Basic Fetal Monitoring

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Introduction

- Purpose
- History
- Methods of Monitoring
- Instrumentation
- Physiology & Pathophysiology
- Uterine Activity
- FHR Patterns & Nursing Interventions
- Establishing Fetal Well Being
- FHR Assessment & Documentation
- Antenatal Testing
- Strip Review

Purpose of FHR Monitoring

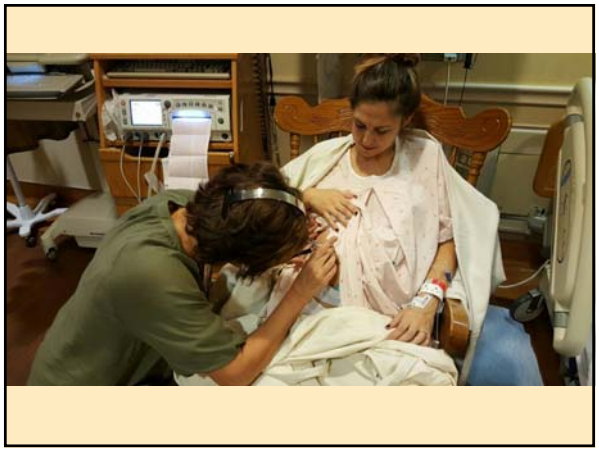
- **To assess the influence of the intrauterine environment for fetal well-being**
  - Identify the fetus at risk
  - Assess fetal well being
    - Identify both reassuring and nonreassuring fetal heart rate changes
- **To assess progress of labor through measurement of uterine activity**

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



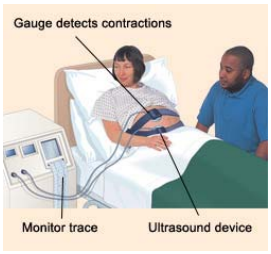
Methods of Monitoring (cont.)

- **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 Intrauterine 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)



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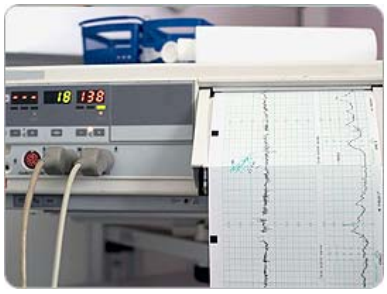


Monitoring Equipment

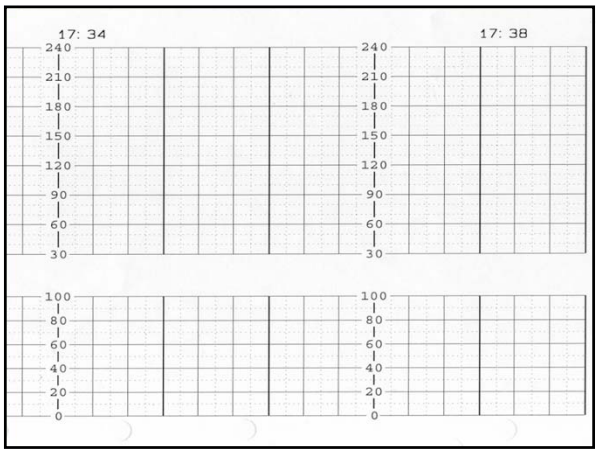
Graph Paper

- 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

Monitoring Equipment

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

External Monitor

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

External Monitor

Tocodynamometer (cont.)

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

External Monitor

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 ! ! !**

External Monitor

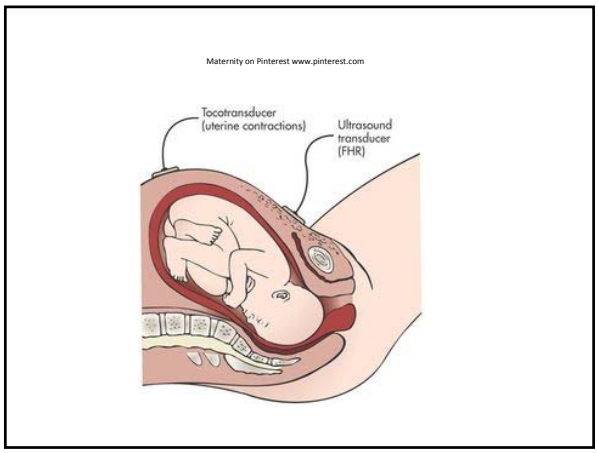
Tocodynamometer (cont.)

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

External Monitor

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



External Monitor

Ultrasound Transducer (cont.)

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

External Monitor

Ultrasound Transducer (cont.)

- **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

External Monitor

Ultrasound Transducer (cont.)

- 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

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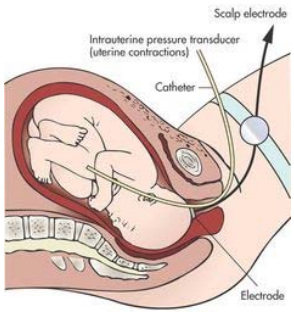
Maternity on Pinterest www.pinterest.com



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)

Internal Monitor

Intrauterine Pressure Catheter (IUPC)

- **Disadvantage**
  - 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

Internal Monitor

Intrauterine Pressure Catheter (IUPC)

- 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

Internal Monitor

Intrauterine Pressure Catheter (IUPC)

- Nursing Assessment/Interventions
  - Application & Placement
    - 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)
      - Document initial resting tone in RL, LL, and supine positions

Internal Monitor

Intrauterine Pressure Catheter (IUPC)

- Patient Education
  - Describe purpose & procedure to patient prior to placement
  - Review benefits/limitations

Internal Monitor

Fetal Spiral Electrode (FSE)

- Measures R to R interval
- So measures ventricular rate

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

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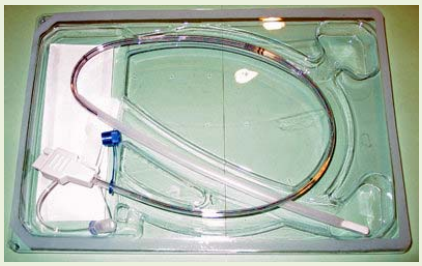

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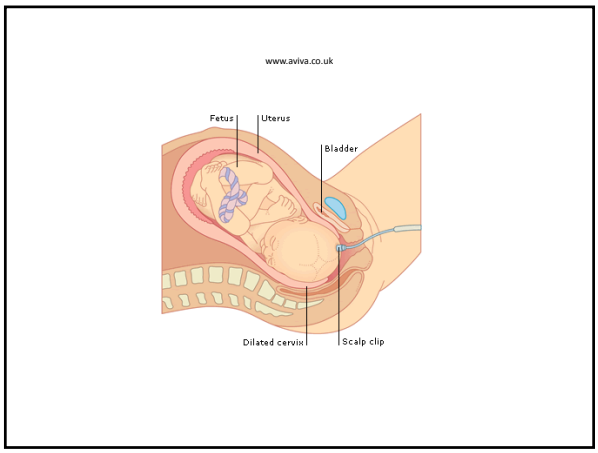


Internal Monitor

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

Internal Monitor

Fetal Spiral Electrode (FSE)

- 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
    - Supraventricular Tachycardia (SVT)

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)

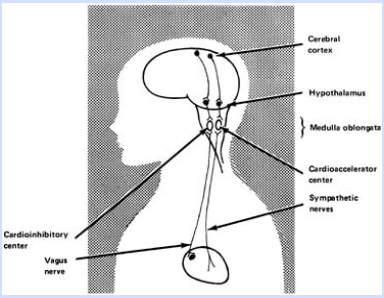
- Nursing Assessment/Interventions
  - Application and placement
    - Place introducer between two examining fingers and firmly place against the fetal head at a right angle
      - Maintain pressure against presenting part and turn clockwise until resistance is met (1-2 times)
      - Release lock 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



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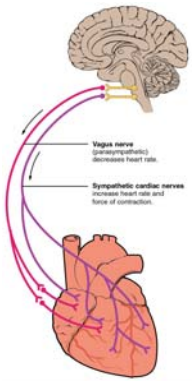

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Nervous System

Central Nervous System (CNS)

Brain
- Cerebrum
- Cerebellum
- Brainstem
  - Medulla Oblongata
  - Pons
  - Midbrain
  - Reticular formation

Spinal Cord

Peripheral Nervous System

Somatic (primarily voluntary)
- Cranial Nerves
- Spinal Nerves

Autonomic (involuntary)
- Sympathetic (speedy)
- Adrenal Medulla
- Parasympathetic (pokey)

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, CO_2 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**

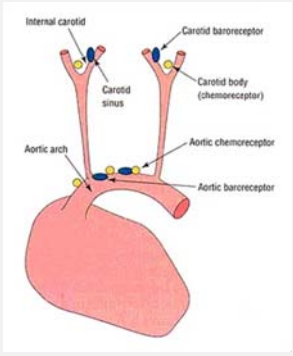
Baroreceptors

- ***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, O_2, CO_2 concentration in cerebrospinal fluid and blood, specifically, pH, PaO_2, and $PaCO_2$
  - Effect changes in the FHR by causing an increase or decrease in HR



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Hormonal Factors

- **Epinephrine and norepinephrine released by adrenal medulla and periaortic nodes**
  - In response to fetal hypoxia: hemodynamic compensatory responses
    - Peripheral vasoconstrictioin
    - 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, & adrenal glands

↓

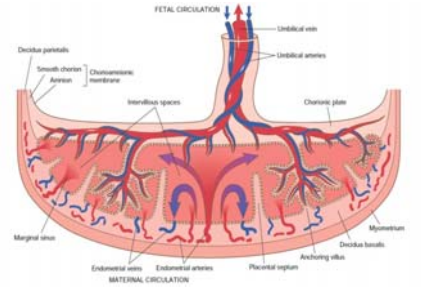
FETAL HEART RATE CHANGES

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



From: medicinase.com/pregnancy, 2015

Placental Insufficiency

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

Uterine Activity

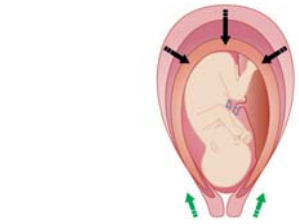
- Labor creates contractions strong enough to compress the spiral arteries cause a temporary interruption of blood flow and O2 to placenta
- Abnormal contraction patterns interfere with placental blood flow and produce fetal heart rate changes

Uterine Activity Monitoring (UA)

- **Measurement of uterine contractions** (UC's)
  - **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)

- Measurement of uterine contractions (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 - mmHg



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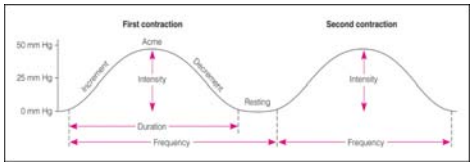

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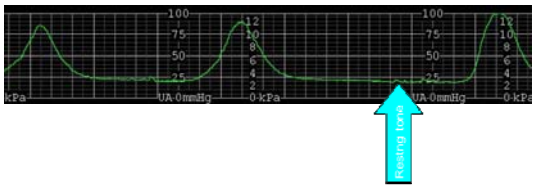


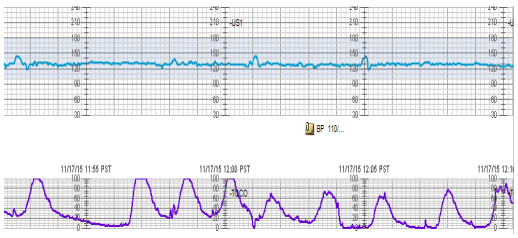
Uterine Contraction Patterns

- **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

Uterine Contraction Patterns

- **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)

Tachysystole



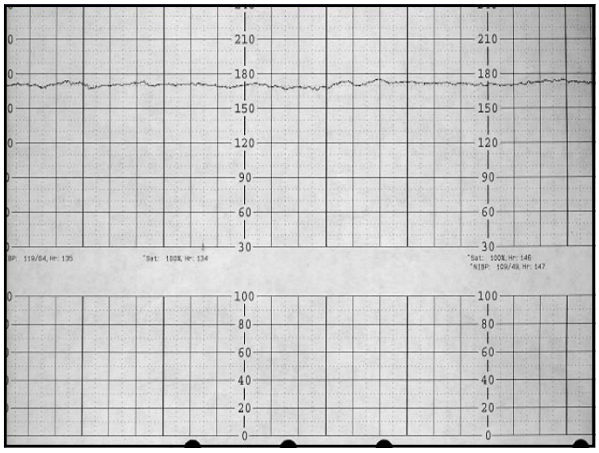
FHR Patterns & Nursing Interventions

- **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 <u>mean</u> 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)

FHR Patterns & Nursing Interventions

<u>Tachycardia</u>

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



Tachycardia

Maternal Causes

- ❖ Maternal/fetal fever (infection)
- ❖ Betasympathomimetic agents (terbutaline)
- – Parasympatholytics, inotropic drugs, illicit drugs (stimulants)
- – Hyperthyroidism
- – Dehydration
- – Endogenous adrenalin/anxiety

Fetal Causes

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

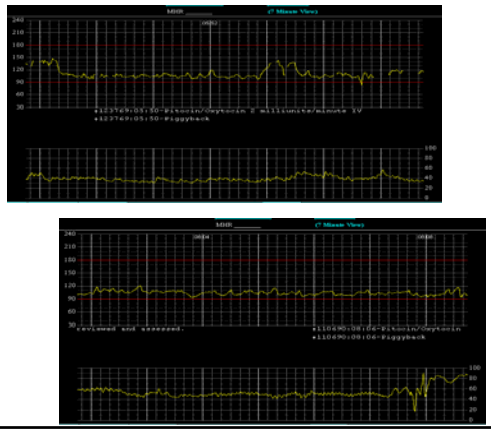
Tachycardia

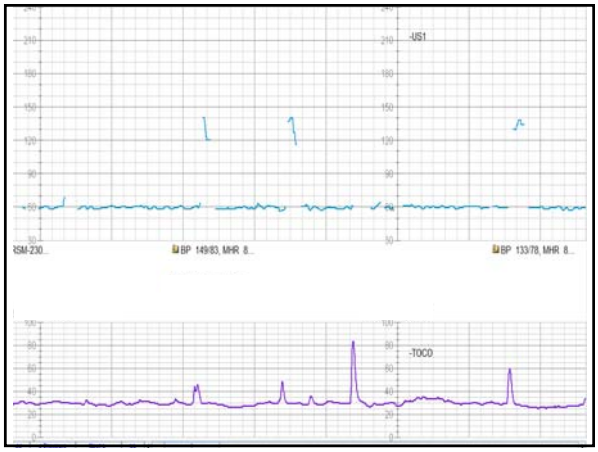
- **Interventions**
  - – **Reduce fever:** fever increases the metabolic requirements of the fetus
    - Medications: provide as ordered
    - Hydrate (fluid bolus 150-200mL, up to 500mL)
    - Cooling measures
  - – **Improve oxygenation**
    - 0_2 @ 10 liters tight face mask
    - Hydrate (fluid 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

Bradycardia

- **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

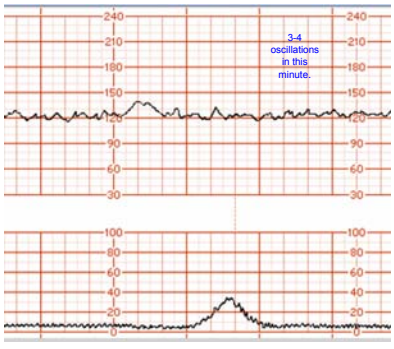
FHR Patterns & Nursing Interventions

Variability ***(the 'squiggleness' of the baseline)***

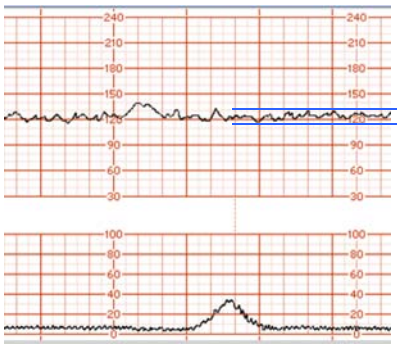
- **Definition**
  - Variability is visually quantitated as the amplitude of peak-to-trough in beats per minute (i.e., the range).
  - Fluctuations in the FHR of 2 cycles or oscillations per minute or greater (usually 3-6 oscillations).
  - Variability is the most sensitive indicator of fetal oxygenation.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

"jagged, irregular" = good!
"smooth, rounded, blunted" = bad!

Fetal Heart Rate Oscillations



Fetal Heart Rate Range

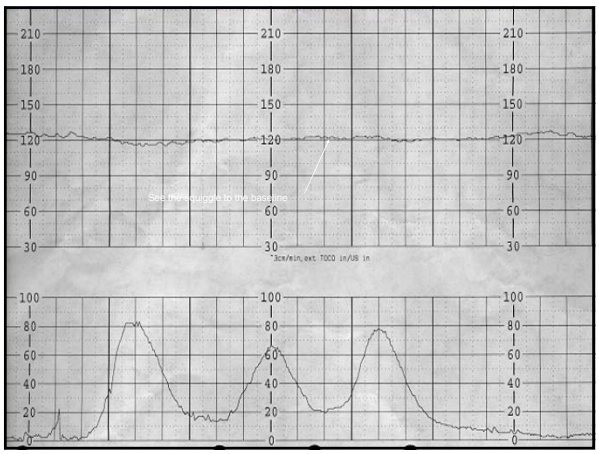


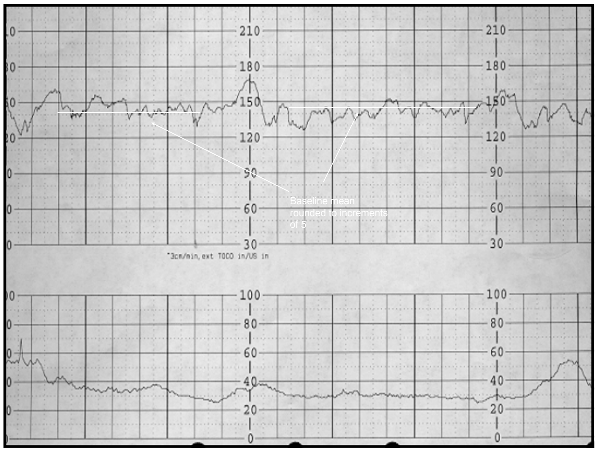
Peak = 130
Trough = 118

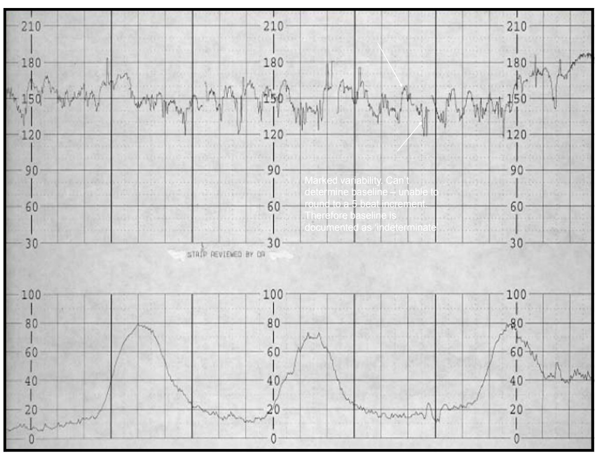
Range = 12 beats
Variability = Mod

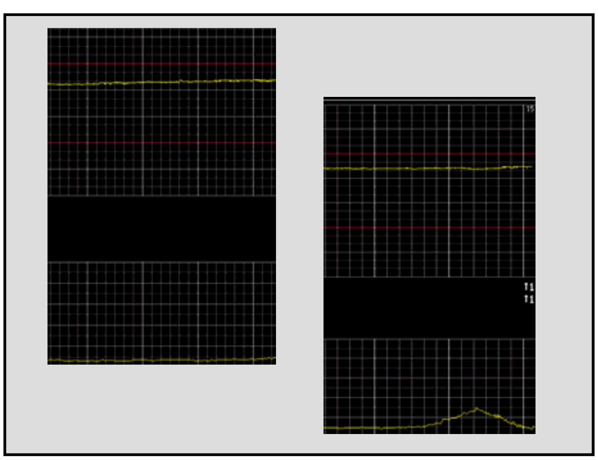
FHR Patterns & Nursing Interventions

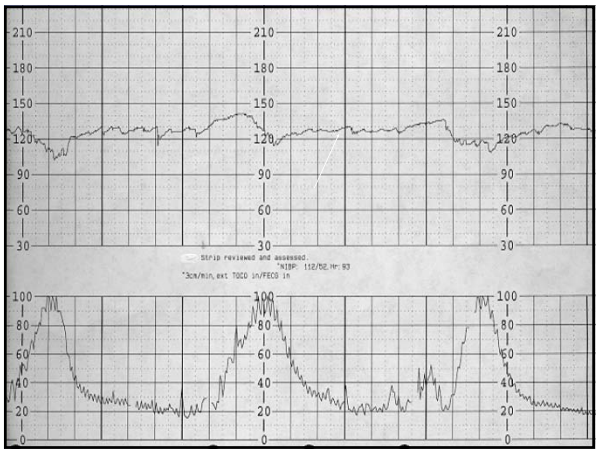
- **Categories of Variability:**
- **Absent** amplitude range is undetectable
- **Minimal** > undetectable but ≤ 5 bpm
- **Moderate** 6-25 BPM
- **Marked** > 25 BPM




Baseline mean
rounded to increments
of 5
"3cm/min, ext TOCO in/US in


Marked variability. Can't
determine baseline – unable to
round to a 5 beat increment.
Therefore baseline is
documented as 'indeterminate'
STRIP REVIEWED BY DR





Factors Affecting Variability

- ***Minimal/Absent Variability***
  - Prematurity (min)
  - Fetal sleep cycles (min)
  - Narcotic administration (min)
  - Congenital anomalies
  - Fetal cardiac arrhythmias
  - Hypoxia
  - Acidosis
- ***Marked Variability***
  - Usually a compensatory response to an acute hypoxic event

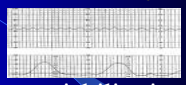
Drugs

- 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 decrease in variability with betamethasone but not dexamethasone
  - Magnesium Sulfate may cause 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

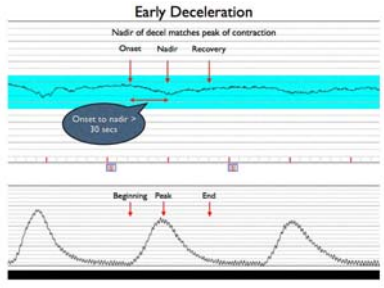
- **Characteristics**
  - Visually apparent, usually symmetrical ***gradual*** (onset to nadir ≥ 30 sec) decrease and return of the FHR associated with a UC (mirrors the UC)
    - The decrease is calculated from the onset to the nadir of the deceleration
  - Onset, nadir, and recovery of the deceleration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

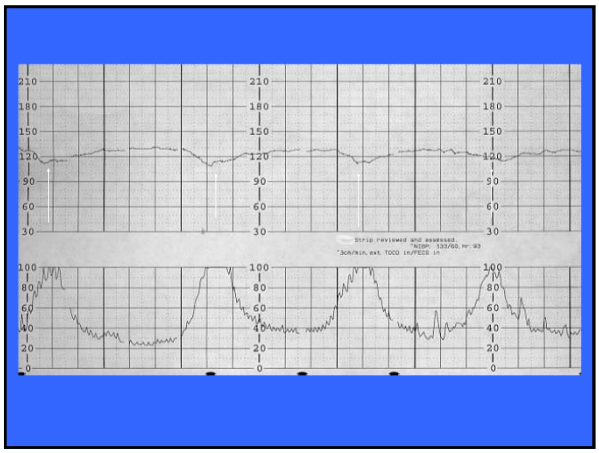
Early Deceleration

- **Etiology**
  - Head compression

babycenter.com

Utilis.net QCOM-Fetal heart Monitoring-Early Deceleration





Mechanism of Early Deceleration

Pressure on fetal head

⇩

⇧Intracranial pressure

⇩

Alteration in cerebral blood flow

⇩

Central vagal stimulation

⇩

FHR deceleration

(Freeman & Garite, 1981)

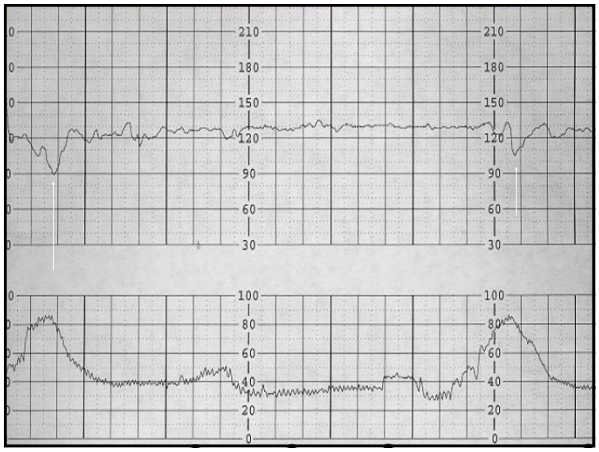
Decelerations (cont.)

Early Deceleration

- Intervention
  - None necessary

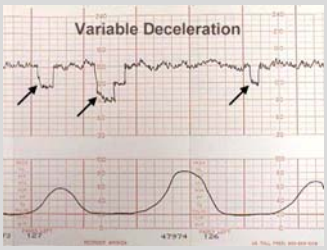
Variable Deceleration

- **Characteristics**
  - Visually apparent ***abrupt*** (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.)

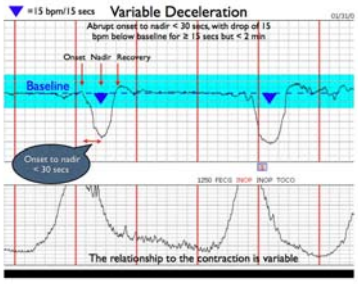
- **Etiology**
  - Cord compression

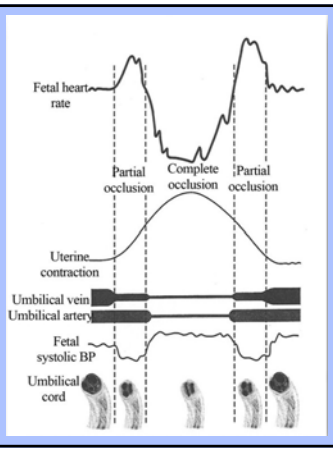


www.newhealthadvisor.com. 2014

L. Potter. Obstetrics & Gynae
http://geekymedics.com/how-to-read-a-ctg/

Utilis.net QCOM-Fetal heart Monitoring-Variable Deceleration

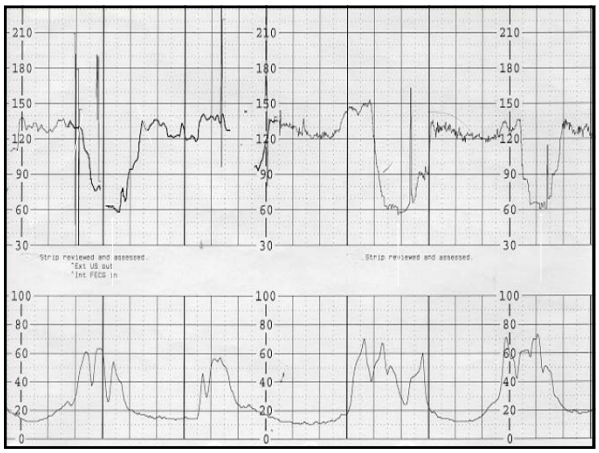




Mechanism of Variable Deceleration

S. L. Sholapurkar, Open **Journal of Obstetrics and Gynecology, 2013**

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



Variable Deceleration (cont.)

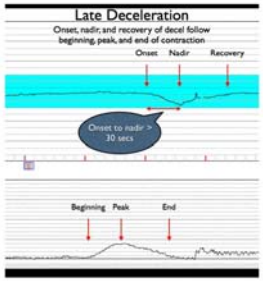
- **Interventions**
  - Improve umbilical circulation and improve oxygenation
    - – Reposition
    - – Hydration
    - – 0_2 (depends of severity, duration, variability)
    - – SVE
    - – May need to discontinue oxytocin, if infusing, & notify provider depending on significance and presence of a recurrent/deteriorating pattern.

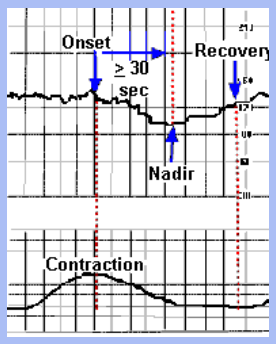
Late Deceleration

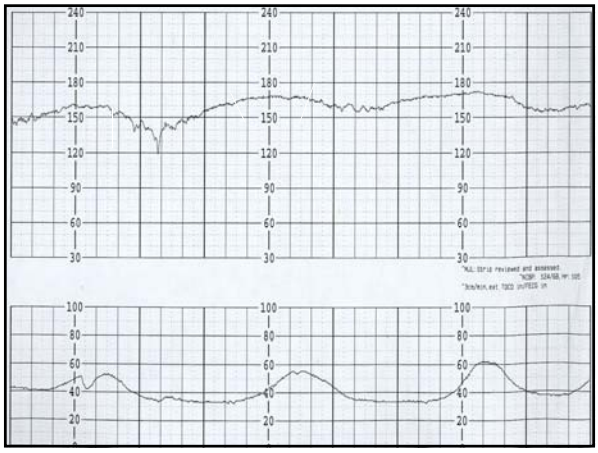
Characteristics

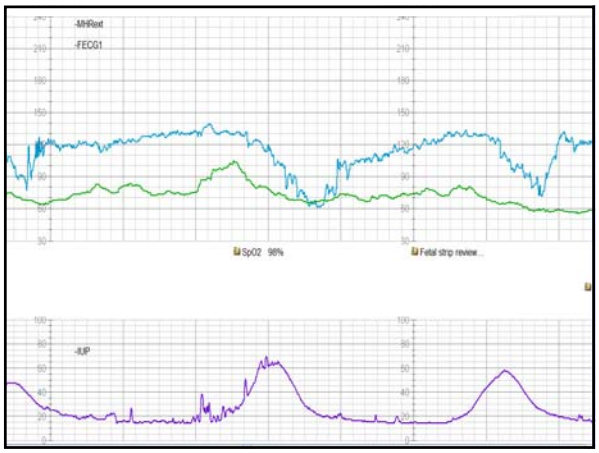
- Visually apparent usually symmetrical ***gradual*** (onset to nadir ≥30 sec) decrease and return in FHR associated with a contraction
  - – The decrease is calculated from the onset to the nadir of the deceleration
- The deceleration **is** delayed in timing, with the nadir of the decel usually occurring 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.

Utilis.net QCOM-Fetal heart Monitoring-Late Deceleration







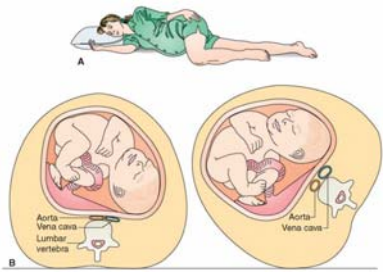


Late Deceleration (cont.)

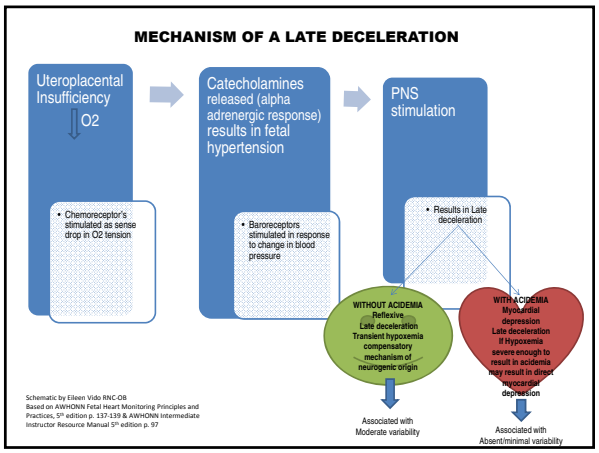
Etiology

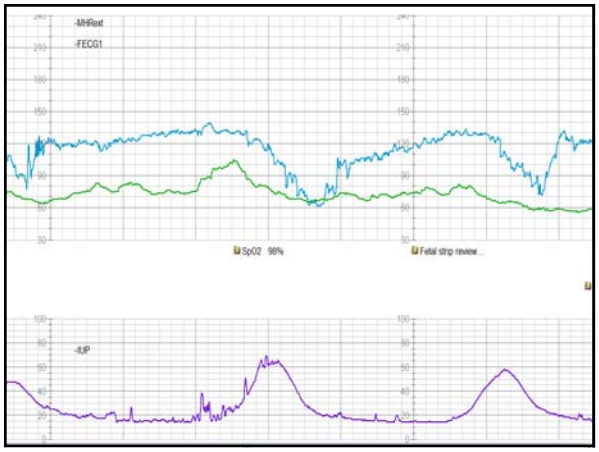
- Utero-placental insufficiency

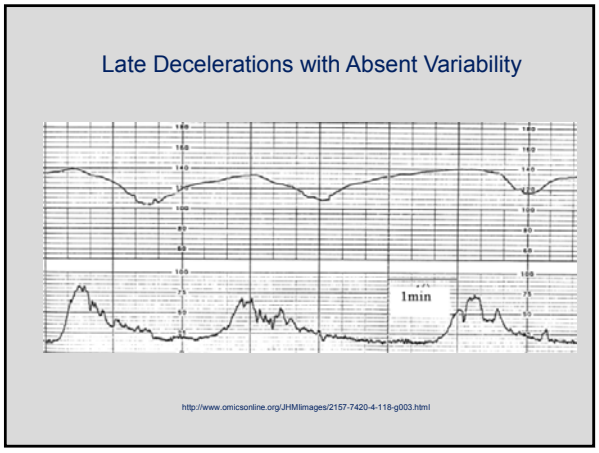
Supine Hypotension



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_AUoAWoVChMIj2Tx_pCYyQIVjNceCh03ARPIimgrc=WdtQMM9hEY_UIM%3A


MECHANISM OF A LATE DECELERATION
Uteroplacental Insufficiency
O2
• Chemoreceptor's stimulated as sense drop in O2 tension
Catecholamines released (alpha adrenergic response) results in fetal hypertension
• Baroreceptors stimulated in response to change in blood pressure
PNS stimulation
• Results in Late deceleration
WITHOUT ACIDEMIA
Reflexive
Late deceleration
Transient hypoxemia
compensatory
mechanism of
neurogenic origin
WITH ACIDEMIA
Myocardial
depression
Late deceleration
If Hypoxemia
severe enough to
result in acidemia
may result in direct
myocardial
depression
Associated with
Moderate variability
Associated with
Absent/minimal variability
Schematic by Eileen Vido RNC-OB
Based on AWHONN Fetal Heart Monitoring Principles and Practices, 5th edition p. 137-139 & AWHONN Intermediate Instructor Resource Manual 5th edition p. 97


MHRext
FECG1
SpO2 98%
Fetal strip review...
IUP


Late Decelerations with Absent Variability
1min
http://www.omicsonline.org/JHMIimages/2157-7420-4-118-g003.html

Late Deceleration (cont.)

Interventions

- Improve uterine blood flow
  - Reposition
  - Hydration
  - Discontinue oxytocin/prostaglandin (any uterotonic agent)
  - Anxiety reduction
  - Notify Provider
- Improve oxygenation
  - 0_2 @ 10 liters tight face mask

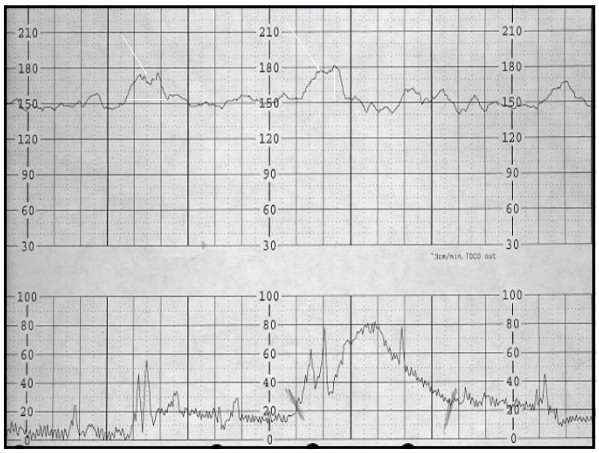
Episodic Changes

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

Accelerations

(reassured fetus doing well)

- **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)**



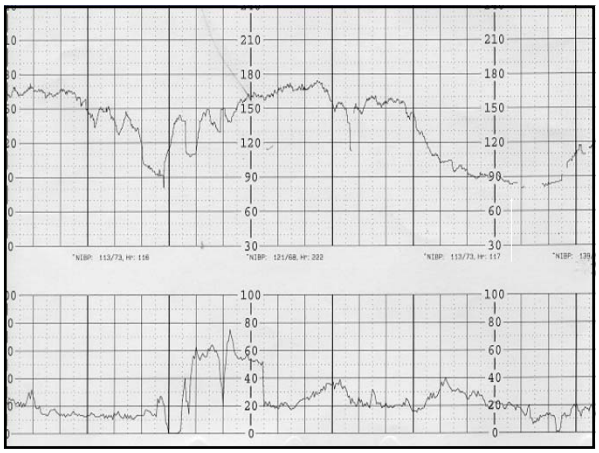
Accelerations (cont.)

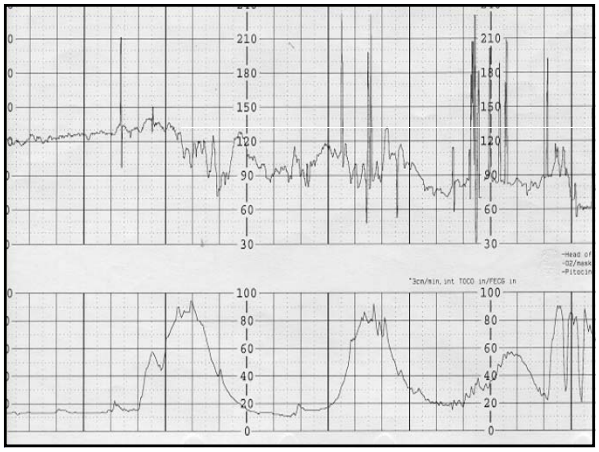
- Associated with a non-acidotic fetus
- Associated with fetal movement
- Represents an intact CNS
- Reassuring because a fetus in metabolic acidosis cannot produce a brisk acceleration of its heart rate

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
  - 0_2 @ 10 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

CATEGORY I: Normal

FHR tracings are strongly predictive of *NORMAL* acid-base status at the time of observation. No specific action required.

- 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

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)

- **Examples includes:**
  - 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

Evaluation

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 ≥ 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.)**

Antepartum Fetal Surveillance

- Purpose of Antepartum Fetal Surveillance
  - To prevent fetal death
  - Antenatal fetal monitoring indirectly assesses fetal brain, cardiac, and placental function

Antepartum Fetal Surveillance Indications

- Any condition in which the risk of antepartum fetal demise is increased
  - i.e., factors associated with risk of hypoxia are present

Indications for Antepartum Fetal Surveillance

- **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
  - Isoimmunization
  - Previous fetal demise (unexplained or recurrent risk)
  - Monochorionic multiple gestation (with significant growth discrepancy)

Types of Antepartum Fetal Surveillance Tests

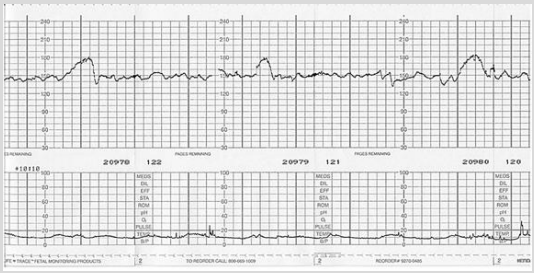
- **Nonstress Test (NST)**
  - Fetal Acoustic Stimulation Test/Vibroacoustic Stimulation Test
- **Contraction Stress Test (CST/BST)**
- **Biophysical Profile (BPP)**
  - Modified Biophysical Profile
- **Fetal Movement Counting** ("Kick Counts")
- **Umbilical Artery Doppler Velocimetry**

Nonstress Test (NST)

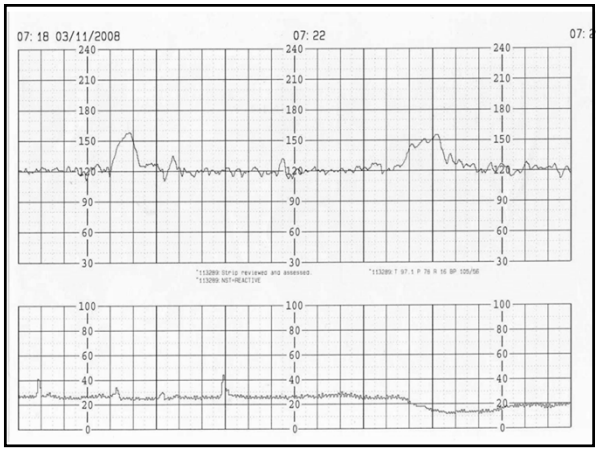
Interpretation

- **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



http://emedicine.medscape.com/article/405454-overview



Nonstress Test (cont.)

Interpretation

- **Nonreactive Nonstress Test**
  - Lacks sufficient fetal heart rate accelerations over a 40-minute period

Nonreactive NST

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

Vibroacoustic Stimulation Test (cont.)

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 (d/t fetal immature cochlear maturation).

Implementation

- 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

- **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!**

Biophysical Score

- **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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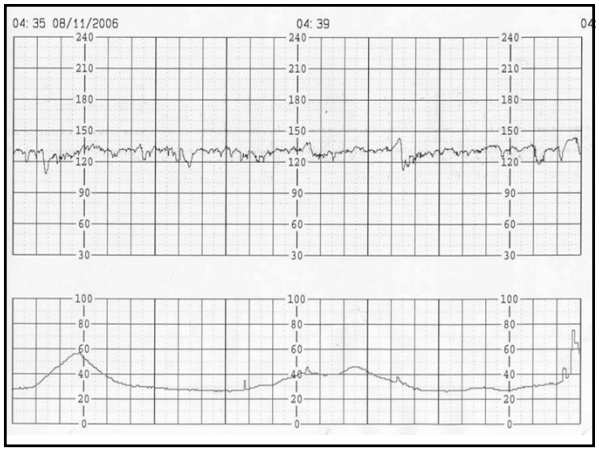
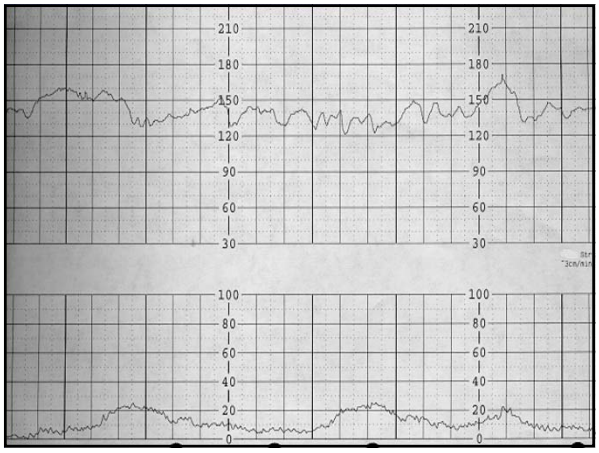
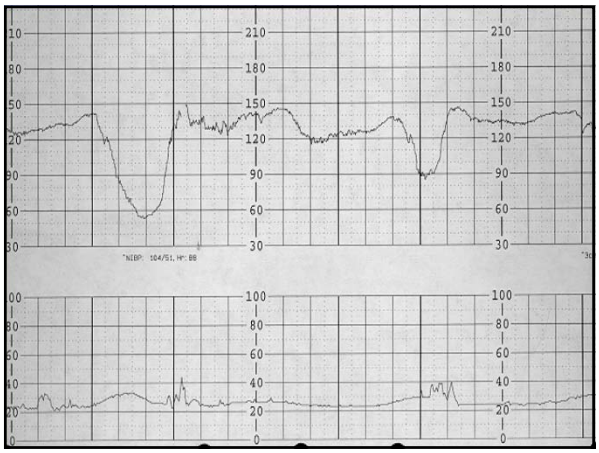
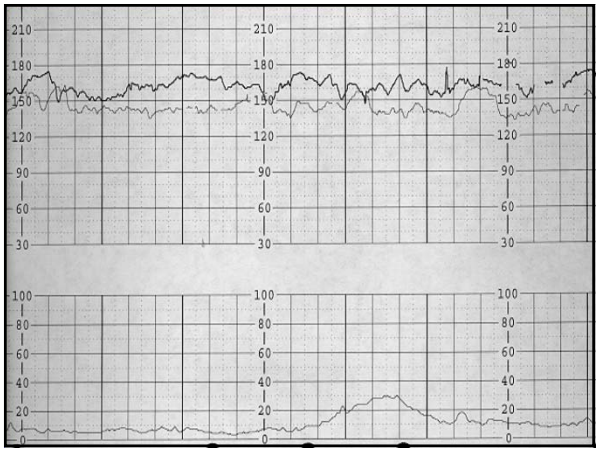
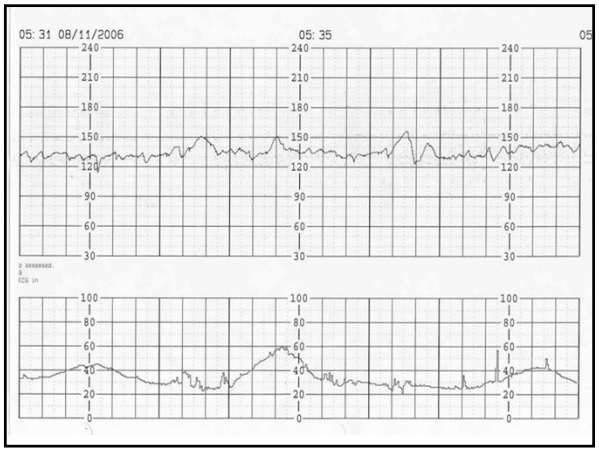
Fetal Strip Review







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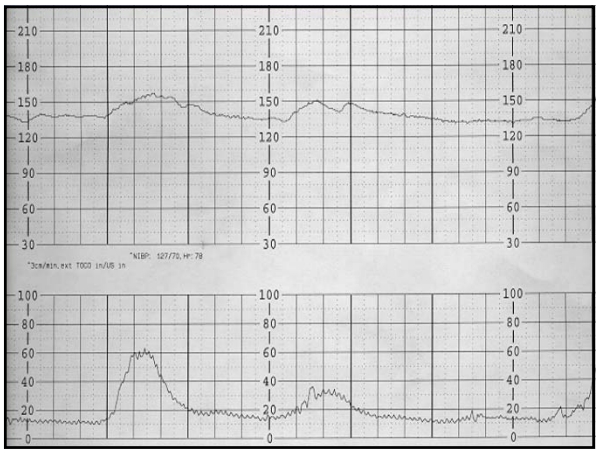

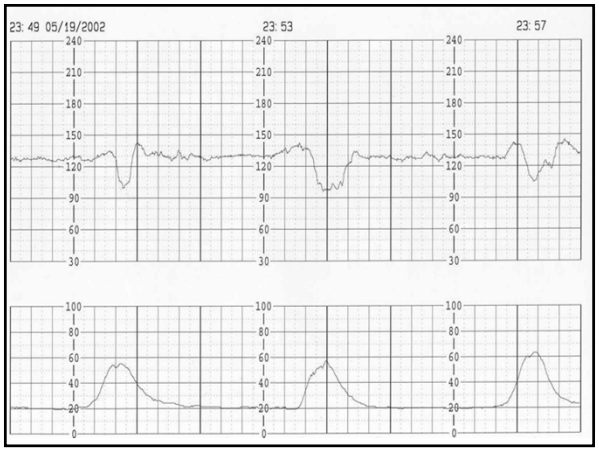
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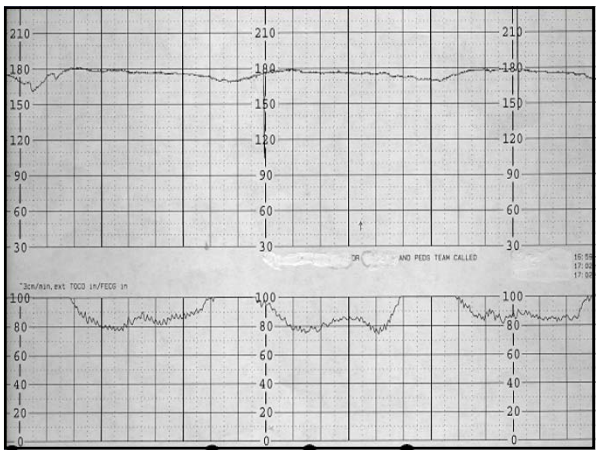

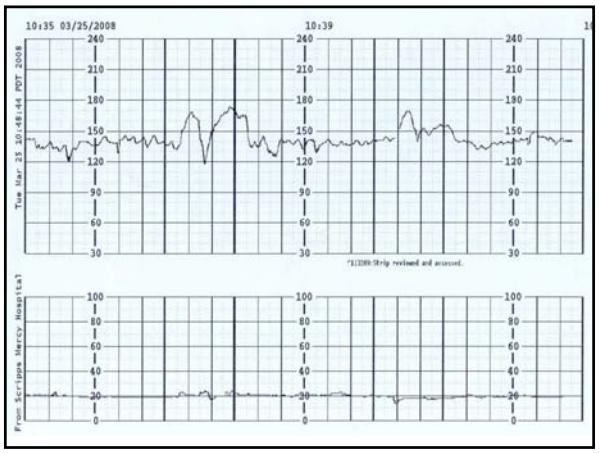
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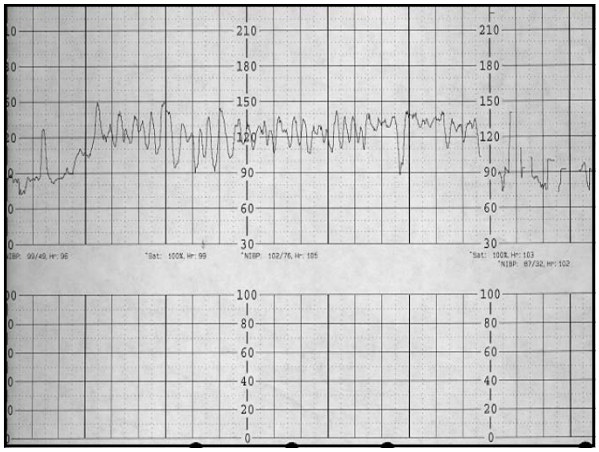

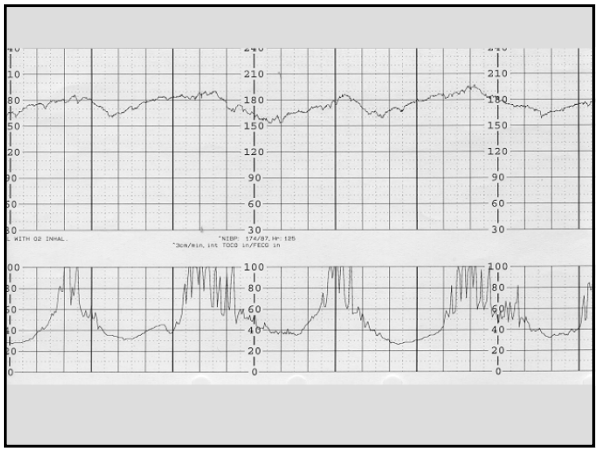

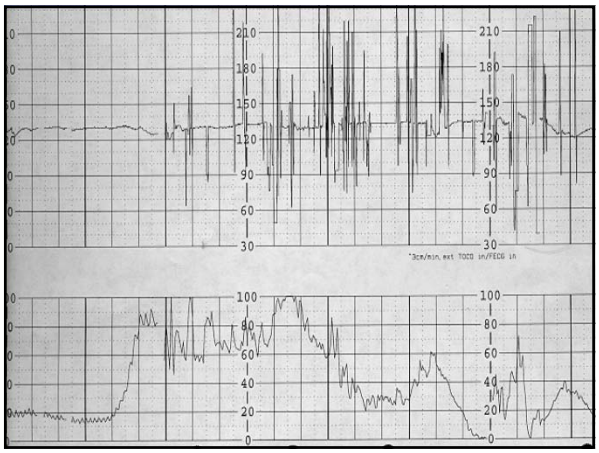
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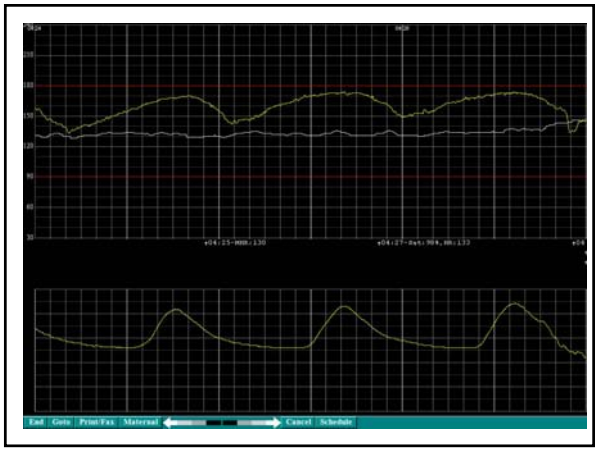
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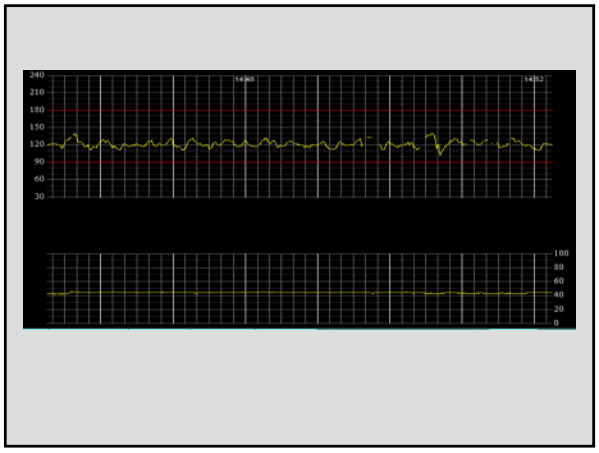
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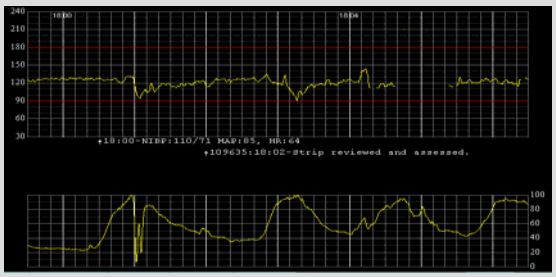
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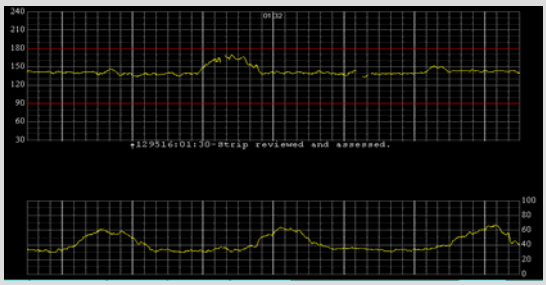
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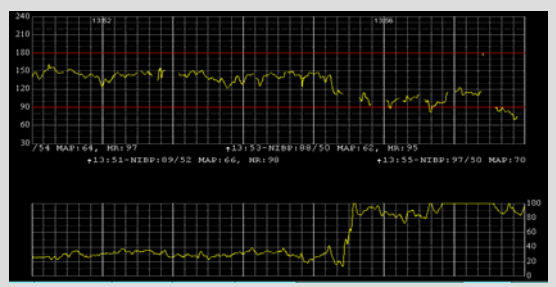
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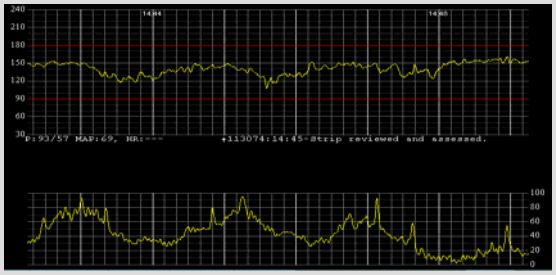
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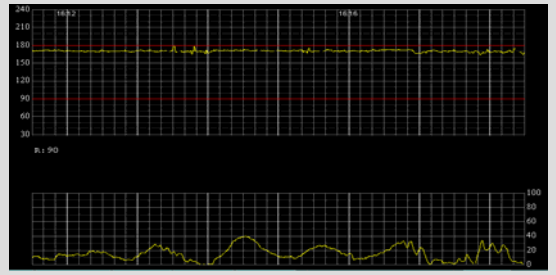
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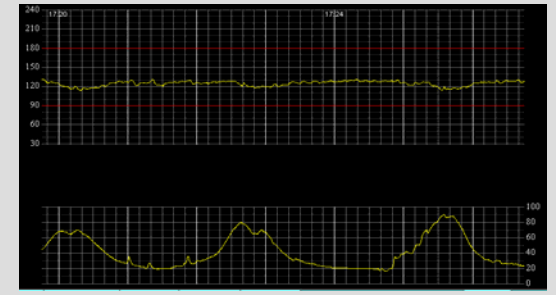
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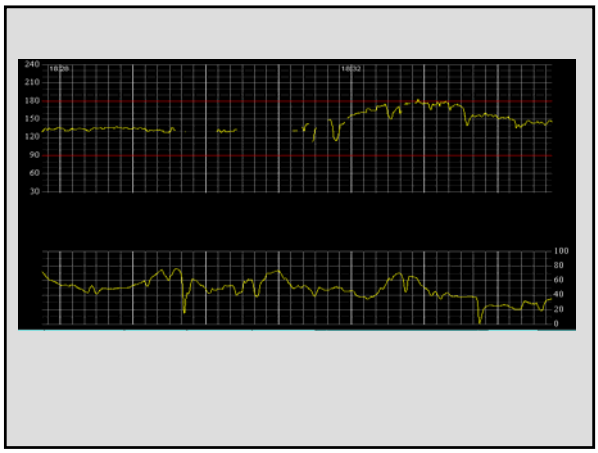
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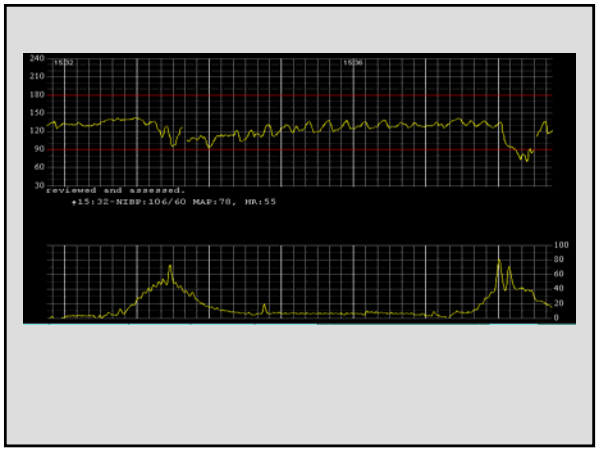
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