Chapter 3C
PEDIATRIC RESUSCITATION

Learning Objectives

- To be able to give efficient pediatric BLS
- To be able to provide efficient Pediatric advanced life support
- To be able to identify different cardiac rhythms.

INTRODUCTION

Hypoxic arrest is the most common cause of cardiac arrest in infants, children and adolescents. It is the end result of progressive tissue hypoxia and acidosis caused by respiratory failure or hypotensive shock. Regardless of the initiating event or disease process, the final common pathway preceding cardiac arrest is cardiopulmonary failure.

It is important for all health workers caring for children to know about the fundamental steps in resuscitation and be prepared to implement resuscitation on an immediate basis. The goal of pediatric resuscitation is to maintain adequate oxygenation and perfusion of blood throughout the body while steps are taken to stabilize the child.

Survival Rates from Pediatric Cardiac Arrest

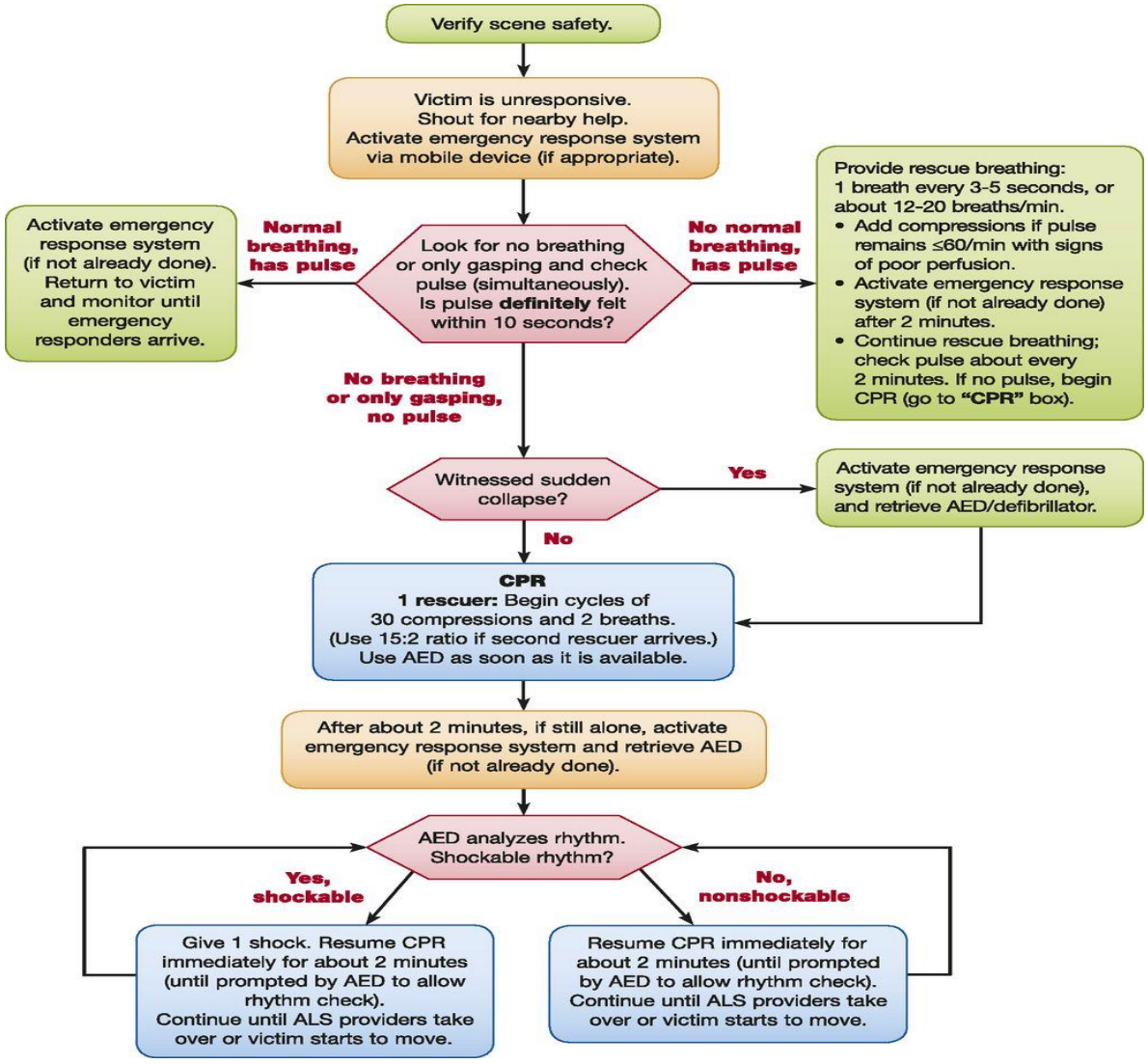
Survival rates vary according to the location of the arrest and the presenting rhythm. Survival is higher if the arrest occurs in hospital (43%) compared with out of hospital (8%). Intact neurologic survival is also much higher if the arrest occurs in hospital. Basic life support (BLS) emphasizes immediate provision of bystander CPR.

Table 3C.1 Overview of Pediatric Basic Life Support

Stages	**Actions**
I) Verify scene safety, check for responsiveness, get help	Perform the following stepwise: • Verify that scene is safe for you and the victim. • Check for responsiveness. Tap child shoulder or heel of the infants' foot and shout "are you OK?" • If victim is not responsive, shout for nearby help. Activate EMS via mobile.
II) Assess for breathing and pulse	Next assess for normal breathing and pulse. • Assess breathing and pulse at the same time. DO NOT spend more than 10 seconds in doing this. • Breathing- look for chest rise and fall, listen for breaths and feel for the air movement. Pulse- infant: palpate brachial pulse. Child: palpate carotid or femoral pulses.
III) i. Breathing normally and pulse is present ii. Not breathing normally but pulse is present iii. if victim is not breathing normally or is only gasping and has no pulse	• Monitor the victim. • Provide rescue breathing: 1 breath every 3-5 seconds • Add compressions if pulse remains 60/min or less with signs of poor perfusion. • Confirm that EMS has been activated • Continue rescue breathing and check pulse every about 2 minutes. • If you are alone and arrest was sudden and witnessed: Leave victim to activate EMS, and then initiate CPR. • If you are alone and arrest was not sudden: Begin high quality CPR starting with chest compressions, for 2 minutes. • Remove clothing covering victim's chest to be able to locate position for chest compression.

IV) High quality CPR	• Push 1/3rd to 1/2 of AP chest depth. • Appropriate rate of (Compression: Ventilation) -Infants and children with two rescuers=15:2 -Infants and children with one rescuer = 30:2 -compression rate of 100-120 times/minute "Push hard Push fast" • Ensure there is a firm surface underneath
V) Attempt Defibrillation with AED	• Use AED as soon as it is available and follow the instructions (give shock if instructed by the AED)
VI) Resume high quality CPR	• After shock delivery "OR" if no shock is advised, immediately resume CPR, starting with chest compressions. • Continue to provide CPR and follow instructions until advanced life support providers take over "OR" child begins to breathe or move.

BLS Healthcare Provider Pediatric Cardiac Arrest Algorithm for Single Rescuer



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

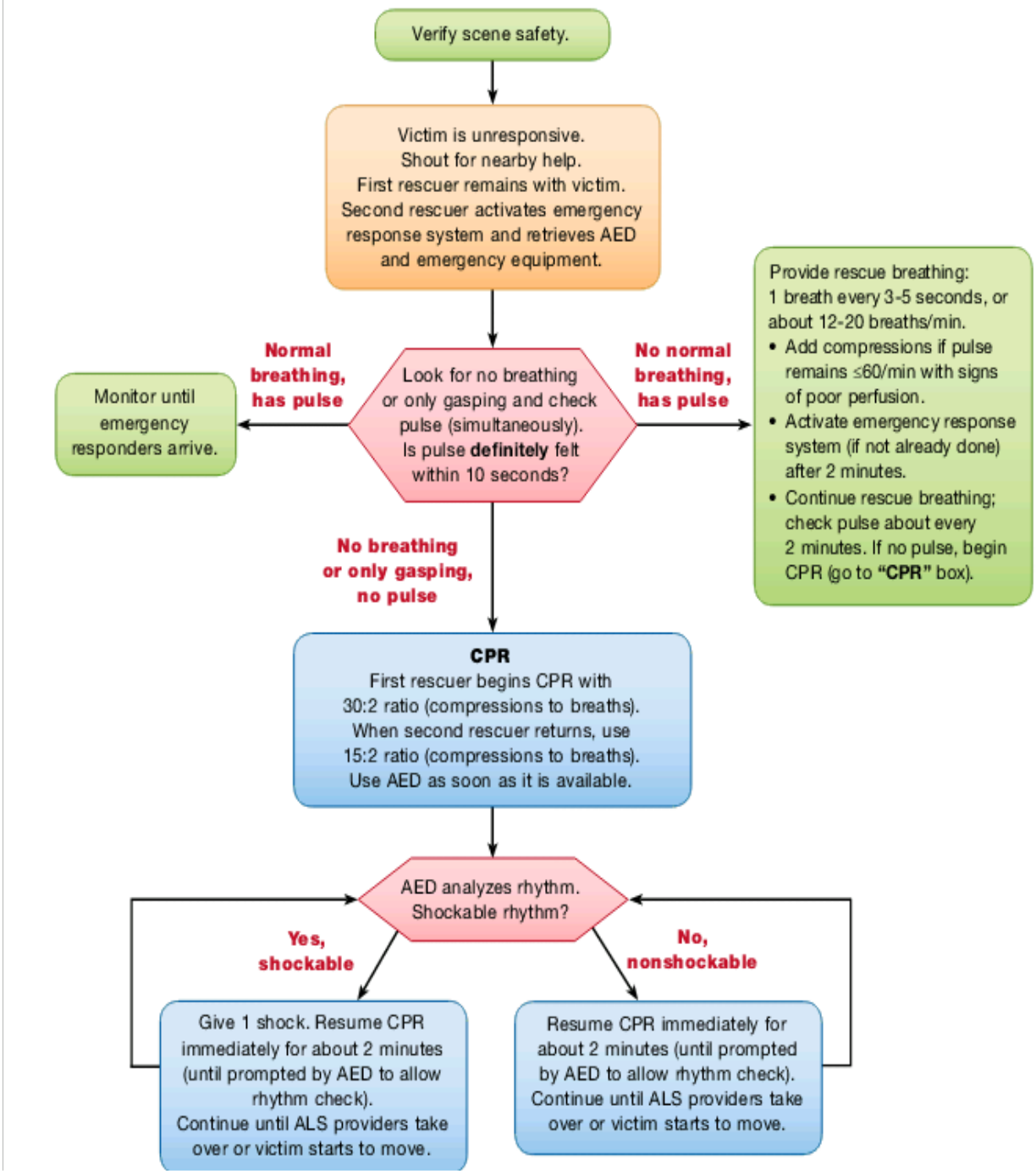


Table 3C.2 Overview of Pediatric Advance Life Support (PALS)

Stages	Actions
Airway	• Head tilt/chin lift (jaw thrust if trauma). • Keep airway in neutral position in infants and sniffing position in children. • May need to place small towel under shoulders in infants to compensate for their relatively large head. • Suction to clear airway. • Consider airway adjunct (oral airway).
Breathing	• Bag mask ventilation with 100% oxygen. • Mask size - from bridge of nose to chin. • Watch for adequate chest rise. • Ventilate in cadence with "squeeze, release, release". • Perform Endotracheal tube intubation
Check Pulse	• If signs of circulation absent, or HR <60 and poor perfusion (do not check for pulse more than 10 seconds) • Perform chest compression
Chest Compressions	• 1/3rd to 1/2 of AP chest depth. • Rate of (compression: ventilation): Infants and children with two rescuers: 15:2, Infants and children with one rescuer 30:2. • chest compression rate 100-120/minute • “Push hard Push fast” • Ensure there is a firm surface underneath
Defibrillation	• Attach to monitor • If dysrhythmia is present: Proceed with defibrillation based on electrical rhythm • Deliver shock as soon as dysrhythmia is identified
Initiate Vascular Access	• Intravenous (IV) Don’t waste much time • Intra-osseous (IO) • In shock give 20ml/kg of NS/RL • Can give up to 60ml/kg of NS/RL • Consider Blood transfusion in Hemorrhagic shock • Consider Inotrope in septic shock

AIRWAY MANAGEMENT

Open and Maintain the Airway

- Place one hand on fore head and tilt head back.
  - ✓ For children keep head in "sniffing" position
  - ✓ For infants keep in neutral position, do minimal head tilt, avoid hyperextension.
- Do jaw thrust in trauma by pulling the mandible forward with 2 or 3 fingers under the angle of the mandible bilaterally.

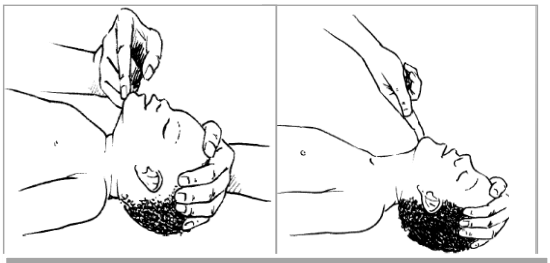


Figure 3C.1 Neutral position to open airway in infant and sniffing position to open airway in older child.

Assess Airway Patency

- look, listen, and feel for evidence of gas exchange.
- If airway is obstructed, reposition and try again.
- Use suction if there are secretions.
- Look for foreign body if repositioning does not help.
- If foreign body visualized, remove it.
- Avoid the blind finger sweep which may damage the airway or force a foreign body further down the airway.

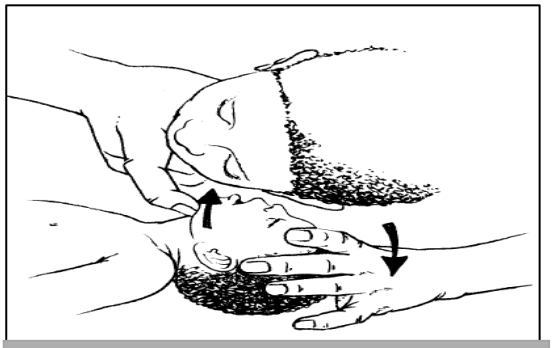


Figure 3C.2 Look, listen and feel for breathing

Always Suspect Cervical Injury

When there is head or neck injury

- Hold head in a midline position
- Use jaw thrust to maintain airway patency.

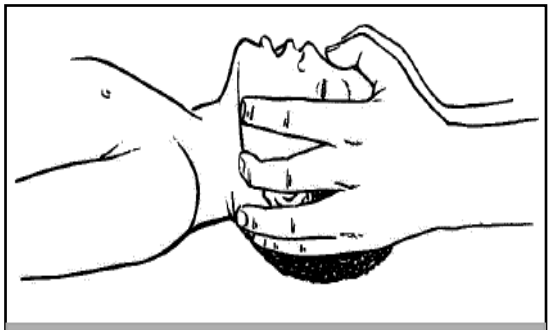


Figure 3C.3 Jaw thrust without head tilt.

Oropharyngeal Airway Device is Optional

- Conscious patients will not tolerate an airway
- Length of the device = distance from the front incisors to the jaw angle (*fig. 3C.4*)
- For insertion in infant, use a tongue depressor and then insert the airway in the same curve as it will occupy in final placement
- For an older child, insert the airway upside-down (tip pointing up) until it reaches the back of the hard palate, then rotate 180 degrees

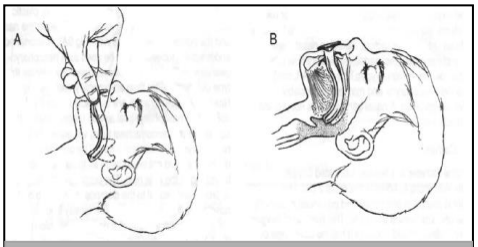


Figure 3C.4 Measurement of OPA

BREATHING

If There Is No Breathing Effort

- Give effective rescue breaths at 1 second per breath
- Begin mouth to mouth & nose breathing for infants and Mouth to mouth breathing for older children (*fig. 3C. v*)
- Watch for adequate chest rise

If There Is No Breathing Effort (Hospital setting)

- Begin Bag and Mask ventilation with 100% oxygen
- Assure appropriate mask size and good mask seal
- Use E-C Clamp technique to maintain mask seal (*fig. 3C. vi*).
- Check for adequate chest rise

Figure 3C.5 Mouth-to-mouth ventilation-child, Mouth-to-mouth and nose ventilation-infant

Breathing Rates for Patients with Pulse:

- Infants and young children:12- 20 breaths/min.
- child > 8 years: 10 to 12 breaths/min

Breathing Rate for Patients without Pulse:

- No advanced airway (Endo tracheal tube):
  - Two rescuers, 15 compressions:2 breaths, at 100-120 compressions/min.
  - One rescuer, 30 compressions:2 breaths, at 100-120 compressions/min.
- Advanced airway in place: give age appropriate breaths/min without pauses.

Mask and Self-inflating Bag

- Adequate for most short-term situations
- For giving breaths, no need to co-ordinate with chest compressions.

Self-inflating Bag Size:

- Child – 600 -1000 ml
- Adolescent and adult –1500-2000ml.

Figure 3C.6 E-C clamp technique of bag-mask ventilation, two thumb/hand-encircling the chest for compression in infant (2 rescuers)

CIRCULATION

Check pulse at the following sites:

- Infant – Brachial
- Child to adolescent – Carotid or femoral

Beginning Compressions:

- If the central pulse is absent, or HR < 60 with poor perfusion **begin chest compressions**
- Use an age-independent compression depth of 1/3rd to 1/2 the total estimated thoracic depth applied to the lower sternum
- Push fast, push hard and do not pause except for shocks, and breaths (if no advanced airway).

Compression breathing ratios in pulseless patient:

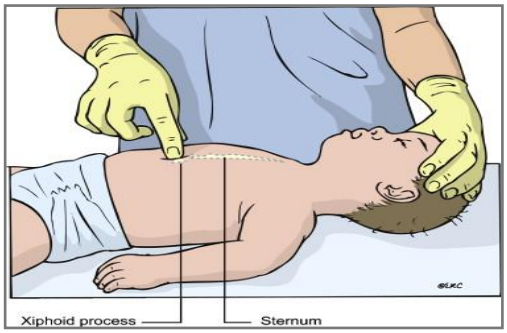
- Infants and children with one rescuer and no advanced airway= 30:2
- Infants and children with two rescuers and no advanced airway= 15:2
- Infants and children with advanced airway: asynchronous.

Compression Rates:

- Infants and children: 100-120/min

Use age-appropriate finger or hand placement:

- infant: encircle chest and compress with both the thumbs, or put 2 to 3 fingers on the lower half of sternum below intermammary line.
- Children > 1year: heel of one hand /two hands on sternum above xiphoid
- Release completely to allow chest to fully recoil.



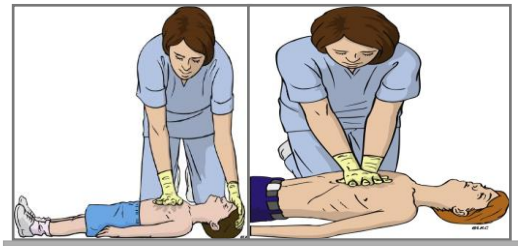


Figure 3C. vii: Chest compression-infant, with one hand in child and with two hands for

ENDOTRACHEAL INTUBATION

- Need to intubate is not same as need to ventilate.

- Do not attempt for more than 30 seconds.
- If child develops Bradycardia: use bag and mask and ventilate

Select Proper Tube Size:

- Uncuffed Endotracheal tube size (mm ID) = (age in years/4) + 4
- Cuffed Endotracheal tube size (mm ID) = (age in years/4) + 3
- Keep tubes with internal diameters that are 0.5 mm smaller and 0.5 mm larger

Laryngoscope Blade - Usually Straight

Confirm Placement by

- Seeing tube go through cords
- Bilateral adequate gentle chest rises
- Equal breath sounds over Axilla
- No sounds over epigastrium

Secure Tube with Elastic Tape

- Mark tube at corner of mouth.
- Avoid excessive head movement.
- Frequently reassess breath sounds.
- Ventilate to cause gentle chest rise.

Intervention efficacy must be gauged by response:

- Ventilation by rise of chest.
- Cardiac compression by central pulse.
- Assess efficacy by observing the combination by color and perfusion.

Best Sign of Effective Ventilation is Chest Rise!

Failure to respond should prompt re-evaluation of Steps Airway, Breathing and Circulation, oxygen tubing and connection.

VASCULAR ACCESS

- Initiate Intravenous (IV) immediately.
- In emergency, don't waste much time.
- If IV access cannot be obtained initiate Intraosseous access (IO).

Intraosseous Line

Placement of cannula into long bone intramedullary canal (marrow space). You can give anything that can be given through an IV (drugs, fluid, and blood).

Indication for IO

- Vascular access required
- Peripheral site cannot be obtained in two attempts, or after 90 sec.

Needle in place if:

- Lack of resistance felt (Bone marrow aspirated).
- Infusion flows freely (Needle stands without support).

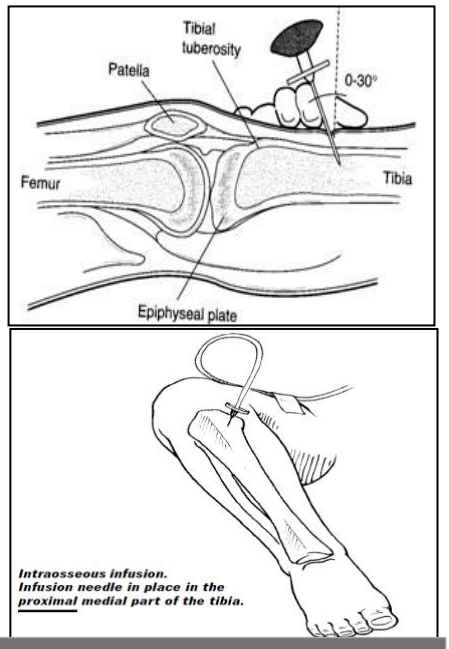


Figure 3C.8 Intraosseous insertion.

Table 3C.3 IO insertion sites and contraindications

Devices	Site	Contraindications
• 16G hypodermic needle • Spinal needle with stylet • Bone marrow needle (preferred)	SITE OF ENTRY (in order of preference): I. Antero medial surface of proximal tibia 2cms below and 1-2 cm medial to tibial tuberosity. II. Distal femur 3cms above lateral condyle in the midline. III. Medial surface of distal tibia -2cms above medial malleolus IV. ASIS at angle of 90 degrees to the long axis of the body.	• Fractures • Burns • sore at the site • Osteogenesis imperfecta

IV FLUIDS (RL/NS)

- Use an isotonic crystalloid solution (Ringers lactate or normal saline) to treat shock.
- Give bolus 20ml/Kg of NS/RL rapidly over 5- 10 mins.
- Can give up to 3 boluses = 60ml/kg of NS/RL.
- Do not give glucose-containing solution to treat shock.

PEDIATRIC RHYTHM DISTURBANCES

In contrast to cardiac arrest in adults, cardiopulmonary arrest in infants and children is rarely sudden and is more often caused by progression of respiratory distress and failure or shock than by primary cardiac arrhythmias.

Broad Classification of Pediatric arrhythmias:

❖ **Fast pulse rate = Tachyarrhythmia**

Tachyarrhythmia are rapid abnormal rhythms originating either from atria or ventricles.

❖ **Slow pulse rate = Brady arrhythmia**

Bradycardia that is associated with arrhythmia is known as bradyarrhythmia.
Two common types of brady arrhythmia are sinus bradycardia and AV block.

❖ **Absent pulse = Pulseless arrest (collapse rhythm).**

Clinical signs of Instability Associated with Arrhythmias:

- Shock with hypotension or poor end organ perfusion
- Altered mental status (decreased level of consciousness)
- Sudden collapse

General Treatment Principles for Unstable Arrhythmias:

- Check for signs of life and the central pulse of any child with an arrhythmia;
- If signs of life are absent, treat as for cardiopulmonary arrest.
- If the child has signs of life and a central pulse, evaluate the hemodynamic status.
- Whenever the hemodynamic status is compromised, the first steps are:
  a. Open the airway.
  b. Give oxygen and assist ventilation as necessary.
  c. Attach ECG monitor or defibrillator and assess the cardiac rhythm.
  d. Evaluate if the rhythm is slow or fast for the child's age.
  e. Evaluate if the rhythm is regular or irregular.

f. Measure QRS complex (narrow complexes: <0.09 s duration; wide complexes: >0.09 s).
g. The treatment options are dependent on the child's hemodynamic stability.

Sinus Tachycardia

Diagnosis is often based upon history. This patient will have a history consistent with a known cause that requires compensation. For example, dehydration, pain, hypovolemia. Rate changes with level of activity, e.g. Increases when crying, in pain.

ECG: P waves are normal, Rhythm is regular and rate is usually less than 220/minute in infants and 180 in children.

Figure 3C.9 Sinus tachycardia in ECG

Treatment: treat the underlying cause. For example, in dehydration replace fluid; treat pain and fever.

Tachyarrhythmia

Symptoms-

- older children complain of palpitations, light headedness and syncope.
- infants: signs due to CHF i.e. irritability, poor feeding, lethargy and tachypnea.

SVT is the most common tachyarrhythmia that causes cardiovascular compromise during infancy, abrupt in onset and fixed rate, P waves are absent or abnormal looking, heart rate usually greater than 220 in infants and greater than 180 in children.

Figure 3C.10 SVT on ECG.

Treatment: if IV or IO is available, give adenosine 0.1mg/kg rapid bolus (maximum of 6mg), can be repeated with a second dose of 0.2mg/kg rapid bolus (maximum of 12mg). If adenosine is unsuccessful or IV/IO access is not available, synchronized cardioversion is indicated. Start at 0.5-1.0 J/kg, if not effective increase to 2J/kg, sedate if needed but do not delay treatment.

VT: Wide QRS complex, uncommon in children, if there are signs of poor perfusion must give immediate synchronized cardioversion, start with 0.5 J/kg, then increase to 2J/kg. If no signs of poor perfusion and the rhythm is regular with monomorphic (all QRS looks alike) consider using adenosine. Give adenosine 0.1mg/kg rapid bolus (maximum of 6mg), can be repeated with a second dose of 0.2mg/kg rapid bolus (maximum of 12mg). Amiodarone and procainamide can also be used (but they SHOULD NOT administered together).

Slow Rhythms

Bradycardia: is an ominous sign of impending cardiac arrest in infants and children, especially if it is associated with hypotension or evidence of poor tissue perfusion. Hypoxemia is the leading cause of slow rhythms and most bradycardia responds to oxygenation and ventilation. For bradycardia secondary to hypoxia/ischemia, preferred first drug is adrenaline. Consider atropine and pacing.

If the patient is stable, identify the cause of the bradycardia and treat it. Complete the basics:

- Be sure that the airway is patent – do whatever is necessary to maintain a patent airway.
- Administer oxygen as needed (02 Saturation less than 94% or the presence of shortness of breath).

- Apply cardiac monitor.
- Take and monitor vital signs including pulse oximetry.
- Obtain IV or IO access.
- 12 Lead ECG – if available and patient stable (do not delay treatment to acquire).

If signs of poor perfusion as mentioned below is present, proceed with treatment.

- Hypotension
- Acutely Altered Level of Consciousness
- Signs of Shock

If no signs of poor perfusion

- Support Basics (ABCs)
- Give oxygen if indicated
- Observe
- Consider Cardiology consultation

Signs of Poor Perfusion:

If HR <60/min with poor perfusion despite oxygen and Ventilation, begin CPR, administer Atropine (0.02mg/kg) if suspected vagal response or if primary AV block, maximum single dose of 0.5mg. Administer Epinephrine 0.01mg/kg (0.1ml/kg) of 1:10,000, can be repeated every 3-5 minutes if bradycardia does not resolve.

Collapse Rhythms: Ventricular Fibrillation (VF) and Pulseless Ventricular Tachycardia (pVT)

Treatment: require defibrillation, start with dose of 2J/kg, then repeat with 4J/kg if not reverted, for 3rd shock onwards give dose of >4J/kg. Maximum dose is 10J/kg. If VF or pVT persists despite defibrillation additional pharmacologic therapy is needed. Give amiodarone of 5mg/kg bolus, can be repeated up to two times, OR Lidocaine can also be used at initial dose of 1mg/kg followed by 20-50 mcg/kg/min infusion.

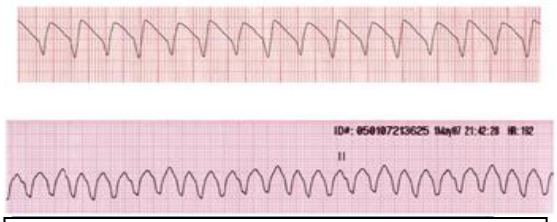


Figure 3C.11 Pulseless VT

Figure 3C.12 Ventricular Fibrillation

Table 3C.4 Potentially Reversible Causes of Arrest:

6 H's	4T's
• Hypoxemia • Hypovolemia • Hypothermia • Hyper/Hypokalemia • Hydrogen ions- acidosis • Hypoglycemia	• Tamponade (cardiac) • Tension Pneumothorax • Toxins/poisons/drug • Thromboembolism

DEFIBRILLATION

Paddle diameter:

- Infants: 4.5 cm.
- Children: 8.0 cm.
- Largest paddles that contact entire chest wall without touching.
- If pediatric paddles unavailable, use adult paddles with A-P placement.

Paddle Position:

Apply firm pressure on the paddles placed over the right side of the upper chest and the apex of the heart (to the left of the nipple over the left lower ribs).

Energy Settings:

- Initial: 2 J/kg
- Repeat: 4 J/kg

Table 3C. 5 Comparison of defibrillation and synchronized cardioversion

Defibrillation	Synchronized cardioversion
Not synchronized with ECG.	Synchronized with ECG
Used for pulseless rhythms (VF and pulseless VT).	Used for rhythms with pulses (symptomatic VT and SVT with pulses)
Dose: 2J/kg, then 4J/kg	Dose: 0.5 to 1J/kg, then 2J/kg Consider sedation.

Cardioversion indications:

Hemodynamically unstable patients with tachyarrhythmia i.e. (SVT, atrial flutter and VT) with a pulse.

Synchronized Cardioversion:

Cardiovert only if signs of decreased perfusion.

Energy settings:

- Initial: 0.5 - 1.0 J/kg
- Repeat: 2.0 J/kg

Treatment for Non-shockable rhythms (PEA and Asystole)

- Begin CPR immediately, obtain IV/IO access.

DRUG THERAPY

Adrenaline:

- Asystole, bradycardia, PEA
- Stimulates electrical/mechanical activity

Atropine:

- 0.01mg/kg IV or IO
- Double the dose via ET tube.
- Minimum dose: 0.1 mg to avoid paradoxical bradycardia
- Maximum single dose: (Child: 0.5 mg, Adolescent: 1mg)

Endotracheal Drugs:

Adrenaline, atropine, lidocaine and naloxone can be given by ET tube

Drug administration through ET tube

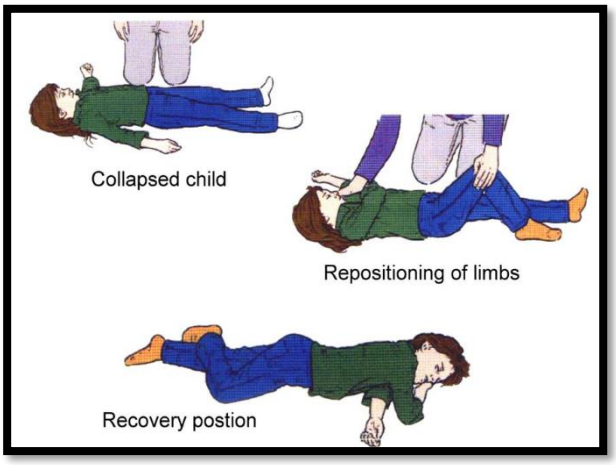
- Do not delay while attempting IV access
- Dilute with normal saline
- Stop compressions
- Inject through catheter passed beyond ETT
- Follow 10 rapid ventilations

Table 3C.6 Doses of Adrenaline for Different Types of Arrhythmia in Children

Dysrhythmia	Route of administration	Dosage and concentration
Bradycardia	IV, IO	0.01 mg / kg (0.1 mL per kg), 1:10,000
	ET	0.1 mg per kg (0.1 mL per kg), 1:1,000
Asystole, ventricular fibrillation, pulseless electrical activity	Initial IV, IO	0.01 mg per kg (0.1 mL per kg),1:10,000
	Subsequent IV, IO	0.1 mg per kg (0.1 mL per kg), 1:1,000
	All ET	0.1 mg per kg (0.1 mL per kg), 1:1,000

RECOVERY POSITION

- An unconscious child whose airway is clear and who is breathing normally should be turned onto his side into the recovery position.
- The child should be placed in as near a true lateral position as possible with his mouth dependent to enable free drainage of fluid.
- The position should be stable. In an infant, this may require the support of a small pillow or a rolled-up blanket placed behind his back to maintain the position.
- There should be no pressure on the chest that impairs breathing.
- The airway should be accessible and easily observed.
- The adult recovery position is suitable for use in children.



PEDIATRIC CHOKING

Occurs most often in children <5 years old.

Causes: Most common items: Food (peanuts, grapes etc.), buttons, coins, toys, jewelry.

Relief of Choking

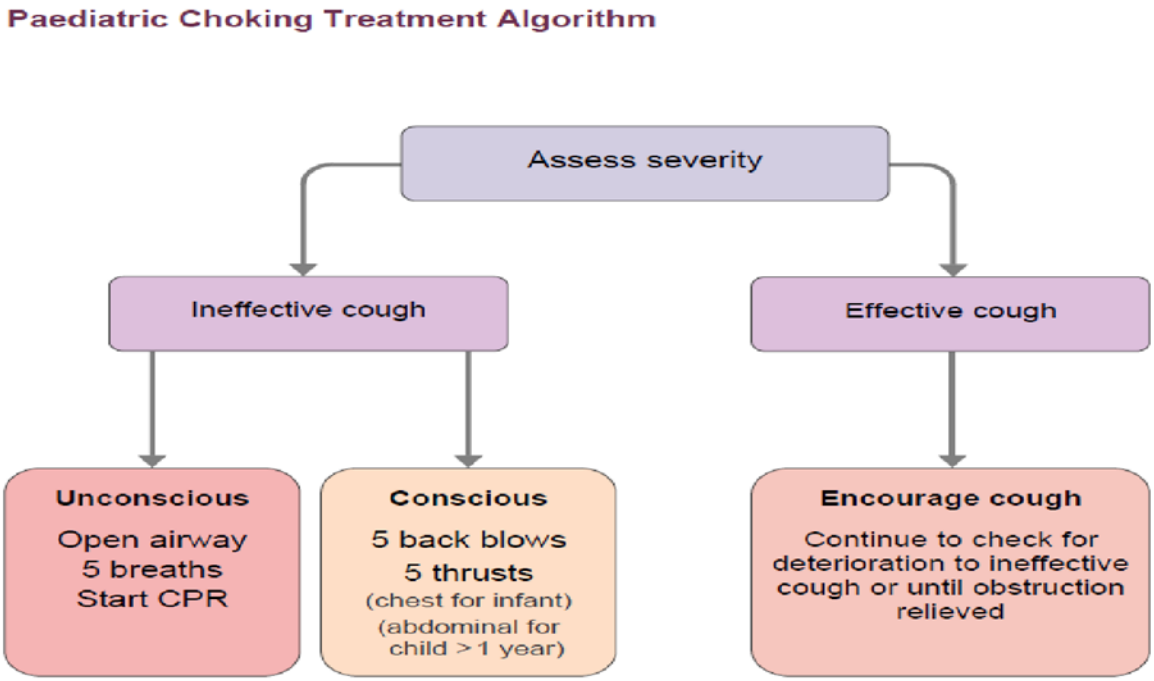
Management:

- If patient is stable (forcefully coughing, well oxygenated), removal of foreign body by bronchoscopy or laryngoscopy should be attempted in a controlled environment if the foreign body doesn't get expelled with coughing.
- If patient is unable to speak, moves air poorly, or is cyanotic, intervene immediately.
- **Infant-**

- Place infant over arm or rest on lap, Give five back blows between the scapulae. If unsuccessful, turn infant over and give five chest thrusts (in the same location as chest compressions).
- Use tongue- jaw lift to open mouth.
- Remove object only if visualized.
- If an infant becomes unconscious, and unresponsive with no breathing or only gasping, begin CPR (no pulse check)
- Each time you open airway to deliver breaths, look into the mouth.
- If you see an object that can be easily removed, remove it,
- If you don't see an object, continue CPR.
- Do not perform a blind finger sweep in an effort to dislodge a foreign body. This may push foreign body farther into the airway. It also may cause trauma and bleeding.
- Repeat sequence as often as necessary, remove foreign body with Magill forceps if needed after direct visualization or laryngoscopy.
- If complete airway obstruction, ventilate with bag and mask or Endotracheal intubation.
- If unsuccessful consider percutaneous (needle) cricothyrotomy.

Figure 3C.13 Back blows and chest thrust for an infant, back blows and abdominal thrust for older child.

- **Child-**
- Perform five abdominal thrusts (Heimlich maneuver) from behind a sitting or standing child or straddled over a child lying supine.
- Direct thrusts upward in the midline and not to either side of abdomen.
- If back, chest and / or abdominal thrusts have failed, open mouth and remove foreign body if visualized.
- Blind finger sweeps are not recommended.
- If the patient is unconscious: (follow same steps as in infant).



POST RESUSCITATION STABILIZATION

The goals of post resuscitation care are to preserve brain function, avoid secondary organ injury, diagnose and treat the cause of illness, and enable the patient to arrive at a higher care facility in an optimal physiological state.

Respiratory System

- Continue supplementary oxygen.
- Monitor by continuous pulse oximetry.
- Intubate and mechanically ventilate the patient if there is significant respiratory compromise (tachypnea, respiratory distress with agitation or decreased responsiveness, poor air exchange, cyanosis, hypoxemia).
- If the patient is already intubated, verify tube position, patency, and security.
- Control pain and discomfort with analgesics (e.g., fentanyl or morphine) and sedatives (e.g., midazolam).
- Insert a gastric tube to relieve and help prevent gastric inflation.

Cardiovascular System

- Continuously monitors heart rate, blood pressure and oxygen saturation.
- Repeat clinical evaluation at least every 5 minutes until the patient is stable.
- Remove the IO access after you have alternate (preferably 2) secure venous lines.

Neurologic System

- One goal of resuscitation is to preserve brain function. Prevent secondary neuronal injury by adhering to the following precautions:
- Do not provide routine hyperventilation.
- Monitor temperature and treat fever aggressively with antipyretics and cooling
- Treat post ischemic seizures aggressively; search for a correctable metabolic cause such as hypoglycemia or electrolyte imbalance.

Renal System

- Ensure urine output is 1-2ml/kg/hr.
- Monitor urine output with an indwelling catheter

Estimating Weight

Use the following rules:

- An average birth weight is 3.5 kg.
- Infants double birth weight by 5 months (7.0 kg).
- Infants triple birth weight at one year (10kg).
- In older children, weight in kg = 8 + (2 x age in years).
- Use Brose low's tape to estimate weight from height.

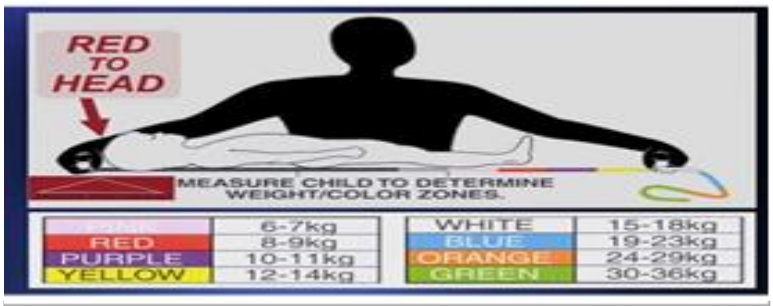
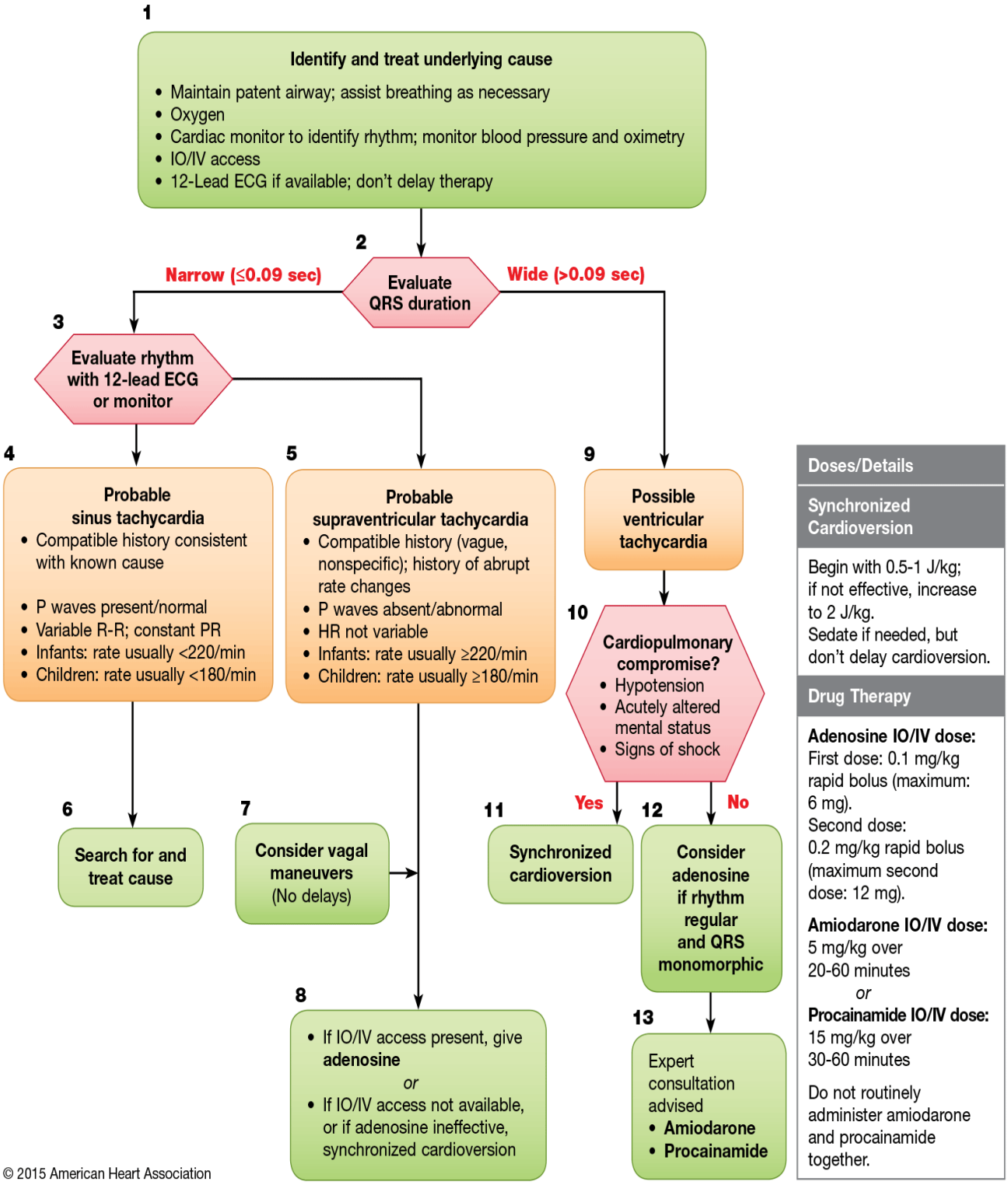


Figure 3C.14 Brose low's tape

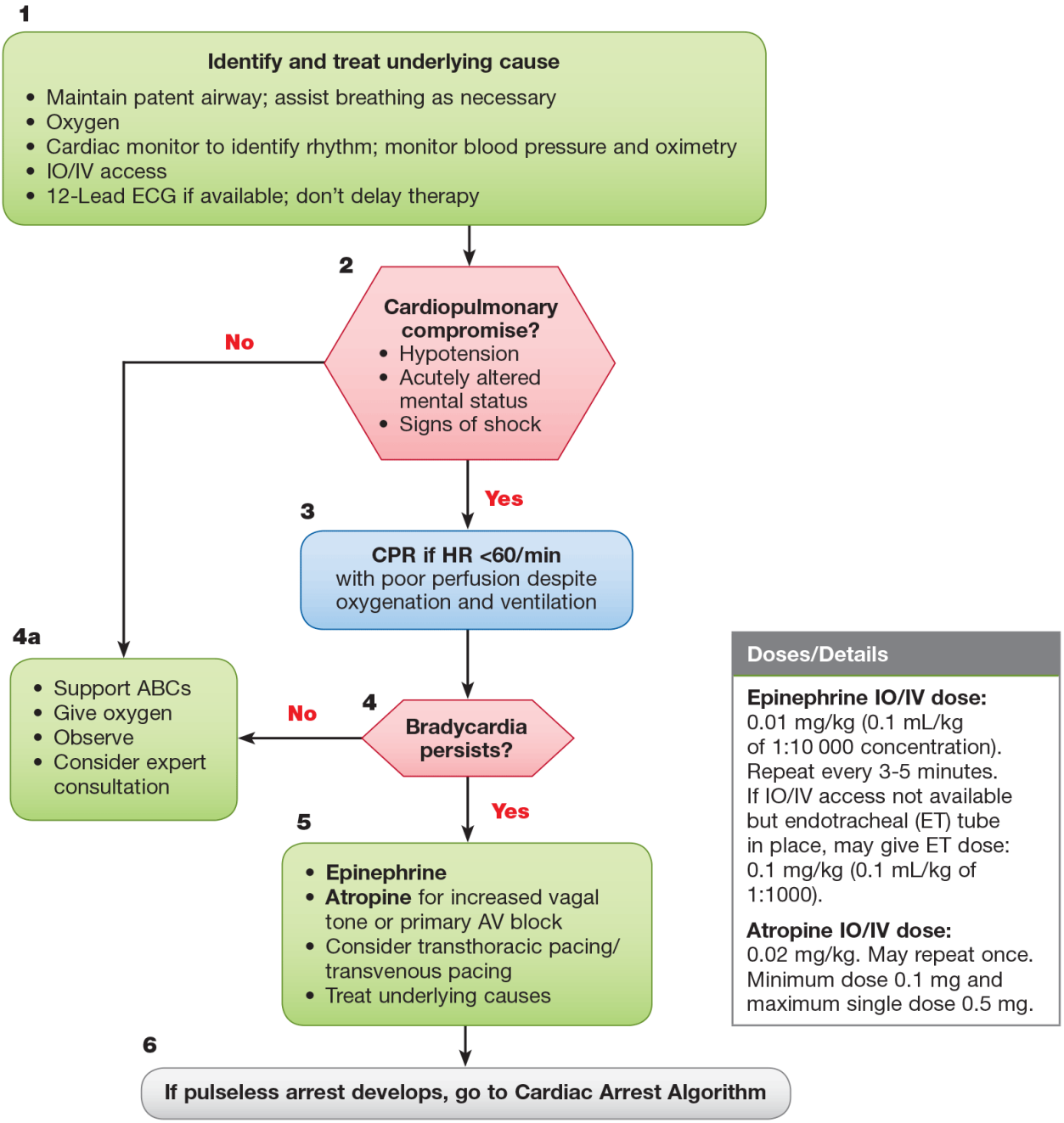
References

- ALS (pediatric advanced life support) provider manual, 2016
- IMNCI Hospital Based manual, 2011.
- The Harriet Lane Handbook, 20th edition.
- Nelson Textbook of Pediatrics, 20th edition.

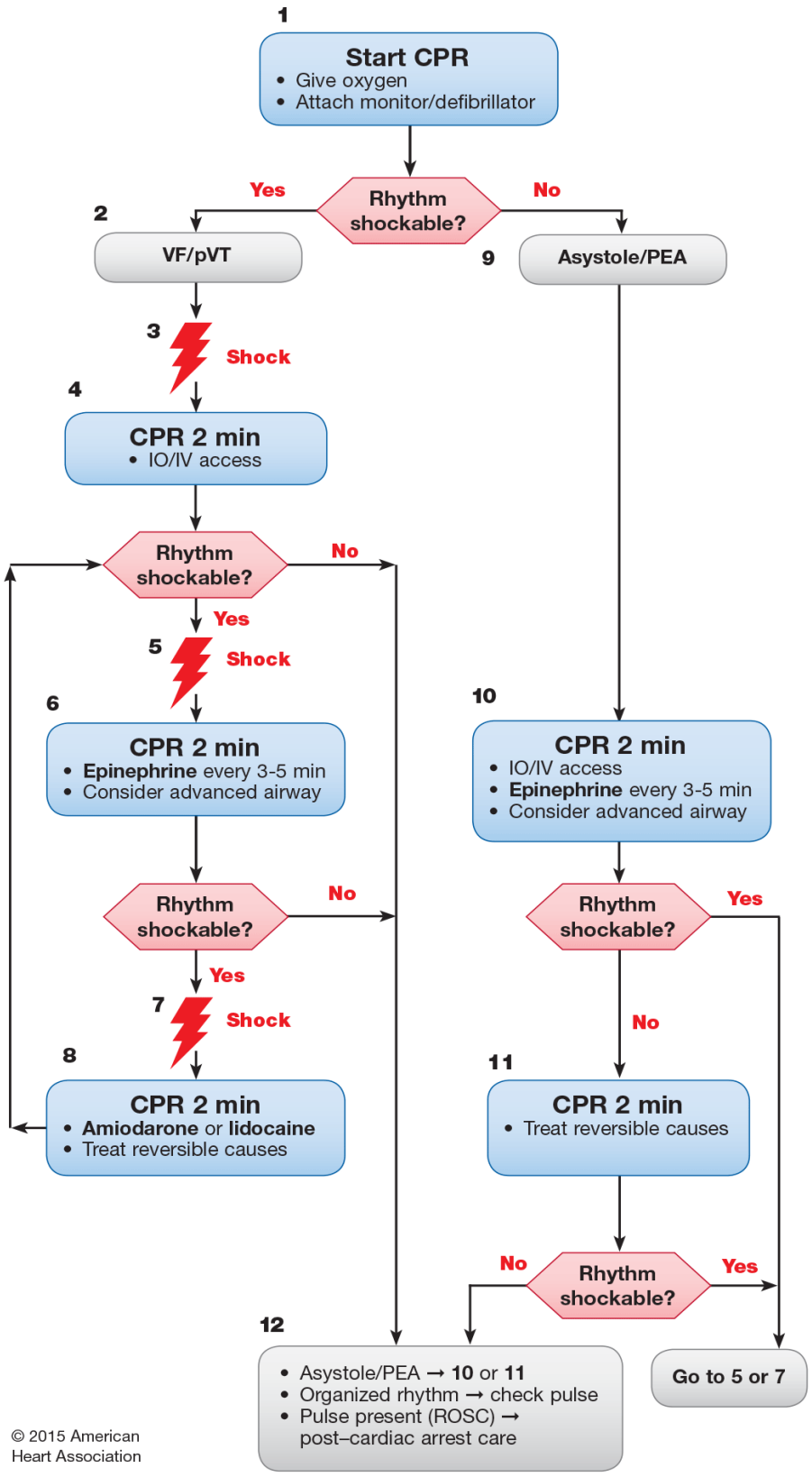
Pediatric Tachycardia With a Pulse and Poor Perfusion Algorithm



Pediatric Bradycardia With a Pulse and Poor Perfusion Algorithm



Pediatric Cardiac Arrest Algorithm—2015 Update



CPR Quality

- Push hard (≥⅓ of anteroposterior diameter of chest) and fast (100-120/min) and allow complete chest recoil.
- Minimize interruptions in compressions.
- Avoid excessive ventilation.
- Rotate compressor every 2 minutes, or sooner if fatigued.
- If no advanced airway, 15:2 compression-ventilation ratio.

Shock Energy for Defibrillation

First shock 2 J/kg, second shock 4 J/kg, subsequent shocks ≥4 J/kg, maximum 10 J/kg or adult dose

Drug Therapy

- **Epinephrine IO/IV dose:** 0.01 mg/kg (0.1 mL/kg of 1:10 000 concentration). Repeat every 3-5 minutes.
  If no IO/IV access, may give endotracheal dose: 0.1 mg/kg (0.1 mL/kg of 1:1000 concentration).
- **Amiodarone IO/IV dose:** 5 mg/kg bolus during cardiac arrest. May repeat up to 2 times for refractory VF/pulseless VT.
- **Lidocaine IO/IV dose:** Initial: 1 mg/kg loading dose. Maintenance: 20-50 mcg/kg per minute infusion (repeat bolus dose if infusion initiated >15 minutes after initial bolus therapy).

Advanced Airway

- Endotracheal intubation or supraglottic advanced airway
- Waveform capnography or capnometry to confirm and monitor ET tube placement
- Once advanced airway in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions

Return of Spontaneous Circulation (ROSC)

- Pulse and blood pressure
- Spontaneous arterial pressure waves with intra-arterial monitoring

Reversible Causes

- **H**ypovolemia
- **H**ypoxia
- **H**ydrogen ion (acidosis)
- **H**ypoglycemia
- **H**ypo-/hyperkalemia
- **H**ypothermia
- **T**ension pneumothorax
- **T**amponade, cardiac
- **T**oxins
- **T**hrombosis, pulmonary
- **T**hrombosis, coronary