Newborn Transition to Extra-Uterine Life

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OBJECTIVES:

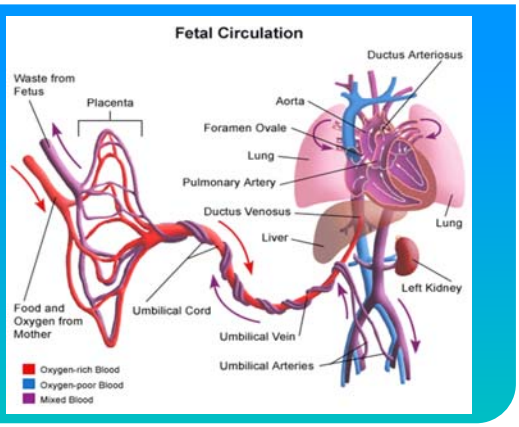
- ✓ Understand fetal circulation and circulatory adjustments post delivery
- ✓ Describe pulmonary adaptation of the new born at birth
- ✓ Discuss other adaptations the newborn makes upon delivery
- ✓ Recognize maternal and newborn risk factors that may impact the newborn's transitional period

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 Ovale- between right & left atrium
  - ✓ Ductus Arteriosus- vein connects pulmonary artery to descending aorta



TRANSITION BEGINS BEFORE DELIVERY

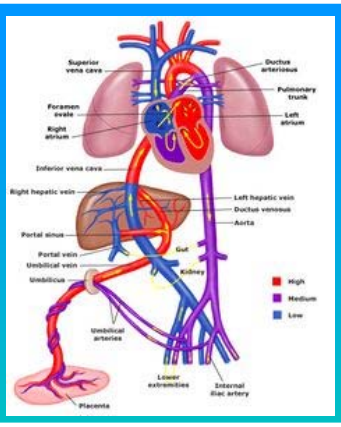
- The infant prepares by…
  - Fetal breathing (producing surfactant at 34 weeks)
  - Storing glycogen in the liver
  - Producing catecholamines
  - Depositing brown fat

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

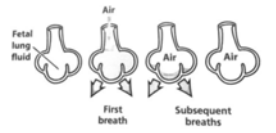
Adaptation to extra-uterine life

- ✓ 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

- ✓ Sudden cold compared to uterine environment
- ✓ Skin receptors send impulses to respiratory center

Sensory stimuli

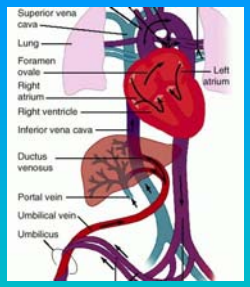
- ✓ Tactile stimulation of the neonate through normal handling and drying after delivery…

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

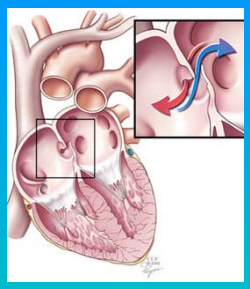
Ductus Venosus

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

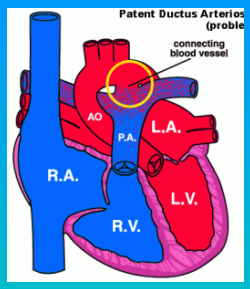


FORAMEN OVALE

- 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

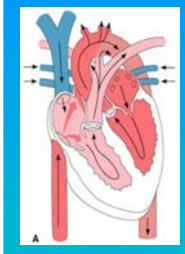


Ductus Arteriosus

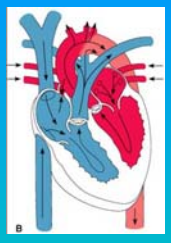


- Fully functioning lungs
- More efficient oxygenation
- Increased PaO2 & prostaglandins help constrict ductus
- Usually closes within hours

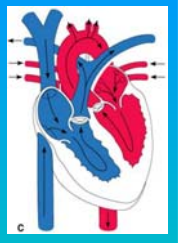
CardioVascular adaptation after birth



Fetal Circulation



Transitional Circulation



Neonatal Circulation

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

Apgar Scale (evaluate @ 1 and 5 minutes postpartum)

	Sign	2	1	0
A	Activity (muscle tone)	Active	Arms and legs flexed	Absent
P	Pulse	>100 bpm	<100 bpm	Absent
G	Grimace (reflex irritability)	Sneezes, coughs, pulls away	Grimaces	No response
A	Appearance (skin color)	Normal over entire body	Normal except extremities	Cyanotic or pale all over
R	Respirations	Good, crying	Slow, irregular	Absent

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

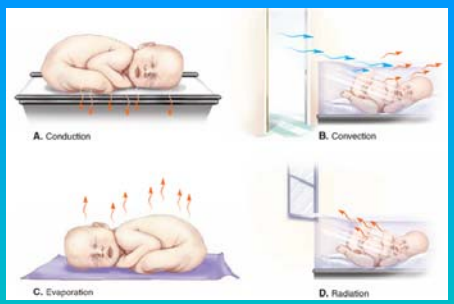
Thermoregulation

- 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
- O_2 consumption increases, pulmonary and peripheral vasoconstriction occur, decreased O_2 uptake by lungs to oxygenate tissue, glycolysis increases, decrease in PO_2 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

TABLE 14.2 CLINICAL SIGNS

Respiratory	Tachypnea Apnea Respiratory distress
Cardiovascular	Tachycardia Bradycardia
Neurologic	Jitteriness Lethargy Weak suck Temperature instability

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 with out 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

- ✓ American Academy of Pediatrics & American Congress of Obstetricians and Gynecologists. (2012). Guidelines for Perinatal Care (7th Ed).
- ✓ American Heart Association & American Academy of Pediatrics (2012). Neonatal Resuscitation Textbook, (6th Ed).
- ✓ Mattson & Smith (2011) Core Curriculum for Maternal-Newborn Nursing.