PEDIATRIC EMERGENCIES
in the Clinic Setting

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UCR SOM - FM Residency Program
October 2016

Acknowledgments

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2. Dr. Quitain, Pediatric Critical Care
3. Jeff Messerole, EMT Instructor / Author
4. Jessica Chichizola, Senior MA

Objectives

1. Pediatric Emergencies are Common
2. Our Clinic's Preparedness
3. Systematic approach
4. Respiratory Emergencies
5. Allergic Emergencies (Anaphylaxis)
6. Shock
7. Neurologic Emergencies
8. Not Discussed

Take Home Points

1. Pediatric emergencies are common in office setting
2. Prepare by knowing what the clinic has to offer and the protocols in place.
3. Mock Codes in the clinic are recommended.

PEDS EMERGENCIES ARE COMMON IN THE CLINIC

PEDS EMERGENCIES ARE COMMON IN THE CLINIC

“Studies have shown that emergencies are common in primary care practices that provide care to children. In 1 study, the authors surveyed 52 pediatric offices and found that these practices saw a median of 24 emergencies per year. Most of the offices (82%) reported that they encountered, on average, at least 1 emergency per month. In another study, 62% of pediatricians and family physicians in an urban setting who were asked about emergencies in their offices reported that they assessed more than 1 patient each week in their offices who required hospitalization or urgent stabilization.

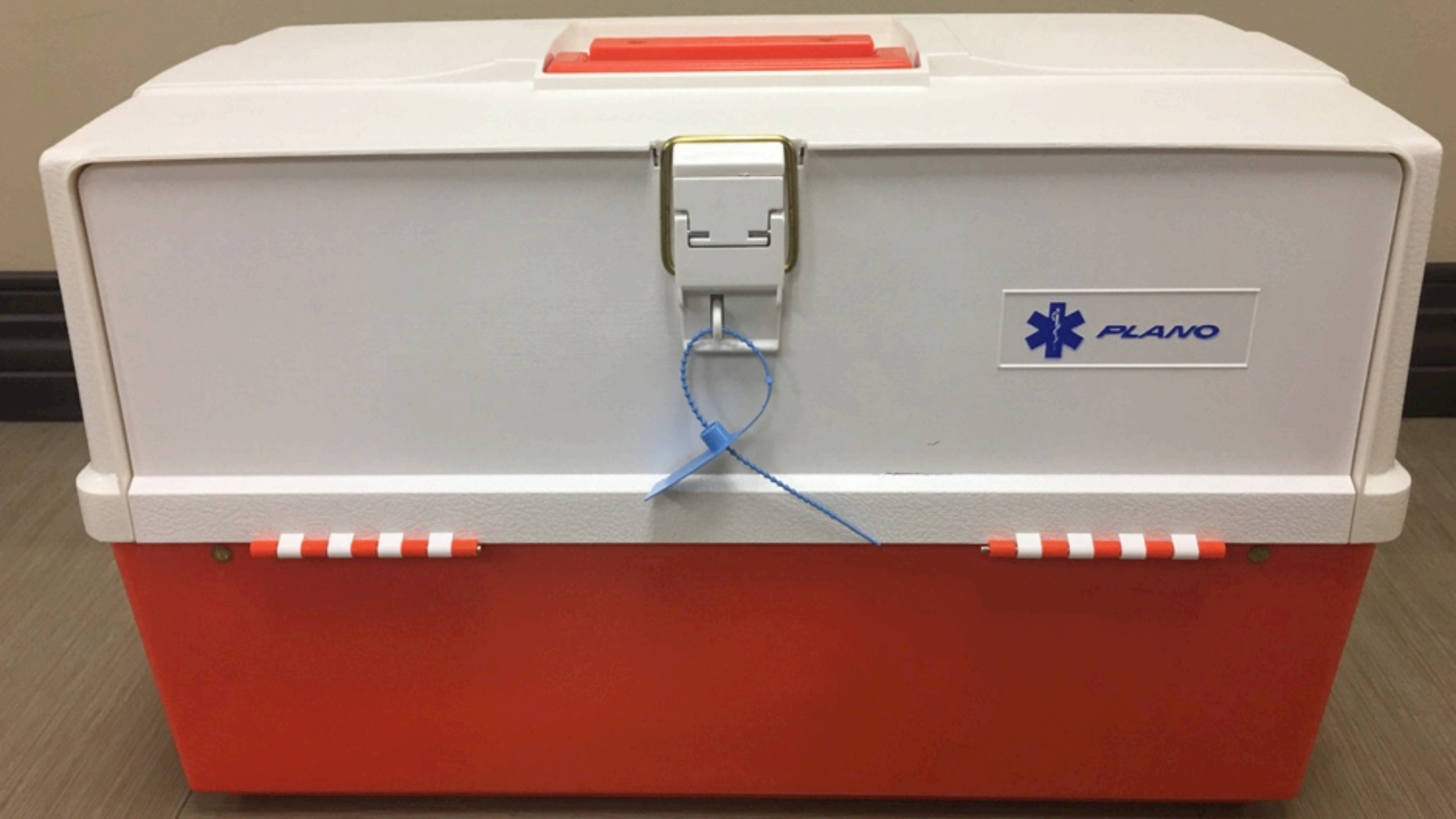
Despite these findings, which suggest that a significant number of children present to primary care offices with urgent or emergent problems, some health care professionals discount the need for preparation because “emergencies are not very common” or because they feel they can rely on rapid response from emergency medical services (EMS) or proximity to a hospital. Some PPCPs have interpreted risk-management guidelines to mean that having emergency equipment and medications on site will increase their liability in emergency situations; however, lack of preparation may be a true cause of increased liability.” AAP

PEDS EMERGENCIES ARE COMMON IN THE CLINIC

1. Children are often taken to the clinic at the time of an emergency
2. The most common types of emergencies include respiratory emergencies, seizures, infections in young infants, and dehydration.
3. PPCPs may be required to provide urgent or emergent care in their offices for children with these conditions, at least until the arrival of EMS. The consequences of being unprepared are serious; therefore, appropriate stabilization of pediatric emergencies and timely transfer to an appropriate facility for definitive care are important responsibilities of every PPCP.
4. We are responsible for stabilizing the patient until EMS comes after we call 9-1-1.
5. The office staff, not just the PPCPs have to be prepared and knowledgeable because the first person to assess patients who arrive in the office may be the least clinically experienced employee: the secretary or receptionist.

What are the response times for EMS to get here after we call 9-1-1?

OUR CLINIC'S PREPARDNESS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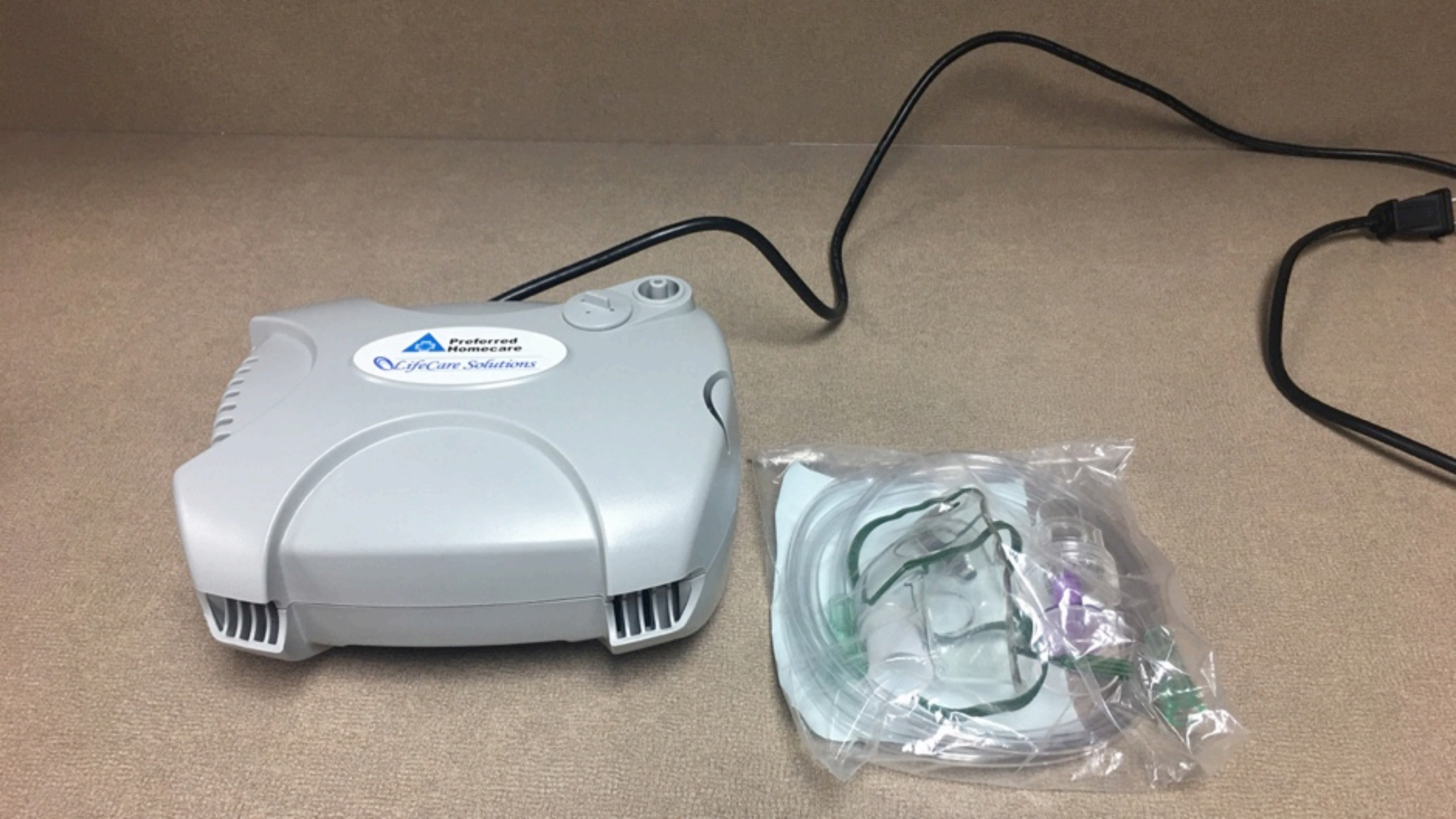
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Homecare
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NDC 0487-0201-60
Ipratropium Bromide 0.5 mg and Albuterol Sulfate 3 mg*
Inhalation Solution
* Equivalent to 2.5 mg albuterol base.
FOR ORAL INHALATION ONLY
STORAGE CONDITIONS: PROTECT FROM LIGHT. STORE IN POUCH UNTIL TIME OF USE.
Store between 2°C and 25°C (36°F and 77°F).
USUAL DOSAGE: See accompanying prescribing information.
USE ONLY AS DIRECTED BY YOUR PHYSICIAN. DO NOT EXCEED RECOMMENDED DOSAGE.
exp. soon
Rx only
Carton contains 60 x 3 mL Sterile Unit-Dose Vials
(Twelve foil pouches, each pouch contains five 3 mL vials)
Manufactured By:
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Albuterol Sulfate Inhalation Solution, 0.083%*
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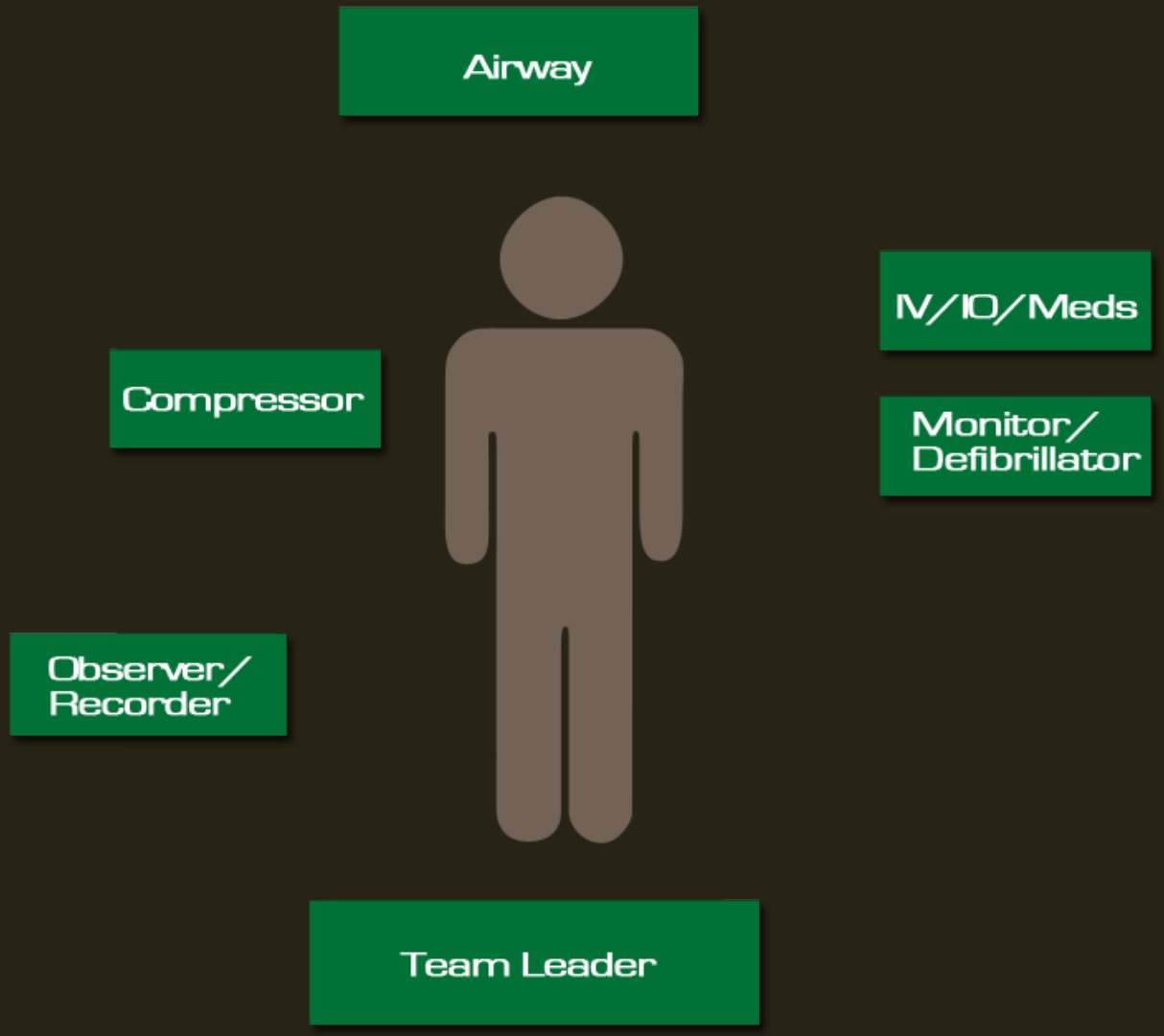
*Potency expressed as albuterol, equivalent to 3 mg albuterol sulfate
FOR ORAL INHALATION ONLY
Equivalent to 0.5 mL Albuterol Sulfate 0.5%* diluted to 3 mL with normal saline.
Attention Pharmacist: Detach "Patient's Instructions For Use"
from package insert and dispense with solution.
Protect from light. Store between 2° and 25°C (36° and 77° F).
Discard if solution becomes discolored.
(Note: Albuterol Sulfate Inhalation Solution is a clear,
colorless to light yellow solution.)
Rx only
25 x 3 mL Sterile Unit-Dose Vials
Manufactured By:
nephron pharmaceuticals corporation
For Customer Service, Call 1-800-443-4313

RECOMMENDATIONS FROM THE AAP & AAFP

- ✓ Perform a self-assessment of office readiness.
- ✓ Develop an plan for emergency response in the office, which includes: Staff communication, roles, and responsibilities at the time of an emergency during times of high and low staffing; protocol to access EMS; and maintaining readiness through practice (mock codes).
- ✓ Maintain recommended emergency equipment and medications
- ✓ Develop a plan to provide education and continuing medical education for all staff.
- ✓ Practice mock codes in the office on a regular basis (quarterly or biannually).
- ✓ Educate families about what to do in an emergency. E.g. 1) Encourage first aid and CPR training for parents and caregivers, etc.
- ✓ Partner with EMS and hospital-based emergency providers to ensure optimal emergency care and emergency/disaster readiness for children.

Effective Resuscitation Team Preparation



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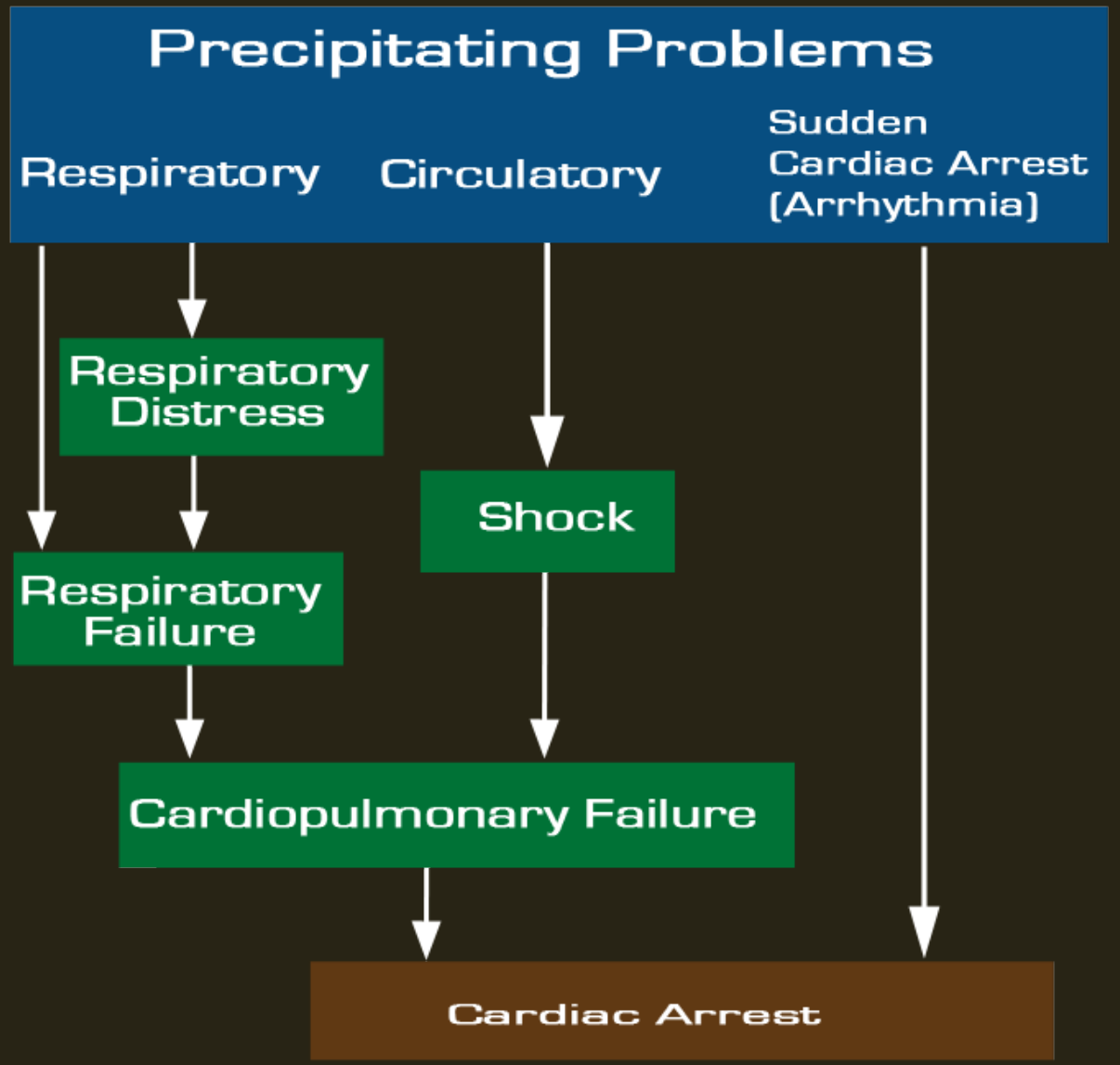
SYSTEMATIC APPROACH

PATHWAYS TO PEDIATRIC CARDIAC ARREST



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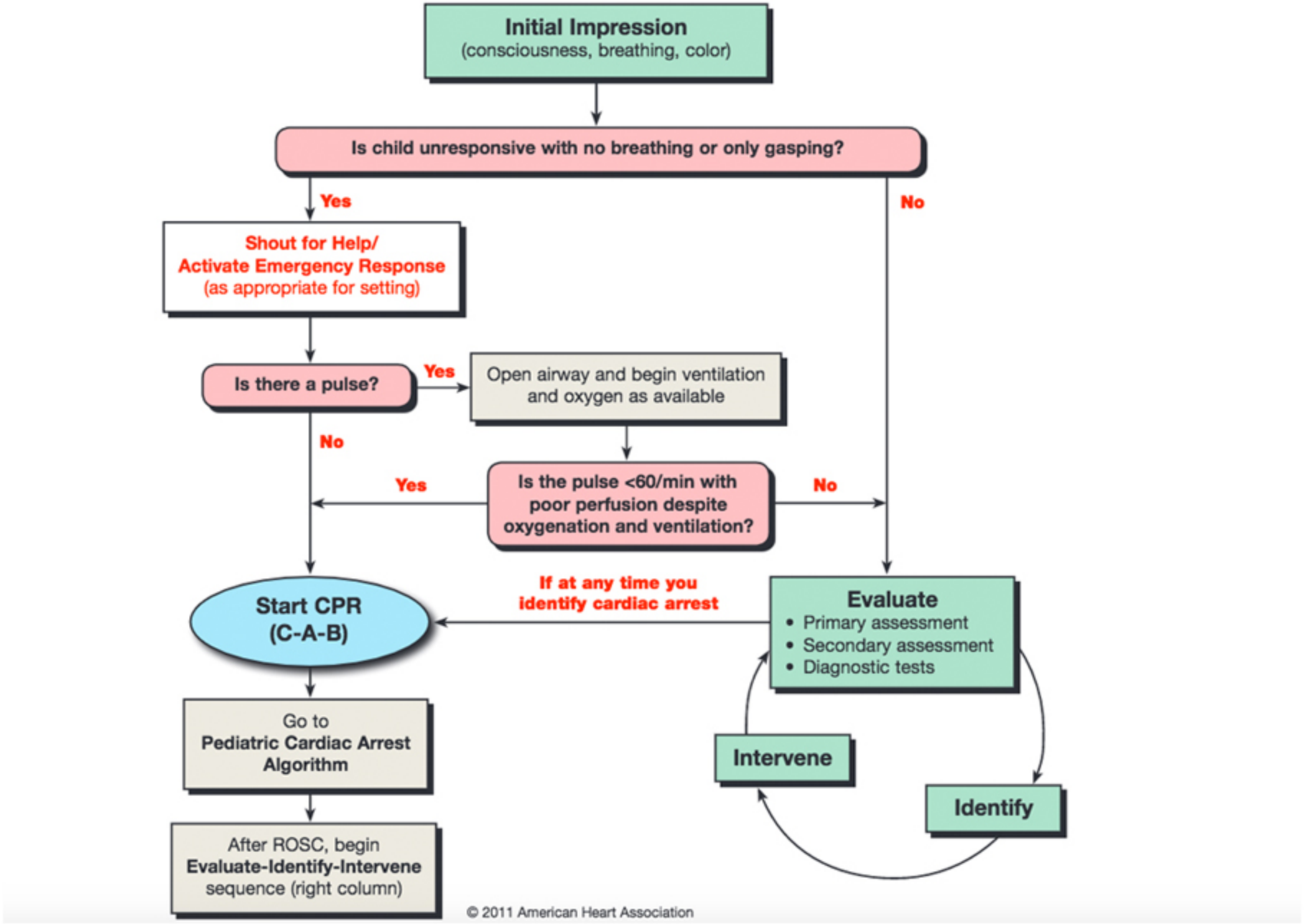
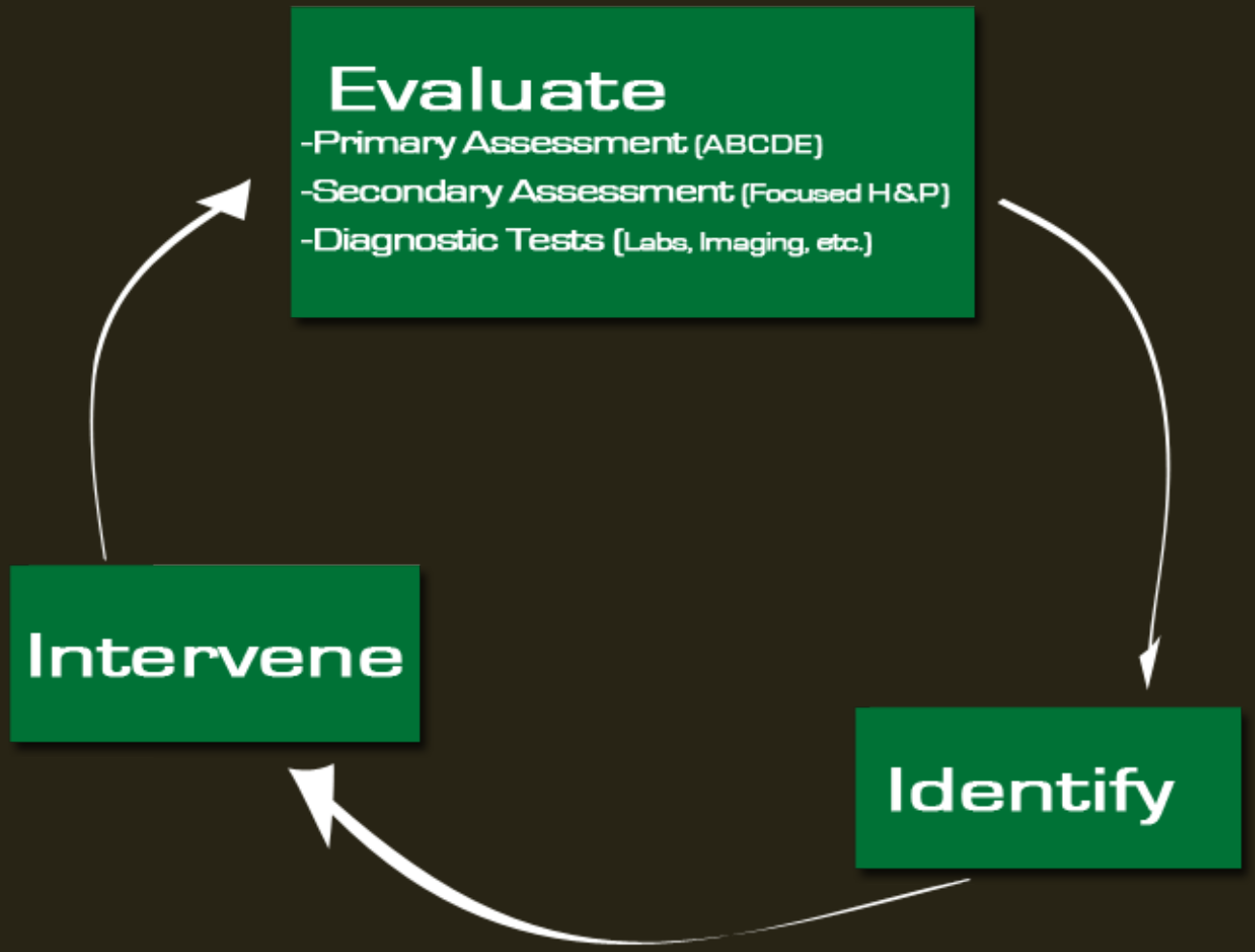
PALS SYSTEMATIC APPROACH



EVALUATE-IDENTIFY-INTERVENE SEQUENCE



Continue the sequence until the child is stable. Use it before and after each intervention. E.g. If you give O2, reevaluate the child. Is he breathing a little easier? Are color and mental status improving? If you give an IV fluid bolus to tx hypovolemic shock, reevaluate. Have the HR and perfusion improved? Is another bolus needed? Use it whenever the pt's condition changes.

EVALUATE: PRIMARY ASSESSMENT (ABCDE)

- ✓ Airway
  - ✓ Assess to det. if it is patent. Is it clear, obstructed but maintainable, or obstructed & not maintainable?
  - ✓ C-A-B if patient is in cardiac arrest!
- ✓ Breathing
  - ✓ Assess rate, effort, chest expansion & air movement, lung & air way sounds, and O2 sats by pulse oximetry.
  - ✓ Respiratory Rate: Tachypnea, bradypnea, apnea
  - ✓ Respiratory Effort: Retractions (Subcostal > Substernal > Intercostal > Supraclavicular > Suprasternal, Sternal), Accessory muscles, Nasal flaring, Head bobbing, Seasaw respirations
  - ✓ Lung and airway sounds: Stridor, Grunting, Gurgling, Wheezing, Crackles

EVALUATE: PRIMARY ASSESSMENT (ABCDE)

- ✓ Breathing (Caution when using pulse ox)
  - ✓ Interpret pulse ox in conjunction with your clinical assessment & signs like RR, effort, level of consciousness, not in isolation. A pt. may be in distress and still have normal pulse ox, esp. if getting O2. If HR from pulse ox is different from the HR on ECG monitor, don't trust the O2 sat from that pulse ox machine.
  - ✓ Pulse ox measures saturation, not delivery. A severely anemic pt may have 100% pulse ox.
  - ✓ Pulse ox won't be accurate in severe shock and cardiac arrest.
  - ✓ If you suspect Met-hemoglobin or Carboxyhemoglobin, get ABG because pulse ox will be wrong.

EVALUATE: PRIMARY ASSESSMENT (ABCDE)

- ✓ Circulation
  - ✓ Assessment: HR & rhythm, pulses, Capillary refill, skin color & temperature, BP, UOP, level of consciousness
- ✓ Disability
  - ✓ Assessment: Quick evaluation of neurologic function [use: AVPU (Alert, responsive to Voice, responsive to Pain, Unresponsive), GCS, pupil response to light (PERRLA?)]
- ✓ Exposure
  - ✓ Undress the pt, one part at a time and examine the pt's body. Keep patient covered and only expose the part being examined.

EVALUATE: SECONDARY ASSESSMENT

Secondary Assessment = Focused History + Focused Physical Exam

- ✓ Focused History – e.g. SAMPLE.
  - ✓ SAMPLE = Signs & symptoms; Allergies, Meds, PMH, Last Meal, Events leading to the current illness/injury.
  - ✓ You don't have to use SAMPLE. May use the usual hx part of admit H&Ps.
- ✓ Focused Physical Exam –
  - ✓ Examine primary area of concern of illness or injury (e.g. respiratory assessment with respiratory distress) as well as do a brief head-to-toe evaluation.

EVALUATE: DIAGNOSTIC TESTS

- ✓ Labs
  - ✓ ABG, VBG, CBC (Hgb.), Lactate
- ✓ Imaging
  - ✓ CXR, CT, Echocardiogram
- ✓ Monitoring, PFTs, etc.
  - ✓ Peak Expiratory Flow Rate
  - ✓ Central venous oxygen sats
  - ✓ CVP Monitoring
  - ✓ Invasive arterial pressure monitoring

IDENTIFY

Try to identify the type and severity of the child's problem.

Type		Severity
Respiratory	-Obstruction, upper airway -Obstruction, lower airway -Lung tissue disease -Disordered control of breathing	-Respiratory distress -Respiratory failure
Circulatory	-Hypovolemic shock -Distributive shock -Cardiogenic shock -Obstructive shock	-Compensated shock -Hypotensive shock
Cardiopulmonary Failure		
Cardiac Arrest		

INTERVENE

Some common interventions you can make are to:

- ✓ Position the child to maintain a patent airway
- ✓ Activate emergency response (call 911)
- ✓ Start CPR
- ✓ Get the Code cart and monitor
- ✓ Place the child on a cardiac monitor and pulse ox
- ✓ Give O2
- ✓ Support ventilation
- ✓ Start meds and fluids (e.g. neb tx, IV/IO fluid bolus)

Is there a Life-Threatening Problem?

Signs of a life-threatening condition include the following:

Airway	**Complete or severe airway obstruction**
Breathing	Apnea, significant increased work of breathing, bradypnea
Circulation	Absence of palpable pulses, poor perfusion, hypotension, bradycardia.
Disability	Unresponsiveness, decreased level of consciousness
Exposure	Significant hypothermia, significant bleeding, petechiae, or purpura consistent with septic shock.

RESPIRATORY EMERGENCIES

Fundamental Issues Associated With Respiratory Problems

- ✓ Respiratory problems = Impairment of either oxygenation, ventilation, or both.
- ✓ The function of the Resp. System is gas exchange (O2 in & CO2 out).
- ✓ O2 sat = % of Hgb. that becomes bound to O2. Note, a small % of O2 is dissolved in blood and O2 sats don't show that.
- ✓ Children have a higher metabolic rate, so the O2 demands per Kg/body weight is high. Infants consume 6 to 8ml/kg/min of O2 vs. 3 to 4ml/kg/min in adults. As such, hypoxemia and tissue hypoxia can develop more rapidly in a child than in an adult if apnea or poor ventilation occurs.
- ✓ Resp. Problems can cause: Hypoxemia, Hypercarbia, or both.

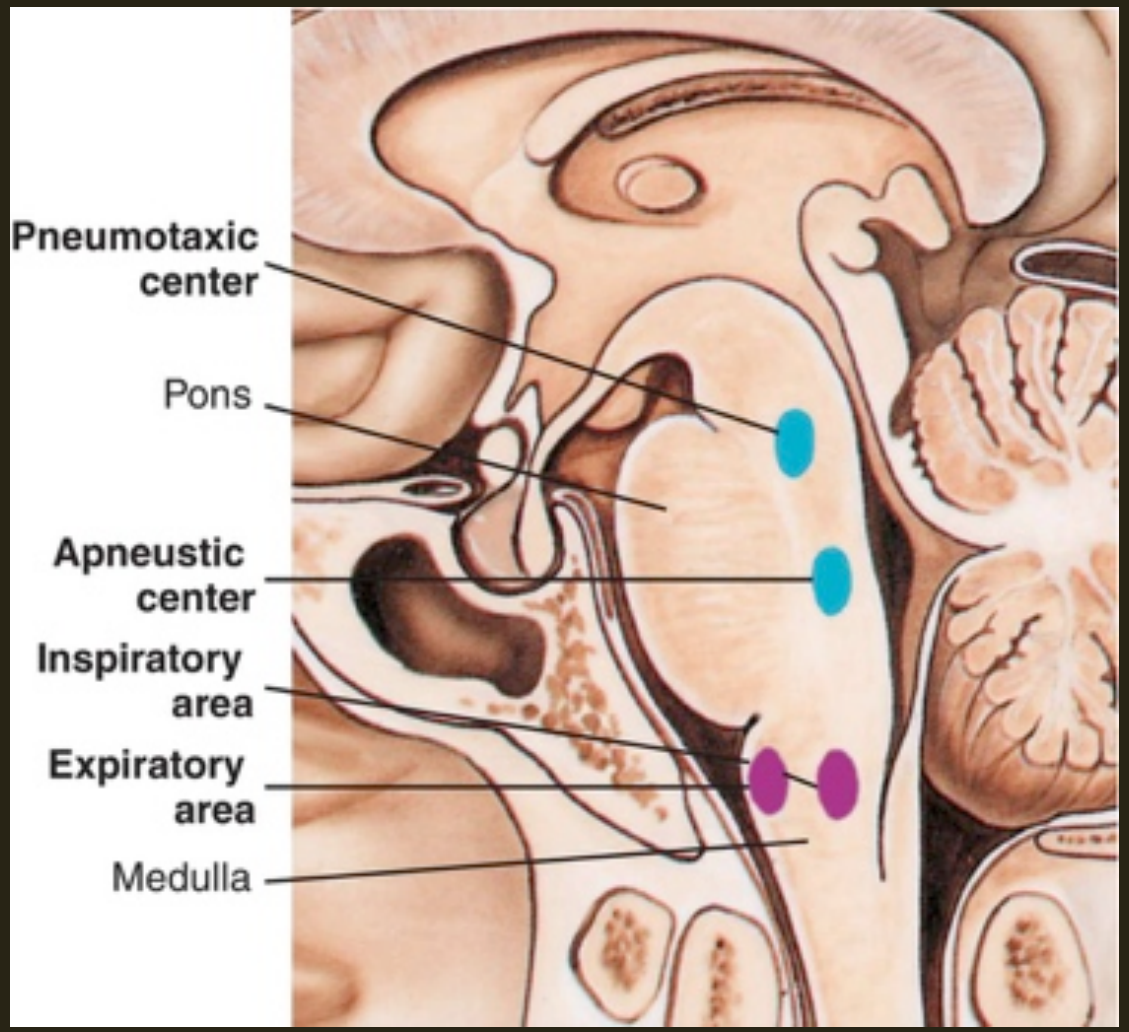
Fundamental Issues Associated With Respiratory Problems

- ✓ Hypoxemia
  - ✓ Is low PaO_2 that is associated with a low O_2 sat assessed by pulse ox (SpO_2)
  - ✓ Hypoxemia = SpO_2 <94% in a child who is breathing room air.
  - ✓ Hypoxemia indicates inadequate oxygenation.
  - ✓ Hypoxemia is NOT tissue hypoxia.
  - ✓ Tissue hypoxia = O_2 delivery is not enough to meet tissue O_2 needs.
  - ✓ Hypoxemic pt can compensate and avoid tissue hypoxia by increasing CO. Also by increasing O_2-carrying capacity (O_2 conc.).
  - ✓ You can have normal O_2 sats & still have tissue hypoxia e.g. in shock or severe anemia.

Where is the respiratory center located?

Respiratory center

- ✓ Brainstem (Pons & Medulla)
- ✓ Pneumotaxic area controls the depth of inspiration & prevents over-distension of lungs. It does so by inhibiting the Apneustic center.
- ✓ Apneustic center stimulates the Medulla leading to apneustic breathing (prolonged end-expiratory phases)
- ✓ Medulla controls both the inspiration & expiration. Controls the rhythm of breathing.



What does the body do when there is tissue hypoxia?

Signs of Tissue Hypoxia

- ✓ Tachycardia (early sign)
- ✓ Tachypnea
- ✓ Nasal flaring, retractions
- ✓ Agitation, anxiety, irritability
- ✓ Pallor
- ✓ Cyanosis (late sign)
- ✓ Decreased level of consciousness (late sign)
- ✓ Bradypnea, apnea (late sign)
- ✓ Bradycardia (late sign)

What is the most common cause of hypoxemia?

V/Q mismatch is the most common cause of hypoxemia in both pediatric. & adult populations b/c the causes are very common

CAUSES OF HYPOXEMIA

CAUSES	DISEASE / PROCESS	MECHANISM	TREATMENT
Low atmospheric Po2	High altitude (decreased barometric pressure)	Decreased PaO2	Supplemental O2
Alveolar Hypoventilation	CNS infection, Traumatic brain injury, Drug overdose, Neuromuscular weakness, Apnea	↑ PaCO2 (hypercarbia) displaces alveolar O2, resulting in ↓ alveolar and arterial O2 tension (low PaO2 or hypoxemia	Restore normal ventilation, supplementary O2.
Diffusion defect	Pulmonary edema, Interstitial PNA, Alveolar proteinosis.	Impaired movement of O2 & CO2 b/n the alveolus and blood results in ↓ PaO2, and if severe, ↑ PaCO2	Supplementary O2 with CPAP or ventilation with an advanced airway and PEEP.
Ventilation / Perfusion (V/Q) Mismatch (Most common cause of hypoxemia)	PNA, Atelectasis, ARDS, Asthma, Bronchiolitis, Foreign Body, PE, COPD.	Mismatch of Ventilation and perfusion: Blood flood through areas of the lung that are inadequately ventilated results in incomplete oxygenation of the blood returning to the left side of the heart. The result is a decreased arterial O2 saturation and PaO2, and to a lesser extent, increased PaO2	PEEP to increase mean airway pressure; supplementary O2; vent ilatory support.
Right-to-left shunt	Cyanotic congenital heart disease, Extracardiac (anatomical vascular shunt). Same causes listed for V/Q mistmatch.	Shunting of deoxygenated blood from the right of the heart to the left (or from the pulmonary artery into the aorta) results in a low PaO2. Effects similar to right to left shunt in the lungs.	Correction of defect (supplementary O2 alone is insufficient)

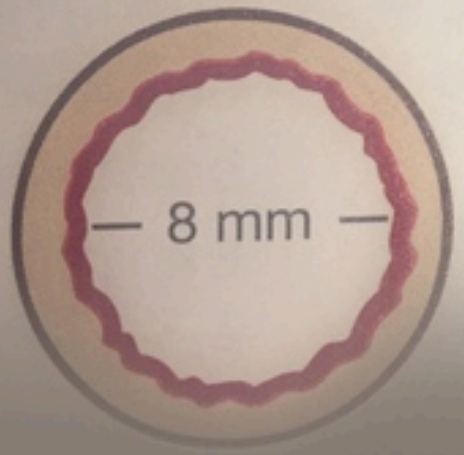
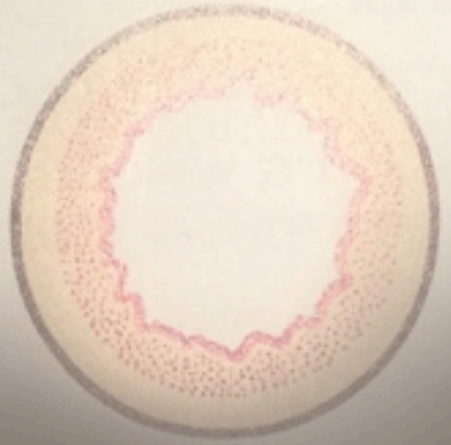
What are signs respiratory effort?

Physiology of Respiratory Disease

Important factors associated with increased work of breathing include:

- ✓ Increased airway resistance (upper and lower)
- ✓ Decreased lung compliance (Distensibility)
- ✓ Use of accessory muscles of respiration
- ✓ Disordered CNS control of breathing.

i.e. Laminar flow

	Normal	Edema 1 mm	Resistance $\left(R \propto \frac{1}{\text{radius}^4}\right)$	Cross-sectional area
Infant			▲16x	▼75%
Adult			▲3x	▼44%

$R \propto \frac{1}{r^5}$ for turbulent flow

Identify Resp. Problems by Severity

Respiratory Distress	Respiratory Failure
A clinical state characterized by abnormal respiratory rate or effort. Clinical Signs of Resp. distress typically include *some or all* of the following:	A clinical state of inadequate oxygenation, ventilation, or both. Suspect probably respiratory failure if *some* of the following are present:
-Increased RR (Tachypnea)	-Marked tachypnea (early)
-Increased resp. effort (e.g. nasal flaring, retractions)	-Bradypnea (late)
-Inadequate resp. effort (e.g. hypoventilation, bradypnea)	-Increased, decreased, or no resp. effort.
-Abnormal airway sounds (e.g. stridor, wheezing, grunting)	-Poor to absent air movement.
-Increased HR (Tachycardia)	-Tachychardia (early)
-Pale, cool skin	-Bradycardia (late)
-Changes in level of consciousness	-Cyanosis
	-Stupor, Coma (late
Resp. distress is classified as mild to severe based on severity of the above signs.	Resp. failure can result from upper or lower airway obstruction, lung tissue disease, and disordered control of breathing (e.g. apnea or shallow, slow respirations). When resp. effort is inadequate, resp. failure can occur without the typical signs of resp. distress)

Signs of Respiratory Problems

Clinical Signs		Upper Airway obstruction	Lower Airway Obstruction	Lung Tissue Disease	Disordered Control of Breathing
A	Patency	Airway open and maintainable / not maintainable			
B	Resp. Rate / Effort	Increased			Variable
	Breath Sounds	-Stridor (typically inspiratory) -Barking Cough -Hoarseness	-Wheezing (typically expiratory) -Prolonged Expiratory phase) -Cough	-Grunting -Crackles -Decreased breath sounds	Normal
	Air Movement	Decreased			Variable
C	Heart Rate	Tachycardia (early), Bradycardia (late)			
	Skin	Pallor, cool skin (early), Cyanosis (late)			
D	Level of Consciousness	Anxiety, agitation (early) Lethargy, unresponsiveness (late)			
E	Temperature	Variable			

Identification of Resp. Problems by Severity

	Respiratory Distress → Respiratory Failure
A	Open and maintainable → Not Maintainable
B	Tachypnea → Bradypnea to apnea
	Work of breathing (nasal flaring/retractions) Increased effort → Decreased effort → Apnea
	Good air movement → Poor to absent air movement
C	Tachycardia → Bradycardia
	Pallor → Cyanosis
D	Anxiety, agitation → Lethargy to unresponsive
E	Variable temperature

What is the major cause of cardiac arrest in children?

Respiratory problems

Is it always possible to differentiate between respiratory distress and failure on the basis of clinical exam alone?

No. In children, the deterioration in resp. function may progress rapidly. Plus you can have failure without distress.

What are the two main functions of the lungs?

Oxygenation & Ventilation

RESPIRATORY EMERGENCIES

Type of Resp. Problem	**Conditions**
Obstruction, Upper Airway	-Severe Croup -Epiglottitis -Foreign Body Aspiration -Allergic Emergencies (Anaphylaxis)
Obstruction, Lower Airway	-Acute Asthma -Bronchiolitis
Lung Tissue Disease	-Infectious PNA -Chemical PNA -Aspiration PNA -Cardiogenic Pulmonary Edema -Non-cardiogenic pulmonary edema (ARDS) *DKA may present with respiratory features
Disordered Control of Breathing	-Increased ICP -Poisoning or drug overdose -Neuromuscular disease

INITIAL MGT. OF ALL RESP. EMERGENCIES

First, ask: *Is this patient in cardiac arrest?* If Yes, begin C-A-B. If not, do A-B-C. The following ABCs apply to all the resp. emergencies. Additional measures will be given for each specific condition.

Evaluate	**Interventions (as indicated)**
Airway	-Support an open airway (allow the child to assume position of comfort) or if necessary, open airway with: --Head tilt-chin lift --Jaw thrust without head tilt if cervical spine injury suspected. If jaw thrust doesn't work, use the head tilt-chin lift or jaw thrust with gentle head extension. -Clear airway if indicated (e.g. suction nose and mouth, remove visualized foreign body). -Consider an OPA or NPA to improve air way patency (in patients with obstruction). * OPA only if the child is deeply unconscious with no gag reflex. Use NPA for conscious patients who still have a gag reflex. Don't use NPA if child has increased risk of bleeding. -Minimize agitation (which often worsens upper airway obstruction)
Breathing (Oxygenation & Ventilation)	-Monitor O2 sats with pulse ox. -Provide O2 (humidified if available). Use a high-concentration delivery device such as a non-rebreathing mask for treatment of severe respiratory distress or possible respiratory failure. -Give inhaled meds (e.g. albuterol, ipratropium, epinephrine) as needed. -Use bag-mask device and supplementary oxygen to assist ventilation if needed (e.g. if no spontaneous respirations). Bag-mask ventilation with cricoid pressure may be used indefinitely if ventilating effectively (look at chest rise). -Prepare to intubate if indicated.
Circulation	-Monitor heart rate, rhythm, and BP -Establish vascular access (for fluid therapy and mediations) as needed.

CROUP

Management based on severity – Mild, Moderate, Severe, Impending Resp. Failure

Severity of Croup	Intervention
Mild	Minimal disturbance, cool mist, hydration, antipyretics, and consider steroids (Dexamethasone).
Moderate to Severe	-1) Give humidified O2; Keep NPO; The efficacy of mist therapy is not established. -2) Nebulized racemic epinephrine. After giving, observe for a minimum of 2 to 4 hours, owing to potential for rebound obstruction. Hospitalize if more than one nebulization required. -3) Dexamethasone, 0.3 to 0.6mg/kg IV, IM, or Po once. Effect lasts 2 to 3 days. Alternatively, nebulized budesonide (2mg) may be used, though little data exist to support its use, and some studies find it inferior to dexamethasone. -4) Heliox for severe disease. A helium-oxygen mixture may decrease resistance to turbulent gas flow through a narrowed airway. c) If a child fails to respond as expected to therapy, consider other etiologies (e.g. retropharyngeal abscess, bacterial tracheitis, subglottic stenosis, epiglottitis, foreign body). Obtain airway radiography, CT, and evaluation by otolaryngology or anesthesiology.
Impending Resp. Failure	-Give high conc. of O2; use non-rebreathing mask if available. -Assist ventilation (i.e. bag-mask ventilation) if necessary (e.g. persistent, severe hypoxemia [<90% O2 Sats] despite O2 administration, inadequate ventilation, or changes in level of consciousness. -Give dexamethasone IM/IV. -Intubate if indicated. Prepare for surgical airway if needed.

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Why are infants and small children especially prone to upper airway obstruction?

- ✓ Large tongue in proportion to oropharyngeal. cavity
- ✓ Prominent Occiput – can easily cause flexion of the neck obstructing upper airway.
- ✓ Smaller airway – the smaller the airway, the easier it is to obstruct.

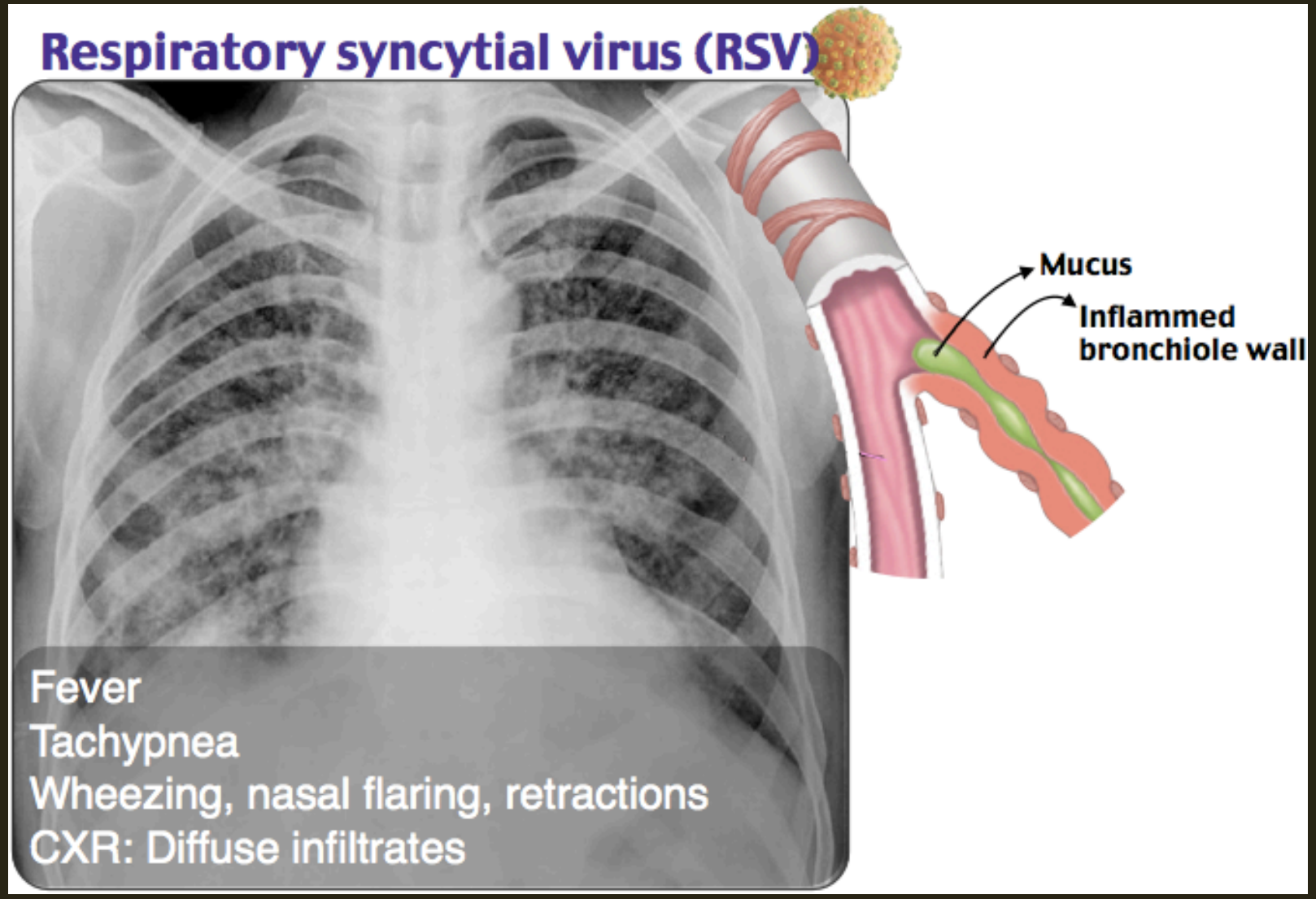
EPIGLOTTITIS

- ✓ Most often affects children between 2 and 7 years, but may occur at any age. This is a true emergency involving cellulitis and edema of the epiglottis, aryepiglottic folds, and hypopharynx.
- ✓ -a) Patient is usually febrile, anxious, and toxic appearing, with sore throat, drooling, respiratory distress, stridor, tachypnea, and tripod positioning (sitting forward supported by both arms, with neck extended and chin thrust out). Any agitation of the child may cause complete obstruction, so avoid invasive procedures/evaluation until airway is secured.
- ✓ -b) Unobtrusively give oxygen (blow-by). Nothing by mouth, monitor with pulse ox, allow the parent to hold patient.
- ✓ -c) Summon epiglottitis team (most senior pediatrician, anesthesiologist, intensive care physician, and otolaryngologist in the hospital).
- ✓ -d) Management options:
  - ✓ –1) If unstable (unresponsive, cyanotic, bradycardic) > emergently intubate.
  - ✓ –2) If stable with high suspicion > take the patient to the operating room for laryngoscopy and intubation under general anesthesia.
  - ✓ –3) If stable with moderate or low suspicion > obtain lateral neck radiographs to confirm.
- ✓ -e) After airway is secure, obtain cultures of blood and epiglottic surface. Begin antibiotics to cover *Haemophilus influenza type B, Streptococcus pneumoniae, group A streptococci, Staphylococcus aureus.*
- ✓ -f) Epiglottitis may be caused by thermal injury, caustic ingestion, or foreign body.

FOREIGN BODY ASPIRATION

- ✓ Mostly seen in 6 months to 3 year olds. It frequently involves hot dogs, candy, peanuts, grapes, or balloons. Most events are unwitnessed, so suspect this in children with sudden-onset choking, stridor, or wheezing.
- ✓ a) If partial airway obstruction is suspected – i.e. the Pt. is stable (can make sounds, cough forcefully, is well oxygenated), do not intervene. Call for help and allow the child to clear the obstruction by coughing. Removal of the FBAO by bronchoscopy or laryngoscopy should be attempted in a controlled environment.
- ✓ b) If complete airway obstruction is suspected – i.e. the pt. makes no sounds, can't speak, unable to cough, moves air poorly / unable to breathe adequately, or is cyanotic:
  - ✓ 1) <1 year: Place infant over arm or rest on lap. Give five back blows/slaps between the scapulae. If unsuccessful, turn infant over and give five chest thrusts (not abdominal thrusts).
  - ✓ 2) ≥1 year: Perform five abdominal thrusts (Heimlich maneuver) from behind a sitting or standing child.
  - ✓ 3) After back, chest, and/or abdominal thrusts, open mouth using tongue-jaw lift and remove foreign body if visualized. Do not attempt blind finger sweeps. Magill forceps may be used to retrieve objects in the posterior pharynx. Ventilate if unconscious, and repeat sequence as needed.
  - ✓ 4) If there is complete airway obstruction and the patient cannot be ventilated by bag-valve mask or ETT, consider percutaneous (needle) cricothyrotomy.
- ✓ If the infant or child becomes unresponsive, start CPR beginning with chest compressions (even if pulse is palpable), until additional expertise is available. This may help to dislodge the foreign body. Before you give breaths, look into the mouth. Remove the foreign body if you see it.

BRONCHIOLITIS



Risk Factors for developing Bronchiolitis include:

- Male gender,
- Lack of breast-feeding,
- Those living in crowded conditions,
- Maternal smoking,
- Preterm birth, and
- Chronic lung disease.

BRONCHIOLITIS

- ✓ ABCs
- ✓ Oral or nasal suctioning as needed
- ✓ Consider viral studies (RSV, influenza A & B), ABG, CXR, CBC, CMP
- ✓ Supplemental O2 to keep O2 sat above 94%
- ✓ Trial of Albuterol Nebs 2.5mg/0.5ml – No longer recommended!
- ✓ Nebulized Hypertonic saline 3% solution. Give 4ml q2h for 3 doses followed by 4ml q4h for 5 doses, followed by 4ml q6h till discharge.
- ✓ Saline drops in the nose and nasal suctioning PRN.
- ✓ Bronchiolitis is self-limiting and requires only supportive care. *Watch for bacterial superimposition.
- ✓ Most common cause is RSV. RSV season is from October to late January, latest April
- ✓ Usually affects children younger than 2 years, with a peak in infants aged 3-6 months.

ASTHMA, mod to severe

- ✓ Results from a triad of *inflammation, bronchospasm, and increased secretions*:
- ✓ Check RR, resp. effort, oxygen sat, peak expiratory flow, HR, alertness, color.
- ✓ Initial Management:
  a) Oxygen: Give humidified oxygen to keep sats > 95%. Use non-rebreather Mask if needed.
  b) Albuterol (beta-agonists): Give MDI or Nebulized solution. If wheezing and aeration are not alleviated, continues albuterol administration may be needed.
  c) Ipratropium bromide by nebs. May use duonebs.
  d) Steroids: Methylprednisolone, 2 mg/kg IV/IM bolus, then 2mg/kg/day IV or IM, divided every 6 hours; or prednisone 2mg/kg PO every 24 hours; requires 3 or 4 hours to take effect.
  e) Diagnostic tests. Get CXR, ABG, etc. as indicated. NOTE: A normalizing PCO2 on ABG is often a sign of impending respiratory failure.

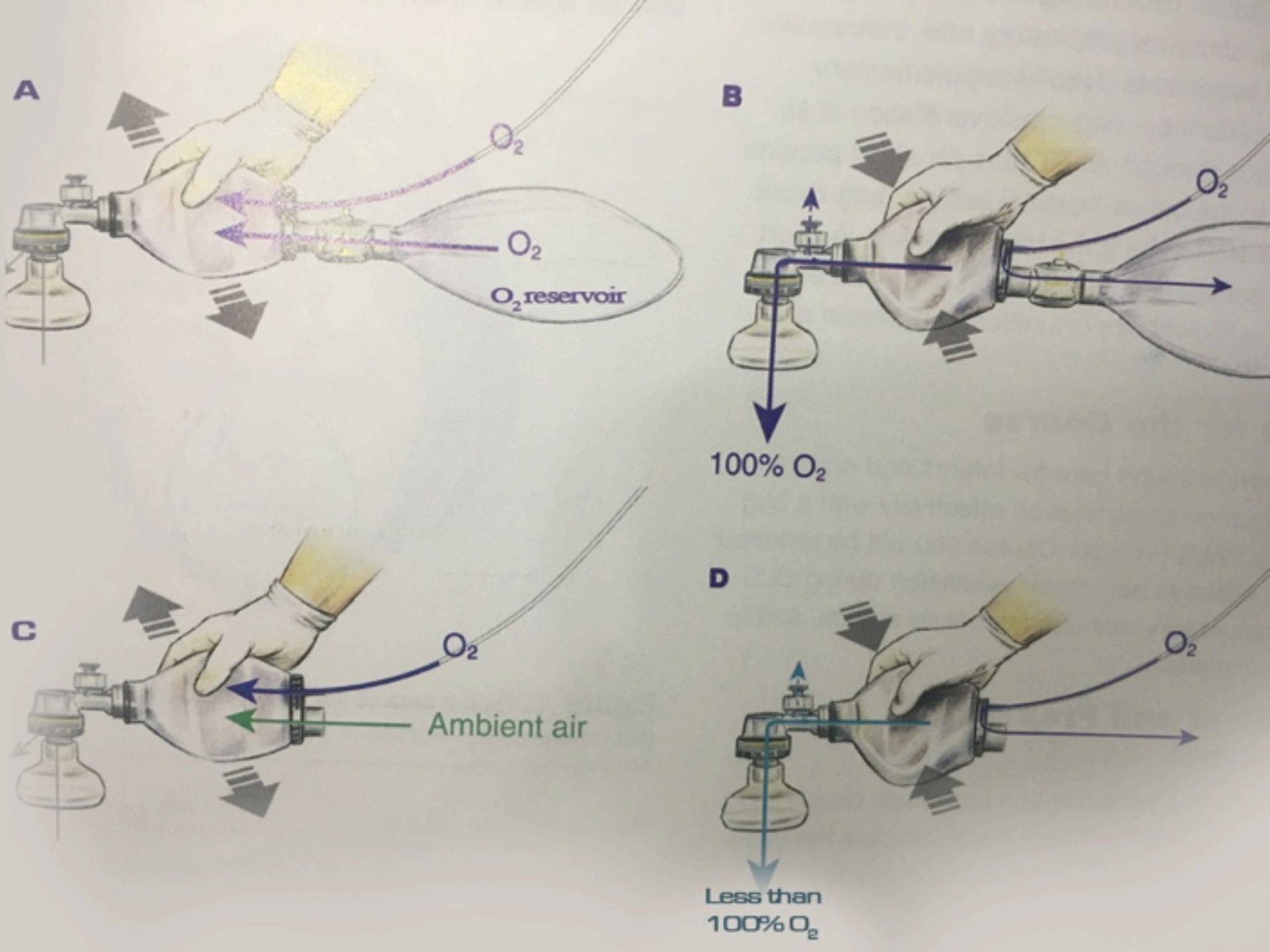
ASTHMA, Impending Resp. Failure

If air movement is still poor despite maximizing above therapy:

- ✓ Epinephrine: 0.01mg/kg (0.01ml/kg) of 1:1000 SQ or IM (Maximum dose 0.5mg). -a) Epinephrine has bronchodilator, vasopressor, and inotropic effects. -b) It is short-acting (~15 min) and should be used as temporizing rather than definitive therapy.
- ✓ Magnesium Sulfate: 25 to 75mg/kg/dose IV or IM (maximum 2g) infused over 20 minutes. – a) Smooth muscle relaxant; relieves bronchospasm. -b) Many clinicians advise giving a saline bolus prior to administration because hypotension may result. -c) Contraindicated if the patient already has significant hypotension or renal insufficiency.
- ✓ Terbutaline: 0.01 mg/kg SQ (maximum dose 0.4mg) every 15 minutes up to three doses. -a) Systemic beta-2 agonist limited by cardiac intolerance. -b) Monitor continuous 12-lead ECG, cardiac enzymes, UA, and electrolytes. May use terbutaline as an infusion.
- ✓ Consider bilevel positive-pressure airway pressure (noninvasive PPV), especially in alert, cooperative children.
- ✓ Consider intubating children with refractory hypoxemia (low O2 sats), worsening clinical condition (e.g. decreasing level of consciousness, irregular breathing), or both.

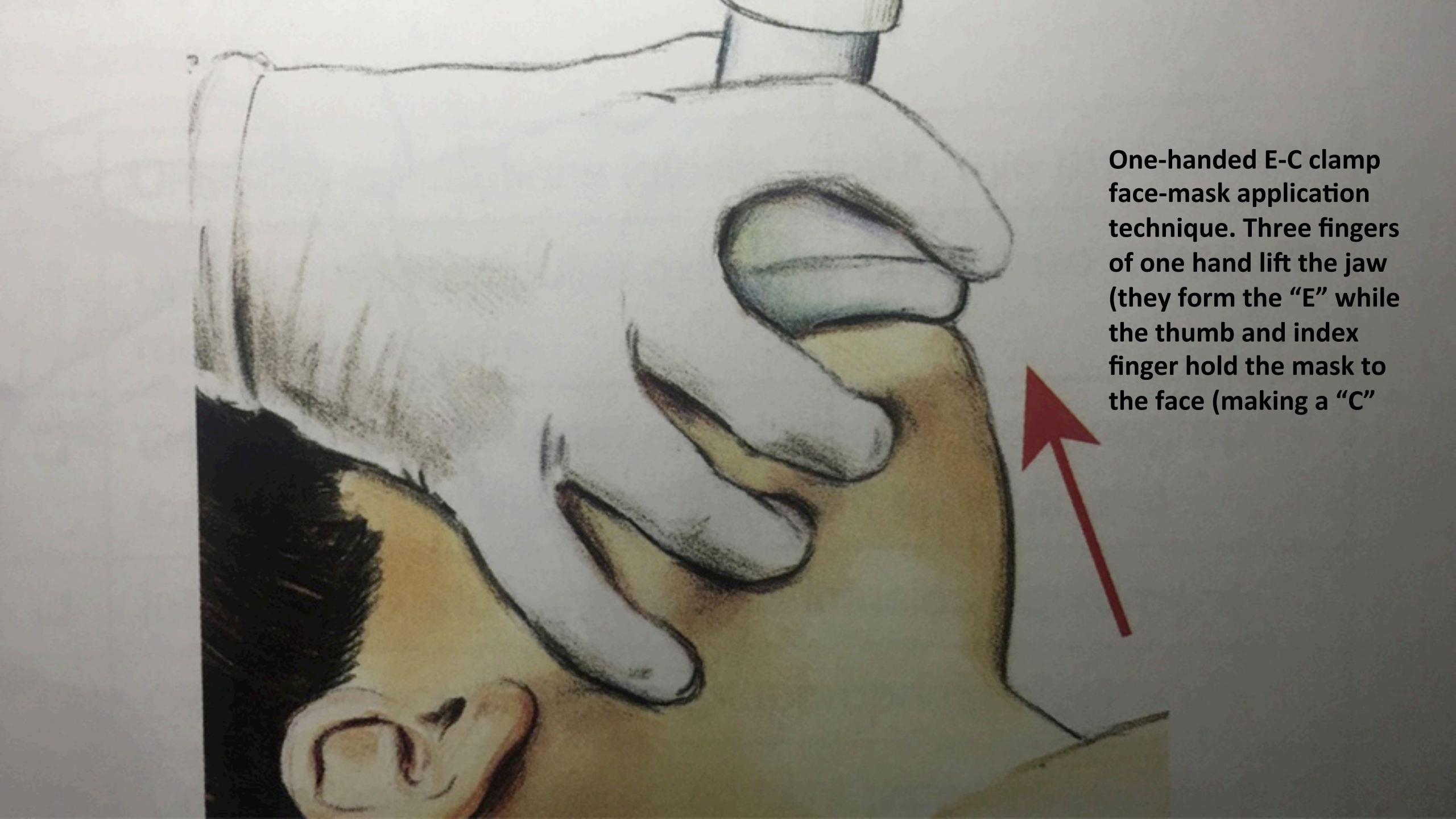
RESOURCES FOR MGT. OF RESP. EMERGENCIES

Self-Inflating Ventilation Bag, with Oxygen reservoir (A & B), and without (C & D).

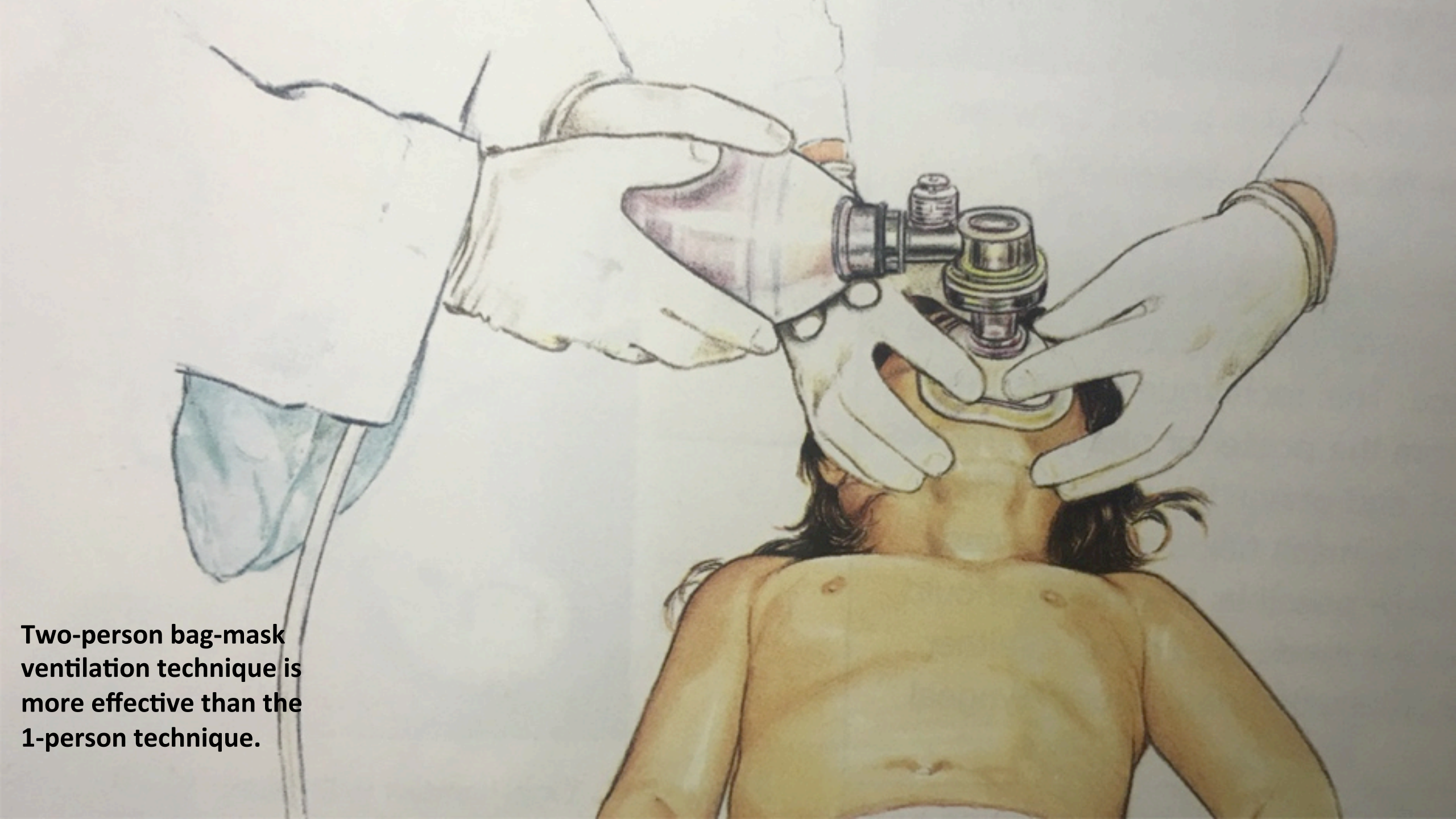


Correct Positioning of the child > 2 years of age for ventilation and Endotracheal intubation.

A & D: Incorrect positions of the neck.
B: A folded sheet or towel placed under the occiput aligns the Pharyngeal (P) and Tracheal (T) axes.
C: Extension of the atlanto-occipital joint results in the alignment of the oral (O), pharyngeal, and tracheal axes.
Note that proper positioning places the external ear canal anterior to the shoulder.



One-handed E-C clamp face-mask application technique. Three fingers of one hand lift the jaw (they form the “E” while the thumb and index finger hold the mask to the face (making a “C”



Two-person bag-mask ventilation technique is more effective than the 1-person technique.

ALLERGIC EMERGENCIES (ANAPHYLAXIS)

What is the most common organ involved in anaphylaxis?

ANAPHYLAXIS - Definition

- ✓ 1. A rapid-onset IgE-mediated release of histamine and other mediators from mast cells and basophils leading to a systemic allergic reaction involving multiple organ systems, including two or more of the following:
  - ✓ a) Cutaneous/mucosal (flushing, urticaria, pruritis, angioedema); seen in 90%.
  - ✓ b) Respiratory (laryngeal edema, bronchospasm, dyspnea, wheezing, stridor, hypoxemia); seen in ~70%
  - ✓ c) GI (N/V/D, crampy abdominal pain); seen in about 40-50%
  - ✓ d) Circulatory (tachycardia, hypotension, syncope); seen in about 30-40%
- ✓ 2. Initial reaction may be delayed for several hours AND symptoms may recur up to 72 hours after initial recovery. Patients should therefore be observed for a minimum of 6 to 24 hours for late-phase symptoms.

ANAPHYLAXIS - Treatment

① Stop exposure to precipitating antigen /allergen

② Epinephrine = mainstay of therapy. While performing ABCs, immediately give IM epinephrine, 0.01mg/kg (0.01ml/kg) of 1:1000 SQ or IM (maximum dose 0.5mg). Repeat every 5 minutes as needed. The site of choice is the lateral aspect of the thigh, owing to its vascularity.

③ Airway - Establish airway

④ Breathing – Give Oxygen and PPV as needed.

⑤ Treat hypotension: Obtain IV access, Trendelenburg position with head 30 degrees below feet, give IV fluid boluses (20ml/kg) followed by pressors (epinephrine infusion) as needed.

⑥ Anti-histamines: Histamine-1 receptor antagonists such as diphenhydramine, 1 to 2mg/kg via IM, IV, or oral (PO) route (maximum dose, 50mg). Also, consider a histamine-2 receptor antagonist (e.g. ranitidine).

⑦ Corticosteroids help prevent the late phase of the allergic response. Administer methylprednisolone in a 2-mg/kg IV bolus, followed by 2mg/kg/day IV or IM, divided every 6 hours, or prednisone 2mg/kg PO once daily.

⑧ Albuterol 2.5mg for <30kg, 5mg for >30mg, for bronchospasm(wheezing). Repeat q15mins prn. MDI or Nebs.

⑨ Racemic epinephrine 0.5ml of 2.25% solution inhaled for signs of upper airway obstruction.

⑩ Patient should be discharged with an Epi-pen (>30kg), Epi-pen junior (<30kg), or comparable injectable epinephrine product with specific instructions on appropriate use, as well as anaphylaxis action plan.

SHOCK

SHOCK

- ✓ Shock is a critical condition that results from inadequate tissue delivery of oxygen and nutrients to meet tissue metabolic demands.
- ✓ Shock is often, but not always, characterized by inadequate peripheral and end-organ perfusion.
- ✓ The definition of shock doesn't depend on BP measurement. Shock can occur with normal, increased, or decreased BP.
- ✓ All type of shock can result in impairment of vital organs like the brain (AMS) and kidneys (low UOP)
- ✓ In children, most shock is characterized by low CO. However, sepsis and anaphylactic shock is high CO shock.

SHOCK

Shock can result from:

Mechanism	Type of Shock	Common Causes
Inadequate blood volume or oxygen-carrying capacity	Hypovolemic shock (Hypovolemia is the most common cause of shock in children worldwide)	-GI losses: Diarrhea; Vomiting -Inadequate fluid intake -Hemorrhage (internal & external) -Osmotic diuresis (e.g. DKA) -Third spacing (e.g. fluid leak into tissues) -Large burns
Inappropriate distribution of blood volume and flow	Distributive shock	1) Septic shock, 2) Anaphylactic shock, 3) -Neurogenic shock (generalized loss of vascular tone which leads to severe vasodilation and HoTN. Also loss of sympathetic innervation of the heart)
Impaired cardiac contractility	Cardiogenic shock	Congenital heart disease; Myocarditis; Cardiomyopathy (inherited or acquired abnormality of pumping function); Arrhythmias, Sepis; Poisoning or drugs; Myocardial injury (e.g. trauma)
Obstructed blood flow	Obstructive shock	Cardiac tamponade; Tension PTX; Massive PE; Ductal dependent congenital lesions

BLOOD VOLUME

9-pound newborn:
Blood volume equals less than a 12-oz (335 mL) can of a soft drink

60-pound child:
Blood volume equals about a 2-liter bottle of a soft drink

125-pound adult:
Blood volume equals about two 2-liter bottles of a soft drink

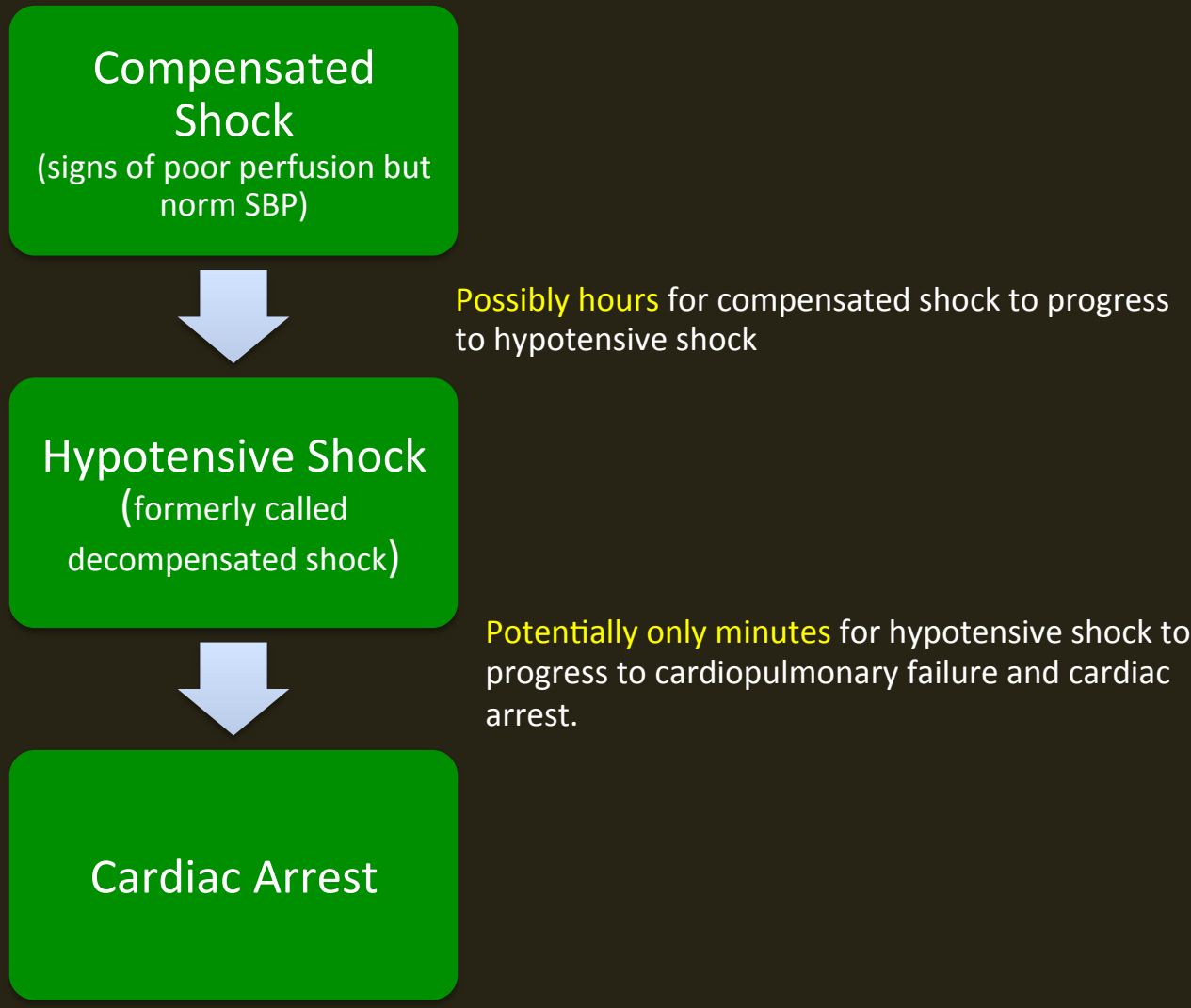
Comparing infant, child, and adolescent /adult blood volumes

SHOCK: Compensatory Mechanisms

As such develops, compensatory mechanisms attempt to maintain O2 delivery to vital organs. These include:

- ✓ Tachycardia
- ✓ Increased SVR (vasoconstriction)
- ✓ Increased strength of cardiac contraction (contractility)
- ✓ Increase in venous smooth muscle tone.

COMPENSATED TO HYPOTENSIVE SHOCK

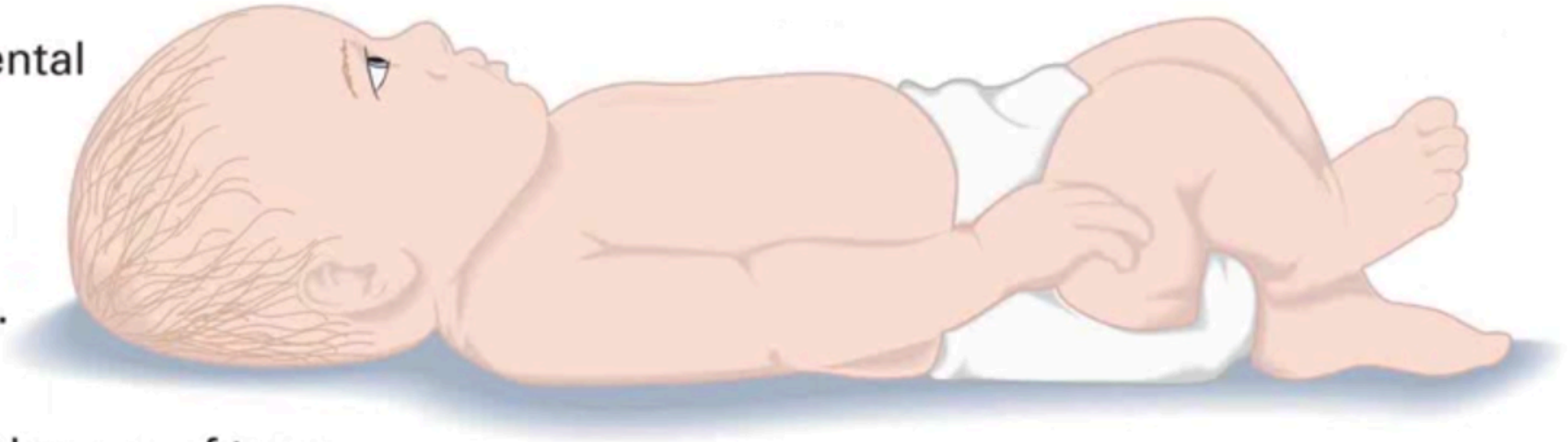


Apathy or lack of vitality.

Rapid respiratory rate.

Rapid or weak and thready pulse.

Altered mental status.



Pale, cool, clammy skin.

Absence of tears when crying.

Falling blood pressure.

Delayed capillary refill.

Signs of shock in an infant or child.

RECOGNITION OF SHOCK FLOWCHART

	Clinical Signs	Hypovolemic Shock	Distributive Shock	Cardiogenic Shock	Obstructive Shock
A	Patency	Airway open and maintainable / not maintainable			
B	Resp. Rate	Increased			
	Resp. Effort	Normal to increased		Labored	
	Breath Sounds	Normal	Normal (+-crackles)	Crackles, grunting	
C	Systolic BP	COMPENSATED SHOCK ➔ HYPOTENSIVE SHOCK			
	Pulse Pressure	Narrow	Variable	Narrow	
	Heart Rate	Increased			
	Peripheral Pulse quality	Weak	Bounding or Weak	Weak	
	Skin	Pale, cool	Warm or cool	Pale, cool	
	Capillary refill	Delayed	Variable	Delayed	
	UOP	Decreased			
D	Level of Consciousness	Irritable (early), Lethargic (late)			
E	Temperature	Varies			

SHOCK: MANAGEMENT

- ✓ Position the child: A) Stable – Allow to remain with caregiver in a position of comfort. B) Unstable– If hypotensive, Put in Trendelenberg IF breathing is NOT compromised.
- ✓ ABCs:
  - ✓ Give high conc. O2 via nonrebreather mask, Pulse Ox, ECG monitor, IO/IV access. Monitor UOP, BP, Pulse pressure
  - ✓ Consider use of CPAP, noninvasive positive airway pressure, or mechanical ventilation with PEEP.
  - ✓ Consider blood transfusion in cases of blood loss or other severe anemia
- ✓ Fluids, fluids, fluids! (20mg/kg of NS or LR rapidly as bolus). Repeat as needed. Give PRBC if trauma or hemorrhage. Modify volume and rate of bolus if cardiogenic shock or severe myocardial dysfunction.
- ✓ Frequent Reassessment: Evaluate-Identify-Intervene sequence continuously.
- ✓ Diagnostic studies: CBC, Accucheck, CMP (K+, Ca++), lactate, ABG, ScvO2, BCx

SHOCK: MANAGEMENT

- ✓ BLS as indicated.
- ✓ Vasopressors and Inotropes as needed.
- ✓ Hemorrhagic shock – Control bleeding, transfuse PRBC as needed, in addition to fluids.
- ✓ Neurogenic shock – Fluids + Vasopressor
- ✓ Septic shock – See algorithm (Fluids, BCx, abx, pressors prn, etc)
- ✓ Cardiogenic shock – See Brady and tachyarrhymia algorithms. For others e.g. CHD, Myocarditis, cardiomyopathy, etc – 5-10ml/kg IVF bolus, repeat prn. Pressors. Consult experts.
- ✓ Obstructive Shock: 1) Tension PTX – Needle decompression / Tube thoracostomy. 2) Cardiac tamponade – Pericardiocentesis; 20ml/kg fluids, 3) PE – Fluids (20ml/kg), consider thrombolytics, anticoagulants. Expert consultation. 3) Ductal-Dependent – PGE1, Consult expert.

NEUROLOGIC EMERGENCIES

NEUROLOGIC EMERGENCIES

- ✓Altered States of Consciousness
- ✓Status Epilepticus
- ✓Head Trauma
- ✓Meningitis
- ✓Suicidal Ideation

STATUS EPILEPTICUS

ACUTE MANAGEMENT OF SEIZURES

Mins	Assessment & Supportive Care	Seizure therapy
0-5	ABCDEs tx: Give 100% O2, suction secretions, IV/ IO access, Vital Signs, etc. Eval for signs of sepsis/meningitis/head trauma. Consider low gluc, thiamine def, intoxication (dextrose, thiamine, and naloxone may be given ASAP if suspected). Get labs: BS, lytes, Ca, Mg, ABG/VBG, CBC, BUN, Cr,, LFTs, tox screen, anticonvulsant levels, BCx(if an infection is suspected). Treat fever (acetaminophen 15 mg/kg PR); tx low BS (IV dextrose 0.25 to 0.5 g/kg)	Benzodiazepine: Lorazepam (Ativan) 0.1 mg/kg IV/IO, max 4 mg OR Diazepam (Valium) 0.2 mg/kg IV/IO, max 8 mg. If IV/IO access not achieved in 3 mins: Buccal midazolam 0.2 mg/kg, max 10 mg OR IM midazolam 0.1 to 0.2 mg/kg, maximum 10 mg OR Rectal diazepam (Diastat gel or injection solution given rectally) 0.5 mg/kg, max 20 mg
5-10	Reevaluate ABCDEs and vital signs. Evaluate for signs of trauma, sepsis, meningitis, or encephalitis. Cont. monitoring, ventilatory support, and vascular access. Give abx if signs of sepsis or meningitis	Benzodiazepine: second dose
10-15	Reevaluate ABCDEs and vital signs. Intubate if needed.	Fosphenytoin: 20 mg PE per kg IV or IO◊ OR, if toxin-induced seizure, Phenobarbital: 20 mg/kg IV or IO, maximum 1 g, (expect respiratory depression with apnea)
15-30	Reevaluate ABCDEs and vital signs. Obtain continuous EEG monitoring, if available	Phenobarbital: 20 mg/kg IV/ IO, max 1 g, (10 mg/kg if phenobarbital already given)§ OR Valproic acid 20 to 40 mg/kg IV/IO OR Levetiracetam 20 to 60 mg/kg IV or IO AND Pyridoxine 100 mg IV/IO in infants <1 year of age Pyridoxine 70 mg/kg IV or IO, maximum 5 g, if INH poisoning suspected. Obtain pediatric neurology consultation. If seizure persists, consider general anesthesia in ICU. Avoid paralytics.

NOT DISCUSSED

NOT DISCUSSED

- ✓Cardiac Emergencies
  - ✓ Bradycardia
  - ✓ Tachyarrhythmias
  - ✓ Cardiac Arrest
- ✓Sepsis
- ✓Any fever in the first 60 days of life
- ✓Any infection in the first 60 days of life
- ✓Meningitis

Objectives

1. Pediatric Emergencies are Common
2. Our Clinic's Preparedness
3. Systematic approach
4. Respiratory Emergencies
5. Allergic Emergencies (Anaphylaxis)
6. Shock
7. Neurologic Emergencies
8. Not Discussed

Take Home Points

1. Pediatric emergencies are common in office setting
2. Prepare by knowing what the clinic has to offer and the protocols in place.
3. Mock Codes in the clinic are recommended.

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Questions?

PEDIATRIC EMERGENCIES
in the Clinic Setting

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October 2016