Basic Fetal Monitoring

INSTRUCTOR: KRISTI EICHHORN MSN, WHNP-BC, CNM
OB PROFESSOR, SAN DIEGO CITY COLLEGE

Originally Created By:
Eileen Vido BSN, RNC-OB
Luann Beacom MSN, MPH, CNS, FNP
Karen Harmon MSN, CNS, RNC
Ana-Maria Gallo PhD, CNS, RNC

OBJECTIVES

- By the end of this presentation the participant shall:
  - Identify the purpose of fetal monitoring
  - Describe the various methods of monitoring
  - Understand the physiology and pathophysiology related to the fetal heart rate
  - Identify FHR patterns and related nursing interventions
  - Have knowledge of antenatal fetal surveillance tests including indications and related nursing interventions

PURPOSE OF FHR MONITORING

- To assess the influence of the intrauterine environment for fetal well-being
  - Identify the fetus at risk
  - Assess fetal well being
    - Identify both reassuring and nonreassuring fetal heart rate changes
  - To assess progress of labor through measurement of uterine activity
HISTORY OF FETAL MONITORING

- 1960's – EFM technology developed
- 1970's
  - Widespread use
  - Inconsistent terminology
- 1980's – Auscultation
- 1990's – AWHONN standardized education
- 2005 – NICHD terminology
- 2008 – NICHD terminology update
- 2009 – ACOG Position Statement re: NICHD

METHODS OF MONITORING

- The two methods of fetal monitoring are:
  - Auscultation
  - Fetoscope
  - Doppler (not true auscultation)
- Electronic monitoring
  - External
  - Internal
The two methods of uterine activity monitoring are:

- Palpation only
- Electronic Monitoring
  - External with tocodynamometer & palpation
    - Palpation needed for strength and resting tone
  - Internal with Intravenous Pressure Catheter (IUPC)
INSTRUMENTATION: ELECTRONIC FETAL MONITORING

- Monitoring equipment
  - Graph paper
  - Display panel
- External Monitoring
  - Tocodynamometer “Toco”
  - Doppler
- Internal Monitoring
  - Intrauterine pressure catheter (IUPC)
  - Fetal Spiral (scalp) electrode (FSE)

![Image](image1.png)

![Image](image2.png)
**MONITORING EQUIPMENT**

**Graph Paper**
- Paper is heat sensitive
- Two distinct sections or channels
  - FHR channel (on top)
    - Vertical – monitors the FHR on a 30-240 bpm per cm scale (USA)
    - Horizontal – each small box represents 10 sec, each dark line marks 1 minute (bar to bar)

**MONITORING EQUIPMENT**

**Graph Paper (Cont.)**
- Uterine Activity “UA” (on bottom)
  - Vertical – measures the intensity of the contractions on a 0-100 mmHg scale
  - Horizontal – each small box represents 10 sec, each dark line marks 1 minute (bar to bar)
MONITORING EQUIPMENT

**Display Panel**

- On/Off
- Volume
  - Increases volume of the FHR (↑)
  - Decreases volume of the FHR (↓)
- UA reference
  - Zeros the UA baseline to 10 mmHg

**Display Panel (Cont.)**

- Test
  - Tests the circuitry of the monitor and prints this on the paper
- Mark
  - Places an arrow (↓) on the tracing at the exact moment of time that it is pressed
- Logic
  - Logic button on/off used for arrhythmia recognition
    (leave in OFF position)
MONITORING EQUIPMENT

Display Panel (Cont.)

- Monitor ports – for cable placement
  - Ultrasound (singleton & twins)
  - ECG (for the fetal spiral electrode)
  - UA (Uterine Activity)
- Loading paper
  - Paper tracing
  - Patient identification
  - Electronic tracing
  - Patient verification

EXTERNAL MONITOR

Tocodynamometer “Toco”

- Indications for use
- Assessment of frequency and duration of contractions
**EXTERNAL MONITOR**

* Tocodynamometer (cont.)
  - Advantages
    - Non-invasive
    - Can be used for any patient
    - Membranes do not have to be ruptured

* Tocodynamometer (cont.)
  - Disadvantages
    - Recording UC accurately may be difficult with obesity or preterm labor patients
    - Location sensitive, improper placement can lead to false information
    - Unable to accurately detect UC intensity and resting tone

* Tocodynamometer (cont.)
  - Disadvantages (cont.)
    - Maternal and fetal motion may be superimposed on waveform
    - May be uncomfortable
    - Limits mobility
**Tocodynamometer (cont.)**

- Nursing assessment/interventions
  - Application and placement
    - Use elastic belt to secure
    - Place the toco (button down) on the top of the fundus
    - Palpate during a contraction to feel where the fundus is firmest
    - UA reference between UC's when uterus is soft
  - TOUCH YOUR PATIENT !!!

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**Tocodynamometer (cont.)**

- Nursing assessment/interventions
  - Patient education
    - Explain basic element of interpretation, benefits and limitations, and central monitoring

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**Ultrasound Transducer “Doppler”**

- Contains crystals inside which transmit high frequency US waves and receives reflected waves.
- Ultrasounds are motion detectors
- Works by detecting cardiac motion
- Indications for use
  - Continuous or intermittent assessment of the FHR
Ultrasound Transducer (cont.)

- Advantages
  - Non-invasive, membranes may remain intact
  - Continuous recording possible
  - Permanent record possible for collaborative decision making and record keeping

- Disadvantages
  - Artifact may distort recording
  - Maternal/fetal movement
  - May limit patient mobility
  - Halving and doubling
EXTERNAL MONITOR

**Ultrasound Transducer (cont.)**

- Nursing assessment/interventions
  - Application and placement
    - Use elastic belt to place doppler on the abdomen over area the FHR is heard the strongest
    - Usually over fetal back
    - Usually on sides of abdomen, reposition each time patient turns
  - Coupling gel must be used because maternal skin reflects ultrasound beams but the gel allows penetration

- Patient Education
  - Volume
  - Basic elements of interpretation
    - E.g., fluctuations of FHR - good
  - Benefits/Limitations
    - E.g., may lose signal if baby or mom move
    - Central monitoring

INTERNAL MONITOR

**Intrauterine Pressure Catheter (IUPC)**

- Transducer or sensor tipped
- Senses intra-amniotic pressure
- Indications for use
- Accurate documentation of frequency, duration and intensity (in mmHg) of contractions and resting tone.
- Amnioinfusion
INTERNAL MONITOR

**Intrauterine Pressure Catheter (IUPC)**

- **Advantages**
  - Increased accuracy in the assessment of frequency, duration, intensity of contractions and resting tone in mmHg
  - Increased accuracy correlating FHR to contractions
  - Accessible port for amnioinfusion
  - Avoids pressure artifact
  - E.g., fetal kicks or maternal vomiting
  - Increased patient comfort (debatable)
Intrauterine Pressure Catheter (IUPC)

Disadvantages
- Invasive
- Potential for uterine perforation
- Risk for ascending infection
- Requires ruptured membranes and cervical dilation
- Requires skill for insertion and calibration
- Placement of IUPC and maternal position affect baseline and contraction intensity

Nursing Assessment/Interventions

Application & Placement
- Prepare IUPC per manufacturer guidelines
- Set up IUPC
- Assemble equipment, attach IUPC to adapter cable
- Flush transducer and catheter, if fluid filled
- Zero per manufacturer guidelines

- Determine cervical site for catheter insertion, gently displace presenting part, if needed
- Use aseptic technique
- Insert guide (containing IUPC) between examining fingers
  - Ensure catheter guide does not extend beyond fingers
  - Insert up to 45cm or until resistance is met
  - Attach to cable and confirm device is working
**INTERNAL MONITOR**

**Intrauterine Pressure Catheter (IUPC)**
- Nursing Assessment/Interventions
  - Application & Placement
    - Document on tracing and in chart: maternal/fetal response
    - Document pressure readings (in mmHg or in Montivideo Units MVU per hospital policy)

**INTERNAL MONITOR**

**Fetal Spiral Electrode (FSE)**
- Measures R to R interval
INTERNAL MONITOR

**Fetal Spiral Electrode (FSE)**

- Indications for use
  - Continuous fetal monitoring is needed
  - The ultrasound tracing is incomplete; gaps in tracing
  - Question of dysrhythmia
Fetal Spiral Electrode (FSE)

Advantages
- Continuous tracing and accurate assessment of the fetal heart rate
- Fetal arrhythmia recognition
- May be more comfortable; belts off abdomen

Disadvantages
- Requires ruptured membranes and cervical dilation
- Invasive
  - Risk of infection
  - Small risk of fetal hemorrhage
- Traces any HR
  - May trace maternal HR in presence of fetal demise
INTERNAL MONITOR

Fetal Spiral Electrode (FSE)

- Disadvantages cont.
  - Fetal dysrhythmia may be missed if logic button is engaged (on)
  - Turn “OFF” logic button
  - Cannot trace rates > 240 or < 30 bpm

INTERNAL MONITOR

Fetal Spiral Electrode (FSE)

- Nursing Assessment/Interventions
  - Application and placement
    - Cleanse perineum as per institutional policy
    - Pull electrode 1 in. back into introducer so it does not extend beyond the end of the introducer
    - VE to determine presenting part; feel for firm bone or buttock
    - Avoid fontanels, sutures, face

INTERNAL MONITOR

Fetal Spiral Electrode (FSE)

- Nursing Assessment/Interventions
  - Application and placement
    - Place introducer between two examining fingers and firmly place against the fetal head at a right angle
    - Maintain pressure against presenting part and turn clockwise until resistance is met (1-2 times)
    - Release lock device and remove introducer
    - Attach monitor to cable device and secure to leg
    - Document placement on the tracing, note in chart, maternal/fetal response
FHR PHYSIOLOGY & PATHOPHYSIOLOGY

- Fetal Homeostasis
  - A relationship between fetal heart rate changes, fetal status, fetal oxygenation and fetal acid-base status exists, and can be influenced by maternal, fetal, or placental factors.

- Fetal Heart Rate
  - The product of numerous factors that may be loosely divided into fetal intrinsic mechanisms and maternal-placental extrinsic mechanisms.

FETAL MECHANISM: ‘INTRINSIC FACTORS’

- Definition
  - Fetal mechanisms of fetal heart rate control and related fetal cardiovascular anatomy and physiology
  - Central Nervous System
  - Autonomic Nervous System
  - Neurohormonal Factors

NERVOUS SYSTEM

Central Nervous System (CNS)
- Brain
  - Cerebrum
  - Cerebellum
  - Brainstem
    - Medulla Oblongata
    - Pons
    - Midbrain
    - Reticular formation
- Spinal Cord

Peripheral Nervous System (PNS)
- Somatic (primarily voluntary)
  - Cranial Nerves
  - Spinal Nerves
- Autonomic (involuntary)
  - Sympathetic (speedy)
  - Parasympathetic (pokey)
  - Cranial Nerves
  - Spinal Nerves
  - Adrenal Medulla

CENTRAL NERVOUS SYSTEM

- Cerebral Cortex
  - Causes changes during periods of fetal activity and sleep, and is effected by medication

- Medulla Oblongata
  - Vasomotor centers
    - Increases or decreases in FHR
    - Oscillatory changes of FHR variability
  - Respond to changes in fetal blood pressure, oxygen, CO2 levels, and hormone levels
AUTONOMIC NERVOUS SYSTEM

(Sympathetic and Parasympathetic interaction affects FHR)

- **Sympathetic**: “Speedy”
  - Nerves distributed throughout the fetal myocardium and when stimulated
  - **Increase fetal heart rate** and increase cardiac output
  - When blocked: Decreases the fetal heart rate

PARASYMPATHETIC NERVOUS SYSTEM

- Controlled via the Vagus nerve originating in the Medulla Oblongata
- Fibers from Vagus innervate both the Sinoatrial (SA) and Atrioventricular (AV) nodes of the fetal heart
- Parasympathetic control of the FHR exerts tonic/oscillatory effect which we refer to as variability.
  - However, need both sympathetic and parasympathetic FHR effects to have variability
  - Parasympathetic: Slows FHR “Pokey”

NEUROHORMONAL FACTORS

- Baroreceptors
- Chemoreceptors
- Hormonal Factors
**BARORECEPTORS**

*Blood Pressure Sensitive*
- Stretch receptors found in vessel walls of the aortic arch and carotid bifurcation
- Stimulation generates impulses transmitted from the aortic arch by vagus nerve to the medulla oblongata
- Baroreceptors can send a message to the brainstem to increase or decrease the FHR in response to a decrease or increase in the BP

**CHEMORECEPTORS**

*Chemistry Sensitive*
- Peripheral chemoreceptors are in the carotid and aortic bodies
- Sensitive to changes in hydrogen, O₂, CO₂ concentration in cerebrospinal fluid and blood, specifically pH, PaO₂, and PaCO₂
- Effect changes in the FHR by causing an increase or decrease in HR

![Diagram of baroreceptors and chemoreceptors](slideplayer.com)
HORMONAL FACTORS
- Epinephrine and norepinephrine released by adrenal medulla and periaortic nodes
  - In response to fetal hypoxia: hemodynamic compensatory responses
    - Peripheral vasoconstriction
    - Preferential shunting of blood to vital organs
    - Startle reflex
    - Increase in FHR

INTRINSIC AND FETAL COMPENSATION
- $O_2$ and/or decreased umbilical blood flow
- Chemoreceptor/baroreceptor stimulus
- Neurohormonal responses including catecholamine production
  - Decreased peripheral blood flow
  - Blood flow to brain, heart, and adrenal glands

FETAL HEART RATE CHANGES

MATERNAL-PLACENTAL MECHANISMS: EXTRINSIC FACTORS
- Definition
  - Maternal-placental influences on fetal heart rate control, fetal environment, maternal cardiovascular and uterine anatomy and physiology, and placental and umbilical cord structure and function
PLACENTAL TRANSFER CAPACITY

- Placental integrity affects the ability of the placenta to provide nutrients to the fetus to allow for growth and development
- Placental structure is the functional placental surface area
- Placental function: reserve
  - Placental reserve allows fetus to cope with stresses of labor

PLACENTAL INSUFFICIENCY

- When reserve is diminished or placental integrity is compromised
- Examples
  - Maternal disease
  - Hypertension
  - Diabetes
  - Postmaturity
  - Prolonged intrapartum stress
  - Oxytocin induction

From: medicinase.com/pregnancy, 2015
UTERINE ACTIVITY

- Labor creates contractions strong enough to compress the spiral arteries cause a temporary interruption of blood flow and O2 to placenta
- Abnormal contraction patterns interfere with placental blood flow and produce fetal heart rate changes

UTERINE ACTIVITY MONITORING (UA)

- Measurement of uterine contractions (UCs)
  - **Frequency** = from the beginning of one UC to the beginning of the next UC (documented in minutes)
  - **Duration** = from the beginning of one UC to the end of the same UC (documented in seconds)

UTERINE ACTIVITY MONITORING (UA) (cont.)

- **Intensity** = the strength of the contraction
  - By palpation (external monitor)
    - Mild - Tip of nose
    - Mod - Chin
    - Firm - Forehead
  - By internal - mmHg
- **Resting tone** = the tone of the uterus between contractions
  - By palpation if external/toco
    - Soft
    - Firm
    - By internal - resting
UTERINE CONTRACTION PATTERNS

- Normal Values: ≤ 5 UC's in 10 minutes
  - Adequate labor
    - UC's every 2-3 minutes, lasting a minimum of 60 sec. and at least 50mmHg in intensity, or palpated firm
    - Resting tone 5-20 mmHg, or palpated soft

- Coupling or Tripling
  - refers to a pattern of 2 or 3 contractions with little or no interval followed by a regular interval of approx. 2 to 5 minutes.

- Tachysystole
  - > 5 UC's in 10 minutes, averaged over 30 minutes

- Irritability
  - High frequency low amplitude waves (HFLA)
    - can occur with a full bladder

HIGH FREQUENCY LOW AMPLITUDE WAVES (HFLA)

HFLA Pattern
TACHYSYSTOLE

> 5 UC's in 10 minutes, averaged over 30 minutes

TACHYSYSTOLE & INADEQUATE RESTING TONE

Inadequate resting tone

FHR PATTERNS & NURSING INTERVENTIONS

- Baseline Rate
  - Reflects the basal status of the fetus during periods in which there are no accelerations, or decelerations, or marked variability
  - Evaluated over a 10-minute period
  - At least 2 minutes of baseline is needed in a 10-minute period
  - If unable to determine, BL go to previous 10 min segment
  - If still can't determine BL it's "indeterminate"
  - Normal range is 110-160 (BPM)
  - Reported as an approximate mean FHR rounded to increments of 5bpm
    - (i.e. If BL range is 132-140 bpm the mean BL is 136 so you round down and say the BL is 135 bpm)
Tachycardia

- Definition
  - A baseline rate greater than 160 for ≥10 minutes

Maternal Causes
- Maternal/fetal fever (infection)
- Beta-adrenergic agents (terbutaline)
- Parasympatholytics, inotropic drugs, illicit drugs (stimulants)
- Hyperthyroidism
- Dehydration
- Endogenous adrenénergic anxiety

Fetal Causes
- Fetal infection
- Compensatory effort following a hypoxic insult
- Prolonged fetal activity or stimulation
- Chronic hypoxia
- Cardiac abnormalities
- Supraventricular tachycardia
TACHYCARDIA

- Interventions
  - Reduce fever: fever increases the metabolic requirements of the fetus
  - Medications: provide as ordered
  - Hydrate (fluid bolus 150-200mL, up to 500mL)
  - Cooling measures
  - Improve oxygenation
    - O₂ @ 10 liters tight face mask
    - (fluid bolus 500ml or even up to 1000mL)
  - Evaluate for fetal dysrhythmia

FHR PATTERNS & NURSING INTERVENTIONS

Bradycardia

- Definition
  - A baseline rate less than 110 for
    - > 10 minutes
  - Can be a normal variant
BRADYCARDIA

Maternal Causes:
- Position
- Hypotension
- Drug responses
- Connective tissue disease, i.e. SLE
- Prolonged maternal hypoglycemia or hypothermia

Fetal Causes:
- Umbilical cord occlusion i.e. prolapsed cord, decompensated fetus
- Severe hypoxia
- Hypothermia
- Cardiac conduction defect
- Excessive parasympathetic nervous system tone produced by chronic head compression in a vertex presentation

Interventions:
- Improve oxygenation
  - O2 @ 10 liters/min tight face mask
  - Reposition if mom supine
  - Hydration
  - Assess BP, particularly if post-epidural
- Improve umbilical circulation
  - Reposition
  - Vaginal exam
  - Check for rapid fetal descent
  - Elevate fetal head if prolapsed cord palpated or suspected
Variability (the 'squiggles' of the baseline)

- Definition:
  - Variability is visually quantitated as the amplitude of peak-to-trough in beats per minute (i.e., the range).
  - Fluctuations in the FHR of 2 cycles or oscillations per minute or greater (usually 3-6 oscillations).
  - Variability is the most sensitive indicator of fetal oxygenation.
  - Presence of accelerations will vary during labor; variability is the constant.

"Jagged, irregular" = good!
"Smooth, rounded, blunted" = bad!
FHR PATTERNS & NURSING INTERVENTIONS

- Categories of Variability:
  - Absent = Amplitude range is undetectable
  - Minimal = > undetectable but ≤ 5 bpm
  - Moderate = 6-25 BPM
  - Marked = > 25 BPM
Marked variability. Can't determine baseline – unable to round to a 5 beat increment. Therefore baseline is documented as 'indeterminate'.

Baseline 125, Moderate Variability
FACTORS AFFECTING VARIABILITY

- **Minimal/Absent Variability**
  - Prematurity (minimal var)
  - Fetal Sleep Cycles (minimal var)
  - Narcotic Administration (minimal var)
  - Congenital Anomalies
  - Fetal Cardiac Arrhythmias
  - Hypoxia
  - Acidosis

- **Marked Variability**
  - Usually a compensatory response to an acute hypoxic event

- **Drugs**
  - CNS Depressants – narcotic analgesics, barbiturates, tranquilizers, phenothiazines, general anesthesia
  - Other Medications that may affect variability
    - Ephedrine may result in a period of marked variability
    - Corticosteroids may result in a decrease in variability with Betamethasone (but not Dexamethasone)
    - Magnesium Sulfate may result in a decrease in variability

INTERVENTIONS: AIMED AT ETIOLOGY

- **Assess fetus**
  - Is baby in sleep cycle or just medicated?
    - (Sleep cycles usually 20 min but can persist up to 60 min)
  - May attempt scalp or vibroacoustic stimulation

- **Hypoxia or impending acidosis**
  - Improve oxygenation
  - 02
  - Reposition
  - Hydration

SINUSOIDAL IS NOT VARIABILITY

- **Sinusoidal Baseline**
  - This pattern differs from variability in that it has a visually apparent, smooth, sine-wave-like undulating pattern in FHR baseline with a cycle frequency of 3-5/min that persists for ≥ 20 min
  - It is excluded in the definition of FHR variability.
PERIODIC CHANGES

- Definition
  - Patterns that are associated in timing with uterine contractions
- Decelerations
  - Early
  - Variable
  - Late

DECELERATIONS

Early Deceleration

- Characteristics
  - Visually apparent, usually symmetrical (onset to nadir ≥ 30 sec) decrease and return of the FHR associated with a UC (mirrors the UC)
    - The decrease is calculated from the onset to the nadir of the deceleration
  - Onset, nadir, and recovery of the deceleration coincide with the onset, peak, and end of the contraction
  - Rarely below FHR of 100

EARLY DECELERATION

- Etiology
  - Head compression
Early Deceleration

- Intervention
  - None necessary

Variable Deceleration

- Characteristics
  - Visually apparent; onset to nadir in < 30 seconds; decrease in FHR below baseline
  - The decrease is calculated from the onset to the nadir of the deceleration
  - The decrease in FHR below the BL is ≥ 15 bpm, lasting ≥ 15 sec., and < 2 min., from onset to return to baseline
  - When variables are associated with contractions their onset, nadir, and duration commonly vary with successive contractions
  - Variables are ‘variable’. They vary in timing, shape & duration!
  - Most common periodic pattern
VARIABLE DECELERATION (CONT.)

- Etiology
  - Cord compression

- [Graph of Variable Deceleration]
MECHANISM OF VARIABLE DECELERATION

- Uterine contraction
- Umbilical cord
- Abruption placentae
- Partial umbilical cord occlusion
- Complete umbilical cord occlusion
- Umbilical cord compression
- Umbilical cord prolapse

Adapted from Williams Obstetrics (2010) and Lee et al. (1975)
VARIABLE DECELERATION (CONT.)

- Interventions
  - Improve umbilical circulation and improve oxygenation
    - Reposition
    - Hydration
  - $O_2$ (depends on severity, duration, variability)
  - SVE
  - May need to discontinue oxytocin (if infusing) & notify provider depending on significance and presence of a recurrent/deteriorating pattern.

LATE DECELERATION

Late Deceleration

- Characteristics
  - Visually apparent usually symmetrical gradual (onset to nadir ≥ 10 sec) decrease and return in FHR associated with a contraction
  - The decrease is calculated from the onset to the nadir of the deceleration
  - The deceleration is delayed in timing, with the nadir of the decel usually occurring after the peak of the contraction
  - In most cases, the onset, nadir, and recovery of the decel occur after the beginning, peak, and ending of the UC, respectively.
LATE DECELERATION (CONT.)

**Etiology**
- Utero-placental insufficiency

SUPINE HYPOTENSION

Source: Google images
https://www.google.com/search?q=supine+hypotensive+syndrome&biw=1920&bih=886&source=lnms&tbm=isch&sa=X&sqi=2&ved=0CAYQ_AUoAWoVC hMIjZfx_pCYyQIVjNc

Uteroplacental Insufficiency

- Oxygen (O2)
- Chemoreceptors stimulated on sense drop in O2 tension
- Catecholamines released (alpha adrenergic response) results in fetal hypertonia
- Baroreceptors stimulated in response to change in blood pressure
- PNS stimulation
- Results in Late deceleration

WITH ACIDEMIA

- Myocardial depression
- Late deceleration
- If Hypoxemia severe enough to result in acidemia may result in direct myocardial depression

WITHOUT ACIDEMIA

- Reflexive Late deceleration
- Transient hypoxemia compensatory mechanism of neurogenic origin

Assisted with

Associated with
- Moderate variability
- Absent/minimal variability
Late Decelerations with Absent Variability

Interventions
- Improve uterine blood flow
- Reposition
- Hydration
- Discontinue oxytocin/prostaglandin (any uterotonic agent)
- Anxiety reduction
- Notify Provider
- Improve oxygenation
  - O₂ @ 10 liters tight face mask
EPISODIC CHANGES

- Definition:
  - Changes in the FHR not associated with uterine contractions
  - Common episodic patterns include:
    - Accelerations
    - Prolonged decelerations
    - Variable decelerations

ACCELERATIONS

- Definition:
  - Visually apparent abrupt increase in FHR above the baseline
  - The acme is ≥ 15 bpm above baseline, lasting ≥ 15 sec, & < 2 min. from onset to return to baseline
  - In fetuses < 32 weeks, acme ≥ 10 bpm above the baseline and a duration of ≥ 10 sec.
  - Prolonged acceleration is ≥ 2 min. and < 10 min. (If accel is > 10 min. this is considered a baseline change)
  - Reassuring that fetus is doing well
ACCELERATIONS (CONT.)

- Associated with a non-acidotic fetus
- Associated with fetal movement
- Represents an intact CNS
- Reassuring because a fetus in metabolic acidosis cannot produce a brisk acceleration of its heart rate

PROLONGED DECELERATION

- **Characteristics**
  - Visually apparent decrease in FHR below the BL. The decrease from the BL is ≥ 15 bpm, lasting ≥ 2 min. but < 10 min. from onset to return to BL.
  - If > 10 min. this is a BL change.
  - Not a homogeneous group of patterns
    - Vary in onset, recovery, relationship to contraction
PROLONGED DECELERATION (CONT.)

**Etiology**
- Post epidural hypotension
- Rapid fetal descent
- Excessive uterine activity
  - Tachysystole
  - Hypertonus
  - Prolonged contraction (Tetanic)
- Manipulation of head – vagal stimulation
- Cord prolapse
- Uterine rupture
- Placental abruption (acute)
- Maternal seizures

PROLONGED DECELERATION (CONT.)

**Interventions**
- Assess for, and treat cause if known
- Improve oxygenation
  - Reposition
  - \( O_2 @ 10 \text{ liters tight face mask} \)
  - Hydrate
- Improve uterine blood flow
  - Treat maternal hypotension
  - Discontinue oxytocin
  - Consider .25 mg SQ Terbutaline
VARIABLE DECELERATION (EPISODIC)

- Cord compression
  - Same physiology as with periodic variable decelerations
  - Usually less severe and shorter duration than with contractions (but must drop 15 beats below baseline and last 15 seconds to call it a variable)
  - From fetus squeezing, kicking, stretching, laying on cord e.g.

NICHD 2008: CATEGORIES FOR INTERPRETATION

- Three-Tier Heart Rate Interpretation System:
  - Category I: NORMAL
  - Category II: INDETERMINATE
  - Category III: ABNORMAL

ESTABLISHING FETAL WELL BEING: CATEGORIES FOR INTERPRETATION

CATEGORY I: Normal

- FHR tracings are strongly predictive of NORMAL acid-base status at the time of observation. No specific action required.
- Category I Tracings Include:
  - Moderate variability
  - Normal baseline rate: 110-160bpm
  - Absence of late or variable decelerations
  - Early decelerations can be present or absent
  - Accelerations can be present or absent
CATEGORIES FOR INTERPRETATION

CATEGORY II: Indeterminate
- FHR tracings include all FHR tracings not categorized as category I or III.
- Not predictive of abnormal acid-base status.
- Require evaluation and continued surveillance and reevaluation, taking into account the entire clinical circumstances.

CATEGORY II (CONTINUED)
- Cat 2 Examples Include:
  - Minimal variability
  - Absent variability if not accompanied by recurrent late decelerations
  - Marked variability
  - Recurrent variables if minimal or moderate variability
  - Prolonged decelerations
  - Recurrent late decelerations with moderate variability
  - Variables with other characteristics such as a slow return to baseline or overshoot

CATEGORIES FOR INTERPRETATION

CATEGORY III: Abnormal
- FHR tracings are abnormal and predictive of abnormal acid-base status at time of observation.
- Requires prompt evaluation and efforts to resolve abnormal FHR pattern.
- Category III Tracings Include:
  - ABSENT FHR variability & any of the following:
    - Recurrent late decelerations
    - Recurrent variable decelerations
    - Bradycardia
    - Sinusoidal pattern
**RECURRENT PATTERN**

- **Definition:**
  - Decelerations occurring with $\geq 50\%$ of UC's in any 20 min. segment

**THE “BIG PICTURE”**

- Describe what is 'good' about the tracing and what's 'bad' about the tracing.
- Many patterns have one foot in each
  - Look at trends; what is the evolution of the pattern?
  - Is there moderate variability?
  - What is important is what we are doing about it?
  - Assess, intervene, reassess.
  - Document not only your assessment and interventions but re-evaluation of the pattern following intervention.

**FHR ASSESSMENT & DOCUMENTATION: "AUSCULTATION"**

- **Used for low-risk women without oxytocin**
  - Fetoscope or hand held doppler
  - Count the FHR after uterine contractions for at least 30-60 seconds
  - AWHONN: FHR should be evaluated:
    - At least hourly during latent phase \( @ < 4 \) cm
    - Q 15-30 min once \( > 4 \) cm
    - Q 15 min when complete during passive descent “laboring down”
    - Q 5-15 min if when starts actively pushing
FHR ASSESSMENT & DOCUMENTATION: *AUSCULTATION*

Document:
- Rate
- Rhythm (regular or irregular)
- Increases or decreases

FHR ASSESSMENT & DOCUMENTATION: *ELECTRONIC MONITORING* - AWHONN

- Evaluation of FHR
  - Low risk pt's
    - At least hourly during latent phase @ < 4 cm
    - Q 30 min once > 4 cm
    - Q 15 min once complete (passive & active descent)
  - High risk pt's (includes oxytocin)
    - Latent phase < 4 cm: q 15 min with oxytocin; q 30 min without
    - Q 15 min once > 4 cm until pushing
    - Q 5 min if/when starts pushing

- Documentation
  - Written documentation of these evaluations may occur at longer intervals based on hospital policy and can be in narrative form, or summary formats (i.e. flow sheets)

FHR ASSESSMENT & DOCUMENTATION: *ELECTRONIC MONITORING* - ACOG

- Low risk pt's
  - FHR should be evaluated every 30 min. in the active phase of the first stage, and every 15 min. in the second stage.

- High risk pt's (includes oxytocin)
  - FHR should be evaluated every 15 min. in the active phase of the first stage and every 5 min. in the second stage.
FHR ASSESSMENT & DOCUMENTATION: "ELECTRONIC MONITORING"

- Evaluation of FHR should include assessment of:
  - Baseline
  - Variability
  - Periodic/Episodic changes
    - Accelerations & decelerations

INTERVENTIONS

Nurses must be able to identify non-reassuring patterns and initiate appropriate interventions

- Interventions are aimed at 4 physiologic goals to:
  - Improve oxygenation: reposition, 02 @ 10 L tight face mask
  - Improve uterine blood flow: reposition, hydration, medication, anxiety reduction
  - Improve umbilical circulation: reposition, vaginal manipulation, amnioinfusion
  - Reduce uterine activity: reposition, hydration, medication

DOCUMENTATION OF UTERINE ACTIVITY

- No national standard for frequency of documentation
- Based on hospital policy
- Frequency of documentation increases with administration of uterotonic agents (Oxytocin, Cervidil, Misoprostol, etc.)
Purpose of Antepartum Fetal Surveillance

- To prevent fetal death
- Antenatal fetal monitoring indirectly assesses fetal brain, cardiac, and placental function

Indications for Antepartum Fetal Surveillance

- Any condition in which the risk of antepartum fetal demise is increased
  - i.e., factors associated with risk of hypoxia are present
  - Maternal conditions:
    - Antiphospholipid syndrome
    - Hyperthyroidism (poorly controlled)
    - Hemoglobinopathies
    - Cyanotic heart disease
    - Systemic lupus erythematosus
    - Chronic renal disease
    - Pregestational diabetes mellitus
    - Hypertensive disorders
  - Pregnancy-related conditions:
    - Preeclampsia
    - Gestational hypertension
    - Decreased fetal movement
    - Gestational diabetes mellitus (poorly controlled or medically treated)
    - Oligohydramnios
    - Fetal growth restriction
    - Late term or post term pregnancy
    - Insinuation
    - Previous fetal demise (unexplained or recurrent risk)
    - Monochorionic multiple gestation (with significant growth discrepancy)
TYPES OF ANTEPARTUM FETAL SURVEILLANCE TESTS

- Nonstress Test (NST)
  - Fetal Acoustic Stimulation Test/Vibroacoustic Stimulation Test
- Contraction Stress Test (CST/BST)
- Biophysical Profile (BPP)
  - Modified Biophysical Profile
- Fetal Movement Counting ("Kick Counts")
- Umbilical Artery Doppler Velocimetry

NONSTRESS TEST (NST)

Interpretation

- Reactive Nonstress Test
  - Definition: Two or more fetal heart rate accelerations that peak at least 15 beats above the baseline and last 15 seconds from baseline to baseline, within a 20-minute period.
  - If < 32 weeks, 10 x 10 accelerations indicate well being unless that fetus has already demonstrated 15 x 15 accelerations.

Reactive NST

NONSTRESS TEST (CONT.)

Interpretation

- Nonreactive Nonstress Test
  - Lacks sufficient fetal heart rate accelerations over a 40-minute period
**VIBROACOUSTIC STIMULATION TEST (VAS)**
A.K.A. **FETAL ACOUSTIC STIMULATION TEST (FAST)**

**Definition**
- Stimulation of the fetus with a loud sound (82 decibels) and vibration
- Evaluates fetal heart rate response using a vibro-acoustic stimulator

**Purpose**
- To evaluate the fetal acid base status non-invasively
- To reduce antepartal testing time

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**INTERPRETATION**

**Reactive Test**
- Two FHR acceleration of 15 bpm above baseline for 15 seconds in response to acoustic stimulation within 20 minutes

**Nonreactive Test**
- Inability to fulfill the criteria for reactivity
BENEFITS OF THE VIBROACOUSTIC STIMULATION TEST

- Noninvasive
- Decreases antepartum testing time
- If the fetus accelerates and the tracing is reactive the fetus is not metabolically acidotic

LIMITATIONS OF THE VIBROACOUSTIC STIMULATION TEST

- Fetuses may be oxygenated and either deaf or with middle ear infections and not respond
- Limited by gestational age
- Do not use under 27-28 weeks gestation (due to fetal immature cochlear maturation).

IMPLEMENTATION OF VAS

- Allow the patient to touch and hear the Acoustic Stimulator before use
- Use after a nonreactive nonstress test- or often done after 20 minutes to reduce testing time
- ACOG: Provide the stimulus for 1-2 seconds. This may be repeated up to three times for progressively longer duration's of up to 3 sec's
- AWHONN: Provide the stimulus for up to 3 seconds. Can be repeated at approx 1 minute intervals up to three times for a total of about 9 seconds.
- Check your own hospital's Policy & Procedure!
IMPLEMENTATION (CONT.)

- Document the maternal/fetal response
  - Did mom feel fetal movement?
  - Was there an acceleration?
  - If no response, or a negative response, further testing is recommended

CONTRACTION STRESS TEST (CST)

- Purpose
  - Another means of assessing placental function and fetal oxygen reserve

- Indication
  - Initiated after a nonreactive nonstress test and when ultrasound evaluation is not available

RELATIVE CONTRAINDICATIONS OF CST

- Preterm labor or certain patients at high risk of preterm labor
- Premature rupture of membranes (PROM)
- History of extensive uterine surgery or classical cesarean delivery scar
- Known placenta previa
- Anytime you do not want your patient to contract!
CONTRACTION STRESS TESTS

- Three Types of Test:
  - Spontaneous
  - Nipple Stimulation
  - Oxytocin Challenge Test (OCT)

SPONTANEOUS CONTRACTION STRESS TEST

- Definition
  - The patient is already having contractions that last greater than 40 seconds
  - There are 3 contractions in 10 minutes

NIPPLE STIMULATION

- Definition
  - The patient stimulates her nipples until she has three (3) contractions, lasting at least 40 seconds, in a 10 minute period.

- Example of Procedure
  - The patient stimulates her nipple through her clothing for 2 minutes or until a contraction begins, may repeat procedure in 5 minutes (if no UC)
OXYTOCIN CHALLENGE TEST (OCT)

- **Definition**
  - Augmentation with intravenous oxytocin until the patient is having three (3) contractions, lasting greater than 40 seconds, in a 10 minute period

IMPLEMENTATION OF OCT

- Explain test to patient
  - Consent for OCT
  - Review risks/benefits
  - Provide privacy (crucial for nipple stim)
- Assess maternal/fetal response
  - Document Fetal Heart Rate
    - Baseline
    - Variability
    - Accelerations/Decelerations
  - Test interpretation

CST INTERPRETATION

- **Negative:** No late or significant variable decelerations
- **Positive:** late decelerations following 50% or more of contractions (even if the contraction frequency is fewer than 3 in 10 minutes)
- **Equivocal-suspicious:** intermittent late decelerations or significant variable decelerations
CST INTERPRETATION (CONT.)

- **Equivocal**: FHR decelerations that occur in the presence of contractions more frequent than every 2 min or lasting longer than 90 sec.
  - Cannot interpret test with excessive uterine activity

- **Unsatisfactory**: Fewer than three contractions in 10 min or an uninterpretable tracing

INTERVENTIONS FOR TACHYSYSTOLE
(OR IF TETANIC CONTRACTION OCCURS)

- **Stop the test!**
- Lateral recumbent position
- Intravenous hydration p.r.n
- Notify physician
- Tocolytic as needed
  - Terbutaline 0.25mg subcutaneous injection (per order)
- Document fetal response

BIOPHYSICAL PROFILE (BPP)

- **History**
  - With the refinement of ultrasound technology in 1980, Dr. Frank Manning developed the Biophysical Profile

- **Definition**
  - A systematic evaluation of the fetus, amniotic fluid volume, and the placenta
  - Reflects fetal status at the time of the test!
The biophysical profile gives a score of 0-2 for each of the 5 categories:
- Nonstress test
- Fetal breathing movements
- Fetal body movements
- Fetal tone
- Amniotic Fluid Volume (AFV)

**BPP Score (Cont.)**

- **Normal** = Composite score of 8-10
- **Equivocal** = Score of 6
- **Abnormal** = Score of 4 or less

**Oligohydramnios** (largest vertical pocket of amniotic fluid volume ≤ 2) = Regardless of composite score, further evaluation is warranted

**Modified Biophysical Profile**

- Nonstress Test and the Amniotic Fluid Volume combined
- **Normal**
  - NST reactive & AFV > 2 cm pocket
  - If AFI used, “normal” is > approx 5 cm (50 mm)
- **Abnormal**
  - Either the NST is nonreactive or the AFV is ≤ 2 cm
FETAL MOVEMENT COUNTING

- Reassuring
  - 10 fetal movements in two hours
- Fetal movement is an indirect measure of an intact Central Nervous System
  - The relationship between motor nerves and sympathetic nerves in the oxygenated brain stem often result in an increase or acceleration in the fetal heart rate

FETAL MOVEMENT IS A SIGN
OF FETAL WELL BEING!

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