hemorrhage, twin-to-twin transfusion syndrome, ruptured vasa previa, traumatic fetal bleeding with severe anemia, or fetal intracranial hemorrhage. Other conditions associated with a sinusoidal FHR include fetal infection, fetal cardiac anomalies, neonatal hypoxia, congenital hydrocephalus, gastroschisis, and maternal cardiopulmonary bypass.

Research suggests that the sinusoidal pattern is related to a change in the CNS control of FHR and implies cerebral ischemia. It is associated with abnormal fetal acid–base status at the time of observation, it is labeled a category III pattern and requires prompt evaluation and intrauterine resuscitation.

A sinusoidal-appearing FHR pattern can follow administration of some analgesic medications (e.g., butorphanol fentanyl, meperidine), fetal sleep cycles, thumb sucking, or rhythmic movements of the fetal mouth.
Intrauterine Resuscitation

Goal

- Promote fetal oxygenation – *What techniques support this?*
- Reduce uterine activity – *What techniques support this?*
- Alleviate umbilical cord compression – *What techniques support this?*
- Correct maternal hypotension – *What techniques support this?*

Oxytocin – Induced Tachysytole (normal FHR)

- Assist mother lateral position
- Give IV fluids at least 500ml LR
- Decrease oxytocin rate

Oxytocin – Induced Tachysytole (Abnormal FHR)

- Discontinue oxytocin

IV fluids in labor is thought to improve placental perfusion by maintaining or correcting maternal intravascular volume (Awhonn, 2018)

Administration of 250-500 ml bolus of LR was found to increase fetal oxygenation

IV fluid bolus as an intrauterine resuscitation measure to promote uteroplacental blood flow and fetal oxygenation

Close monitoring of I & O’s is important in certain medical conditions (cardiac disease, preeclampsia, use of magnesium) or use of medications known to affect maternal fluid balance, or hemodynamic stability.
• Oxytocin is the most preferred pharmacologic agent for inducing labor when the cervix is favorable or ripe.
• Numerous studies have focused on oxytocin inductions. It has been found that low-dose (physiologic) and high-dose (pharmacologic) oxytocin regimens are equally effective in establishing adequate labor patterns.

Endogenous Oxytocin

- **First stage of labor**: Maternal circulating contribution = 2 to 4 mU/min
- **Fetal Contribution**: Secretion similar to 3 mU/min
- **Combined effects = 5 to 7 mU/min**
- **Second stage of Labor**: Surge of oxytocin at Ferguson’s reflex
Exogenous Oxytocin

- **Initial phase (1.5 to 2hrs)**
  - Uterine contractions will progressively increase in frequency and intensity.

- **Stable phase**
  - Any further increase will not cause more frequent normal changes in uterine activity.

- **Response to long periods of oxytocin**
  - Receptor site decrease significantly during prolonged oxytocin-induced or augmented labor compared to spontaneous labor.

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Second Stage of Labor

- Women are coached to take a deep breath and hold it for at least 10 seconds while bearing down 3 to 4 times during each contraction.
- Women are instructed not to make a sound and to bring their knees up toward their abdomen with their elbows outstretched while pushing.
- Many clinicians will assist by holding the woman’s legs back against her abdomen and counting to 10 with each pushing effort.
- These approaches are outdated and physiologically inappropriate (AWHONN, 2021)

Valsalva Maneuver

Valsalva maneuver is instituted when the birthing woman takes a deep breath and holds it (closed glottis)

This technique increases intrathoracic pressure, impairs blood return from lower extremities, decreases BP, and decreases uteroplacental blood flow

In the newborn, hypoxemia, acidemia, and lower Apgar scores may result. Sustained pushing of 9 to 15 seconds can result in significant decelerations in the FHR and decreases in fetal SpO2. Based on the results of a randomized clinical trials, when compared to spontaneous pushing, Valsalva pushing can have significant adverse effects including an increase in the length of the second stage of labor, a decrease in Apgar scores

Lower Extremity Nerve Damage

- Transient and permanent peroneal nerve damage have been reported following prolonged periods of coached pushing with the woman in the supine lithotomy position.
- Pressure applied to the peroneal nerve during pushing over a prolonged period, nerve damage resulting in numbness and tingling of the legs, inability to bear weight, and loss of feeling may result. Impairments can be unilateral or bilateral. Lower extremity nerve injury generally resolves within 2 to 6 months, although symptoms may persist for years or be permanent, AWHONN Practice Brief 11, 2021.
- This type of iatrogenic injury can be prevented by encouraging the woman to keep her feet flat on the bed during second-stage pushing.
- Healthcare providers should avoid forcibly pushing the woman's legs against her abdomen and placing the woman's legs in stirrups while pushing, because these techniques increase the risk of peroneal nerve damage.
Awhonn 2\textsuperscript{nd} stage quick care guide

Legal Aspects of EFM

- National standards
  - AWHONN
- Standardized Terminology
  - NICHD
- Hospital Policies
  - TJC
- State Law
  - Nurse Practice Act
- Communication
  - SBAR-R-R
  - Chain of Command/Consultation
  - Use of Translators
  - Hand of Communication
- Documentation
  - Fetal heart rate components, uterine activity and mode of assessment.

Communication

• Communication with the Woman and her Family
  • Shared-decision making
  • They should be an ongoing participant in the decision-making process
  • Collaborative approach for exploring choices and clarifying options

• Communication with Healthcare Providers
  • Clear, direct and patient-centered
  • Individual clinicians can proactively contribute toward effective communication by assuming positive intentions in others, understanding their perceptions are informed by their personal perspectives

Documentation

- SYSTEMATIC
- ONGOING
- COMMUNICATION W/PATIENT, NURSING, PROVIDERS
- NARRATIVE NOTES
- TREATMENT REFUSAL
What is category are we in? Is there evolution of pattern over time? What interventions have been done? Has the healthcare provider been notified? What level of situational awareness do we have?

What is our resting tone? Do we have tachysystole? Have we performed appropriate troubleshooting steps and documented them? Have we touched the patient? Are we using any induction agents?

Describe patterns Any interventions Maternal & fetal response Communication with provider
References

- AWHONN POSITION STATEMENT | VOLUME 47, ISSUE 6, P874-877, NOVEMBER 01, 2018 DOI:https://doi.org/10.1016/j.jogn.2018.09.007

Thank you
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