
Perinatal Education Programs 2020
Midlands Perinatal Systems
Self Study Module:
Working to Improve Outcomes Through Case Studies
Nursing CE Credit: October 12, 2020 – April 12, 2021
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Michelle Flanagan, BSN, RNC - Obstetric Outreach Educator
If sound does not start automatically, click here
PRISMA HEALTH

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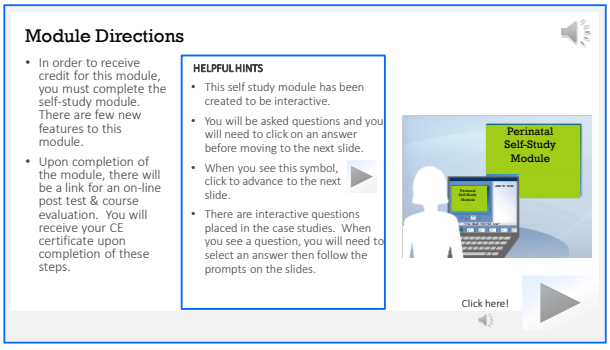
Module Directions
In order to receive credit for this module, you must complete the self-study module. There are few new features to this module.
Upon completion of the module, there will be a link for an on-line post test & course evaluation. You will receive your CE certificate upon completion of these steps.
HELPFUL HINTS
This self study module has been created to be interactive.
You will be asked questions and you will need to click on an answer before moving to the next slide.
When you see this symbol, click to advance to the next slide.
There are interactive questions placed in the case studies. When you see a question, you will need to select an answer then follow the prompts on the slides.
Perinatal Self-Study Module
Click here!

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OBJECTIVES
Overall Goal/Purpose:
Perinatal nurses will increase their knowledge with identifying maternal/neonatal warning signs and provide appropriate management in emergency situations.
Objectives:
By the end of the program, participants will be able to identify leading causes of maternal and neonatal morbidity and mortality.
By the end of the program, participant will be able to recognize warning signs and risk factors associated with maternal and neonatal emergent scenarios

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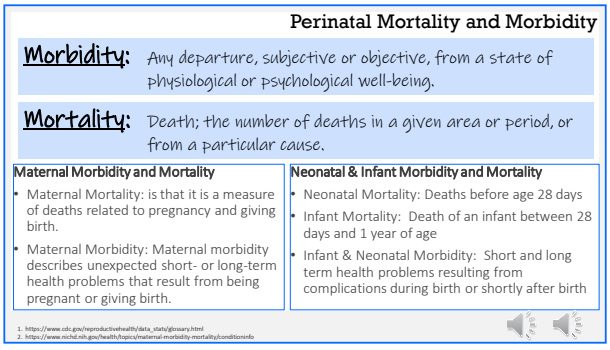
Perinatal Mortality and Morbidity
Morbidity: Any departure, subjective or objective, from a state of physiological or psychological well-being.
Mortality: Death; the number of deaths in a given area or period, or from a particular cause.
Maternal Morbidity and Mortality
Maternal Mortality: is that it is a measure of deaths related to pregnancy and giving birth.
Maternal Morbidity: Maternal morbidity describes unexpected short- or long-term health problems that result from being pregnant or giving birth.
Neonatal & Infant Morbidity and Mortality
Neonatal Mortality: Deaths before age 28 days
Infant Mortality: Death of an infant between 28 days and 1 year of age
Infant & Neonatal Morbidity: Short and long term health problems resulting from complications during birth or shortly after birth
1. https://www.cdc.gov/reproductivehealth/data_stats/glossary.html
2. https://www.nichd.nih.gov/health/topics/maternal-morbidity-mortality/conditioninfo

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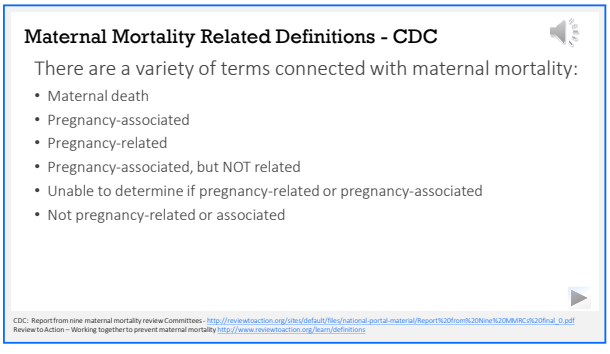
Maternal Mortality Related Definitions - CDC
There are a variety of terms connected with maternal mortality:
Maternal death
Pregnancy-associated
Pregnancy-related
Pregnancy-associated, but NOT related
Unable to determine if pregnancy-related or pregnancy-associated
Not pregnancy-related or associated
CDC: Report from nine maternal mortality review Committees - http://reviewtoaction.org/sites/default/files/national-portal-material/Report%20from%20Nine%20MMRCs%20final_0.pdf
Review to Action – Working together to prevent maternal mortality http://www.reviewtoaction.org/learn/definitions

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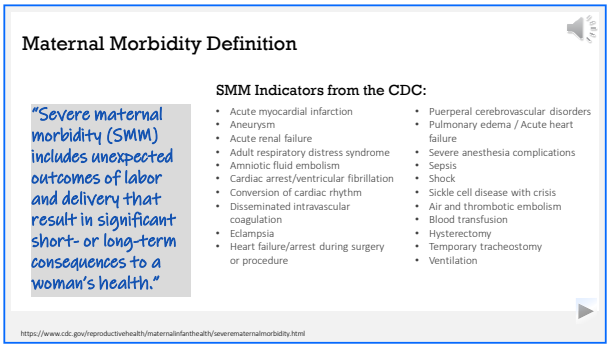
Maternal Morbidity Definition
"Severe maternal morbidity (SMM) includes unexpected outcomes of labor and delivery that result in significant short- or long-term consequences to a woman's health."
SMM Indicators from the CDC:
Acute myocardial infarction
Aneurysm
Acute renal failure
Adult respiratory distress syndrome
Amniotic fluid embolism
Cardiac arrest/ventricular fibrillation
Conversion of cardiac rhythm
Disseminated intravascular coagulation
Eclampsia
Heart failure/arrest during surgery or procedure
Puerperal cerebrovascular disorders
Pulmonary edema / Acute heart failure
Severe anesthesia complications
Sepsis
Shock
Sickle cell disease with crisis
Air and thrombotic embolism
Blood transfusion
Hysterectomy
Temporary tracheostomy
Ventilation
https://www.cdc.gov/reproductivehealth/maternalinfanthealth/severematernalmorbidity.html

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Infant & Neonatal Definitions

- Neonatal Death
  - Neonatal death is when a baby dies in the first 28 days of life
  - Neonatal death happens in about 4 in 1, 000 babies each year in the United States
  - Non-Hispanic black women are more likely to have a baby die than women of other races or ethnicities
- Infant Death
  - Death of an infant before his or her first birthday

https://www.cdc.gov/reproductivehealth/maternalinfanthealth/infantmortality.htm

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What is Neonatal Morbidity?

- "The risk of death during the newborn period - the first 28 days of life." (Olds SB et al., 2004).

SUPPLEMENTAL TABLE 4 Components of the Composite Indicator Used for SMM

Conditions
Respiratory distress syndrome
Seizure
Intraventricular hemorrhage (grades 2, 3, 4)
Cerebral infarction
Periventricular leukomalacia
Birth trauma (intracranial hemorrhage, paralysis because of brachial plexus injury or skull or long bone fractures)
Hypoxic-ischemic encephalopathy
Necrotizing enterocolitis
Bronchopulmonary dysplasia
Sepsis and/or septicemia (*Streptococcus, Staphylococcus, Escherichia coli*, unspecified Gram-negative)
Pneumonia
Other respiratory (primary atelectasis, respiratory failure)
Procedures
Resuscitation
Ventilatory support (mechanical ventilation and/or continuous positive airway pressure)
Central venous or arterial catheter
Transfusion of blood or blood products
Pneumothorax requiring an intercostal catheter
Any body cavity surgical procedure
Any intravenous fluid

For further specific details, see Lee et al.[9]

https://pediatrics.aappublications.org/content/pediatrics/suppl/2018/01/02/peds.2017-1726.DCSupplemental/PEDS_20171726SupplementaryData.pdf

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Maternal Early Warning Signs

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"MEWS": Maternal Early Warning System

- Goal of early warning systems is to ensure timely recognition of patients developing acute illness
  - The early warning systems in use for non-Obstetric patients do not work well for Obstetric patients.
- We know abnormal physiologic signs and symptoms often precede critical illness
- In 2010 the Joint Commission issued a requirement for birth facilities to develop written criteria describing early warning signs indicating a change or deterioration in a patient's condition and the requirement to promptly seek further assistance.
- In 2007, the United Kingdom recommended adoption of the Modified Early Obstetric Warning System

1. Mhyre, et al. Obstetrics & Gynecology: October 2014 - Volume 124 - Issue 4 - p 782–786. The Maternal Early Warning Criteria: A Proposal From the National Partnership for Maternal Safety
2. D'Alton, et al. VOL. 123, NO. 5, MAY 2014 OBSTETRICS & GYNECOLOGY The National Partnership for Maternal Safety

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Early Obstetric Warning System

- Differences in the OB Warning system:
  - physiologic changes that occur during pregnancy
  - small number of conditions responsible for most maternal severe morbidity and mortality.
- "In this system, 2 moderately abnormal parameters (yellow alerts) or 1 severely abnormal parameter (red alert) triggers a clinical response to urgently assess the patient's status and make a follow-up surveillance plan."

Table 3
A modified early obstetric warning system

Physiologic Parameters	Yellow Alert	Red Alert
Respiration rate	21–30	<10 or >30
Oxygen saturation		<95
Temperature	35–36	<35 or >38
Systolic blood pressure	150–160 or 90–100	<90 or >160
Diastolic blood pressure	90–100	>100
Heart rate	100–120 or 40–50	>120 or <40
Pain score	2–3	
Neurologic response	Voice	Unresponsive, pain

2 yellows = a trigger for clinical response

1 red = a trigger for clinical response

Alexander M. Friedman, MD. Maternal Early Warning Systems. Obstet Gynecol Clin N Am 42 (2015) 289–298

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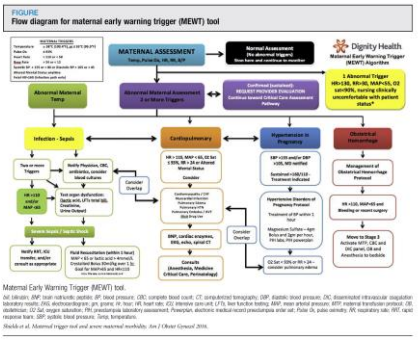
Sample MATERNAL Early Warning System

FIGURE
Flow diagram for maternal early warning trigger (MEWT) tool



Maternal Early Warning Trigger (MEWT) tool.

Shields, et al. (2016) American Journal of Obstetrics and Gynecology. Use of Maternal Early Warning Trigger tool reduces maternal morbidity, 2016-04-01, Volume 214, Issue 4, Pages 527.e1-527.e6,

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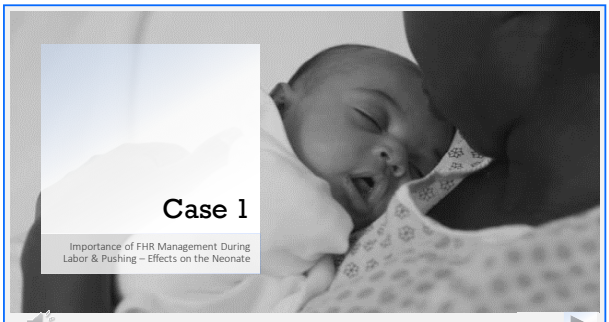

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Case 1 – Background

- Maternal History:
  - 28 year old, G3P2002, 39 5/7 weeks
  - Admitted to Labor & Delivery 6 hours ago in active labor. Reports fetal movement felt, no complaints of vaginal bleeding, leakage of fluid. Just contractions.
  - No co-morbidities or chronic conditions
  - Previous deliveries were both SVD in 2 and 4 years ago
  - SVE on Admission: 6/100/-1
  - VS on Admission: BP - 115/75 HR - 85 RR – 12 T – 98.3°F
  - Spontaneous Rupture of Membranes 2 hours ago, moderate amount of clear fluid.

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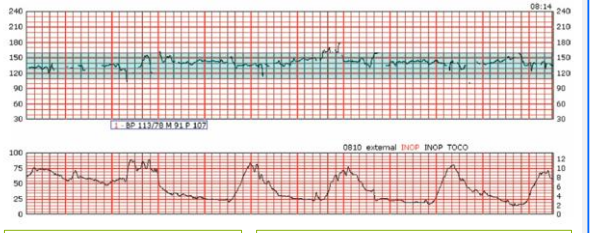
Case 1 – Fetal Strip A

Question: Please assess the above fetal monitoring strip (Please click choose A or B)



A. The fetus is adequately oxygenated as shown by baseline FHR 130, Moderate Variability and accelerations present.

B. There is not enough information to determine fetal oxygenation

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A. The fetus is adequately oxygenated as shown by baseline FHR 130, Moderate Variability and accelerations present.

CORRECT!

- A fetus is considered to be oxygenated when Baseline fetal heart rate is between 110-160 bpm, Moderate variability and Accelerations present.

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B. There is not enough information to determine fetal oxygenation

INCORRECT

- A fetus is considered to be oxygenated when Baseline fetal heart rate is between 110-160 bpm, Moderate variability and Accelerations present. Fetal Strip 1 shows all of these features and there indicates that the fetus is adequately oxygenated at this moment in time.

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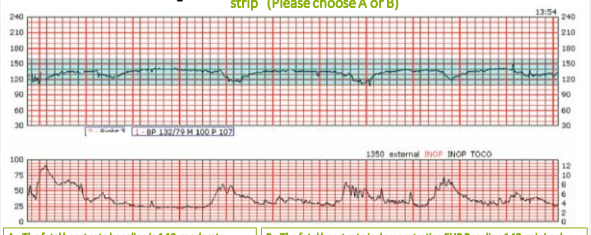
Case 1 – Fetal Strip B

Question: Please assess the above fetal monitoring strip (Please choose A or B)



A. The fetal heart rate baseline is 140, moderate variability and early decelerations. The fetus remains oxygenated, continue to support maternal coping in labor

B. The fetal heart rate is demonstrating FHR Baseline 140, minimal variability and late decelerations. The nurse should begin interventions including lateral position change and 500 ml IV Fluid bolus.

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A. The fetal heart rate baseline is 140, moderate variability and early decelerations. The fetus remains oxygenated, continue to support maternal coping in labor.

INCORRECT

- The Fetal tracing correctly interpreted is a Baseline of 140, minimal variability and late decelerations.
- The nurse should begin interventions including, but not limited to: Position change, IV Fluid bolus. If the patient was receiving oxytocin, the nurse should consider decreasing or discontinuing the oxytocin.

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B. The fetal heart rate is demonstrating FHR Baseline 140, minimal variability and late decelerations. The nurse should begin interventions including lateral position change and 500 ml IV Fluid bolus.

CORRECT!

- This is the correct interpretation of the fetal heart rate tracing.
- The nurse should begin interventions including, but not limited to: Position change, IV Fluid bolus. If the patient was receiving oxytocin, the nurse should consider decreasing or discontinuing the oxytocin.

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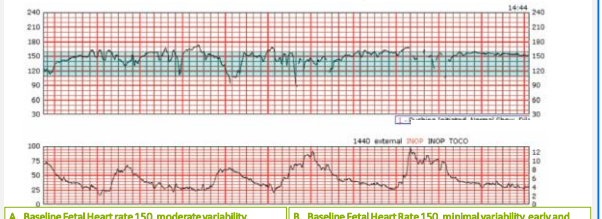
Case 1 – Fetal Strip C

Patient is complete with the urge to push, nurse at bedside. Patient begins pushing at the end of this strip.

Question: Please assess the above fetal monitoring strip (Please choose A or B)



A. Baseline Fetal Heart rate 150, moderate variability, variable decelerations. Contractions q 1-3 min, 60-120 sec, palpate as moderate with relaxed resting tone.

B. Baseline Fetal Heart Rate 150, minimal variability, early and late decelerations. Contractions q 1-3, 60-120 sec. palpate as moderate with relaxed resting tone

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A. Baseline Fetal Heart rate 150, moderate variability, variable decelerations. Contractions q 1-3 min, 60-120 sec, palpate as moderate with relaxed resting tone.

CORRECT!

- This is the correct interpretation of the fetal heart rate tracing.
- Because there is evidence of moderate variability, this indicates that the fetus is currently oxygenated.
- The decelerations in this slide are variables, indicated by their abrupt onset.
- As defined by National Institute of Child Health and Human Development (NICHD):
  - Visually apparent abrupt decrease; onset of deceleration to the beginning of nadir <30 seconds; The decrease in the FHR is ≥ 15 bpm, lasting ≥ 15 seconds and < 2 minutes in duration
  - When variables are associated with contractions, their onset, depth, and duration commonly vary with successive contractions

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B. Baseline Fetal Heart Rate 150, minimal variability, early and late decelerations. Contractions q 1-3, 60-120 sec. palpate as moderate with relaxed resting tone

INCORRECT!

- Fetal Strip 3 showed moderate variability and variable decelerations.
- Because there is evidence of moderate variability, this indicates that the fetus is currently oxygenated.
- The decelerations in this slide are variables, indicated by their abrupt onset.
- As defined by National Institute of Child Health and Human Development (NICHD):
  - Visually apparent abrupt decrease; onset of deceleration to the beginning of nadir <30 seconds; The decrease in the FHR is ≥ 15 bpm, lasting ≥ 15 seconds and < 2 minutes in duration
  - When variables are associated with contractions, their onset, depth, and duration commonly vary with successive contractions

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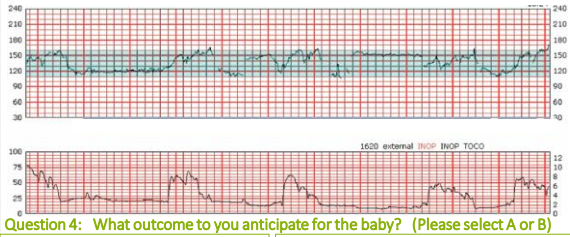
Case 1: Fetal Strip D

This is the last tracing prior to delivery. She is making good progress with pushing.



Question 4: What outcome to you anticipate for the baby? (Please select A or B)

A. The tracing remains reassuring. I anticipate a normal vaginal delivery with infant crying and vigorous.

B. The tracing is not reassuring. I anticipate a vaginal delivery and the need for neonatal support.

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B. The tracing is not reassuring. I anticipate a vaginal delivery and the need for neonatal support.

CORRECT!

- This tracing is suspicious for signal ambiguity.
- The nurse should be verifying maternal versus fetal heart rate and completing interventions to readjust the ultrasound transducer in order to appropriately support fetal oxygenation.
- The nurse should do interventions to confirm maternal versus fetal heart rate and call the neonatal resuscitation team for delivery.

Please click the "Next" button to proceed to the neonatal outcome

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Neonatal Care

Delivery Summary:

- Spontaneous Vaginal Delivery 39 5/7
- Female
- APGARS: 2/4/3/4
- pH: 6.89 base: -21
- Saturation: 40%
- Weight: 3500

Targeted Pre-ductal SpO_2 After Birth	
1 min	60%-65%
2 min	65%-70%
3 min	70%-75%
4 min	75%-80%
5 min	80%-85%
10 min	85%-95%

Infant apneic, dried and stimulated. Suctioned, pulse oximeter placed, infant remains apneic, cyanotic and limp. PPV started x 30 seconds.
HR: 40bpm
Saturation: 40%

QUESTION:
What is the next step for the resuscitation?

A. Two-thumb encircling chest compressions started for 1 minute and infant intubated with 3.5 ET Tube, increase oxygen to 100%. Attempt to start UVC or PIV.

B. 2 finger chest compression started, PPV Continued, Oxygen increased to 30%

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A. Two-thumb encircling chest compressions started for 1 minute, increase oxygen to 100%, and infant intubated with 3.5 ET Tube. Attempt to start umbilical venous catheter or PIV

CORRECT!

- Neonates who remain apneic after 30 seconds of effective PPV and have a heart rate below 60bpm, the NRP algorithm should be started including chest compression, increasing oxygen to 100%, and intubation with a correct size tube.

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B. 2 finger chest compression started, PPV Continued, Oxygen increased to 30%

INCORRECT!

- Neonates who remain apneic after 30 seconds of effective PPV and have a heart rate below 60bpm, the NRP algorithm should be started including chest compression, increasing oxygen to 100%, and intubation with a correct size tube.

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At 2 Minutes of Life

- Continue PPV with 100% oxygen via ET Tube, assessment as follows:
  - HR: 40 bpm
  - O2 Saturation: 40%
  - UVC unsuccessful, PIV placed

Targeted Pre-ductal SpO_2 After Birth	
1 min	60%-65%
2 min	65%-70%
3 min	70%-75%
4 min	75%-80%
5 min	80%-85%
10 min	85%-95%

QUESTION:
What is the next appropriate step?

A. Give 0.35ml Epinephrine (1:1,000) via ET Tube, continue chest compressions. Continue PPV with 100% oxygen via ET Tube.

B. Give 0.35ml Epinephrine (1:10,000) IV, continue chest compressions. Continue PPV with 100% oxygen via ET Tube.

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A. Give 0.35ml Epinephrine (1:1,000) via ET Tube, continue chest compressions. Continue PPV with 100% oxygen via ET Tube.

INCORRECT!

- The recommended concentration for Epinephrine for newborns is 1:10,000. The above answer has the wrong concentration of epinephrine.
- The preferred route for Epinephrine during NRP is umbilical venous catheter (UVC) or PIV.
  - The correct IV dose is 0.1 to 0.3 ml/kg (Always start with lowest dose first for IV dosing)
    - Infant's Estimated weight is 3500g, giving us a dose of 0.35 ml.
- The ET tube dosing is 0.5-1.0 ml/kg. Appropriate ET tube dose for a 3500 gm infant would be 1.75ml to 3.5ml. (When giving epinephrine via ET tube, maximum dose is preferred secondary to unknown absorption rate)
- Chest compressions should continue during this process as well as continued PPV.

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B. Give 0.35ml Epinephrine (1:10,000) IV, continue chest compressions. Continue PPV with 100% oxygen via ET Tube.

CORRECT!

- The preferred route for Epinephrine during NRP is Intravenous (IV). Because the infant already has IV access, the best option is to give the dose intravenously.
- The recommended concentration for Epinephrine for newborns is 1:10,000
- The correct IV dose is 0.1 to 0.3 mL/kg (Always start with lowest dose first for IV dosing)
  - Infant's Estimated weight is 3500g, giving us a dose of 0.35 ml.
- Chest compressions should continue during this process as well as continued PPV.

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At 3 Minutes of Life

- Heart Rate checked 1 minute after epinephrine given. HR = 120bpm
- O2 Saturation is 80%
- Infant is taking some spontaneous breaths but remains intubated.
- The providers stop chest compressions and continue to PPV via ET Tube
- Oxygen weaned by 10% to FiO2 90%.

Targeted Pre-ductal SpO_2 After Birth	
1 min	60%-65%
2 min	65%-70%
3 min	70%-75%
4 min	75%-80%
5 min	80%-85%
10 min	85%-95%

QUESTION:
As the neonatal care team, what should you be considering with this infant's history?

Recall Delivery Summary: Spontaneous Vaginal Delivery 39 5/7, Female infant, Weight: 3500; APGARS: 2/4/3/4; Arterial pH: 6.89 base: -21

A. You suspect this infant has metabolic acidosis and may be a candidate for therapeutic hypothermia secondary to hypoxic-ischemic encephalopathy

B. You suspect this infant has respiratory acidosis and will only require post resuscitation care.

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A. You suspect this infant has metabolic acidosis and may be a candidate for therapeutic hypothermia secondary to hypoxic-ischemic encephalopathy

CORRECT!

- Respiratory Acidosis is a build up of CO2 levels, which is usually corrected quickly, with appropriate ventilation
- Metabolic acidosis is a caused by anaerobic metabolism leading to a building up lactic acid. This occurs over a longer period of time takes longer to resolve.
- Criteria for therapeutic hypothermia includes:
  - GA ≥ 36 wk
  - Weight ≥ 1800 gm
  - pH ≤ 7.0 (source cord or baby's 1st ABG at less than 1 hour of age)
  - Base deficit > 16
  - APGAR Score ≤ 5 at 10 minutes
  - Acute perinatal event has occurred
- All infants will receive post-resuscitation care.

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B. You suspect this infant has respiratory acidosis and will only require post resuscitation care.

INCORRECT!

- Respiratory Acidosis is a build up of CO2 levels, which is usually corrected quickly, with appropriate ventilation
- Metabolic acidosis is a caused by anaerobic metabolism leading to a building up lactic acid. This occurs over a longer period of time takes longer to resolve.
- Criteria for therapeutic hypothermia includes:
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  - Base deficit > 16
  - APGAR Score ≤ 5 at 10 minutes
  - Acute perinatal event has occurred
- All infants will receive post-resuscitation care.

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Case 1 Debrief

Let's discuss some of the issues that were highlighted in this case.

- Maternal Issue
- Neonatal Issues

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Responses to the Case

What was *YOUR* response to the delivery outcome?

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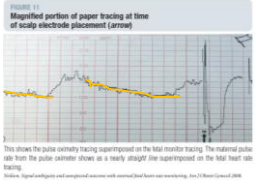
What *is* Signal Ambiguity?



- The fetal signal is replaced by an alternative signal from the mother or a second fetus without the usual recognizable transition associated with such signal source shifting.
  - The most characteristic indication of this problem is the pattern of repeated heart rate accelerations during second stage.
    - Mothers typically show accelerations in heart rate while pushing and do not show decelerations.
    - Fetuses commonly show decelerations with pushing, and almost never show repeated accelerations.
  - The conditions under which this phenomenon occurs are maternal tachycardia with excursions into the fetal range and simultaneous fetal bradycardia or tachycardia outside the normal fetal range.

Neilson Jr, MD, D. Et al. (JUNE 2008) Signal ambiguity resulting in unexpected outcome with external fetal heart rate monitoring. American Journal of Obstetrics & Gynecology

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How Can Signal Ambiguity Be Addressed In The Intrapartum Period?

- Suggestions for quality improvement stem from the provider's ability to verify maternal heart rate versus comparison to fetal heart rate.
  - Auscultation
    - During auscultation of fetal heart rate, simultaneous palpation of maternal pulse
  - Electronic Fetal Monitoring:
    - Ultrasound Transducer or Ultrasound Doppler:
      - Manual palpation of a maternal radial pulse rate is compared with FHR being emitted from bedside equipment
    - Fetal Spiral Electrode:
      - Awareness that a maternal heart rate may be recorded when an intrauterine fetal death has occurred.
      - Verification of maternal heart rate for comparison

"Perinatal best practice is to intermittently palpate a woman's pulse throughout labor."

Cypher, R. (April/June 2019). When Signals Become Crossed - Maternal-Fetal Signal Ambiguity. The Journal of Perinatal & Neonatal Nursing

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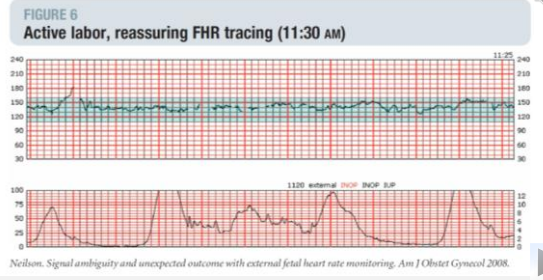
Sample with signal ambiguity in labor.



Neilson. Signal ambiguity and unexpected outcome with external fetal heart rate monitoring. Am J Obstet Gynecol 2008.

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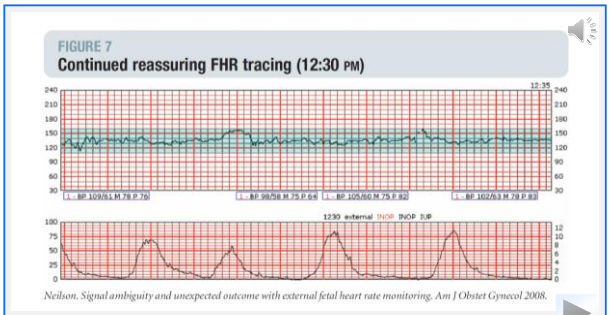

Neilson. Signal ambiguity and unexpected outcome with external fetal heart rate monitoring. Am J Obstet Gynecol 2008.

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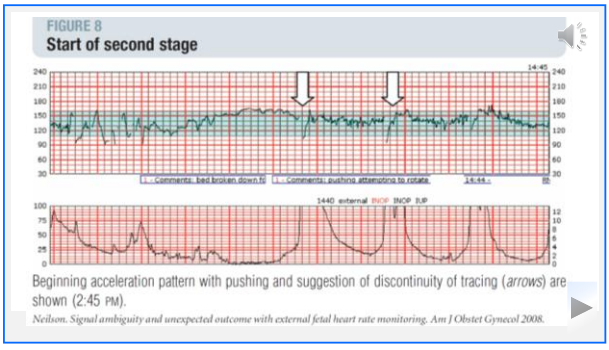

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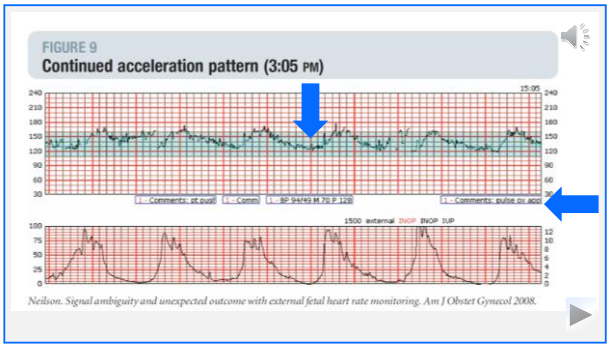

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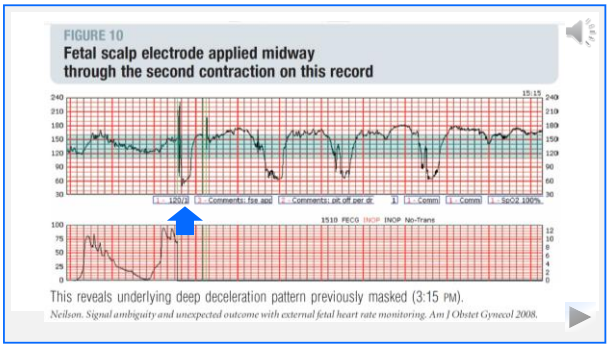

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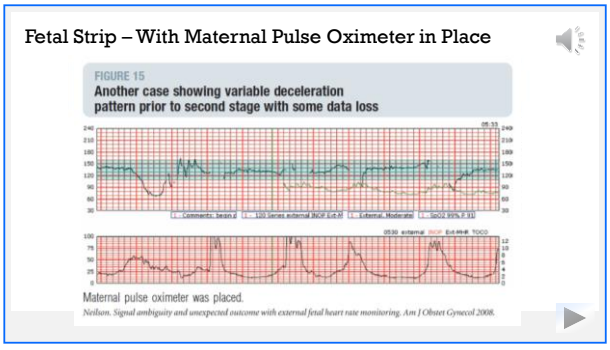

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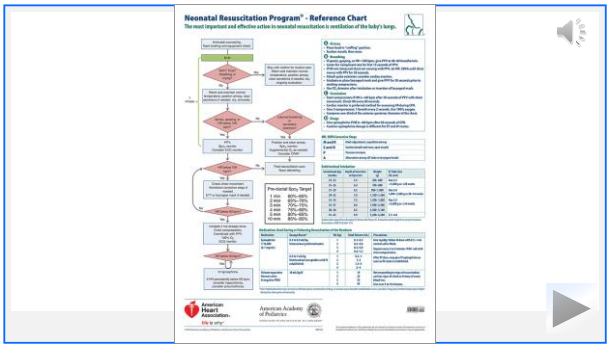
Neonatal Care

- Delivery Summary:
  - Spontaneous Vaginal Delivery 39 5/7 weeks
  - Female Infant
  - APGARS 2/4/2/4
  - pH: 6.89 Base: -21
  - Infant's weight 3500 grams

47



48

Criteria For Neonatal Therapeutic Hypothermia

- Spontaneous Vaginal Delivery 39 5/7
- Female
- APGARS: 2/4/3/4
- pH: 6.89 base: -21
- Weight: 3500

- Candidates For Whole Body Cooling
  - Gestational age ≥36 weeks
  - ≤6 hours of age
  - pH ≤7.00 or base deficit ≥16 mmol/L in an umbilical cord blood sample or any blood sample obtained within the first hour after birth
  - Moderate or severe encephalopathy on clinical examination
  - Acute Perinatal event
  - Assisted ventilation at birth and continued for 10 minutes
  - APGAR score ≤5 at 10 minutes after birth

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6th Edition STABLE Program

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Neuro-exam check list

6th Edition STABLE Program

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Definitions

- Birth Injury
  - Fetal or neonatal injury has occurred during the process of birth.
  - Examples of injury
    - Brachial plexus injury
    - Fracture clavicle
    - Damage to facial nerve
- Birth Asphyxia
  - Asphyxia occurs during the first and second stages of labor when the fetus was otherwise normal
- Perinatal Asphyxia
  - Asphyxia occurred at any time in the perinatal period. From conception through the first month of life

52

Proper Terminology

- The AAP and ACOG recommend using Hypoxic-Ischemic Encephalopathy because this term describes the clinical condition, encephalopathy from asphyxia, without implying the time of brain injury.
- The AAP and ACOG also advise not using the terms perinatal asphyxia or birth asphyxia because it is difficult to identify the time of brain injury.
- HIE is characterized by clinical and laboratory evidence of acute or subacute brain injury due to asphyxia.

53

Incidence of HIE

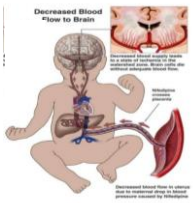
- Major cause of death and disabilities
- Occurs 1-3/1000 births
- Mortality rates 10-60%
- Morbidity 25%
- 15-28% incidence of cerebral palsy

http://www.medscape.com/viewarticle/749601_2

54

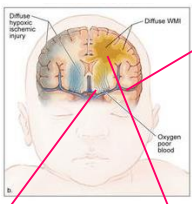
Acute Perinatal Events

- Impaired Placental and Fetal Perfusion
- Acute Perinatal Event
  - Placental abruption
  - Uterine rupture
  - Prolapsed or ruptured cord
  - Maternal collapse requiring CPR



55

Areas of the Brain Affected by HIE

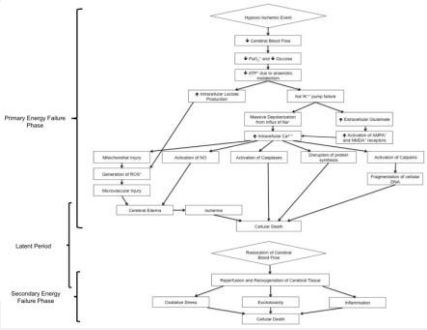


Perinatal event disrupts brain perfusion

Striate vessels underperfused

Diffuse white matter injury

56



57

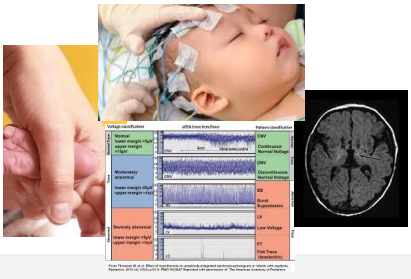
Systemic Complications of HIE

- Acute renal failure
- Myocardial dysfunction and hypotension
- Elevated LFT's
- Coagulation impairment

- SUPPORTIVE CARE REQUIRED!

58

Assessment Tools



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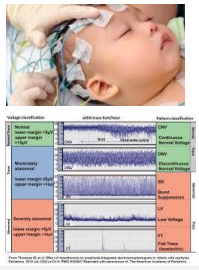
Assessment Tools in HIE

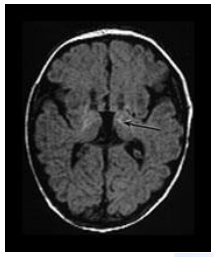
- Electroencephalogram (EEG)
  - Neonatal seizures
  - Presence and severity of encephalopathy
- Amplitude integrated EEG (aEEG)
  - Useful to distinguish mild from severe neonatal encephalopathy
  - Marginal abnormal or normal aEEG reassuring for good outcome
  - Severely abnormal aEEG raises probability of death or severe disability from 25% to 75%



60

Assessment Tools in HIE

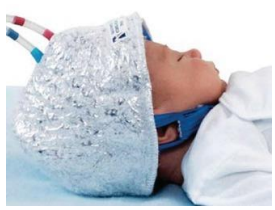
- Neuroimaging
  - Cranial ultrasound
    - Not a sensitive tool to identify milder white matter abnormalities
  - CT Scan
    - Milder degrees of edema and white matter injury can be difficult to detect
  - MRI Scan
    - Most appropriate scan
    - Most sensitive for detecting cortical and white matter injury, deep gray matter lesions, arterial infarction and developmental brain malformations



http://www.uptodate.com/contents/clinical-features-diagnosis-and-treatment-of-neonatal-encephalopathy#H3

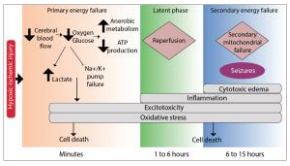
61

Therapeutic Neuroprotective Hypothermia



62

Mechanism of Action of Hypothermia Therapy



- Hypothermia therapy slows down the metabolism and helps prevent what is know as the "Cascade of Neurologic Injury" that occurs in the first 48-72 hours after birth. Hypothermia helps prevent disruptions to cerebral metabolism, decreases the cerebral metabolic rate for glucose and oxygen, and decreases the loss of high energy phosphates.
- Hypothermia appears to have multiple effects at a cellular level. Hypothermia reduces vasogenic edema (vasogenic edema contributes significantly to morbidity. This edema results from disruption of the blood brain barrier, allowing protein-rich fluid to accumulate in the extracellular space.
- Hypothermia limits intracellular calcium accumulation
- Free radical production is lessened (which helps protect damage that occurs during reperfusion)
- Cytotoxic edema and loss of cerebral cortical activity that is seen with secondary energy failure is also prevented.

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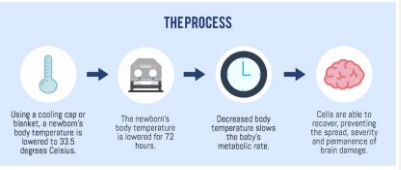
Cooling Process

- Whole body cooling using blanket and servo controlled cooling system
  - The aim is to cool infants with moderate to severe HIE within 6 hours of life
  - Goal esophageal temp: 33.5°C (92.3°F)
  - Continued for 72 hours
  - Supportive care as indicated
    - NPO
    - Respiratory Support
    - Circulatory Support
    - Anticonvulsants
    - Antibiotics



http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3743149/

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Rewarming

- Initiated after 72 hours of cooling
- Slow rewarming
  - 0.5°C per hour until desired temp of 36.5°C (97.7°F)
  - Approximately over 4-6 hours
  - Cooling device discontinued
  - Temperature control using servo mode on radiant warmer

65

Role of Referring Hospital In Optimizing The Outcome

- Early identification of possible candidates
  - History of adverse perinatal event
  - Laboratory evidence of acidosis
  - Signs of encephalopathy on examination
- Early consultation with the Regional Perinatal Center (RPC)
- Stabilization
  - Avoid hypoglycemia and hyperthermia
  - Identification and treatment of seizures
  - Arrange for transport
  - Passive cooling
    - Initiated by turning off radiant warmer/isolette
    - Time to reach target temperature: ~2 hours

Guidelines for Passive Cooling

1. Identify patient and discuss with Prisma Health Richland Neonatologist within one (1) hour of birth
   a. Refer to STABLE Candidacy for Therapeutic Neuroprotective Hypothermia Checklist
   b. If infant is 35 weeks call Neonatologist to inquire if candidate
2. Once determined to be candidate for cooling, turn radiant warmer off and leave infant uncovered except diaper
3. Monitor core/rectal temperature every 15 minutes. Record temperatures on flow sheet
4. Allow temperature to fall to target temperature range:
   a. Target rectal temperature is 33.5-34.5°C or 92.3-93.4°F
5. Avoid overcooling. When rectal temperature reaches 33.5°C (92.3°F), cover infant with blanket or plastic (avoid covering face)
6. If rectal temperature continues to fall quickly or remains less than 33.5°C (92.3°F), increase warmer setting
   a. Increase temperature to lowest setting and continue to recheck rectal temperature every 15 minutes
   b. Avoid overheating. Minimize big changes in heater settings that may result in overcorrections
7. Monitor vital signs and glucose levels closely
8. Call Neonatologist with any questions or concerns (803-434-5886)

66

67

Case 2: Maternal Background

Maternal History:

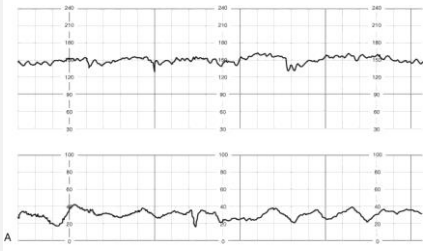
- 35 year old, G5P2204, 38 1/7 weeks
- Presents to Labor & Delivery complaining of contractions x 1 hour. Reports fetal movement felt, no complaints of vaginal bleeding, leakage of fluid.
- Previous deliveries SVD X 2 of term infants and 2 C/S of Preterm Infants

Initial Assessment Care:

- Patient placed on the Monitor
- VS on Admission: BP - 110/68 HR - 115 RR – 16 T – 98.3°F
- SVE: 2 cm/50%/-3 (this is the same as her PNV last week)

68

Case 2: Fetal Strip A – Admission Tracing



QUESTION:
The fetal heart rate tracing is reassuring at this time; however, as the primary nurse, I am concerned about the uterine activity. True or False?

A. True

B. False

69

A. True

CORRECT!

- This Fetal monitoring strip shows the fetus has a Baseline fetal heart rate of 150 bpm, Moderate variability and Accelerations
- The uterine activity is suspicious for irritability. The nurse should palpate the abdomen, and readjust the monitor as needed.
- The nurse should also ask the patient about the perception of contractions, pain.
- In this case, the nurse palpates uterine contractions and the patient complains of abdominal pain.

70

B. False

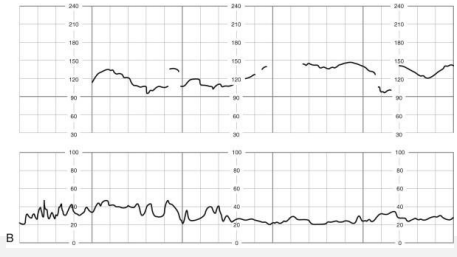
INCORRECT!

- It is correct that this Fetal monitoring strip shows the fetus has a Baseline fetal heart rate of 150 bpm, Moderate variability and Accelerations
- The uterine activity is suspicious for irritability. The nurse should palpate the abdomen, and readjust the monitor as needed.
- The nurse should also ask the patient about the perception of contractions, pain.
- In this case, the nurse palpates uterine contractions and the patient complains of abdominal pain.

71

Case 2: Fetal Strip B – 20 minutes later

- Nurse and OB Provider present to the room after noting the following strip on the central monitor
- A vaginal exam reveals the patient is now 4cm/70/-1 with mild vaginal bleeding.



QUESTION:
The bleeding noted at this time is indicative of:

A. Normal bloody show with continued cervical change

B. Possible Placental Abruption

72

A. Normal bloody show with continued cervical change

INCORRECT!

- While there is often bloody show when there is cervical change, this should not be the first conclusion in this case.
- The fetal heart rate now shows minimal variability and decelerations. We can not currently designate the decelerations on the strip because the uterine activity is not clear.
- The other symptoms of uterine irritability, with palpated uterine activity with the vaginal bleeding increase the potential for placental abruption
- The nurse palpates uterine contractions and the patient complains of abdominal pain. The nurse turns the patient to the left side and starts a 500 ml bolus of LR.

73

B. Possible Placental Abruption

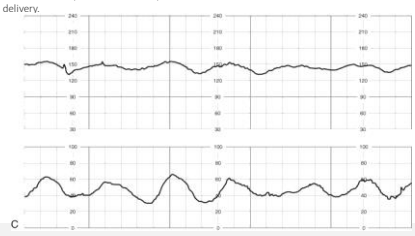
CORRECT!

- While there is often bloody show when there is cervical change, this should not be the first conclusion in this case. With palpated uterine activity and the current vaginal bleeding increase the potential for placental abruption.
- The fetal heart rate now shows minimal variability and decelerations. We can not currently designate the decelerations on the strip because the uterine activity is not clear.
- The nurse palpates uterine contractions and the patient complains of abdominal pain. The nurse turns the patient to the left side and starts a 500 ml bolus of LR.

74

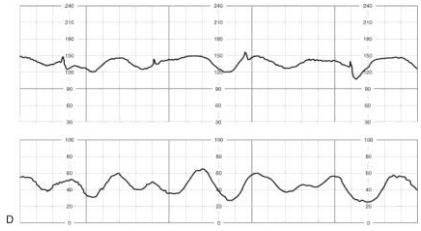
Case 2: Fetal Strip C

- The fetal monitor was readjusted and now the fetal heart monitoring strip shows baseline fetal heart rate of 150, minimal variability and recurrent late decelerations.
- Additional labs are drawn, a 2nd IV is started, the neonatal resuscitation team and the OR team are notified of a possible cesarean delivery.



75

Case 2: Fetal Strip D



QUESTION:
The uterine activity is noted that contractions are occurring every 30 sec – 1 min. As noted on Strip "D" there are at least 7 contractions noted in approximately 5 minutes. This is has continued for the last 30 minutes. This type of uterine activity is called:

A. Normal

B. Tachysystole

76

A. Normal

INCORRECT

- As Defined by the 2008 NICHD article, the following terms are used to describe uterine activity:
  - **Normal Uterine Activity:**
    - ≤ 5 contractions in 10 minutes, averaged over a 30-minute window.
  - **Tachysystole:**
    - >5 contractions in 10 minutes averaged over a 30-minute window
      - Is qualified as to the presence or absence of associated FHR decelerations
      - Applies in both spontaneous or stimulated lab or
      - Clinical response to tachysystole may differ depending on whether contractions are spontaneous or stimulated.

77

B. Tachysystole

CORRECT

- As Defined by the 2008 NICHD article, the following terms are used to describe uterine activity:
  - **Normal Uterine Activity:**
    - ≤ 5 contractions in 10 minutes, averaged over a 30-minute window.
  - **Tachysystole:**
    - >5 contractions in 10 minutes averaged over a 30-minute window
      - Is qualified as to the presence or absence of associated FHR decelerations
      - Applies in both spontaneous or stimulated lab or
      - Clinical response to tachysystole may differ depending on whether contractions are spontaneous or stimulated.

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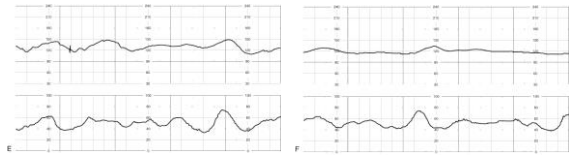
Case 2: Fetal Strip E & F



QUESTION:
The progression of the fetal heart monitoring strip is showing: (Please select A or B)

A. Stable fetal heart rate at this time. The fetus is able to continue to oxygenate through intrinsic mechanisms. Labor should be allowed to continue to progress normally.

B. Worsening fetal heart rate. It is important to expedite the delivery of the fetus.

79

A. Stable fetal heart rate at this time. The fetus is able to continue to oxygenate through intrinsic mechanisms. Labor should be allowed to continue to progress normally.

INCORRECT

- The fetal heart rate is showing signs of worsening with continued decrease in variability as well as decrease in baseline. The maternal heart rate should be compared to ensure that the tracing is truly recording the fetal heart rate.
- When an abruption occurs, the placenta is no longer able to adequately supply oxygenated blood to the fetus. The Fetus has some compensatory mechanisms to allow it to maintain oxygenation for a limited period of time. However, continued bleeding and worsening of the fetal heart tracing indicates a lack of the fetus's ability to maintain oxygenation.

80

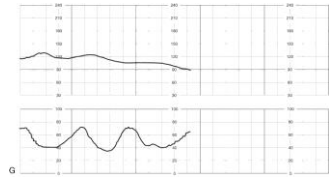
B. Worsening fetal heart rate. It is important to expedite the delivery of the fetus.

CORRECT

- The fetal heart rate is showing signs of worsening with continued decrease in variability as well as decrease in baseline. The maternal heart rate should be compared to ensure that the tracing is truly recording the fetal heart rate.
- When an abruption occurs, the placenta is no longer able to adequately supply oxygenated blood to the fetus. The fetus has some compensatory mechanisms to allow it to maintain oxygenation for limited period of time. However, continued bleeding and worsening of the fetal heart tracing indicates a lack of the fetus's ability to maintain oxygenation.

81

Case 2: Fetal Strip G – Final Tracing in the OR prior to Abdominal Preparation.



- The current fetal heart rate shows the beginning of a prolonged deceleration or potential bradycardic rate.
- What do you anticipate for the care of this neonate?

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NEONATAL CARE

Delivery Summary

- Stat C/S for non-reassuring fetal heart rate 38 1/7
- Male infant
- Noted 80% abruption at delivery
  - Mom with QBL of 1500 cc blood loss.
- APGARS: 6/8
- pH: 7.2 base: -9
- Weight: 2950
- Infant with weak cry, dried and stimulated. Infant pale with poor tone. Pulse oximeter placed.
  - HR: 140 bpm
  - 2 minute saturation: 52%
  - Capillary refill time >5 seconds

Targeted Pre-ductal SpO_2 After Birth	
1 min	60%-65%
2 min	65%-70%
3 min	70%-75%
4 min	75%-80%
5 min	80%-85%
10 min	85%-95%

QUESTION:
What is the next step for the resuscitation?

A. Give 30% free-flow oxygen by holding the oxygen tubing close to the baby's mouth and nose, continue to monitor heart rate, start PIV. Notify provider of maternal history, infant's vital signs and need for blow-by oxygen. You anticipate the physician will have you give the infant 30ml normal saline, draw capillary blood gas, and continue to follow infant closely.

B. Give 21% blow-by oxygen, continue to monitor heart rate, start PIV. Notify provider of maternal history, vital signs and need for blow-by oxygen. You anticipate the physician will have you give the infant 40ml normal saline, draw capillary blood gas, and continue to follow infant closely.

83

A. Give 30% free-flow oxygen by holding the oxygen tubing close to the baby's mouth and nose, continue to monitor heart rate, start PIV. Notify provider of maternal history, infant's vital signs and need for blow-by oxygen. You anticipate the physician will have you give the infant 30ml normal saline, draw capillary blood gas, and continue to follow infant closely.

CORRECT:

- The infant's saturation is 52% at 1 minute of life. The range for saturation at 1 minute of life is 60-65%. Supplemental oxygen is used when the oximeter reading remains below the target range for the baby's age. The goal is to prevent hypoxia without using excess oxygen and exposing the newborn to the potential risks of hyperoxia.
- Normal capillary refill time is less than 3 seconds. Secondary to maternal history, prolonged capillary refill time, weak cry and poor tone, the provider may be concerned the infant may be exhibiting signs of shock. Appropriate volume expanders for neonatal resuscitation are normal saline or PRBC's 10ml/kg. The infant's weight is 2950 grams, so appropriate dose is 30cc of normal saline over 5-10 minutes.

84

B. Give 21% blow-by oxygen, continue to monitor heart rate, start PIV. Notify provider of maternal history, vital signs and need for blow-by oxygen. You anticipate the physician will have you give the infant 40ml normal saline, draw capillary blood gas, and continue to follow infant closely.

INCORRECT:

- The infant's saturation is 52% at 1 minute of life. The range for saturation at 1 minute of life is 60-65%. Supplemental oxygen is used when the oximeter reading remains below the target range for the baby's age. The goal is to prevent hypoxia without using excess oxygen and exposing the newborn to the potential risks of hyperoxia.
- Normal capillary refill time is less than 3 seconds. Secondary to maternal history, prolonged capillary refill time, weak cry and poor tone, the provider may be concerned the infant may be exhibiting signs of shock. Appropriate volume expanders for neonatal resuscitation are normal saline or PRBC's 10ml/kg. The infant's weight is 2950 grams, so appropriate dose is 30ml of normal saline over 5-10 minutes.

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Case 2 Debrief

Let's discuss some of the issues that were highlighted in this case.

- Maternal Issue
- Neonatal Issues

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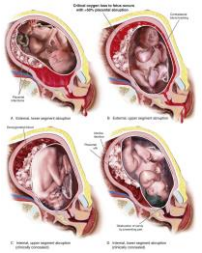
Definition of Abruption (Abruptio Placentae)

- Placental abruption sometimes called abruptio placentae, refers to the premature separation of a normally implanted placenta from the uterus prior to delivery of the fetus.
- The diagnosis is typically reserved for pregnancies greater than 20 weeks of gestation.



Francois, K. Et al. Gabbe's Obstetrics: Normal and Problem Pregnancies. Published December 31, 2020. Pages 343-374. © 2021.
Image From: https://obgynkey.com/evaluation-and-management-of-antepartum-and-intrapartum-hemorrhage/

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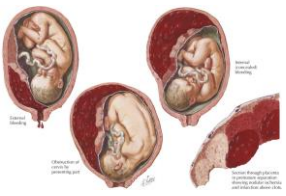
Risk Factors for Abruption



- Prior abruption
- Increasing parity and maternal age
- Maternal substance use
  - Cigarette smoking
  - Cocaine and methamphetamine abuse
- Trauma
- Maternal diseases
  - Hypertension
  - Hypothyroidism
  - Asthma
- Preterm premature rupture of membranes
- Rapid uterine decompression associated with multiple gestation and polyhydramnios
- Uterine, placental, and fetal factors
  - Uterine anomalies
  - Synechiae
  - Fibroids
  - Cesarean scar
  - Abnormal placental formation
  - Chronic ischemia
  - Fetal congenital malformation

Image from: Figure 235.1 Netter's Obstetrics and Gynecology. Smith, Roger P., MD. Published December 31, 2017. Pages 488-489. © 2018.

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Diagnosis of Placental Abruption

- The diagnosis of placental abruption is made based on clinical findings.
  - Differential Diagnosis
    - Uterine rupture
    - Placenta or vasa previa
    - Bloody show
    - Chorioamnionitis
    - Other sources of abdominal pain
    - Preterm labor
  - Workup and Evaluation
    - Laboratory
    - Imaging
    - Special Tests
    - Diagnostic Procedures
    - Pathologic Findings

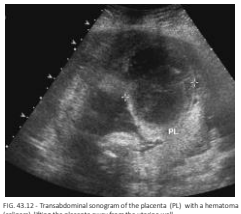

FIG. 43.12 - Transabdominal sonogram of the placenta (PL) with a hematoma (calipers) lifting the placenta away from the uterine wall.

Sonographic Evaluation of the Placenta - Diagnostic Ultrasound. Shipp, Thomas D.. Published January 1, 2018. Pages 1465-1494. © 2018.

Smith, RP MD. Netter's Obstetrics and Gynecology 3rd Edition © 2018 by Elsevier, Inc.
Hull, AD, et al. Creasy and Resnik's Maternal-Fetal Medicine: Principles and Practice. 8th Edition © 2019 by Elsevier, Inc.

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Complications and Management

Risk of Complications:

- Maternal complications are related to the severity of the abruption
- Fetal complications are related to both the severity and timing of the hemorrhage.

Patient Management:

- Depends on its severity as well as gestational age and maternal-fetal status.
- Anticipate the possible life-threatening consequences for both mother and fetus.
- Baseline laboratory assessment (hemoglobin, hematocrit, platelet count, type and screen, fibrinogen, coagulation studies, complete metabolic profile, and urine toxicology screen),
- Appropriate intravenous access, maternal hemodynamic monitoring, IV fluid resuscitation, blood-loss quantification, availability of blood products, continuous FHR and contraction monitoring, and communication with anesthesia, operating room, and neonatal personnel.

Gabbe's Obstetrics: Normal and Problem Pregnancies. Francois, Karrie E.; Foley, Michael R.. Published December 31, 2020. Pages 343-374. © 2021. Fig. 18.4

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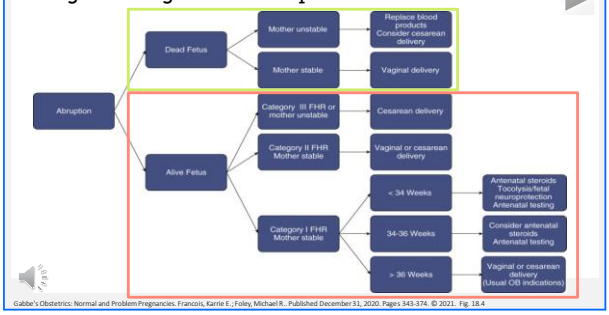
Management Algorithm - Abruption



Gabbe's Obstetrics: Normal and Problem Pregnancies. Francois, Karrie E.; Foley, Michael R.. Published December 31, 2020. Pages 343-374. © 2021. Fig. 18.4

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Additional Maternal Considerations

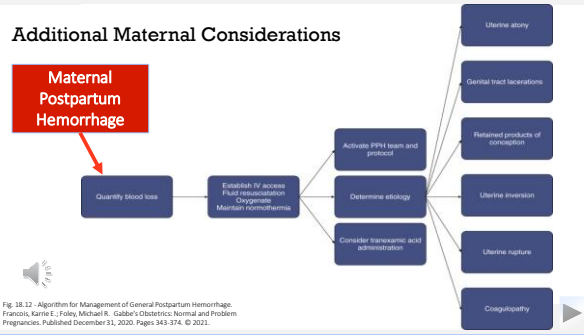
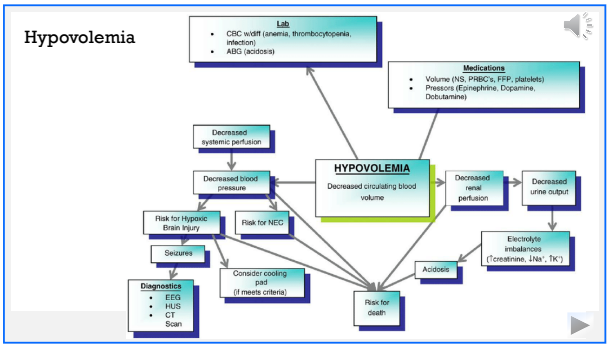


Fig. 18.12 - Algorithm for Management of General Postpartum Hemorrhage. Francois, Karrie E.; Foley, Michael R.. Gabbe's Obstetrics: Normal and Problem Pregnancies. Published December 31, 2020. Pages 343-374. © 2021.

92

Hypovolemia



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Shock:

For the cells to survive and function, they need oxygen. When tissue perfusion and oxygen delivery to vital organs becomes inadequate, a state of shock develops.

Compensated Shock

A series of responses are activated to maintain blood pressure and preserve blood flow to vital organs (brain, heart, and adrenal glands)

Signs and symptoms of compensated shock are increased heart rate from base line, decreased urine output, and no change with blood pressure

If not quickly recognized and reversed , the phase of uncompensated shock will begin

Uncompensated Shock

Oxygen debt worsens, metabolism converts from aerobic to anaerobic, and metabolic acidemia develops. Cardiac output falls as the heart muscle weakens. The body will try and compensate but when hypotension develops the phase of uncompensated shock has begun.

Signs and symptoms of uncompensated shock are increased heart rate from base line, decreased urine output, and decreased blood pressure.

REMEMBER: Hypotension is a late sign of cardiac decompensation. It is very important to recognize that waiting for hypotension to develop may be detrimental to the infant's well being. Failure to promptly recognize and treat shock may lead to cellular dysfunction, multiple organ failure, and even death. TREATMENT must be PROMPT and AGGRESSIVE!

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Signs and Symptoms of Shock

- **Respiratory**
  - Tachypnea
  - Increased work of breathing
  - Apnea
  - Gasping
- **Color**
  - Cyanosis
  - Pale, white skin color
- **Heart Rate**
  - Normal heart rate is between 120-160 beats per minute
  - Bradycardia with evidence of poor perfusion
  - Tachycardia
- **Blood pressure**
  - May be normal or low
- **Pulses**
  - Weak peripheral pulses
- **Peripheral perfusion**
  - Poor perfusion
  - Prolonged capillary refill time
    - Greater than 3 seconds in a sick infant is generally considered abnormal
  - Cool skin
  - Mottle skin
- **Heart**
  - Enlarged heart size on x-ray (myocardial dysfunction/CHF)
  - Smaller than normal or compressed (poor filling or pre-load)
  - Evaluate for murmur
- **Urine output**
  - Less than 1ml/kg/hour or declining urine output

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Three Types of Shock

- Hypovolemic Shock
- Cardiogenic Shock
- Septic Shock

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Hypovolemic Shock

- Hypovolemic shock results from a low circulating blood volume
- Causes of Hypovolemic Shock
  - Acute blood loss during the intrapartum period
    - Placental hemorrhage
    - Umbilical cord injury
    - Organ laceration (liver or spleen)
    - Fetal-to-maternal hemorrhage
    - Twin-to-twin transfusion syndrome (acute or chronic hemorrhage)

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Laboratory Evaluation for Shock

Blood Gas

- Metabolic acidosis is present if the PH and Bicarbonate are low. Infant may also have a mixed respiratory and metabolic acidosis if the infant is experiencing respiratory insufficiency
  - pH less than 7.30 is abnormal
  - pH less than 7.25 is concerning epically if infant has poor perfusion, tachycardia and or low blood pressure
  - pH less than 7.20 is significantly abnormal
  - pH less than 7.10 infant is in severe crisis

Other Labs

- **Blood Lactate**
  - Increased lactate level signifies anaerobic metabolism is occurring in the tissues
- **CBCD and Blood Culture**
  - Infant will need to be evaluated for sepsis, anemia, polycythemia and low platelet count
- **Coagulation Studies**
  - **PT:** Prothrombin Time is used to assess extrinsic and common portions of the coagulation cascade
    - Normal value for newborn: 11-14
  - **PTT:** Partial Thromboplastin Time is used to assess intrinsic and common portions of the coagulation cascade
    - Normal value for newborn: 23-35
  - **Fibrinogen** is used to assess the circulating level of this protein substrate, required for clot formation
    - Normal value for newborn: 200-500 mg/dl

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Laboratory Evaluation for Shock

- Glucose
  - Infant may be hyperglycemic in response to stress because of catecholamine release
  - In the presence of shock, glucose utilization may be markedly increased which raises the risk for hypoglycemia
    - Evaluate the blood sugar levels frequently until you have a pattern of stability
- Electrolytes
  - Monitoring for hyponatremia and hypernatremia
  - Monitoring for hypokalemia and hyperkalemia
  - Ionized calcium
    - Calcium is needed for myocardial contractility
    - If the calcium level is low, other inotropes will be significantly less effective
- Renal function test
  - BUN
  - Creatinine
  - Monitor urine output for oliguria or anuria

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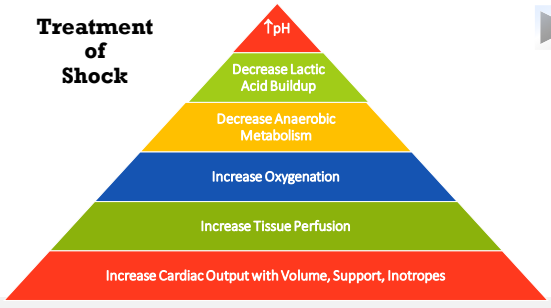
Treatment of Shock



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Treatment of Hypovolemic Shock

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There is NO acute blood loss

- Normal Saline 0.9%
- Indications: Volume infusion, to improve preload
- Dose: 10ml/kg/dose
- Route: IV, UVC
- Time interval: Give over 15 to 30 minutes (STABLE) or 5 to 10 minutes (NRP)

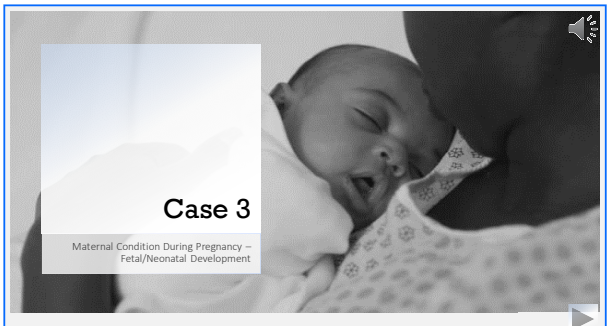
There is acute blood loss

- Give normal saline to begin volume resuscitation while waiting on Packed Red Blood Cells (PRBC's)
- PRBC's dose: 10ml/kg/dose
- Route: IV, UVC
- Time interval: Give over 30 minutes to 2 hours

Example: Calculating Volume Bolus

Desired Dose: 10ml/kg/dose Weight: 2950 grams
Final Dose: 10 (ml) x 2.9 = 29ml (you could round up and give 30ml)

101



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Case 3: Maternal Background

Maternal History:

- 18 year old G1P0000, 36 1/7 weeks
- Presents to Labor and Delivery from OB office for complaints of Headache and B/P: 165/105

- Patient placed on the Monitor
- VS on Admission: BP - 165/95 HR - 90 RR – 14 T – 97.9°F
- SVE: deferred
- No complaint of contractions, leakage of fluid
- Ultrasound shows fetal growth restriction

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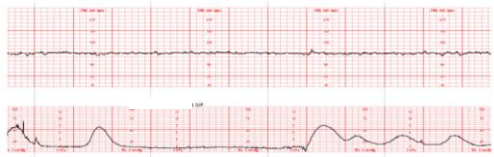
Case 3: Fetal Strip A

- VS on Admission: BP - 165/95 HR - 90 RR – 14 T – 97.9°F
- Patient reports usual fetal movement today.
- Reports headache is 8/10 for pain. She reports headache since yesterday.



QUESTION: The fetal monitor tracing currently shows minimal variability on admission, therefore:

A. The fetus is adequately oxygenated. The patient should be given antihypertensive and pain medication and allowed to sleep

B. The nurse is concerned about the oxygenation of the fetus and should work to determine the cause of the decreased variability in addition to treatment of the elevated blood pressure and complaint of pain.

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A. The fetus is adequately oxygenated. The patient should be given antihypertensive and pain medication and allowed to sleep

INCORRECT

- Recall that a fetus is considered to be adequately oxygenated when there is are 1) baseline FHR 110-160, 2) Moderate variability, 3) no variable or late decelerations.
- When minimal variability on admission a care provider should consider or rule out one of three options for the cause.
  1) Fetus is in a sleep cycle
  2) Fetus is sedated (ex: medications)
  3) Fetus is "sick", developing acidosis and therefore concerned that the fetus is not oxygenated.
- Hypertensive diagnoses could lead to decreased perfusion to the uterus and placenta therefore leading to decreased oxygenation for the fetus.
- It is important to appropriately manage elevated blood pressures and manage pain for the patient as well.

105

B. The nurse is concerned about oxygenation and should work to determine the cause of the decreased variability in addition to treatment of the elevated blood pressure and complaint of pain.

CORRECT

- Recall that a fetus is considered to be adequately oxygenated when there is are 1) Baseline FHR 110-160, 2) Moderate variability, 3) no variable or late decelerations.
- When minimal variability on admission a care provider should consider or rule out one of three options for the cause.
  1) Fetus is in a sleep cycle
  2) Fetus is sedated (ex: medications)
  3) Fetus is "sick", developing acidosis and therefore concerned that the fetus is not oxygenated.
- Hypertensive diagnoses could lead to decreased perfusion to the uterus and placenta therefore leading to decreased oxygenation for the fetus.
- It is important to appropriately manage elevated blood pressures and manage pain for the patient as well.

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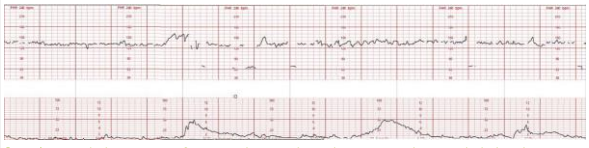
Case 3: Fetal Strip B

- 200 mg Labetalol IV was given to the patient for the admission blood pressure of 165/95.
- The patient was positioned on her left side, given 1000 mg Tylenol and comfort measures were provided.
- After 20 minutes, the fetal heart rate tracing showed moderate variability with accelerations as seen below.



Question: With the current information known about the patient, what is included in the differential diagnosis for this patient?

A. Gestational Hypertension, Chronic Hypertension, Preeclampsia, Preeclampsia with Severe Features or Chronic Hypertension with Superimposed Preeclampsia

B. Preterm Labor, Gestational Diabetes, Hyperthyroidism, Acute Fatty Liver of Pregnancy, Antiphospholipid Syndrome

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A. Gestational Hypertension, Chronic Hypertension, Preeclampsia, Preeclampsia with Severe Features or Chronic Hypertension with Superimposed Preeclampsia

CORRECT

- The patient has presented with a history of elevated blood pressure and headache. The hypertensive disorders are the most likely differentials to be assessed.
- With the admission information given, the other option for differential diagnoses are not the best choice.

108

B. Preterm Labor, Gestational Diabetes, Hyperthyroidism, Acute Fatty Liver of Pregnancy, Antiphospholipid Syndrome

INCORRECT

- With the admission information given, this answer is not the best choice.
- The patient has presented with a history of elevated blood pressure and headache. The hypertensive disorders are the most likely differentials to be assessed.

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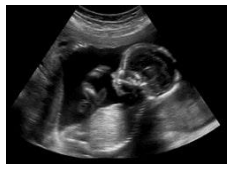
Maternal Update Hospital Day 2:

GA = 36 1/7



- The patient required PO and IV antihypertensives. Her Blood pressures ranged from 150–165/90 – 110.
- With Laboratory results, recurrent blood pressures and complaint of continued headache she was diagnosed with preeclampsia with severe features.
- Ultrasound confirmed fetal growth restriction.

QUESTION:
The plan of care for the patient should include

A. Delivery is recommended with maternal and fetal stabilization.

B. Expectant management is recommended with appropriate monitoring of maternal and neonatal risk.

110

A. Delivery is recommended with maternal and fetal stabilization.

CORRECT:

The gestational age of 36 1/7 weeks, diagnosis of preeclampsia with severe features and indications of intrauterine growth restriction lead to a recommendation of delivery.

Recommendations from ACOG Practice Bulletin # 222 "Gestation Hypertension and Preeclampsia" Interim Update June 2020:

- "In women with gestational hypertension or preeclampsia without severe features at or beyond 37 0/7 weeks of gestation, delivery rather than expectant management upon diagnosis is recommended."
- ***"Delivery is recommended when gestational hypertension or preeclampsia with severe features is diagnosed at or beyond 34 0/7 weeks of gestation, after maternal stabilization or with labor or prelabor rupture of membranes. Delivery should not be delayed for the administration of steroids in the late preterm period."***
- "The expectant management of preeclampsia with severe features before 34 0/7 weeks of gestation is based on strict selection criteria of those appropriate candidates and is best accomplished in a setting with resources appropriate for maternal and neonatal care. Because expectant management is intended to provide neonatal benefit at the expense of maternal risk, expectant management is not advised when neonatal survival is not anticipated. During expectant management, delivery is recommended at any time in the case of deterioration of maternal or fetal condition."
- "The mode of delivery in women with gestational hypertension or preeclampsia (with or without severe features) should be determined by routine obstetric considerations."

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B. Expectant management is recommended with appropriate monitoring of maternal and neonatal risk.

INCORRECT:

The gestational age of 36 1/7 weeks, diagnosis of preeclampsia with severe features and indications of intrauterine growth restriction lead to a recommendation of delivery.

Recommendations from ACOG Practice Bulletin # 222 "Gestation Hypertension and Preeclampsia" Interim Update June 2020:

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- "The mode of delivery in women with gestational hypertension or preeclampsia (with or without severe features) should be determined by routine obstetric considerations."

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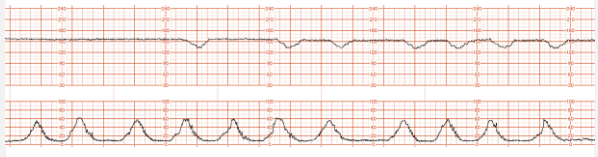
Case 3: Fetal Strip C

Case Update: The patient requested to attempt a vaginal delivery as she is a Gravida 1. Her Vaginal exam was closed, thick and high. Induction of labor was begun with cervical ripening. She is currently on 10 mU of Pitocin.



QUESTION: After assessing the fetal tracing, what is the most appropriate nursing intervention?

A. The current tracing shows a Category 2 with Baseline 150 bpm, Minimal variability and early decelerations. The nurse should continue to support labor progress with the peanut ball

B. The current tracing shows a Category 2 with Baseline 150 bpm, Minimal variability and recurrent late decelerations and uterine tachysystole. The nurse should turn off the Pitocin, position mom in a lateral position and start an IV fluid bolus of 500 ml of LR.

113

A. The current tracing shows a Category 2 with Baseline 150 bpm, minimal variability and early decelerations. The nurse should continue to support labor progress with the peanut ball.

INCORRECT:

The correct interpretation of the strip is: "The current tracing shows a Category 2 with Baseline 150 bpm, Minimal variability and recurrent late decelerations and uterine tachysystole. The nurse should turn off the Pitocin, position mom in a lateral position and start an IV fluid bolus of 500 ml of LR."

Understanding the pathophysiology of both the effect of Preeclampsia on the placenta and uterine blood flow and the knowledge of recognized intrauterine growth restriction should warrant a close observation of the fetal heart rate. This fetus potentially has less reserve capacity during the intrapartum period.

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B. The current tracing shows a Category 2 with Baseline 150 bpm, minimal variability and recurrent late decelerations and uterine tachysystole. The nurse should turn off the Pitocin, position mom in a lateral position and start an IV fluid bolus of 500 ml of LR.

CORRECT:

This is the correct interpretation of the strip and correct nursing interventions.

Having a good understanding the pathophysiology of both the effect of Preeclampsia on the placenta and uterine blood flow and the knowledge of recognized intrauterine growth restriction should warrant a close observation of the fetal heart rate. This fetus potentially has less reserve capacity during the intrapartum period.

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NEONATAL CARE

Delivery Summary

- C/S for Non-Reassuring Fetal Heart Rate with worsening hypertensive symptoms and diagnosis of Preeclampsia with severe features.
- 36 1/7 Female infant
- APGARS: 5/ 8
- pH: 7.32 base: -6
- Weight: 1600 grams
- Infant with good strong cry, dried and stimulated. Infant pink with good tone. Pulse oximeter placed.
  - HR: 150 bpm
  - Resp Rate: 60
  - 2 minute saturation: 80%
  - Assessment of infant per picture

Targeted Pre-ductal SpO_2 After Birth	
1 min	60%-65%
2 min	65%-70%
3 min	70%-75%
4 min	75%-80%
5 min	80%-85%
10 min	85%-95%

Physical Assessment: Infant appears to have relatively large head compared with rest of body. Loose skin with excessive skin folds. Visible rib cage. Relatively large feet when compared to rest of body. Poor breast bud formation and immature female genitalia.

QUESTION: Secondary to maternal history and infant's exam, you are concerned this infant is IUGR. Do you think this infant would be considered Symmetric or Asymmetric IUGR?

A. I am concerned this infant has Symmetric IUGR

B. I am concerned this infant has Asymmetric IUGR

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A. I am concerned this infant has Symmetric IUGR

INCORRECT!

- The correct answer is Asymmetric IUGR:
- Maternal factors such as pre-eclampsia and hypertension can put an infant at risk for asymmetrical IUGR. You would expect the infant's exam to show an infant with what appears to be a relatively large head compared with rest of body. Loose skin with excessive skin folds. Visible rib cage. Relatively large feet when compared to rest of body. Poor breast bud formation and immature female genitalia.

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B. I am concerned this infant has Asymmetric IUGR

Correct!

- The answer is Asymmetric IUGR
- Maternal factors such as pre-eclampsia and hypertension can put an infant at risk for asymmetrical IUGR. You would expect the infant's exam to show an infant with what appears to be a relatively large head compared with rest of body. Loose skin with excessive skin folds. Visible rib cage. Relatively large feet when compared to rest of body. Poor breast bud formation and immature female genitalia.

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Case 3 Debrief

Let's discuss some of the issues that were highlighted in this case.

- Maternal Issue
- Neonatal Issues

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Hypertensive Disorders in Pregnancy

- Preeclampsia (with and without severe features)
  - A disorder of pregnancy associated with new-onset hypertension, which occurs most often after 20 weeks of gestation and frequently near term. Although often accompanied by new-onset proteinuria, hypertension and other signs or symptoms of preeclampsia may present in some women in the absence of proteinuria
- Gestational hypertension
  - Hypertension without proteinuria or severe features develops after 20 weeks of gestation and blood pressure levels return to normal in the postpartum period
- HELLP (hemolysis, elevated liver enzymes, and low platelet count)
  - One of the more severe forms of preeclampsia because it has been associated with increased rates of maternal morbidity and mortality
- Eclampsia
  - Convulsive manifestation of the hypertensive disorders of pregnancy and is among the more severe manifestations of the disease. Eclampsia is defined by new-onset tonic-clonic, focal, or multifocal seizures in the absence of other causative conditions such as epilepsy, cerebral arterial ischemia and infarction, intracranial hemorrhage, or drug use.

ACOG Practice Bulletin # 222 "Gestation Hypertension and Preeclampsia" Interim Update June 2020:

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Diagnostic Criteria for Preeclampsia

Blood Pressure

- Systolic blood pressure of 140 mmHg or more or diastolic blood pressure of 90 mmHg or more on two occasions at least 4 hours apart after 20 weeks of gestation in a woman with a previously normal blood pressure
- Systolic blood pressure of 160 mmHg or more or diastolic blood pressure of 110 mmHg or more.

+ AND

Proteinuria

- 300 mg or more per 24 hour urine collection

  OR
- Protein/creatinine ratio of 0.3 mg/dL or more

  OR
- Dipstick reading of 2+ (used only if other quantitative methods not available)

OR

In the absence of proteinuria, new-onset hypertension with the new onset of any of the following:

- Thrombocytopenia: Platelet count less than 100,000 × 109/L
- Renal insufficiency: Serum creatinine concentrations greater than 1.1 mg/dL or a doubling of the serum creatinine concentration in the absence of other renal disease
- Impaired liver function: Elevated blood concentrations of liver transaminases to twice normal concentration
- Pulmonary edema
- New-onset headache unresponsive to medication and not accounted for by alternative diagnoses or visual symptoms

ACOG Practice Bulletin # 222 "Gestation Hypertension and Preeclampsia" Interim Update June 2020:

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Preeclampsia with Severe Features

- Systolic blood pressure of 160 mm Hg or more, or diastolic blood pressure of 110 mm Hg or more on two occasions at least 4 hours apart (unless antihypertensive therapy is initiated before this time)
- Thrombocytopenia (platelet count less than 100×10^9/L
- Impaired liver function that is not accounted for by alternative diagnoses and as indicated by abnormally elevated blood concentrations of liver enzymes (to more than twice the upper limit normal concentrations), or by severe persistent right upper quadrant or epigastric pain unresponsive to medications
- Renal insufficiency (serum creatinine concentration more than 1.1 mg/dL or a doubling of the serum creatinine concentration in the absence of other renal disease)
- Pulmonary edema
- New-onset headache unresponsive to medication and not accounted for by alternative diagnoses
- Visual disturbances

ACOG Practice Bulletin # 222 "Gestation Hypertension and Preeclampsia" Interim Update June 2020:

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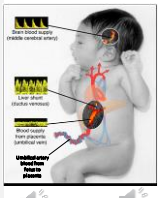
Doppler Velocimetry



- Doppler Velocimetry:
  - Shows the direction and characteristics of blood flow
  - Can be used to examine the maternal, uteroplacental, or fetal circulations.
- Three Common Doppler Flow Studies used in determining IUGR
  - Umbilical Artery
  - Middle Cerebral Artery
  - Ductus Venosus

- https://www.sciencedirect.com/topics/neuroscience/doppler-velocimetry
- https://www.ajog.org/article/S0002-9378(12)00201-1/fulltext American Journal of Obstetrics & Gynecology APRIL 2012 Doppler assessment of the fetus with intrauterine growth restriction Society for Maternal-Fetal Medicine Publications Committee, with the assistance of Eliza Berkley, MD; Sunesh P. Chauhan, MD; and Alfred Abuhamad, MD
- Image: Godfrey KM, Haugen G, Kiserud T, Inskip HM, Cooper C, et al. (2012) Fetal Liver Blood Flow Distribution: Role in Human Developmental Strategy to Prioritize Fat Deposition versus Brain Development. PLOS ONE 7(8): e41754. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0041754

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Hypertension in Pregnancy Management ACOG Recommendations:

- Pregnant women or women in the postpartum period with acute-onset, severe systolic hypertension; severe diastolic hypertension; or both require urgent antihypertensive therapy.
- Close maternal and fetal monitoring by a physician and nursing staff are advised during the treatment of acute-onset, severe hypertension.
- After initial stabilization, the team should monitor blood pressure closely and institute maintenance therapy as needed.
- Intravenous (IV) labetalol and hydralazine have long been considered first-line medications for the management of acute-onset, severe hypertension in pregnant women and women in the postpartum period.

ACOG Committee Opinion #767, "Emergency Therapy for Acute-Onset, Severe Hypertension During Pregnancy and the Postpartum Period." Feb 2019

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ACOG Recommendations Continued

- Immediate release oral nifedipine also may be considered as a first-line therapy, particularly when IV access is not available.
- The use of IV labetalol, IV hydralazine, or immediate release oral nifedipine for the treatment of acute-onset, severe hypertension for pregnant or postpartum patients does not require cardiac monitoring.
- In the rare circumstance that IV bolus labetalol, hydralazine, or immediate release oral nifedipine fails to relieve acute-onset, severe hypertension and is given in successive appropriate doses, emergent consultation with an anesthesiologist, maternal–fetal medicine subspecialist, or critical care subspecialist to discuss second-line intervention is recommended.
- Magnesium sulfate is not recommended as an antihypertensive agent, but magnesium sulfate remains the drug of choice for seizure prophylaxis for women with acute-onset severe hypertension during pregnancy and the postpartum period. Starting magnesium should not be delayed in the setting of acute severe hypertension; it is recommended regardless of whether the patient has gestational hypertension with severe features, preeclampsia with severe features, or eclampsia.

ACOG Committee Opinion #767, "Emergency Therapy for Acute-Onset, Severe Hypertension During Pregnancy and the Postpartum Period." Feb 2019

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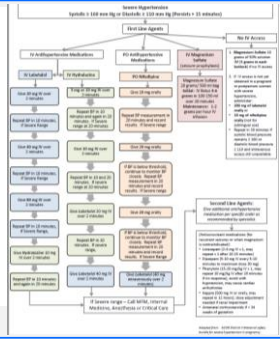
Hypertensive Medication Algorithm



*SC BOI – SimCOACH™ Training

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Terms for Fetal Growth

- Intrauterine Growth Restriction (IUGR)
- Fetal Growth Restriction (FGR)
- IUGR = FGR
- Small for Gestational Age (SGA)
- SGA and IUGR have been used synonymously in medical literature
  - *BUT*, there exist small differences between the two

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Fetal Growth Restriction

- IUGR/FGR:
  - Fetus who does not achieve the expected in utero growth potential due to genetic or environmental factors
    - Moderate FGR is defined as birthweight in the 3rd to 10th percentile
    - Severe FGR is birthweight less than the 3rd percentile
- SGA:
  - Infants with a BW below the 10th percentile for gestational age

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IUGR Classifications

- Symmetric IUGR
  - Reduction in all organ systems with the body, head, and length proportionally affected
  - IUGR begins early in gestation
    - Decreased nutrient supply early in development can restrict growth of all organs
  - Usually caused by intrinsic factors (Congenital infections or Chromosomal abnormalities)

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IUGR Classifications

- Asymmetric IUGR
  - Disproportionate growth restriction
  - Head circumference preserved, length is somewhat affected, and weight is compromised to the greatest degree
  - Normal sized head now appears large compared with rest of body
  - Typically begins in late 2nd or early 3rd trimester
- Results from fetal nutrients that limit glycogen and fat storage, yet allow continued brain growth

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What's Going On With the IUGR Fetus?

- How does the fetus respond to the compromised nutrient supply?
  - Reduces its overall size by:
    - preserving brain growth
    - Accelerating lung maturation
    - Increases red blood cell production
  - Fetus redirects blood flow from less vital organs to the brain, heart, adrenal glands, and placenta
  - Total body fat and bone mineral content are reduced
    - Results are wasted appearance
  - Nitrogen and protein content are lower because of reduced muscle mass
  - Glycogen is decreased in muscle and liver because of lower fetal plasma glucose and insulin concentrations

https://www.uptodate.com/contents/infants-with-fetal-intrauterine-growth-restriction

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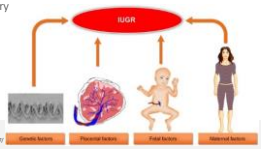
IUGR Causes

- Maternal
  - Age
  - Substance Abuse
  - Poor pregnancy weight gain
  - Medical disorders
    - Ex: Preeclampsia, Chronic hypertension
  - Maternal infection
- Placental
  - Placental dysfunction
  - Single umbilical artery
  - Multiple gestation
- Fetal
  - Genetic abnormalities (account for 5-10% IUGR)
    - Example: Trisomy 18
  - Infection (account for 5-10% of IUGR)
    - Ex: CMV and toxoplasmosis are most common
  - Congenital Anomalies (TE fistula, CHD)
  - Metabolic Disorders (Galactosemia, agenesis of pancreas)
- Genetic Factors



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Clinical Exam

Asymmetric Clinical Exam:

- Loose, dry, peeling skin
- Long fingernails
- Decreased muscle mass
- Decreased subcutaneous fat
- Absent buccal fat
- Small or scaphoid abdomen
- Thin umbilical cord
  - Often meconium stained
- Large head compared to rest of body (Asymmetric)
- Large/wide anterior fontanelle
  - poor formation of membranous bone
- Relatively large hands/feet compared to rest of body
- Anxious/hyper alert
- Poor breast bud formation & immature female genitalia

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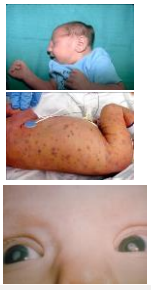
Clinical Exam

Symmetric IUGR:

- Dysmorphic features
- Congenital anomalies
- Features of congenital viral infections/ TORCH
  - Microcephaly
  - Petechiae
  - Blue-berry muffin (purple skin lesions due to dermal erythropoiesis)
  - Cardiac defects
  - Hepatosplenomegaly
  - Intracranial Calcifications
  - Chorioretinitis
  - Cataracts



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IUGR Complications

- Prematurity
  - Risk for preterm delivery
  - Early delivery because of risk to infant
- Hypoxia
  - Do not tolerate stress of labor
- Hypothermia
  - Diminished subcutaneous fat insulation
  - Unable to metabolism brown fat due to hypoxia
- Hypoglycemia
  - Chronically stressed fetus may use most, it not all, of the placentally transferred glucose for growth and survival. This limits the ability to make or store glycogen for use after birth

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Thank you!

We hope you enjoyed the module.

In order to receive Nursing CE Credit, you must complete the Post-Test and Evaluation

Click here for Post-Test & Course Evaluation or use this QR Code

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If you have any questions or concerns, please email: PerinatalSystems@PrismaHealth.org

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