Newborn Transition to Extra-Uterine Life
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OBJECTIVES:
- Understand fetal circulation and circulatory adjustments post delivery
- Describe pulmonary adaptation of the new born at birth
- Discuss other adaptations the newborn makes upon delivery
- Recognize maternal and newborn risk factors that may impact the newborn’s transitional period

Review PLACENTAL Function
- Exchanges O2 and CO2 by simple diffusion
- Eliminates waste products
- Does the work of the lungs in utero
- Uterine venous blood has
  - PCO2=38 mmHg
  - PO2=40-50 mmHg
  - pH=7.36
Review: Fetal Circulation

- One Umbilical Vein: oxygenated blood
- Two Umbilical Arteries: deoxygenated blood
- Three Fetal Shunts...
  - Ductus Venosus: hepatic system
  - Foramen Ovalis: between right & left atrium
  - Ductus Arteriosus: vein connects pulmonary artery to descending aorta

TRANSITION BEGINS BEFORE DELIVERY

- The infant prepares by...
  - Fetal breathing (producing surfactant at 34 weeks)
  - Storing glycogen in the liver
  - Producing catecholamines
  - Depositing brown fat
What Happens at CORD CLAMP??
- Placenta no longer works as lungs
- Lungs begin to exchange gases
- First breath inflates lungs and causes circulatory changes
- Lungs inflate - decreased pulmonary vascular resistance, increases blood flow through lungs & blood flow from pulmonary arteries
- This results in Newborn Circulation

Adaptation to extra-uterine life
- Profound physiologic adaptation
- Shift from maternal dependent oxygenation to continuous respiration
- Change from fetal circulation to mature circulation:
  - → increase in pulmonary blood flow
  - → loss of left-to-right shunting
- Commencement of independent glucose homeostasis
- Independent thermoregulation
- Oral feedings
- Physiologic adaptation is considered complete when vital signs, feeding and renal function are normal
Respiratory Adaptation: MECHANICAL STIMULI
- Compression of neonatal chest during delivery
- Expulsion of fetal lung fluid
- Air is drawn into fetal lungs as thorax recoils (negative pressure) and air fills the alveoli
- As baby cries intrathoracic positive pressure keeps alveoli open.

Respiratory Adaptation: Chemical stimuli
- Stress of delivery can lead to mild hypoxia, increased CO2 and acidosis
- Chemoreceptors tell medulla to trigger respirations
- Surfactant production increases lung compliance, elasticity
- Catecholamines increase due to the stress of labor:
  - Improves lung compliance in hours following delivery
  - Clears the lungs by decreasing lung fluid secretion and increases absorption through the lymphatics
  - Releases surfactant into the lungs

Thermal Stimuli
Sensory stimuli

- Tactile stimulation of the neonate through normal handling and drying after delivery...

Cardiovascular Adaptation

- Increase pressure in left heart w/ increased systemic resistance associated with the physiologic changes associated with lung inflation
- With neonatal respiration, oxygenated blood enters the pulmonary musculature leading to dilation of the pulmonary artery and decreases the pulmonary vascular resistance
  - Transition to newborn circulation, involves 3 fetal shunts:
    1. Ductus venosus
    2. Foramen ovale
    3. Ductus arteriosis

Ductus Venosus

- Absence of venous return leads to closure
- Functionally closes within 2-3 days
FORAMEN OVALE

- The foramen ovale is a normal cardiac structure found in all newborns and can be best described as a "door" between the right and left atria.
- Decreased PVR
- Decreased pressure in RA/RV
- Increased SVR
- Increased pressure in LA/LV
- Leads to closure within minutes
- Usually seals by 1st month of life

Ductus Arteriosus

- Fully functioning lungs
- More efficient oxygenation
- Increased PaO2 & prostaglandins help constrict ductus
- Usually closes within hours

CardioVascular adaptation after birth
Immediate care of newborn after delivery

- Ensure that there is a qualified person present that is trained & skilled in newborn resuscitation
- Ensure the availability of necessary equipment
- Stimulate while drying the infant
- Ensure thermoregulation
- Follow NRP guidelines
- Can take a newborn up to 12 hours to transition from intra to extra-uterine life

APGAR SCORE

- Provides rapid assessment of newborn's physiologic state & adjustment to extra-uterine life
- Standardized approach to determine who may need immediate intervention

1952 - Dr. Virginia Apgar

Evaluations are made at 1 and 5 minutes

- Based on (5) Signs
- If score is below 7, it is repeated every 5 minutes up to 20 minutes of life as needed.
Thermoregulation

- Balance between heat loss and heat production
- Heat regulation is critical to newborn transition
- Hypothermia from excessive heat loss is common because newborns have large surface area to body weight, limited body fat, limited ability to shiver.
- PROMOTE SKIN TO SKIN...

Newborns attempt to stay warm by:

- Increasing muscle activity
- Burning brown fat
- Peripheral vasoconstriction

Convection, Radiation, Evaporation, Conduction
COLD STRESS

- Excessive heat loss through evaporation, convection, conduction, and radiation
- O2 consumption increases, pulmonary and peripheral vasoconstriction occur, decreased O2 uptake by lungs to oxygenate tissue, glycolysis increases, decrease in PO2 and pH, leading to metabolic acidosis, hypoxia, and shock
- Signs and Symptoms
  - Cool extremities
  - Lethargy
  - Apnea/Tachypnea
  - Poor feeding
  - Grunting/Flaring/Retractions
  - Hypoglycemia

Tips to prevent cold stress

- Use radiant warmer
- Encourage mother to snuggle skin-skin with infant
- Keep newborn’s clothing and bedding dry
- Double-wrap newborn and use a cap on head
- Reduce the newborn’s exposure to drafts
- Warm objects that will be in contact with the newborn

Feeding

- Healthy term and near-term neonates should have frequent early feedings on demand.
  - Term: maximum of 4 hours between feeds
  - Pre-term: maximum of 3 hours between feeds
  - Late Preterm: maximum of 3-4 hours as per clinical condition
- Evaluate sucking, swallowing and breathing prior to feeding
- Contraindications to feeding
  - HIV, Maternal drug use, CMV+ mother
Glucose needs and feeding

- Delivery stress - conversion of fats and glycogen to glucose for energy
- At 1-2 hours of age glucose level falls
- Baseline glucose 30 mins-1 hr. of age
- Goal-Glucose level
  - > 50 ml/dl

Risk factors for hypoglycemia

- Asphyxia
- Cold Stress
- Increased work of breathing
- Sepsis
- Premature or SGA
- Infants of mother with diabetes or gestational diabetics
- LGA babies

Signs & Symptoms

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<th>TABLE 14.2</th>
<th>CLINICAL SIGNS</th>
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<td>Respiratory</td>
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<td>Weak suck</td>
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<td>Temperature instability</td>
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Neonatal Assessment considerations

- Maternal...Medications
  - Illness
- Labor and Delivery...
  - Fetal Distress
  - Delivery Complications
  - Type of Delivery
- Resuscitation Measures: NRP DRIVEN

Neonatal Assessment considerations

- Vital Signs
- Measurements
- Gestational Age Assessment
- Head to Toe Exam
- Glucose/Feeding

Respiratory Considerations

- Tachypnea
- Apnea ( > 20 sec)
- Abnormal Sounds: Grunting
- Stridor
- Wheezing
- Crackles/rales
- Retracting
- Retained Lung Fluid
- Pneumonia
- Infection
- Aspiration- Mec
- Insufficient surfactant
- Pneumothorax
- Cold Stress
Acidosis and hypoxia

If hypoxia or acidosis are present at birth and/or continue without correction, the vessels can remain constricted, limiting blood flow to the lungs.

Problems that may occur during transition:
- Birth Trauma
- Birth Asphyxia
- Pulmonary
- Cardiovascular
- Infection
- Congenital Anomalies

Medication considerations:
- 0.5% Erythromycin eye ointment give within 2 hrs. of birth
- Vitamin K (phytonadione) give within 2 hrs. of birth
- Hepatitis B vaccine & Hepatitis B immunoglobulin (HBIG) give within 12 hrs. if mom + or unknown
- Hepatitis B vaccine only at d/c if negative
References