

Pediatric Emergencies

Lecture notes

for 5th year undergraduate medical students

Faculty of Medicine, Sohag University

2019/2020

Intended learning outcomes:

By the end of this course, you will be able to:

1. Value the importance of early detection and management of pediatric emergencies.
2. Recognize early manifestations of serious illness in children.
3. Perform cardiopulmonary resuscitation (CPR).
4. Describe manifestations and initial emergency measures of common pediatric emergencies.

Contents

1. Approach to evaluation of pediatric emergencies.
2. Detection of seriously ill children.
3. Pediatric cardiopulmonary resuscitation (CPR).
4. Respiratory emergencies.
5. Cardiovascular emergencies.
6. Neurological emergencies.
7. Metabolic emergencies.
8. Intoxications.

Lecture (1)

Intended learning outcomes:

By the end of this lecture, you will be able to:

1. Describe the approach to evaluation of pediatric emergencies.
2. Value the importance of early detection of seriously-ill children
3. Recognize early manifestations of serious illness in children.

Contents

1. Approach to evaluation of pediatric emergencies:

Primary assessment

Secondary assessment

Tertiary assessment

2. Early Detection of serious illness in children:

Respiratory

Cardiovascular

Neurological

Others

Approach to evaluation of pediatric emergencies

- Management of pediatric emergencies requires a systematic plan, considering:
 - Safety of the scene
 - Condition of the child
 - Available resources

- Primary assessment:
 - ❖ Goal: detect and treat immediate life threatening conditions:
 - Airway obstruction
 - Respiratory arrest
 - Cardiac arrest

 - ❖ Components: Cardiopulmonary resuscitation (CPR)
 - Basic Life Support (BLS)
 - Advanced Life Support (ALS)

- Airway

- B**reathing

- C**irculation

- D**isability

- E**xposure

- Secondary assessment:
 - ❖ Goal: detect and support failing body systems:
 - Respiratory
 - Cardiovascular
 - Neurologic
 - Metabolic
 - Hematologic
 - ❖ Components: - Focused history
 - Focused examination
 - Supportive management

- Tertiary assessment:
 - ❖ Goal: detect and support failing body systems as well as detect and treat specific etiology.
 - Respiratory
 - Cardiovascular
 - Neurologic
 - Metabolic
 - Hematologic
 - ❖ Components: - Detailed history
 - Detailed examination
 - Investigations
 - Supportive and specific management

Detection of seriously-ill children

- Progression of an illness may dangerously affect most important vital systems:
 - Respiratory
 - Cardiovascular
 - Neurologic
- In general, children need resuscitation because respiratory and/or cardiovascular systems has failed.

✚ *What is the patient's outcome after CPR?*

Generally poor (survival, neurologic function)

- Therefore, early detection and treatment of serious respiratory or circulatory problems, before progressing to cardiorespiratory arrest, is very important.

✚ *Detection of seriously ill-children: Is it easy or hard?*

Generally poor (survival, neurologic function)

- Approach for spotting the sick child:
 - Scientific
 - Systematic
 - Rapid
 - Focus on severity of physiological derangement
 - *Consider safety*

(1) Detection of serious respiratory illness:

- Evaluation of:
 - A. Work of breathing
 - B. Effectiveness of breathing
 - C. Effects of respiratory insufficiency on other body systems

A. Work of breathing:

- Respiratory rate:
 - Consider effects of crying and body temperature
 - Normal values:
 - Infants: 30- 40 breaths / min
 - 2 – 5 years: 25 – 30 breaths / min
 - 5 – 12 years: 20 – 25 breaths / min
 - > 12 years: 15 – 20 breaths / min
 - Causes of tachypnea:
 - Respiratory
 - Non-respiratory (e.g., heart failure)
- Retractions:
 - Types: Intercostal, subcostal, sternal, suprasternal
 - More associated with narrowing of airways.
 - Degree of retractions usually correlates with the severity of respiratory difficulty.
- Grunting:
 - A sound produced by exhalation against a partially closed glottis.
 - More associated with disease of lung parenchyma.
 - Usually indicates severe respiratory distress, particularly in infants
- Excess use of accessory muscles:
 - Head nodding (sternocleidomastoid)
 - Abdominal breathing (diaphragm)
- Working ala nasi

✚ **Important note:** A child may have a serious respiratory problem but without increased work of breathing:

- Exhaustion
- Central respiratory depression
- Severe neuromuscular disease

✚ Bradypnea is a dangerous sign of impending respiratory arrest

B. Effectiveness of breathing:

- Auscultation: for air entry
- Measuring arterial oxygen saturation (SpO₂):
 - by pulse oximetry
 - Must be measured in every critically-ill child whatever the degree of respiratory illness.
 - An early indicator for hypoxemia (compared with cyanosis)
 - Value below 93% on room air is abnormal

C. Effects of respiratory insufficiency on other body systems:

- Heart rate:
 - Early hypoxia causes tachycardia
 - Severe & prolonged hypoxia causes bradycardia

✚ Bradycardia is a dangerous sign of impending cardiac arrest

- Mental status:
 - hypoxia leads to agitation (usually early) and drowsiness (usually late)
- Skin color:
 - Early hypoxia causes pallor
 - Cyanosis usually appears when level of deoxyhemoglobin reaches 3 gm/dl
 - Cyanosis is a late sign of hypoxemia

(2) Detection of serious cardiovascular illness:

- Evaluation of: A. Cardiovascular status
 C. Effects of circulatory insufficiency on other body systems

A. Cardiovascular status:

- Pulse rate:
 - Consider effects of crying and body temperature
 - Site: Brachial pulse in infants, carotid pulse in older children
 - Normal values: Infants: 80 – 140 beats / min
 2 – 5 years: 70 – 130 beats / min
 5 – 12 years: 60 – 110 beats / min
 > 12 years: 60 – 100 beats / min
 - Tachycardia is an early indicator of shock
- Pulse volume: Weak pulse is an indicator of shock.
- Capillary refill:
 - Assess skin perfusion
 - Site: peripheral or central (press on sternum for 5 seconds)
 - Capillary refill time (CRT) is prolonged if > 2 seconds
 - Prolonged CRT is an early sign of shock
- Blood pressure:
 - Use age-appropriate cuff
 - Normal values? age-adjusted charts
 - Rough estimation of lower limit of systolic pressure by age:
 - * < 1 yr: 70 mmHg
 - * 1-10 yrs: $70 + (\text{age in yr} \times 2)$
 - * > 10 yrs: 90 mmHg
 - Hypotension is a late sign of shock

B. Effects of circulatory insufficiency on other body systems:

- Respiratory system:
 - Shock stimulates respiratory centers (tachypnea)
 - Shock causes metabolic acidosis (acidotic breathing)
- Mental status:
 - Poor cerebral perfusion leads to agitation (usually early) and drowsiness (usually late)
- Skin color:
 - Poor skin perfusion causes pale, cold, and mottled skin

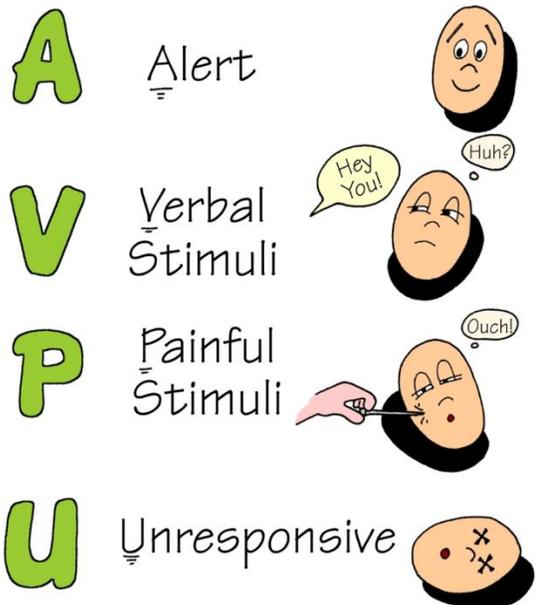
(3) Detection of serious neurologic illness:

✚ *Assessment of neurological system should be done after Airway, Breathing and Circulation are assessed and treated.*

- Evaluation of: A. Neurologic function
 C. Effects of serious neurologic illness on other body systems

A. Neurologic function:

- Conscious level:
 - Glasgow-coma scale is used for comprehensive assessment
 - AVPU method is used for rapid assessment during emergencies



- Pupils:

- Assess for equality and pupillary response to light
- Asymmetrical: suggests space occupying lesion, intracranial hemorrhage

✚ Unequal pupils: a sign of lateralization that mandates brain computed tomography (CT)

- Sluggish response to light: drugs/toxins, post-seizures

- Limbs & tone:

- Assess for differences between left and right sides of body (a sign of lateralization)

B. Effects of serious neurologic illness on other body systems:

- Respiratory system:

- May cause many patterns of abnormal breathing, such as hypoventilation/apnea, hyperventilation, and periodic breathing.

- Cardiovascular system:

- Increased intracranial pressure (ICP) may cause hypertension and bradycardia (Cushing response)
- Cushing response is a late sign of ICP in children

(4) Others:

- Blood sugar: **A B C Don't Ever Forget Glucose**
- Temperature
- Abdomen
- ENT

Best Wishes