A Structured Approach to the Seriously Ill Child

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Senior Sister
WMPRS
Learning outcomes

By the end of this session, you will be able to demonstrate an understanding of:

• the structured approach to the seriously ill child
• the clinical assessment sequence to identify life-threatening illness in a child
Cardiac arrest in children - Aetiologies

- Respiratory Obstruction
  - Foreign body
  - Asthma
  - Croup
- Respiratory Depression
  - Convulsions
  - Poisoning
  - Raised ICP
- Fluid Loss
  - Blood Loss
  - Burns
  - Vomiting
- Fluid Maldistribution
  - Sepsis
  - Anaphylaxis
  - Cardiac Failure

- Respiratory Failure
- Circulatory Failure

- Cardiac Arrest
Recognition of serious illness

- Potential respiratory failure
- Potential circulatory failure
- Potential central neurological failure
Systematic approach

- Airway
- Breathing
- Circulation
- Disability
- Exposure

<table>
<thead>
<tr>
<th>Primary assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resuscitation</td>
</tr>
<tr>
<td>Secondary assessment – identification of key features</td>
</tr>
<tr>
<td>Emergency treatment</td>
</tr>
<tr>
<td>Stabilisation, transfer to definitive care</td>
</tr>
</tbody>
</table>
Rapid assessment

- Airway and Breathing
  - Effort
  - Efficacy
  - Effects

- Circulation
  - Heart rate
  - Capillary refill time
  - Blood pressure
  - Skin temperature

- Disability
  - Conscious level
  - Posture
  - Pupils
Potential respiratory failure

Effort of Breathing
Effort of breathing

- Respiratory rate
- Accessory muscle use - Recession
- Nasal flaring
- Child's position
Effort of breathing - Associated sounds

- Inspiratory stridor
  - upper airway pathology

- Expiratory wheeze
  - lower airways pathology

- Grunting
  - airspace pathology (1° or 2°)
<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Resp rate (per minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1</td>
<td>30 - 40</td>
</tr>
<tr>
<td>1 - 2</td>
<td>25 - 35</td>
</tr>
<tr>
<td>2 - 5</td>
<td>25 – 30</td>
</tr>
<tr>
<td>5 - 12</td>
<td>25 - 15</td>
</tr>
<tr>
<td>&gt;12</td>
<td>12 - 20</td>
</tr>
</tbody>
</table>
Why are children different?

AIRWAY

- Paediatric airway is smaller
- Relatively larger tongue and smaller oral cavity
- Infants have a relatively larger occiput
- Infants are nose breathers.
- Trachea is more cartilaginous and soft
- Larynx is higher and more anterior.
- Shape of the epiglottis
- Cricoid ring is the narrowest point in the airway
- The trachea is short
Effort of breathing - Subcostal recession

mild

severe
Subcostal recession
Exceptions to effort of breathing

Increased effort
ABSENT in

1. exhaustion
2. central respiratory depression
3. neuromuscular disease
Potential respiratory failure

- Effort of Breathing
- Efficacy of Breathing
- Effects of Respiratory Inadequacy
Efficacy of breathing

- Chest expansion
- Air entry
- Pulse oximetry
Efficacy of breathing

A SILENT CHEST IS A PRE–TERMINAL SIGN
Why are children different?

BREATHING

- Ribs positioned more horizontally
- Thin chest wall
- Diaphragmatic breathing
- Fewer Type 1 fibres in respiratory muscles.
- Respiratory rate varies with age
- Heart rate
Breathing

Adult chest x-ray showing arched ribs

Neonate chest x-ray showing flattened ribs

Ribs positioned more horizontally
Potential respiratory failure

Effort of Breathing

Efficacy of Breathing

Effects of Respiratory Inadequacy
Effects of respiratory inadequacy

- Heart rate
- Skin colour
- Mental status
Effects of respiratory inadequacy

Cyanosis is a pre-terminal sign.

Oxygen saturation of <85% in air is a pre-terminal sign.
Potential respiratory failure
Resuscitation equipment
Respiratory Assessment

- Tachypnoea
- Increased respiratory effort
- Diminished breath sounds
- Decreased conscious level
- Decreased response to parents
- Decreased response to pain
- Poor skeletal muscle tone
- Cyanosis
Potential circulatory failure
Early recognition of shock

Cardiovascular Signs
Cardiovascular signs

• Heart rate
• Pulse volume - What if there is:
  
  A *thready pulse* (narrow pulse pressure)?
  
  A *bounding pulse* (wide pulse pressure)?
  
  *Loss of central pulses*

• Capillary refill time – is it important?
• Blood pressure - A fall of 10mmhg systolic pressure is serious and needs aggressive treatment

Systolic BP (50th centile) = 85 + (age in years x 2)
Systolic BP (5th centile) = 65 + (age in years x 2)

*In septic shock it is* 90 + (age in years x 2)
## Heart Rates

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Heart rate (per minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1</td>
<td>110 – 160</td>
</tr>
<tr>
<td>1 - 2</td>
<td>100 - 150</td>
</tr>
<tr>
<td>2 - 5</td>
<td>95 – 140</td>
</tr>
<tr>
<td>5 - 12</td>
<td>80 - 120</td>
</tr>
<tr>
<td>&gt;12</td>
<td>60 - 100</td>
</tr>
</tbody>
</table>
## Blood Pressure

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Systolic BP 50th centile</th>
<th>Systolic BP 5th centile</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1</td>
<td>80 - 90</td>
<td>65 - 75</td>
</tr>
<tr>
<td>1-2</td>
<td>85 - 95</td>
<td>70 - 75</td>
</tr>
<tr>
<td>2-5</td>
<td>85 - 100</td>
<td>70 - 80</td>
</tr>
<tr>
<td>5-12</td>
<td>90 - 110</td>
<td>80 – 90</td>
</tr>
<tr>
<td>&gt;12</td>
<td>100 - 120</td>
<td>90 – 105</td>
</tr>
</tbody>
</table>
Why are children different?

CIRCULATION

- Blood volume is relatively larger, but absolute volume is smaller
  - 80-90ml/kg v's 65-70ml/kg.
- Systemic vascular resistance is lower
- Hypotension is a late sign
- Renal Function - Urine output is commonly used to assess circulatory adequacy.
  - Urine output = 1-2 ml/kg/hr in children/infants
  - Urine output = 0.5 ml/kg/hr in adults
- Fixed-stroke volume
- Smaller vessels / more subcutaneous tissue
Cardiovascular signs - Capillary refill

- press for 5s
- release
- colour should return <2s in well-perfused, warm child
Cardiovascular signs - Capillary refill

A delay of >2s with other signs of shock and in a warm child suggests poor peripheral perfusion.
Cardiovascular signs

HYPOTENSION IS A PRE–TERMINAL SIGN
Potential circulatory failure
Early recognition of shock

Cardiovascular Signs

Effects of Circulatory Inadequacy
Effects of circulatory inadequacy

• Respiratory rate
• Skin temperature/colour
• Mental status
Distinguishing cardiac problems

- Cyanosis despite $O_2$
- Marked tachycardia
- Raised jugular venous pressure
- Gallop rhythm / murmur
- Enlarged liver
- Absent femoral pulses
Potential circulatory failure
Resuscitation equipment
Potential central neurological failure

Conscious level
Potential central neurological failure
Conscious level

Alert
Responds to Voice
Responds only to Pain
Unresponsive to all stimuli
Potential central neurological failure

Conscious level

Posture

assess with painful stimulus
Potential central neurological failure: postures

decorticate

decerebrate
Potential central neurological failure

- Conscious level
- Posture
- Pupillary signs
Anthony’s case

• Anthony is a one and half year old child who has had a runny nose and now has a barking cough and noisy breathing. On arrival at hospital he is clinging to his mother when disturbed and his breathing sounds harsh.
**Anthony’s case:**
*Primary assessment and resuscitation*

<table>
<thead>
<tr>
<th>On examination</th>
<th>Resuscitation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong> Inspiratory stridor</td>
<td></td>
</tr>
<tr>
<td><strong>B</strong> Recession ++</td>
<td></td>
</tr>
<tr>
<td>rate 50</td>
<td></td>
</tr>
<tr>
<td>Sats in air 88</td>
<td></td>
</tr>
<tr>
<td><strong>C</strong> Pulse 190</td>
<td></td>
</tr>
<tr>
<td><strong>D</strong> Drowsy but agitated when disturbed</td>
<td></td>
</tr>
</tbody>
</table>
Bernadette’s case

- Bernadette is a two month old baby with a runny nose and a cough for two days. Now her feeding is poor and she is sleeping more than usual. Her mother is worried about her breathing.
### Bernadette’s case: Primary assessment and resuscitation

<table>
<thead>
<tr>
<th>On examination</th>
<th>Resuscitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Patent</td>
<td></td>
</tr>
<tr>
<td>B Expiratory wheeze Recession + Sats 90 in air</td>
<td></td>
</tr>
<tr>
<td>C Heart rate 180 Pale</td>
<td></td>
</tr>
<tr>
<td>D Drowsy AVPU</td>
<td></td>
</tr>
</tbody>
</table>
### Bernadette’s case: What emergency treatment?

<table>
<thead>
<tr>
<th>Key Feature</th>
<th>Diagnosis</th>
<th>Emergency Tt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 1 year</td>
<td>Bronchiolitis</td>
<td>Oxygen and monitor resps for apnoeas, ensure adequate hydration</td>
</tr>
<tr>
<td></td>
<td>Asthma</td>
<td>Steroids and bronchodilators</td>
</tr>
</tbody>
</table>
Carlos’ case

• Carlos is three years old. He has had a fever and been drowsy for just a few hours, but he is so unlike his usual active self that his mother is really worried about him and has brought him to ED.
Carlos’ case:
Primary assessment and resuscitation

<table>
<thead>
<tr>
<th>On examination</th>
<th>Resuscitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Patent</td>
<td></td>
</tr>
<tr>
<td>B Resp rate 40</td>
<td></td>
</tr>
<tr>
<td>Sats not recordable</td>
<td></td>
</tr>
<tr>
<td>No significant recession</td>
<td></td>
</tr>
<tr>
<td>C Pale</td>
<td></td>
</tr>
<tr>
<td>Heart rate 170</td>
<td></td>
</tr>
<tr>
<td>Weak peripheral pulses</td>
<td></td>
</tr>
<tr>
<td>BP 80 systolic</td>
<td></td>
</tr>
<tr>
<td>CRT 4 secs</td>
<td></td>
</tr>
<tr>
<td>D AVPU</td>
<td></td>
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</table>
Carlos’ case:
What emergency treatment?

<table>
<thead>
<tr>
<th>Key Feature</th>
<th>Diagnosis</th>
<th>Emergency Tt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastroenteritis</td>
<td>IV/IO Fluid</td>
<td></td>
</tr>
<tr>
<td>Septicaemia</td>
<td>IV/IO Fluid</td>
<td>Antibiotics</td>
</tr>
<tr>
<td>Anaphylaxis</td>
<td>Adrenaline</td>
<td></td>
</tr>
<tr>
<td>Cardiomyopathy</td>
<td>Prostaglandin</td>
<td>Diuretics, inotropes</td>
</tr>
<tr>
<td>Arrhythmia</td>
<td>Arrhythmia</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>Fluid</td>
<td>Insulin</td>
</tr>
<tr>
<td>Arrhythmia</td>
<td>Arrhythmia</td>
<td></td>
</tr>
<tr>
<td>High blood glucose</td>
<td>Diabetes</td>
<td></td>
</tr>
<tr>
<td>Abnormal rhythm on ECG</td>
<td>Arrhythmia</td>
<td></td>
</tr>
</tbody>
</table>
Any Questions?
Summary - Rapid assessment

- Airway and Breathing
  - Effort
  - Efficacy
  - Effects

- Circulation
  - Heart rate
  - Capillary refill time
  - Blood pressure
  - Skin temperature

- Disability
  - Conscious level
  - Posture
  - Pupils
Websites

https://www.spottingthesickchild.com

http://www.wmprs.nhs.uk