First Breath

- With birth lungs are filled with amniotic fluid and need to empty
- The first breath can generate up to -70 mmHg and water moves from lungs into the circulation
- PVR falls
- Air stimulates ductal closure
First Breath

- Ductal closure raises SVR
- Cord clamping increases SVR
- Increased LA pressure closes foramen ovale
- Voila! Series circulation and functioning lungs

Newborn Circulation

Newborn Heart Function

- Suddenly one low pressure side and one high pressure side
- Ventricles “see” different loads
- But the myocardium isn’t ready for Prime Time
- High MVO2 requires high cardiac output
- Makes the heart mainly rate dependent
Newborn Lung Function

- Large airways mostly complete
- Alveoli mostly lacking
- Very tender tissues
- Soft chest wall
- Brain can't remember to breathe regularly

Newborn Liver Function

- Hasn't really been doing too much
- Suddenly responsible for everything
- High red blood cell breakdown
- Hyperbilirubinemia disturbs drugs and monitors
- Birth uses much of the stored glycogen

Newborn Kidney Function

- Tubular structures present at birth
- Salt and urea gradients deficient
- Low blood flow before birth
- Operates at about 20% in utero
- Need to get rid of body water from fetal life
Newborn Renal Function

- 70% water at term
- Drops 10% weight in first 2 days
- Starts urinating on the first day
- Recovers body weight by 7 days by taking in solids and developing renal gradients
- Lower Tmax for glucose

Newborn Neurological Function

- Pain pathways are integrated into neuroendocrine, somatic and autonomic systems early in gestation
- Newborns may have an exaggerated response to pain
- Neural tissue, CSF are higher in proportion to body mass
- Myelination is incomplete

Temperature Maintenance

- Large surface area that doesn't vasoconstrict well
- Less shivering and sweating
- Less subcutaneous fat to insulate
- Less muscle mass to shiver with
- Less tolerant of thermal stress
- Thermal neutral temperature 10 degrees higher
Neonate to Infant

- One week to one month
- Ductus still only physiologically closed
- Lungs dried out
- Kidney function approaching 50%
- Ventilatory control stabilizes
- Sympathetic cardiovascular responses appear

- Higher O2 consumption than adults
- Requires higher resting cardiac output
- Causes rapid desaturation by consuming FRC faster
- Brain grows accustomed to regular breathing
- Still can't concentrate or dilute urine as well

Infant to Toddler

- 6 months to one year
- Ventricular function and pulmonary resistance stabilize
- PDA closed anatomically
- Lung function and ventilatory control stabilize
- Liver and kidney function exceed 50%
Toddler to School Age

- Brain – not done cooking
- Heart – pretty much done
- Lungs – still making alveoli
- Liver – functions at high level
- Kidneys – good to go

Adolescence

- Brain – the teen years, need I say more?
- Heart – frequently broken, but no longer a child’s
- Lungs – fully developed
- Liver – getting ready for adult beverages, I suppose
- Kidneys

AFLOAT

- A airway/apnea
- F fluids
- L  lytes/glucose
- O  oxygen
- A atropine-friendly heart
- T  temperature