How pediatric resuscitation differs from adult resuscitation

- WEIGHT
- ANATOMICAL SIZE AND SHAPE
- CARDIOVASCULAR, RESPIRATORY and IMMUNE FUNCTION
- INTELLECTUAL ABILITY AND EMOTIONLA RESPONSE

Weight

3.2 kg at birth = 10.3 kg at year 1
BROSELOW Tape: uses height to estimate weight

Formula: **weight = 2 x (age + 4)**

Airway

- In infants, head is large, neck is short. In supine position, the neck will flex and the airway will obstruct.
- The mouth is small
- The teeth may be loose
- The tongue is relatively large
- Floor of the mouth is easily compressible (when chin lifting)

Under 6 months, EVERYONE is an obligate nose breather
So, if the nose is blocked with snot, the airway is obstructed.

After that, in the 3 to 8 yr olds, adenotonsillar hypertrophy becomes a problem

EPIGLOTTIS IS HORSESHOE-SHAPED

- **It projects posteriorly at 45 degrees.**
- **This makes intubation more difficult**

LARYNX IS HIGH AND ANTERIOR: level of C2-C3, instead of 5-6

The trachea itself is soft and short.

A foreign body is equally likely to go into the right or main bronchus

The cricoid ring is the narrowest part of the trachea, not the larynx
Here, it Is lined with loose pseudostratified columnar epithelium and this means it is susceptible to oedema

Because this is where the cuff of the tube would lie, in order to avoid oedema,
CUFFLESS TUBES are preferred in prepubertal children

Breathing

- In the infant, the **lungs are immature** and the total gas exchange area is ~ 3 m^2
- **Smaller airways**, thus more easily obstructed
- **Greater reliance on diaphragmatic breathing:** and they have fewer of the type 1 slow twitch oxidative fibres; so they tire more quickly. The more preterm you are, the more quickly you tire.

Circulation

- At birth the ventricles are about the same mass
- 2 months after birth the left ventricle is twice the mass of the right ventricle
- **This is reflected in the ECG**
- As time goes on the
  - P wave enlarges
  - QRS complex elrages
  - QRS duration lengthens
  - P-Q interval duration lengthens

CIRCULATING BLOOD VOLUME = 70-80 ml/kg
That's more than the adult! But the overall volume is less

Body surface area

- Surface area to weight ratio is high: it decreases as you age.
- This means the children are more prone to hypothermia
- At birth **the head accounts for 19% of the surface area**

Respiratory physiology

- Infants have greater metabolic rate and oxygen consumption

- Respiratory rate is increased
- However: **tidal volume remains the same to adulthood**: 5-7ml/kg

- At age 1, rate is 30-40
- At age 2, rate is 25-35
- 2-5, rate is 25-30
- 5-12, rate is 20-25

- In the newborn, the majority of the impedance to expansion of the chest is from the lungs: so, **surfactant is critical to normal respiration**
- Later on, in the adult the compliance of the chest wall comes to play a greater role
- Also:
  - At birth, the oxygen dissociation curve is shifted to the left (p50, the PO2 at 50% Sats is greatly decreased)- because 70% of their Hb is foetal Hb (disappears by 6 months)
  - **Prolonged ventilation of an infant → bronchopulmonary dysplasia: and the potential for oxygen dependence for a year, or perhaps even more!**

Cardiovascular physiology

- Infants have a
  - **ridiculously SMALL STROKE VOLUME: 1.5ml/kg**
  - **But: a HUGE CARDIAC INDEX: 300ml/min/kg**
  - Compartively, adoslescents = 100ml/min/kg, and adults = 70-80

- Stroke volume increases as the heart gets bigger;
- This underlies the changes in heart rate seen in childhood
  - **110-160 at yr 1**
  - **100-150 yrs 1-2**
  - **95-140 yrs 2-5**
  - **80-120 yrs 5-12**

  After age 12, HR approaches adult values

In infants, stroke volume is small and fixed: this means they can only vary the heart rate to increase their cardiac output.

THIS MEANS:

response to volume therapy is blunted

Stroke volume cannot increase greatly in response to fluid therapy.
B age 2, you get a more normal response to fluid challenges, and this phenomenon goes away.

Blood pressure is low at birth, and rises towards adulthood

This is because systemic vascular resistance is low at birth, and continues to rise.
From 70-90 systolic at birth, it rises to 80-95 by years 1-2, and 80-100 at years 2-5.
At 5-12, it is 90-110.

Immune physiology

- Breastfeeding provides protection against respiratory and gastrointestinal pathogens, but otherwise, placental transfer of antibodies stops and the baby takes 6 months to ramp up its own production of antibodies