Queensland Paediatric Emergency Care

Nursing Skill Sheets

How Children Are Different - Anatomical and Physiological Differences

Infants and children possess important anatomical and physiological differences when they are compared with adults. This skill sheet will touch on some of the unique anatomical and physiological differences to consider when caring for infants and children.

Neurological Differences

- Temperature regulation is not well developed. Neonates and infants can become hypothermic if left exposed. They are also susceptible to heat loss from the surface of their exposed head.
- Larger heads in relation to body size (higher centre of gravity), making children more susceptible to head injuries.
- Motor development is incomplete, increasing their risk of falls.
- Thinner cranial bones compared to the thicker bones found in the adult skull. As a result childrens' brain tissue is less protected (haemorrhages and diffuse brain injury with head trauma more common in children than adults).
- The presence of fontanelles. The anterior fontanelle remains open until 12-18 months of age. The posterior fontanelle closes between 2-3 months of age.

Respiratory Differences

Paediatric airways are narrower meaning they are at greater risk of obstruction from:

- Swelling (inhalations burns or conditions such as croup)
- Foreign bodies (small toys or food)
- Nasal mucous (caused by infections such as RSV bronchiolitis)
- Large tongues with small mouths in infants
- External pressure inadvertently placed on the soft cartilage of the airway

Respiratory Differences Continued:

- Funnel shaped larynx and trachea with the narrowest point being at the cricoid cartilage. The glottis sits high and is stiff. These are all important considerations when attempting airway management.
- Higher basal metabolic rate. This results in naturally higher respiratory rates and oxygen consumption. The higher respiratory rate results in a greater loss of water from the lungs.
- The thoracic cage is soft, the chest wall is compliant and intercostal muscles are poorly developed. Infants and young children rely on their diaphragm to create negative pressure and chest wall movement. They tire quickly.
- Infants are obligatory nasal breathers. Even if only partially blocked, increased resistance, laboured breathing and difficulty feeding results.
- Smaller and fewer alveoli. This results in limited alveolar surface for gas exchange and increased dead space. Infants must breathe faster to achieve adequate minute ventilation.

Cardiovascular Differences

- Large body surface area. This results in greater fluid loses through evaporation. Children require greater fluid requirements to maintain an adequate circulating volume.
- Large heart in relation to body size. Despite this, the heart has a decreased contractile efficiency. Infants and children have difficulty manipulating their cardiac stroke volume. They increase their heart rate to increase their cardiac output.
- Small volumes of blood will constitute significant blood loss in small children. For example, a 100mL haemorrhage experienced by a 5kg child, represents the loss of approximately 10% of their total blood volume.
- Cardiac output and oxygen delivery in children are higher per kilogram than in adults. Oxygen consumption in children is also high. Anything that causes an increase in oxygen consumption or a decreased oxygen delivery can result in decompensation.
- Small veins and increased subcutaneous tissue. Vascular access in young children and infants can be difficult.
- There is increased workload for the cardiovascular system due to a higher metabolic rate.

Gastrointestinal Differences

- Increased glucose requirements with poor glycogen stores. Neonates, infants and children can all rapidly develop hypoglycaemia and muscle fatigue.
- Reliance on others for fluid and nutrition. This can be particularly difficult for caregivers to meet the increased nutritional or fluid requirements of a sick child.
- Higher metabolic rate. This results in increased waste production and increased fluid and nutrition requirements.
- Cylindrical shaped abdomen. This results in poor protection for vital organs such as the liver and spleen.
- Proportionally longer intestinal length, resulting in greater fluid losses.
- Immature lower oesophageal sphincter tone until 1 month but may persist until 12 months. This results in regurgitation or possits of feeds.

Musculoskeletal Differences

- Infants lack muscle tone, power and coordination: they rely on the support and supervision of others to keep them stable and safe.
- Bones are soft until puberty, therefore bones will break and bend more easily. As bones are more flexible, serious internal injuries can be present without fractures present.
- As infants and children are still growing they have growth plates located between the middle and the end of the long bones. Fractures may occur that effect these growth plates requiring specialised attention.
- As children live active lives they often have to wear casts and splints to protect healing fractures.
- Babies are born with more bones than adults. As they grow some bones fuse together.

Renal Differences

- Larger total body water. Infants and children have greater fluid requirements and susceptible to more rapid fluid loss.
- Immature tubular function. This can result in sodium wasting.
- Decreased ability to concentrate urine, resulting in a loss of water.
- Age-related changes in pharmacokinetics and pharmacodynamics, resulting in the slower excretion of some drugs.
- The expected urine output for an infant and child is 1-2mL/kg/hr. For an adolescent, urine output should be 0.5-1mL/kg/hr.

Guide to Normal Vital Sign Parameters

Normal adult vital sign parameteres are very different to those of children. Its important to remember that normal observation ranges differ throughout the different age groups. In the table below we outline what these ranges are outlined as per the Children's Early Warning Tool (CEWT):

Age	< 1 year	1-4 years	5-11 years	> 12 years
Respiratory rate (RR) (breaths/minute)	21-45	16-35	16-30	16-25
Heart rate (HR) (beats/minute)	100-159	90-139	80-129	60-119
Blood Pressure (systolic range)	75-119	80-124	85-129	90-149

ALERT

Any assessment findings outside of the expected normal range must be reported to the nursing team leader and medical team and appropriate emergency action taken as necessary.

Refer to CEWT instructions for further details.

For further information:

CHQ Nursing Standard: Clinical Assessment of the Paediatric Patient – Rapid Assessment / Primary and Secondary Survey / Vital Signs. (QH only)

Nursing Standard: Clinical Observations - Considerations in Children. (QH only)

References:

This Queensland Paediatric Emergency Nursing Skill Sheet was developed by the Emergency Care of Children working group (funded by the Queensland Emergency Department Strategic Advisory Panel) with the help of the following resources:

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