



## **Pediatric Emergencies**

*Lecture notes*

*for 5<sup>th</sup> 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 (3): Approach to Respiratory Emergencies

### Contents:

1. Introduction
2. Acute airway obstruction
3. Respiratory distress & failure



### 1. Introduction

- If not early managed, a serious respiratory disease in children can rapidly progress to respiratory failure.
- Hypoxia is the most common cause of cardiac arrest in children.
- Prolonged hypoxia may result in irreversible brain damage.
- Hypoxia can adversely affect any organ (e.g., brain, heart, kidney, liver, GIT).

### 2. Acute Airway Obstruction

- Children <5 yr old are particularly susceptible to foreign-body aspiration and choking.
- *High index of suspicion: Any child with a sudden onset of choking, stridor, or respiratory distress has foreign body aspiration until proved otherwise.*
- The clinical presentation of foreign-body aspiration varies according to:
  - Level of obstruction: upper or lower airways.
  - Extent of obstruction: complete or partial.
  - Nature of foreign body:
  - Time interval: early or delayed presentation.

- ***Emergency management of foreign-body aspiration***

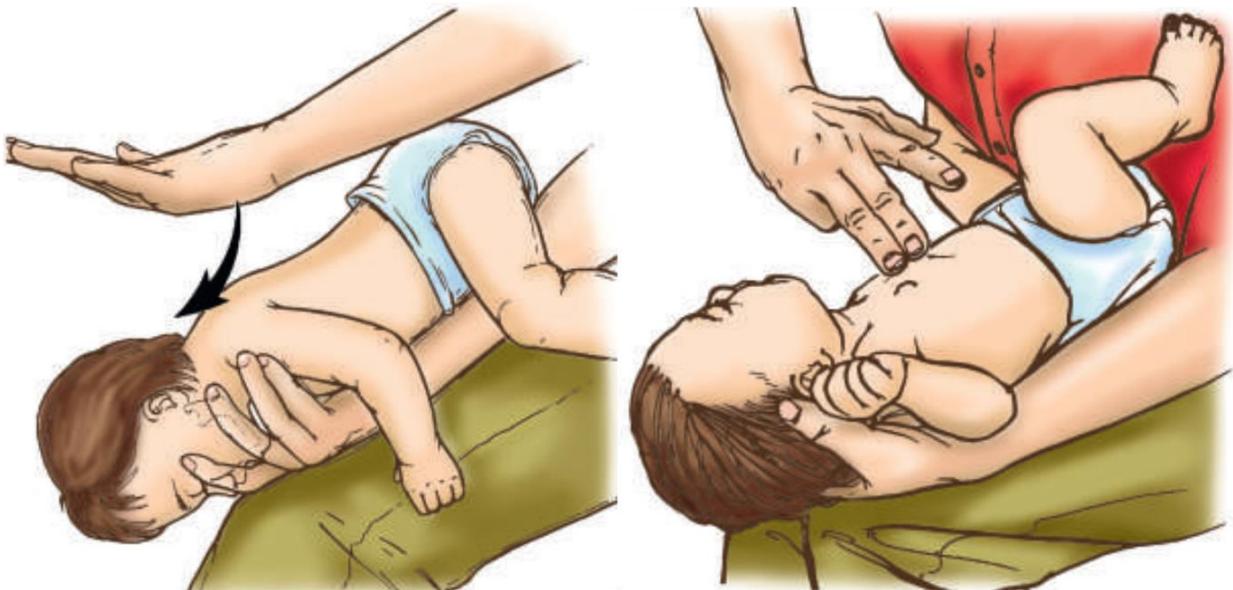
- Follow the sequence of pediatric resuscitation.
- Evaluate the responsiveness and presence of effective cough.

***A. Conscious and has effective cough:***

- Encourage coughing with close monitoring for either relief of airway obstruction or deterioration.

***B. Ineffective cough:***

- Physical maneuvers for foreign-body dislodgement.
  - **In infants:** a combination of 5 back blows + 5 chest thrusts  
With the head lower than the trunk, 5 back blows are delivered rapidly with the heel of the hand between the infant's shoulders.  
Chest thrusts are delivered in the same manner as cardiac compression.



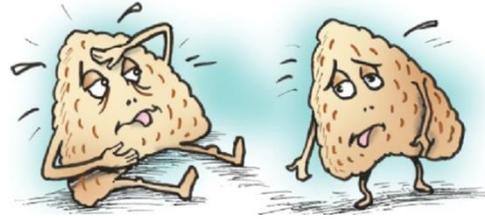
- In Children: 5 abdominal thrusts (Heimlich maneuver).

Given while the child is standing/sitting (if conscious) or lying on supine position (if unconscious)



- ✚ Physical maneuvers aim at complete or *partial* dislodgement of foreign body.
- ✚ Physical maneuvers are repeated as needed if re-evaluation revealed persistent complete obstruction of airway.
- ✚ Blind finger sweeping is *contraindicated*.: Try to remove foreign body only if it is *clearly visualized* and *completely accessible*; otherwise, leave it!!  
***Manipulation of foreign body can turn partial airway obstruction to complete***
- ✚ Ultimate management may require laryngoscopy or bronchoscopy for removal of foreign body under direct vision.

### **3. Respiratory distress & Failure:**



- **Respiratory distress:**

- Definition: increased work of breathing.
- Common causes in children:
  - Primary pulmonary: Bronchiolitis, pneumonia, bronchial asthma.
  - Extra-pulmonary:
    - Cardiovascular: Congestive heart failure, hypovolemia/shock.
    - Metabolic acidosis: DKA, renal failure, sepsis.
    - Neurologic: Encephalitis, drugs, toxins.
    - Hematologic: Severe anemia.
- Manifestations: discussed in the 1<sup>st</sup> lecture (increased work of breathing).
- Grading:
  - Grade 1: Tachypnea
  - Grade 2: Retractions
  - Grade 3: Grunting
  - Grade 4: Cyanosis and/or disturbed conscious level

- **Respiratory failure:**

- Definition: Inability of the lungs to provide sufficient oxygen and/or remove carbon dioxide to meet the metabolic demands of body organs.
- Causes:
  - Causes of severe respiratory distress
  - Central respiratory depression: Trauma, increased intracranial pressure, drugs/toxins.
  - Neuromuscular diseases: Guillain Barre syndrome, Poliomyelitis.

- Manifestations:

- Increased work of breathing (not in all cases).
- Hypopnea, bradypnea, irregular breathing:
  - In central respiratory depression, neuromuscular diseases, and exhaustion following severe cases with respiratory distress.
- Effects on other organs: disturbed conscious level, cyanosis.
- Manifestations related to etiology.

- Types:

- Type 1 (hypoxic): Failure of oxygenation
  - Common causes: bronchiolitis, pneumonia, asthma, pulmonary edema.
- Type 2 (hypercarbia): Failure of ventilation
  - Common causes include central respiratory depression, neuromuscular disorders, and central airway obstruction
- Mixed: Failure of oxygenation and ventilation.
  - Occurs with severe cases of type 1 & 2.

- Assessment:

✚ *Respiratory emergency & supportive measures should not be delayed waiting for full assessment.*

- Clinical:

- Severity: discussed in the 1<sup>st</sup> lecture “evaluation of serious respiratory disease).
- Etiology.

- Investigations:

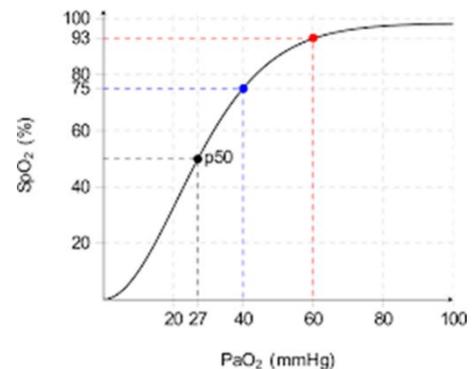
- Pulse oximetry:

- Non-invasive method for measuring arterial oxygen saturation (SpO<sub>2</sub>).



➤ Arterial blood gases (ABG):

- Invasive
- Assess oxygenation, ventilation, and acid-base status
- Measured parameters:
  - \* PaO<sub>2</sub>: normal level 90 – 100 mmHg on room air
  - \* pH: normal level 7.35 – 7.45
  - \* pCO<sub>2</sub>: normal level 35 – 45 mmHg
  - \* HCO<sub>3</sub>: normal level 20 – 26 mEq/L



- ***PaO<sub>2</sub> is a more sensitive indicator of hypoxia than SpO<sub>2</sub>.***

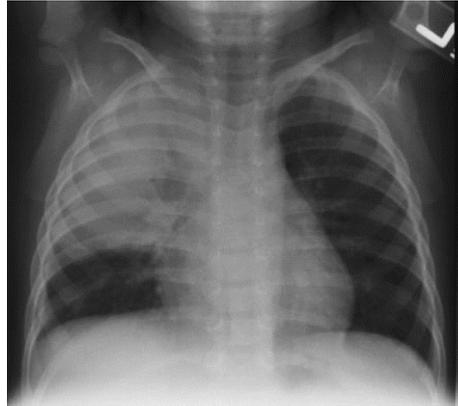
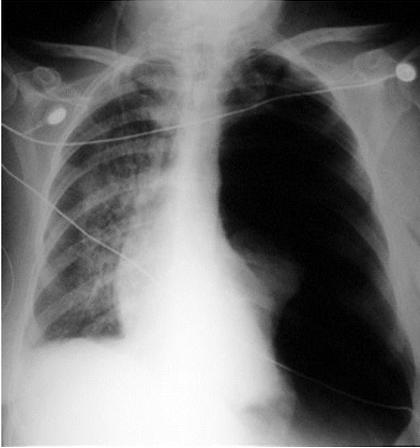
***Why?*** (revisit the oxyhemoglobin dissociation curve).

- Low pH is called “acidemia”, whereas high pH is called “alkalemia”
- Hypoventilation leads to elevated pCO<sub>2</sub> (respiratory acidosis), and hyperventilation leads to decreased pCO<sub>2</sub> (respiratory alkalosis).
- Elevated pCO<sub>2</sub> with decreased pH is called (respiratory acidemia).
- In order to compensate for respiratory acidosis, the kidney increases reabsorption of HCO<sub>3</sub>, leading to an increase in its serum level.
- ***Renal compensation requires time.***
- Acute hypoventilation is more likely associated with low pH and normal HCO<sub>3</sub> levels, whereas chronic hypoventilation is more likely associated with normal or slightly low pH and elevated HCO<sub>3</sub>.

***ABG will be discussed again with metabolic acidosis in the 5<sup>th</sup> lecture***

➤ Chest X-ray:

- Useful to detect etiology, particularly causes requiring emergent intervention, such as pneumothorax, pleural effusion, collapse.



➤ Pulmonary function tests:

- Such as using spirometry for assessment of acute bronchial asthma.

➤ Others: such as blood glucose

● **Management:**

✚ ***Follow general approach to pediatric emergency: Primary, secondary, and tertiary assessment (see 1<sup>st</sup> & 2<sup>nd</sup> lecture)***

- Oropharyngeal airway is indicated in unconscious patients without gag reflex to protect airway from obstruction by tongue and relaxed upper airway muscles.
- Endotracheal intubation is required to maintain open airway particularly in cases of advanced life support and need for mechanical ventilation.
- Suction is important in case of excessive secretions.

○ **Oxygen:**

➤ Indications:

- ***Initial step in most emergencies***  
***(respiratory, cardiovascular, neurological)***

- Severe respiratory distress.
- Hypoxemia/cyanosis (other than cyanotic heart disease)

➤ Methods of administration:

- Nasal cannula: Delivers 24-40% oxygen with commonly used flow of 1-2 L/m



- Simple face mask: Delivers 30-60% oxygen with commonly used flow of 6-10 L/m



- Oxygen tent/hood: Can deliver higher oxygen concentration depending on the used flow.

➤ Monitoring: ***Oxygen is a drug***

- Clinical (e.g, improved respiratory distress or cyanosis).
- Pulse oximetry.
- Arterial blood gases.



○ ***Mechanical ventilation:***

➤ Indications:

- Apnea
- Severe persistent hypoxemia
- Severe persistent respiratory acidosis
- *Non-respiratory* indications  
(refractory heart failure, status epilepticus)



➤ Complications:

- Pneumothorax
- Ventilator-associated pneumonia
- Endotracheal tube displacement/obstruction



***Best Wishes***