saving children's lives

ETAT+

Emergency Triage Assessment and Treatment plus admission

Newborn Transition to postnatal life

REPUBLIC OF KENYA

MINISTRY OF HEALTH

NEST360°

University of Nairobi

KENYA PAEDIATRIC ASSOCIATION

KEMRI | Wellcome Trust

Keprecon

Kenya Paediatric Research Consortium

Objectives

Outline transition from intrauterine life to extrauterine life with a focus on;

- Phases of transition
- Important aspects of lung development and adaption
- Neonatal thermoregulation
- Hemoglobin changes
- Physiological Jaundice
- Newborn glucose and feeding needs

Newborn Transition

- How long should it take a newly born to transition from intrauterine life to extra-uterine life?

  a) 1 - 2 hours

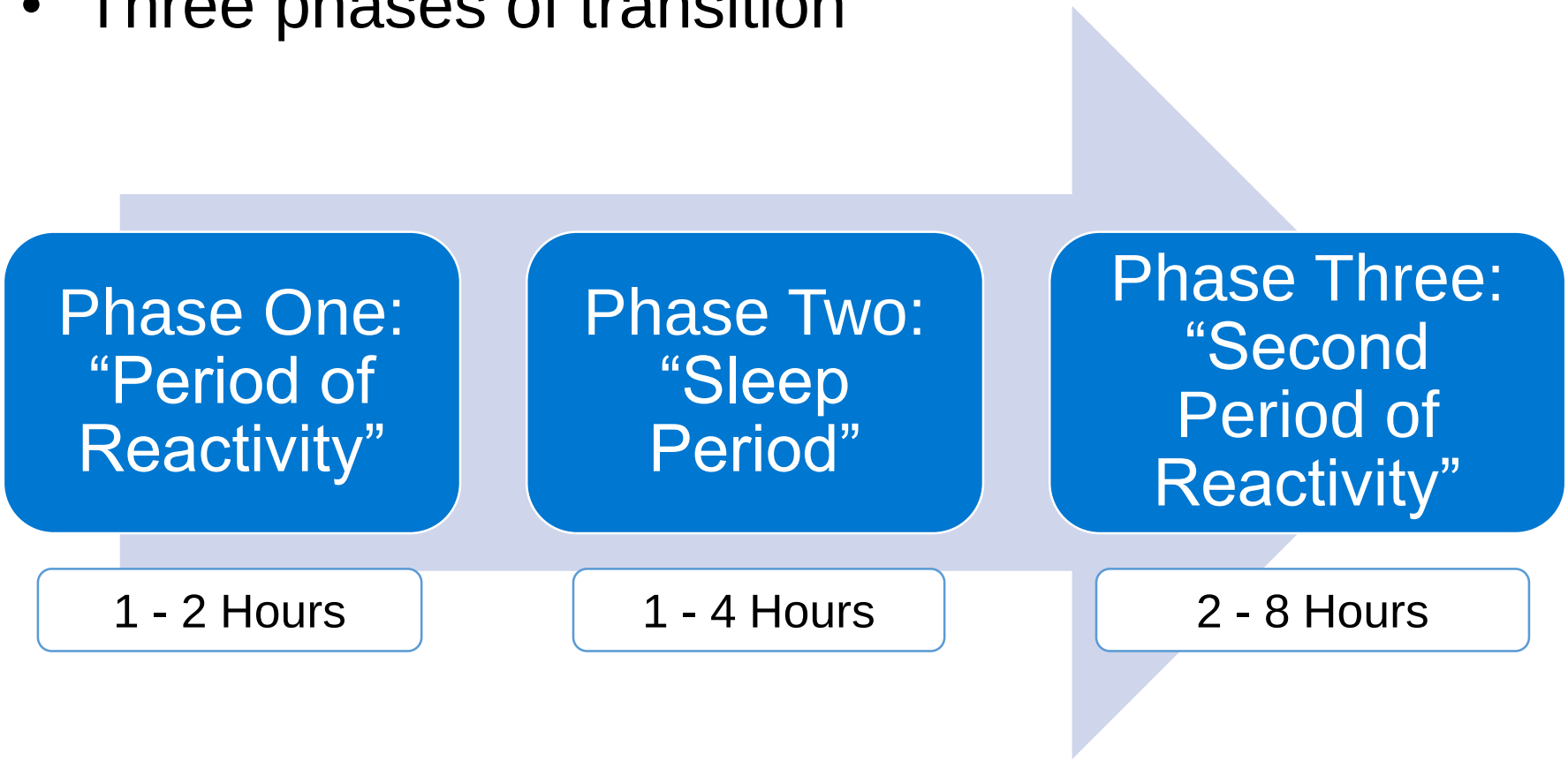
  b) 2 - 3 hours

  c) 3 - 6 hours

  d) 6 - 12 hours

Newborn Transition

- Transition period can last 3 - 6 hours
- Three phases of transition



Newborn Transition

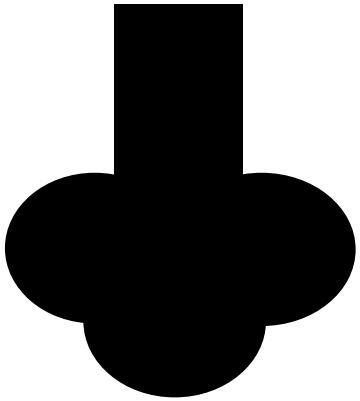
Lung Transition

Fluid filled alveoli in utero. Lungs hyperextended, critical for stimulating lung development

Placental gas exchange.

Labor - stimulates surfactant production - Birth

Air filled alveoli in after birth



Pulmonary respiration.

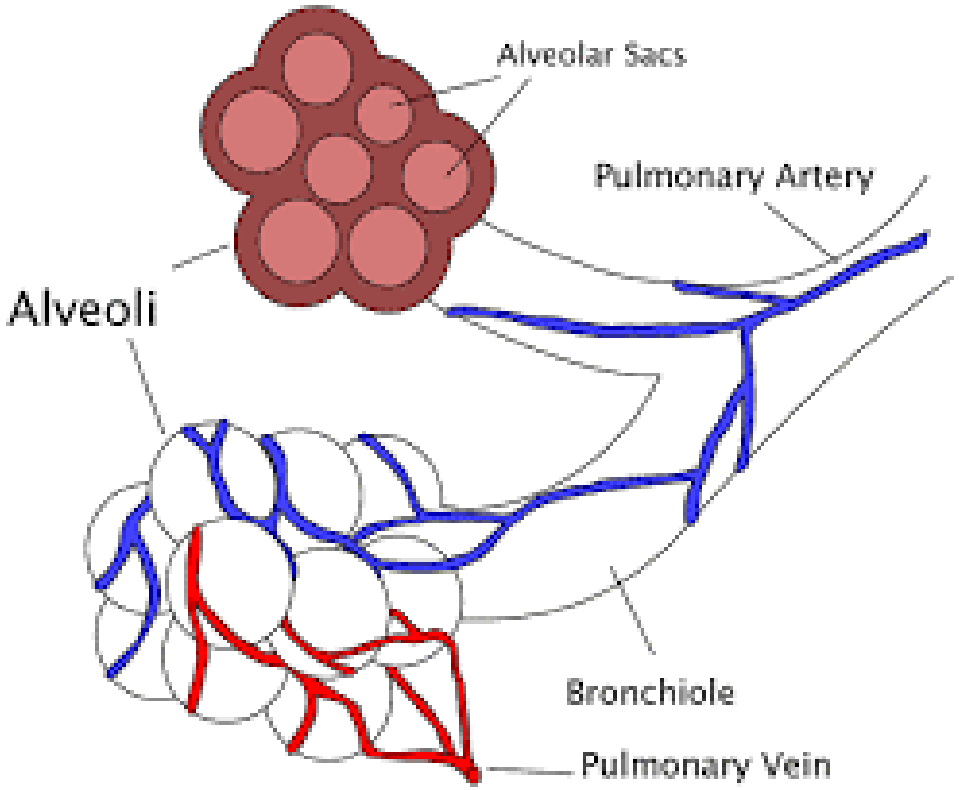
Immediately after birth the respiratory epithelium role changes from fluid secretion to fluid absorption linked to trans-pulmonary pressures generated during inspiration

Clearance of Fluid in the Fetal Lungs

- Clearance of fluid in the fetus lungs begins before birth, enhanced by labor & completed by 2hrs of age.
- During labor and immediately after birth - the respiratory epithelium changes

- Preterm babies have delayed clearance of foetal lung fluid
- Infants with TTN have delayed clearance of foetal lung fluid

Lung Adaptation



Requires the coordinated activities

- **Clearance of fetal lung fluid**
- **Surfactant secretion**
- **Onset of consistent breathing**

Lung Adaptation

- Fetal breathing starts at 10 weeks gestation
    - Fetal breathing movements help with lung development & prevents lung hypoplasia
- Lung development
    - 2nd trimester – Gas exchanging portions of the airway are formed
    - 24 weeks – Alveolar ductal development
    - 36 weeks – Septation of the air sacs

Surfactant Production

- Production begins at 24 weeks - mature levels at 34 week
- Surfactant secretion into the fetal lungs further stimulated by labour and by the stretch of the alveolar by initiation of ventilation
- Surfactant lowers surface tension in the lungs, allowing for inflation at lower pressures increasing the functional residual capacity (FRC)

First Postnatal Breathe

- First postnatal breath/initiation of ventilation of results in increased oxygen exposure
- This leads to a decrease in pulmonary resistance with increase pulmonary blood flow and well oxygenated blood to the left side of the heart.
- As ventilation is initiated – the inspiratory volume is higher than the expiratory volume resulting in a functional residue capacity (FRC)

First Postnatal Breathe

- Preterm infants with lower amounts of surfactant have a lower baseline FRC
- Continuous positive airway pressure (CPAP) can help preterm infants adapt by triggering production and secretion of surfactant.

Thermoregulation

- Normal range 36.5^{0}C- 37.5^{0}C
- In utero - Thermostability
- At birth, infants emerge covered in liquid, resulting in potential heat loss via evaporation.
- Heat can also be lost by; Convection/Conduction/Radiation
- Neonates are at high risk of hypothermia because of;
  1. Higher body surface area compared to children
  2. Limited capacity to generate heat via shivering
  3. Decreased subcutaneous fat for insulation

Thermoregulation

- Newborns can generate heat and prevent heat loss by;
  - Brown adipose tissue lipolysis triggered by norepinephrine. This brown adipose tissue however, develops at 34 weeks gestation
  - Peripheral vasoconstriction
  - Surge of thyroid hormone
- Neonatal thermoregulation – requires increased oxygen consumption and use of glucose

Thermoregulation

- Evidence suggest an increased risk of mortality by at least 28% for each 1° below 36.5^{0}C body temperature at admission and dose-dependent effect size.
- Preterm babies have a large surface area–to–volume ratio and increased evaporative fluid losses from the skin.
- Strategies introduced to minimize heat loss include use of;
  a) Occlusive wrapping
  b) Exothermic warming mattresses
  c) Warmed humidified resuscitation gases
  d) Caps/Hats
  e) Increased delivery room temperature

Thermoregulation

- Hyperthermia (temperature greater than 37.5°C) also increases the risk for neonatal mortality and morbidity in both term and preterm infants.

Fetal Hb Vs Adult Hb

Intrauterine environment

- Relatively hypoxic
- Fetal Hb has enhance oxygen binding capacity
- High Hb (19 - 21g/dl)

Extrauterine environment

- High oxygen concertation
- Lower Hb
- Increase in adult Hb

Preterms have;

- Less Iron stores because transfer from maternal store takes place in late 3rd trimester
- An immature hemopoietic system
- Lower erythropoietin levels

Physiological Jaundice

Neonates have high RBC mass and shortened life span

Unconjugated bilirubin bound to albumin is transported to the liver. **Binding is low in ill neonates**

Low activity of the conjugating enzyme in neonates

Increased Breakdown of RBC and haemoglobin

Unconjugated bilirubin

Lipid soluble; Can cross the blood brain barrier

Conjugated bilirubin

Water soluble; Eliminated via urine & faeces

Unconjugated bilirubin - predominant form, usually less than 255mmo/l
Bilirubin level 290 - 305mmol/l may be accepted as normal in term health newborn

Glucose Needs & Feeding

- Delivery stress causes conversion of fats and glycogen to glucose for energy
- At 1 - 2 hours of age, glucose levels fall and baseline glucose is achieved at 30 mins -1hour of age
- A newborn's brain relies on glucose to fuel development.
- Low blood glucose levels (hypoglycemia) at birth have been associated with brain injury and intellectual and developmental disabilities.
- Higher blood glucose level may be protective.
- Protective target glucose not yet defined

Questions

Summary

1. Most babies transit well to the extra uterine life
2. A few babies don’t and will require to be supported in;
    - Breathing
    - Keeping warm
    - Maintaining blood sugars