Below are some guidelines and treatment scenarios for pediatric emergencies. The first section contains guidelines that have been published by the American Heart Association for cardiopulmonary resuscitation and emergency cardiac care. Simple bag valve mask technique is also presented. Common diseases that present to the office are presented after the AHA and bag valve mask refreshers.

**AMERICAN HEART ASSOCIATION CPR/BLS & FIRST AID GUIDELINE UPDATE(S) 2015**

In 2015, the American Heart Association (AHA) revised the CPR/BLS guidelines for both adult and pediatric patients. Below are links to the web pages delineating those changes. Also attached are the single and two person rescuer algorithms and a pictogram for infant CPR technique.

Briefly:
- The Circulation-Airway-Breathing sequence as the preferred sequence for adult and pediatric CPR
- Strongly reaffirming that compressions and ventilation are needed for pediatric BLS
- Reaffirmed two fingered compressions for infants
- Mirroring the adult BLS recommended chest compression rate of 100 to 120/min
- Chest compression depth is 1.5 inches (4 cm) in infants to 2 inches (5 cm) in children. The upper limit is 6 cm for chest compression depth in an adolescent. Best recalled as the sequence 4-5-6 cm.
- New algorithms for 1-rescuer and multiple-rescuer pediatric HCP CPR in the cell phone era

AHA 2015 CPR & ECC GUIDELINES-main web page

AHA 2015 COMPLETE UPDATE-CPR/BLS/FIRST AID-36 pages of all 2015 update recommendations from the AHA

AHA 2015 ADULT CPR/BLS UPDATES-web page for adult changes

AHA 2015 PEDIATRIC CPR/BLS UPDATES-web page for pediatrics

**PEDIATRIC SINGLE RESCUER ALGORITHM 2015**
PEDIATRIC TWO PERSON RESCUER ALGORITHM 2015

AHA 2015 FIRST AID GUIDELINES
BLS Healthcare Provider
Pediatric Cardiac Arrest Algorithm for the Single Rescuer—2015 Update

Verify scene safety.

Victim is unresponsive. Shout for nearby help. Activate emergency response system via mobile device (if appropriate).

Activate emergency response system (if not already done). Return to victim and monitor until emergency responders arrive.

Look for no breathing or only gasping and check pulse (simultaneously). Is pulse definitely felt within 10 seconds?

Normal breathing, has pulse

No normal breathing, has pulse

Provide rescue breathing: 1 breath every 3-5 seconds, or about 12-20 breaths/min.
- Add compressions if pulse remains ≤60/min with signs of poor perfusion.
- Activate emergency response system (if not already done) after 2 minutes.
- Continue rescue breathing; check pulse about every 2 minutes. If no pulse, begin CPR (go to "CPR" box).

Witnessed sudden collapse?

Yes

Activate emergency response system (if not already done), and retrieve AED/defibrillator.

No

CPR
1 rescuer: Begin cycles of 30 compressions and 2 breaths. (Use 15:2 ratio if second rescuer arrives.) Use AED as soon as it is available.

After about 2 minutes, if still alone, activate emergency response system and retrieve AED (if not already done).

AED analyzes rhythm. Shockable rhythm?

Yes, shockable

Give 1 shock. Resume CPR immediately for about 2 minutes (until prompted by AED to allow rhythm check). Continue until ALS providers take over or victim starts to move.

No, nonshockable

Resume CPR immediately for about 2 minutes (until prompted by AED to allow rhythm check). Continue until ALS providers take over or victim starts to move.

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BLS Healthcare Provider
Pediatric Cardiac Arrest Algorithm for 2 or More Rescuers—2015 Update

Verify scene safety.

Victim is unresponsive. Shout for nearby help. First rescuer remains with victim. Second rescuer activates emergency response system and retrieves AED and emergency equipment.

Monitor until emergency responders arrive.

No normal breathing, has pulse

Look for no breathing or only gasping and check pulse (simultaneously). Is pulse definitely felt within 10 seconds?

No breathing or only gasping, no pulse

CPR
First rescuer begins CPR with 30:2 ratio (compressions to breaths). When second rescuer returns, use 15:2 ratio (compressions to breaths). Use AED as soon as it is available.

AED analyzes rhythm. Shockable rhythm?

Yes, shockable
Give 1 shock. Resume CPR immediately for about 2 minutes (until prompted by AED to allow rhythm check). Continue until ALS providers take over or victim starts to move.

No, nonshockable
Resume CPR immediately for about 2 minutes (until prompted by AED to allow rhythm check). Continue until ALS providers take over or victim starts to move.

Provide rescue breathing: 1 breath every 3-5 seconds, or about 12-20 breaths/min.
- Add compressions if pulse remains ≤60/min with signs of poor perfusion.
- Activate emergency response system (if not already done) after 2 minutes.
- Continue rescue breathing; check pulse about every 2 minutes. If no pulse, begin CPR (go to “CPR” box).
General Technique

Bag-mask ventilation is an essential CPR technique for healthcare providers. Bag-mask ventilation requires training and periodic retraining in the following skills: selecting the correct mask size, opening the airway, making a tight seal between the mask and face, delivering effective ventilation, and assessing the effectiveness of that ventilation.

Use a self-inflating bag with a volume of at least 450 to 500 mL for infants and young children, as smaller bags may not deliver an effective tidal volume or the longer inspiratory times required by full-term neonates and infants. In older children or adolescents, an adult self-inflating bag (1000 mL) may be needed to reliably achieve chest rise.

A self-inflating bag delivers only room air unless supplementary oxygen is attached, but even with an oxygen inflow of 10 L/min, the concentration of delivered oxygen varies from 30% to 80% and is affected by the tidal volume and peak inspiratory flow rate. To deliver a high oxygen concentration (60% to 95%), attach an oxygen reservoir to the self-inflating bag. Maintain an oxygen flow of 10 to 15 L/min into a reservoir attached to a pediatric bag and a flow of at least 15 L/min into an adult bag.

Effective bag-mask ventilation requires a tight seal between the mask and the victim’s face. Open the airway by lifting the jaw toward the mask making a tight seal and squeeze the bag until the chest rises. Because effective bag-mask ventilation requires complex steps, **bag-mask ventilation is not recommended for a lone rescuer during CPR**. During CPR the lone rescuer should use mouth-to-barrier device techniques for ventilation. Bag-mask ventilation can be provided effectively during 2-person CPR.

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”).
Healthcare providers often deliver excessive ventilation during CPR, particularly when an advanced airway is in place. Excessive ventilation is harmful because it increases intrathoracic pressure and impedes venous return and therefore decreases cardiac output, cerebral blood flow, and coronary perfusion.

Causes air trapping and barotrauma in patients with small-airway obstruction.

Increases the risk of regurgitation and aspiration in patients without an advanced airway.

Avoid excessive ventilation; use only the force and tidal volume necessary to just make the chest rise.

Give each breath slowly, over approximately 1 second, and watch for chest rise. If the chest does not rise, reopen the airway, verify that there is a tight seal between the mask and the face (or between the bag and the advanced airway), and reattempt ventilation.

Because effective bag-mask ventilation requires complex steps, bag-mask ventilation is not recommended for ventilation by a lone rescuer during CPR.

Patients with airway obstruction or poor lung compliance may require high inspiratory pressures to be properly ventilated (sufficient to produce chest rise). A pressure-relief valve may prevent the delivery of a sufficient tidal volume in these patients. Make sure that the bag-mask device allows you to bypass the pressure-relief valve and use high pressures, if necessary, to achieve visible chest expansion.

Two person Bag Valve Mask technique

If skilled rescuers are available, a 2-person technique may provide more effective bag-mask-ventilation than a single-person technique. A 2-person technique may be required to provide effective bag-mask ventilation when there is significant airway obstruction, poor lung compliance, or difficulty in creating a tight seal between the mask and the face. One rescuer uses both hands to open the airway and maintain a tight mask-to-face seal while the other compresses the ventilation bag. Both rescuers should observe the chest to ensure chest rise. Because the 2-person technique may be more effective, be careful to avoid delivering too high a tidal volume that may contribute to excessive ventilation.
**Oxygen Concentration in CPR**

Animal and theoretical data suggest possible adverse effects of 100% oxygen, but studies comparing various concentrations of oxygen during resuscitation have been performed only in the newborn period. Until additional information becomes available, it is reasonable for healthcare providers to use 100% oxygen during resuscitation. Once circulation is restored, monitor systemic oxygen saturation. It may be reasonable, when appropriate equipment is available, to titrate oxygen administration to maintain the oxyhemoglobin saturation ≥94%. Provided appropriate equipment is available, once ROSC is achieved, adjust the FIO₂ to the minimum concentration needed to achieve transcutaneous or arterial oxygen saturation of at least 94% with the goal of avoiding hyperoxia while ensuring adequate oxygen delivery.

*Since an oxygen saturation of 100% may correspond to a PaO₂ anywhere between ~80 and 500 mm Hg, in general it is appropriate to wean the FIO₂ for a saturation of 100%, provided the oxyhemoglobin saturation can be maintained ≥94%.*

**Other oxygen delivery techniques**

Simple oxygen masks can provide an oxygen concentration of 30% to 50% to a victim who is breathing spontaneously. A non-rebreather mask with 15 liters of 100% oxygen can deliver higher concentration of oxygen, they are tight fitting essentially sealed masks with all air flow coming from an attached oxygen reservoir bag.

Infant- and pediatric-size nasal cannulas are suitable for children with spontaneous breathing. The concentration of delivered oxygen depends on the child’s size, respiratory rate, and respiratory effort. A general rule of thumb is that each liter of nasal cannula oxygen will provide 3% more oxygen (so 1 liter will provide 24% oxygen to the patient). Most patients will not tolerate more than 4 liters of flow. High flow devices (HFNC) can deliver both pressure support and higher oxygen concentrations.
Clinical Scenarios to recognize in the Pediatrics

Most of this material is thoroughly covered during a Pediatric Advance Life Support Course (PALS) and there is no intent here to duplicate such an in depth session. However, a quick, easy to use reference material on basic life support is presented.

The majority of pediatric emergencies do not involve complete cardiopulmonary arrest, but more typically severe presentations of common pediatric problems are seen. Parents may not recognize the severity of an illness or the potential for deterioration, and may take the child to the primary care office rather than the emergency department. Early intervention by the primary care provider in these situations can truly make the difference between a good and bad outcome.

With this in mind, guideline for treatment of severe presentations of common pediatric emergencies are presented. Some therapies may be very familiar while others are more obscure, and typically rendered in the pediatric emergency department or the intensive care unit.

It is not expected that the providers will have all of the suggested equipment or therapeutic agents at his/her disposal in the office or in the field. Sometimes the local EMS unit can supply necessary equipment or agents for stabilization. In other situations, such as an urgent care site, emergency department or acute care hospital, equipment and therapeutic agents are readily available.

It is hoped that this section will be very quickly reviewed prior to organizing and running a mock code, or even used as a rapid reference in that rare instance that a critically ill child is identified.

ANAPHYLAXIS

Definition An acute, often rapidly progressive, systemic reaction characterized by urticaria (hives), respiratory distress with wheezing or stridor and then vascular collapse. Anaphylaxis occurs in a person who is allergic to something is exposed to that agent (allergen or antigen).

Urticaria: Local wheals and erythema in the dermis.

Angioedema: A similar eruption, but with larger edematous areas of swelling that involve subcutaneous structures as well as the dermis.

Acute urticaria and angioedema are essentially anaphylaxis limited to the skin and subcutaneous tissues.

Etiologies Exposure to any number of potential antigens. Most common causes are foreign blood products, certain drugs, desensitizing injections and insect stings. Food allergies (from eggs, shellfish, nuts or fruits) typically result in urticaria or angioedema, but may be severe and lead to anaphylaxis in some individuals after exposure to even very small amounts.

Pathophysiology- A Type I allergic reaction occurs when the antigen reaches the circulation. Histamine and other vasoactive substances are released when the antigen reacts with IgE on basophils and mast cells. These substances cause smooth muscle contraction and vascular dilatation.

Signs and Symptoms Typically in 1 to 15 minutes the patient complains of a sense of uneasiness and may become agitated and flushed. Older children may complain of palpitations, pruritus and difficulty
breathing. An urticarial rash may quickly appear. The patient’s face, eyes and tongue may rapidly swell. Stridor and/or wheezing may also quickly become audible and severe. These symptoms may develop over minutes to hours or, if very severe, may progress to respiratory and/or circulatory failure very rapidly.

**Treatment: Severe Anaphylaxis**
1. BASIC AND ADVANCED LIFE SUPPORT
   Always begin here
   Assess Airway, Breathing and Circulation-okay to this order as long as not unresponsive then would start with CAB.
   Oxygen should be applied
   IV access can be attempted but should not delay dosing with Epinephrine

   2. EPINEPHRINE NO IV PRESENT: 0.01 cc/kg subcutaneously of 1:1,000 Epinephrine.
      Administer as rapidly as possible as this therapy, more than any other, reverses all effects of anaphylaxis and should be effective almost immediately. Should always be used if any respiratory or circulatory abnormalities are noted.

      EPINEPHRINE-IV PRESENT and severe respiratory symptoms or circulatory collapse, 0.1 cc/kg of 1:10,000 Epinephrine

   3. VOLUME If IV present, 20 cc/kg of lactated Ringers or normal saline.

**Treatment: Mild to Moderate Urticaria and/or Angioedema**
1. EPINEPHRINE 0.01 cc/kg of 1:1,000 Epinephrine subcutaneously
2. BENADRYL 1 mg/kg IV or IM
3. STEROID Methylprednisolone (Solu-Medrol) 1-2 mg/kg IV or Decadron 1 mg/kg IM

See attached Algorithm for Anaphylaxis (below).
For a suspected or active food allergy reaction

**SEVERE SYMPTOMS**

- **LUNG:** Short of breath, wheezing, repetitive cough
- **HEART:** Pale, blue, faint, weak pulse, dizzy
- **THROAT:** Tight, hoarse, trouble breathing/swallowing
- **MOUTH:** Significant swelling of the tongue, lips
- **SKIN:** Many hives over body, widespread redness
- **GUT:** Repetitive vomiting, severe diarrhea
- **OTHER:** Feeling something bad is about to happen, anxiety, confusion

**MILD SYMPTOM**

- **NOSE:** Itchy/runny nose, sneezing
- **MOUTH:** Itchy mouth
- **SKIN:** A few hives, mild itch
- **GUT:** Mild nausea/diarrhea

**INJECT EPINEPHRINE IMMEDIATELY.**

**1. Call 911.** Request ambulance with epinephrine.

**Consider Additional Meds**
(After epinephrine):
- Antihistamine
- Inhaler (bronchodilator) if asthma

**Positioning**
Lay the person flat and raise legs. If breathing is difficult or they are vomiting, let them sit up or lie on their side.

**Next Steps**
- If symptoms do not improve, or symptoms return, more doses of epinephrine can be given about 5 minutes or more after the last dose.
- Transport to and remain in ER for at least 4 hours because symptoms may return.

Do not depend on antihistamines. When in doubt, give epinephrine and call 911.
**UPPER AIRWAY OBSTRUCTION**

The procedure for removal of a foreign body from the airway depends on the age of the child. For the child older than 1 year, the abdominal thrust is recommended; for the younger child, back blows followed by chest thrusts are the maneuvers of choice.

**OVER 1 YEAR** The abdominal thrust, or Heimlich maneuver, is recommended for relieving airway obstructions in children older than 1 year. It can be performed with the child standing, sitting, or lying down. When the child is conscious, the thrusts can be delivered in any of these three positions. When the child is unconscious, deliver the thrusts while he or she is supine.

**Conscious - Standing or Sitting**
1. ENCIRCLE CHEST Stand behind the child, arms directly under the armpits, and encircle the chest.
2. HAND PLACEMENT Place the thumb side of one fist against the middle of the child’s abdomen, slightly above the navel and well below the xiphoid.
3. UPWARD HAND THRUSTS Grasp the fist with the other hand and exert five quick upward thrusts. The fist should not touch the xiphoid or the lower margins of the rib cage, because force applied to these structures may damage internal organs.
4. COMPLETE 5 THRUSTS deliver each thrust in a separate, distinct movement. Continue the thrusts until the foreign body is expelled OR five thrusts are completed. If the child still hasn’t expelled the obstruction, breathe directly into the mouth three or four times. If the child loses consciousness, use the following instructions with the child lying down.

**Unconscious – Lying Down**
1. PLACE SUPINE Place the child supine. Kneel close to the child’s side or straddle the hips while facing the child’s head.
2. JAW THRUST Use a chin lift or jaw thrust to open the victim’s airway.
3. HAND PLACEMENT Place the heel of one hand in the middle of the child’s abdomen, slightly above the navel and well below the rib cage and the end of the xiphoid. Place the other hand on top of the first.
4. UPWARD THRUSTS Press both hands into the abdomen with a quick upward thrust. If necessary, perform up to five separate and distinct thrusts. Direct each thrust straight upward towards the child’s head, not to either side of the abdomen.
5. CHECK MOUTH AND REPEAT THRUSTS After five abdominal thrusts, check mouth for foreign body. DO NOT blind sweep. Try mouth to mouth breathing three or four times. If the airway remains obstructed, go back to step 1 and repeat the process.

**UNDER 1 YEAR**

Back blows followed by chest thrusts are recommended for relieving airway obstructions in infants younger than 1 year.
1. POSITION INFANT Hold the infant face down, resting on your forearm. Support the infant’s head by firmly holding the jaw. Rest your forearm on your thigh to support the infant; the victim’s head should be lower than the trunk.

2. BACK BLOWS Forcefully deliver five back blows between the infant’s shoulder blades, using the heel of the hand.

3. REPOSITION INFANT After delivering the back blows, place your free hand on the infant’s back, holding the head so that the infant is sandwiched between your two hands. One hand supports the neck, jaw, and chest, while the other rests on the back.

4. TURN THE INFANT Turn the infant, supporting the head and neck carefully, and position the victim face up across your thigh. The infant’s head should remain lower than the trunk.

5. CHEST THRUSTS Make five quick downward chest thrusts in the lower half of the chest, approximately one finger’s width below the nipple line. These thrusts are similar to external chest compressions used during CPR, but are performed at a slower rate. Check mouth for foreign body. DO NOT blind sweep. Breathe three or four times directly in the child’s mouth. If the airway remains obstructed, go back to step 1 and repeat the process.

**BRONCHIOLITIS/WHEEZING**

*Pathophysiology*  Narrowing of the mid to small airways resulting in difficulty with exhalation. During inspiration, negative intrathoracic pressure “pulls” the small airways open. During exhalation, the positive intrathoracic pressure tends to compress the already narrowed airways. This leads to air-trapping in the lungs and dead space (area of lung that is filled with gas but does not exchange with fresh air with each breath). Dead space results in ventilation/perfusion mismatch and hypoxia. In the most severe cases hypercarbia and respiratory failure may develop. Airway narrowing is caused by a combination of mucus plugging, airway wall edema and smooth muscle bronchial wall constriction. Treatment, therefore, is aimed at reversing all these processes.

*Etiology*  Asthma? Implies an inherent abnormality of the airway. Asthma may be triggered by the following: allergies, cold air, exercise, environmental irritants (smoke), and most commonly, viral upper and lower respiratory tract infections of almost any etiology.

*Bronchiolitis*, by definition, implies an infection of the bronchioles. The most common cause is RSV; however, many other viral agents may cause it as well.

*Differentiation*  Because Asthma typically implies some degree of bronchoconstriction, the term is usually reserved for children over 1 year of age (as they have developed smooth muscle in the walls of the small airways) or for those who have had multiple bouts of wheezing. Bronchiolitis usually refers to viral URI’s associated with wheezing (in children under one year of age). The distinction is often blurred between these two processes as Asthma is commonly triggered by viral infections (even RSV) and many patients who have bronchiolitis clearly respond to bronchodilators indicating smooth muscle development in their small airways. Therefore, treatment for the two processes is very much the same. This is especially true when the wheezing is severe with distress, hypoxia and impending failure as in this case.
**Treatment of Severe Wheezing Asthma or Bronchiolitis**

1. ABC’s, as always, first and foremost (or CAB if unresponsive, apneic or pulseless).
2. OXYGEN Administer 100% oxygen.
3. ALBUTEROL NEBULIZED can be trialed—no benefit in majority of patients with Bronchiolitis. Albuterol 2.5 mg (0.5 cc of concentrated Albuterol) in 2.5 cc saline nebulized (may use 5 mg if ineffective) May be repeated every 10 to 20 minutes if there was a notable effect in distress or wheezing. Evidence shows benefit is given with IPATROPIUM NEBULIZED 250 mcg in 2.5 cc saline nebulized (500 mcg if >10 years).
4. STEROIDS can be considered if Asthma likely—no benefit in Bronchiolitis. Solu-Medrol 2 mg/kg IV bolus or Decadron 1 mg/kg IM if no IV

**Pending Respiratory Failure**

1. PICU REFERRAL Consult with pediatric critical care expert; call EMS as soon as possible to transfer to nearby ED
2. CONTINUOUS ALBUTEROL Continuous albuterol nebulization or 2.5 mg per dose back to back.

**CROUP—LARYNGOTRACHEOBRONCHITIS**

**Pathophysiology** Infectious croup is usually caused by a viral upper respiratory infection causing erythema and edema of the subglottic region. The vocal cords are also often edematous, with impaired mobility. Hypoxemia develops when upper airway obstruction becomes severe and results in decreased alveolar ventilation. Other signs of infection are often present—including low grade fever and congestion. In contrast, spasmodic croup is not usually associated with an infection. It occurs at night with sudden onset of dyspnea, barking cough, and stridor in a previously healthy child. It often recurs on 3-4 consecutive nights.

**Etiology and Epidemiology**

Most common infectious agents are Parainfluenza type I, III; Adenovirus, RSV, Influenza A

Patients are aged 6-36 months, seen in late fall and early winter

**Diagnosis** 1-2 days of prodromal URI, followed by hoarse voice, barking cough, stridor, often begins at night, typically have mild fever. Classic presentation obviates the need for diagnostic testing.

If the attack is **severe**: one will see retractions, delayed air entry, hypoxia with irritability and in extreme cases lethargy will be noted.

*If a radiograph of the neck (AP soft tissue radiograph) is obtained*, Subglottic edema with narrowing of the airway into the “steeple sign”.

In all cases of stridor it is important to consider epiglottitis, which is always a life-threatening emergency. These patients are almost always toxic in appearance, drooling and sitting in the tripod position—sitting, leaning forward with their neck extended, they have a high fever and sudden onset of symptoms.
Treatment—Moderate to Severe
1. HUMIDIFIED OXYGEN by the least obnoxious means it moistens, humidifies and cools the airway to decrease edema

2. NEBULIZED EPINEPHRINE 0.25 cc of standard 1:1000 IV epinephrine added to 2.5 cc of normal saline in the nebulizer. It is not necessary to use racemic epinephrine as it is more expensive and provides no additional clinical benefit over the L-isomer. Used the intravenous form of epinephrine.

3. STEROIDS Decadron 0.6 mg/kg with maximum of 16 mg, may be given orally, IM or IV (only if already in place, IV is not first line.

Respiratory Failure from obstruction
Proceed to manage as with any form of respiratory failure. ABC’s. Even though airway obstruction may be severe, most patients can be adequately bag-valve-mask ventilated. If intubation is necessary, may need to choose an endotracheal tube that is smaller by 0.5 to 1.0 mm than would normally be used for that aged patient.

EPIGLOTTITIS

Pathophysiology Supraglottic and epiglottic cellulitis with massive edema resulting in sore throat, dysphagia, and muffled stridor due to decreased air flow. Total airway obstruction may occur and be life-threatening because of the difficulty placing an endotracheal tube through a swollen and closed larynx.

Etiology H. influenza type B (by far the most common cause, but substantially decreased in incidence since the advent of the H flu vaccine), S. pneumoniae, S. aureus, group A and C beta-hemolytic streptococci. Seen increasingly in teen and adults due to H. Flu vaccine given to young children.

Diagnosis Acute onset fever (usually quite high), sore throat, drooling, rapidly progressing to respiratory distress and failure. Child appears anxious, toxic, air hungry, tachycardic with drooling and tripoding posture-leaning forward on hands while sitting with head tilted upward (as if getting ready for intubation).

Testing is rarely needed. This is a clinical diagnosis, radiographs and lab tests delay treatment and may precipitate respiratory arrest from agitation.

Treatment Epiglottitis always represents a life-threatening medical emergency because of the risk of sudden upper airway obstruction. It is impossible to know when or if this obstruction will occur; therefore, the airway must be protected with an endotracheal tube once the diagnosis has been made (or even highly suspected).

1. TRANSPORT Immediately transport to the nearest emergency facility (911) and call ahead to notify them of this patient’s impending arrival. Intubation in a controlled location with direct visualization by a critical airway team (anesthesia and otolaryngology) is the ideal. Blind intubation in the office is less successful in most cases.

2. IF RESPIRATORY FAILURE occurs
If complete airway obstruction occurs enroute or in the office, begin basic life support. Despite the severity of the airway obstruction, bag-valve mask ventilation is almost always still effective!! Emergency tracheostomy should be planned for, but is very rarely required.

**STATUS EPILEPTICUS-TONIC CLONIC SEIZURES**

**Definition** Continuous seizure activity, or intermittent seizure activity without recovery of consciousness between seizures, that lasts for more than 30 minutes.

**Pathophysiology** A. Abnormal cortical electrical discharge emanating from an abnormal focus in the brain which in turn spreads across the entire cortex resulting in loss of consciousness and generalized tonic-clonic motor activity.

Most common causes in children:
- Febrile illness in patients 1 to 5 year old (Approximately 25%)
- Idiopathic seizure disorder (first presentation of epilepsy) (Approximately 25%)
- Head trauma with possible increased intracranial pressure and/or hemorrhage
- Hyponatremia in children under 6 months of age who receive too much free water
- Hypoglycemia
- Intracranial infections: Encephalitis more common cause than bacterial meningitis (which rarely presents with seizures)
- Calcium and magnesium abnormalities are extraordinarily rare

Patients are typically unresponsive; the motor activity is almost rhythmic and cannot be stopped by holding an extremity

The seizure itself is rarely detrimental to the patient; theoretically, the brain will develop nutritional deprivation and become permanently injured after 45 minutes to 1 hour of absolute, continuous seizure activity. This is extremely rare and only occurs when patients have prolonged seizures related to underlying problems (trauma, infection, severe electrolyte disturbances).

Airway and breathing often appear to be compromised as breathing is noisy and irregular, and the patient may be appear dusky.

**RESPIRATORY FAILURE OR SEVERE HYPOXIA ARE RARELY CAUSED BY THE SEIZURE ITSELF.** Respiratory failure occurs much more commonly secondary to respiratory depressive effects of medications used to treat the seizure.

**Goals of Therapy**
A. Prevent complications from extraordinarily prolonged seizures  
B. Prevent secondary complications from the cause of the seizure (i.e. prolonged hypoglycemia)  
C. Prevent complications from side effects of the treatment of status epilepticus

**Treatment** ABC’S Rapidly assess and manage airway, breathing and circulation. As stated above, the airway is often intermittently obstructed and the breathing irregular. The patient is often mottled and cool. Usually no intensive airway or circulatory support is necessary unless apnea or severe shock are present.
INCREASED ICP If increased intracranial pressure is suspected (intracranial hemorrhage, tumor, head trauma), treat immediately by intubation and hyperventilation. Call EMS immediately and consult trauma center or pediatric intensivist.

OXYGEN Apply oxygen via face mask or nasal cannula. Pulse oximeters often work poorly in patients in status epilepticus. Blood sampling (not indicated at this time) would likely demonstrate metabolic acidosis and/or mild hypercarbia, which usually require no treatment.

Bag valve mask ventilation if respiratory effort is poor or if it appears respirations are ineffective-discoordinated.

PREVENT INJURY Prevent patients from harming themselves. Never place any objects in the mouth or nose.

EMS Notify EMS as soon as possible

DETERMINE CAUSE Look for common causes of status epilepticus. Check:
- Temperature
- Glucose if hypoglycemia suspected
- Sodium if hyponatremia suspected

ESTIMATE DURATION
Estimate duration that the patient has been in status epilepticus.

DRUG THERAPY NECESSARY??
If seizure has lasted longer than 10 to 15 minutes, begin treatment with anticonvulsants.

IV attempted and successful? Lorazepam (Ativan): 0.1 mg/kg IV push

Avoid diazepam (Valium) IV if possible (may give 0.1 mg/kg, but has greater association with respiratory depression than Ativan).

Repeat a single dose of either medication if seizures persist.

IV not successful? Valium 0.5 mg/kg RECTALLY up to 20 mg

Some centers have had success with intranasal Midazolam (0.2 mg/kg with max 10 mg) or Lorazepam (0.1 mg/kg with maximum of 4 mg).

Web page protocol @
**SHOCK**

The clinical definition is inadequate oxygen delivery to the organ systems to meet their needs resulting in decreased function. The brain is the most sensitive organ and so patients in shock will typically manifest confusion or lethargy or in the worst case unresponsiveness. Shock can occur with or without low blood pressure (hypotension), hypotension when seen classifies the shock as uncompensated.

Etiologies are dehydration/hypovolemia, sepsis and cardiac dysfunction.

Pathophysiology: The most common cause of shock in children is hypovolemia related to severe dehydration from vomiting, diarrhea and poor oral intake. This leads to a decrease in total fluid volume or dehydration. Newborns and infants are more sensitive as they have very little fluid reserve. Septic shock occurs when the body is overwhelmed by an infection (meningococcemia in older children and group B streptococcal infections in neonates) and is relatively rare in an otherwise healthy child. The infection if severe enough leads to the relaxation of blood vessel muscle tone and leakage of fluid into the tissues—there is some dehydration but there is a more significant distribution of the fluid away from the heart.

In hypovolemia, the primary problem leading to shock is low volume in the circulation with decreased blood flow to the heart that decreases the cardiac output. The body tries to compensate for the decreased blood return by increasing the heart rate. If hypovolemia is severe, the cardiac output will remain low despite rapid heart rates. The body will then attempt to maintain blood pressure by increasing the muscle tone in the vessels (vascular resistance). Extremities will be cool to cold, the pulses weak in the arms/legs along with prolonged capillary refill. The blood pressure may be completely normal (compensated shock), young infants can lose 50% of their normal volume before their blood pressure falls (decompensated shock).

In sepsis, there is poor vascular tone and leakage of fluid into the tissues. Decreased cardiac output occurs, heart rate increases but the body cannot increase the vascular resistance. The extremities will be warm and the pulses strong. The blood pressure may be completely normal (compensated shock), young infants can lose 50% of their normal volume before their blood pressure falls (decompensated shock).

**Signs and Symptoms of hypovolemic shock**

Mild (3-5%) - Behavior is normal, mucosa is moist, fontanelle (infant) is flat, pulses rapid and refill normal, and urine is less dilute with decreased volume

Moderate (6-10%) – Behavior irritable, mucosa is tacky, fontanelle variable, pulses rapid and refill prolonged, urine is even less dilute and more decreased in volume

Severe (over 10%) – Behavior Irritable/Lethargic, mucosa is parched, fontanelle sunken, pulse rapid, decreased in arms and legs, refill very prolonged and blood pressure probably low with no urine output

**Signs and Symptoms of septic shock**

Mild (3-5%) - Behavior is normal, mucosa is moist, fontanelle (infant) is flat, pulses rapid and refill normal, and urine is less dilute with decreased volume
Moderate (6-10%) – Behavior irritable, mucosa is tacky, fontanelle variable, pulses rapid and refill brisk, urine is even less dilute and more decreased in volume

Severe (over 10%) – Behavior Irritable/Lethargic, mucosa is parched, fontanelle sunken, pulse rapid and bounding, refill brisk and blood pressure probably low with no urine output

**Treatment of Shock**

**AIRWAY & BREATHING**
It is not helpful to support the circulation if the patient is not able to get oxygen into the lungs and subsequently into the bloodstream. Every patient in shock should be treated emergently with 100% oxygen.

**CIRCULATION** Perform chest compressions if asystolic or bradycardic.

Obtain vascular access as rapidly as possible. If patient is in impending circulatory collapse or arrest, spend no more than 1 to 2 minutes attempting peripheral IVs. If unsuccessful in that time period and the patient is under 6 years old, place intraosseous needle for vascular access.

Administer 20 cc/kg of normal saline or lactated ringers as a volume bolus over several minutes.

Reassess the patient after each volume bolus.

Repeat 20 cc/kg fluid boluses until the patient demonstrates some signs of improving circulatory status (heart rate decreases, mental status improves, blood pressure normalizes). This may require as much as 60 to 100 cc/kg in children with severe shock. Early aggressive volume resuscitation has been shown to reduce mortality in shock!!

Treat underlying cause of shock if able: Broad spectrum antibiotics if infection suspected.

**NO INOTROPES** Inotropic support may be necessary in severe cases of shock, but should not be used until intravascular volume is restored and adequate monitoring can be done. There is no role for this treatment in office setting.

**VOLUME OVERLOAD?**
Do not worry about “volume overload” in unusual cases of cardiogenic shock, such as myocarditis. Volume support is always indicated in the initial therapy and rarely results in clinical deterioration. In cases of septic shock, volume administration may lead to pulmonary edema and respiratory deterioration. This does NOT mean too much fluid was administered; often it is an unfortunate but expected finding in the course of the disease process.