ESSENTIAL MEDICAL TRAINING, LLC
772-781-9249 OFFICE
772-382-0607 FAX
EMAIL: treasurecoastcpr@gmail.com

"Providing Quality, Professional Training"

Pediatric Advanced Life Support (PALS)

Course Study Guide and Agenda

Course Outline and General Information

Today's course is provided by:

Essential Medical Training, LLC

772-781-9249 office

772-382-0607 fax

Email: treasurecoastcpr@gmail.cm

Website: www.EssentialMedicalTraining.com

Pediatric Advanced Life Support (PALS)

Course Objectives:

- Identify and treat problems that place the child at risk for cardiac arrest
- Concepts of a systematic approach to pediatric assessment
- BLS proficiency
- Use the "Evaluate-identify-intervene" sequence
- Use PALS algorithms and flowcharts
- Demonstrate effective resuscitative team dynamics

Course time: Approximately 7.0 hours for renewal and 14.0 hours for initial course

Curriculum: American Heart Association PALS Student Manual ISBN: 978-1-61669-599-0 (2015 Edition)

Source: American Heart Association (2015)

The following information is a guide and basic course outline. The information provided within the packet is limited and maybe incomplete. Students should refer to their course books and the American Heart Association's Emergency Cardiovascular Care Handbook for complete and accurate information.

Upon completion of the course the student will receive a course completion card. The American Heart Association recommends the student renew every 2 years.

Lost cards: If you lose your provider card. You can obtain a duplicate reprint by contacting us. The cost for duplicate cards is currently $30 and the price is subject to change without notice.

Thank you for choosing Essential Medical Training, LLC for all your training needs.

Enjoy your class!

PEDIATRIC ADVANCED LIFE SUPPORT

The American Heart Association updates their information every 5 years to reflect to new science. The information in the study guide is from the 2010 update. The next update is expected in 2015.

The Pediatric Chain of Survival emphasizes that multiple things must come together to enhance survival in cardiac arrest. The biggest impact on pediatric survival is when bystander CPR is initiated quickly and effectively. There have been reports of up to 70% neuro intact survival when everything goes perfectly as planned. Shockable rhythms, ventricular fibrillation and pulseless ventricular tachycardia, are present in only 5%-15% of pediatric in-hospital and out-of-hospital cardiac arrest.

Survival from in-hospital cardiac arrest in infants and children in the 1980's was about 9%. Approximately 20 years later, that figure has increased to 17%, and by 2006, to 27%. Overall survival to discharge from out-of-hospital cardiac arrest in infants and children has not changed substantially in the past 20 years and remains at about 6%.

BASIC LIFE SUPPORT

- Changed from ABC to CAB
- Begin CPR with 30 chest compressions rather than 2 ventilations
- Hypoxic arrest is more common than VF in infants and children
- CAB simplifies training with the hopes that more victims will receive bystander CPR

AGE:

- Infants: < 1 year of age
- Children: 1 year to puberty
    - Puberty approximately 8 years of age or
    - Girls: breast development
    - Boys: armpit hair

ASSESSMENT

The rescuer checks for responsiveness and absence of NORMAL breathing. If the victim is not breathing or not breathing normally begin CPR. Agonal respirations are when a victim is not breathing normally. This should not be mistaken for normal breathing and CPR should be started.

- If the victim is unresponsive and not breathing assume the need for CPR and begin immediately.
- Healthcare providers may take **10 seconds** to check for a pulse. If after 10 seconds you do not feel a pulse or are not sure, begin CPR
  - Brachial in an infant
  - Carotid or femoral in a child
- If there is a pulse, but no or inadequate breathing, rescue breaths are provided at a rate of 12-20 breaths per minute (1 every 3-5 seconds)

CHEST COMPRESSIONS:

- "PUSH HARD, PUSH FAST" at a rate of at least 100 to 120 per minute
- Compress the chest at least 1/3 the anterior-posterior diameter of the chest (approximately 1 ½ inches in infants and 2 inches in children)
- Allow full chest recoil
- 30 compressions; **1 Rescuer:** 30 compressions and 2 rescue breaths; **2 Rescuer's** 15 compressions and 2 rescue breaths
- Minimize interruptions in chest compressions
- Avoid hyperventilation
- 2 rescuers should use the 2-thumb encircling technique. Encircle the chest with both hands; spread your fingers around the thorax, and place your thumbs together over the lower third of the sternum
  - Preferred because it provides higher coronary artery perfusion pressures and more consistently results in appropriate depth or force of compressions
  - May generate higher systolic and diastolic pressure

Two Thumb–Encircling Hands Technique
Preferred for Infant 2-Rescuer CPR by HCP

AIRWAY AND VENTILATIONS

- Open the airway using the head tilt chin lift maneuver. Use caution not to hyperextend. The head should be placed in a neutral position.
- When an advanced airway is in place, cycles of ventilations to compressions are no longer performed.
- Ventilations with an advanced airway should be performed at a rate of 8-10 breaths per minute (1 breath every 6-8 seconds).
- Rescue breaths with simple face mask should be performed at a rate of 12-20 breaths per minute (1 breath every 3-5 seconds)

BRADYCARDIA WITH POOR PERFUSION

- Pulse less than 60 with poor perfusion despite support of oxygenation and ventilation, begin chest compressions
  - Cardiac output in infancy and childhood is dependent upon heart rate
  - Cardiac arrest is imminent and beginning CPR prior to full cardiac arrest results in increased survival
  - These patients have the highest survival rate among in hospital patients
  - The 2 most common potentially reversible causes of bradycardia are hypoxia and increased vagal tone.

DEFIBRILLATION USING AUTOMATED EXTERNAL DEFIBRILLATOR (AED)

- AEDs have high specificity in recognizing pediatric shockable rhythms
- Some are equipped to attenuate the delivered energy to make them suitable for infants and children
- In infants, a manual defibrillator is preferred when a shockable rhythm is identified by a healthcare provider
- Recommended first dose energy is 2 joules/kg
  - Second dose is 4 joules per kg
  - At least 4 joules/kg for subsequent doses and higher energy levels may be considered not to exceed 10 joules/kg
  - AED equipped with a pediatric attenuator (pediatric pads) is preferred for infants and children. If it is not available and an AED without a dose attenuator is available, it should be used on both infants and children with shockable rhythms.
  - The time between the last compression and the shock delivery should be minimized as much as possible

CPR ADJUNCTS

There is insufficient data in infants and children to recommend for or against the use of mechanical devices to compress the chest, active compression-decompression CPR, interposed abdominal compression, the impedance threshold device, or pressure sensor accelerometers.

RESUSCITATION AND EMERGENCY CARDIOVASCULAR CARE

The secret to treating pediatrics and preventing cardiac arrest is to recognize and treat problems before the progress. Respiratory Failure is one of the most common and important ones to recognize. Respiratory failure can be secondary to inadequate ventilation, insufficient oxygenation or both. Be on the lookout for respiratory failure if any of the following are present:

- Increased work of breathing
    - Rate
    - Effort – nasal flaring, retractions, seesaw breathing or grunting
- Inadequate respiratory rate, effort or chest excursion
    - Diminished breath sounds or gasping
    - Decreased mental status
- Cyanosis with abnormal breathing despite oxygen administration

Shock is the second most common cause of cardiac arrest and healthcare providers must be prepared to recognize it and intervene as necessary. Shock is defined as inadequate blood flow and oxygen delivery to meet the metabolic demands of tissue. There are several types of shock, but the most common in children is hypovolemic.

Shock is a progressive state. In its early stages the body compensates for shock by increasing heart rate and using vascular resistance to maintain blood pressure. Decompensation occurs when compensatory mechanisms fail and the patient becomes hypotensive.

The key to early treatment of shock and therefore prevention of progression to cardiac arrest is to recognize the early signs and symptoms which are related to the body's attempt to compensate for inadequate tissue perfusion. They include:

- Tachycardia
- Cool and pale distal extremities caused by the body using vasoconstriction to push blood from extremities toward central circulation
- Prolonged (>2 seconds) capillary refill (despite warm temperatures)
- Week peripheral pulses compared with central pulses
- Normal systolic blood pressure

The problem is that as adult care providers we are used to many of these conditions being present at baseline in many of our patients. For example, in the elderly it is common to have diminished distal pulses or delayed capillary refill due to peripheral vascular disease. We have to change our mind set in infants and children and realize that they are brand new and remain under warranty so all of their systems work normally. There should be NO abnormalities at baseline, so when we find them they must be investigated.

As these compensatory mechanisms fail, signs of inadequate tissue perfusion develop. These can include:

- Depressed mental status
- Decreased urine output
- Metabolic acidosis
- Tachypnea
- Weak central pulses
- Deterioration in color such as mottling
- Hypotension

HYPOTENSION

Age	Hypotensive Systolic Blood Pressure
0-28 days	<60 mm Hg in term neonates
1-12 months	<70 mm Hg in infants
1-10 years	<70 mm Hg + (2x age in years) in children 1-10
Greater than 10 years	< 90 mm Hg in children older than 10

RESPIRATORY PROBLEMS

Respiratory distress is a clinical state characterized by abnormal respiratory rate (tachypnea) or effort (nasal flaring, retractions, or use of accessory muscles).

Respiratory failure is a clinical state of inadequate oxygenation, ventilation, or both. Respiratory failure is often the end stage of respiratory distress.

Types of Respiratory Problems can be classified into one of the following types:

- **Upper airway obstruction-** obstruction in the nose, pharynx, or larynx. Common causes are foreign body aspiration (food) and swelling of airway (anaphylaxis, croup, epiglottis).
- **Lower airway obstruction-** occurs in the lower trachea, bronchi, or the bronchioles. Asthma and bronchiolitis are common cause of lower airway obstruction. Typical signs prolonged expiratory phase associated with wheezing.
- **Lung tissue disease-** is a term given to a heterogeneous group of clinical conditions that generally affect the lungs at the level of the point where gas exchange occurs. Abnormalities in oxygenation associated with lung tissue disease.

- **Disordered control of breathing**- common causes are neurological disorder (seizures).

Glucose Monitoring- critically ill or injured children, perform a rapid glucose test to rule out hypoglycemia as a cause of or a contributing factor to shock or decreased level of consciousness.

AIRWAY MANAGEMENT

It is important that each and every healthcare provider who is going to assess or treat infants and/or children be proficient at airway management at whatever level is within the scope of practice of the individual. Proper airway management can and will save many pediatric lives.

Airways

Sizing of both oropharyngeal and nasopharyngeal airways is of the utmost importance. Oral airways are used in patients who are deeply unconscious. However, one that is too small can actually obstruct the airway by pushing the base of the tongue farther into the airway. If it is too large, the airway itself may obstruct.

Nasopharyngeal airways work well in children who have an intact gag reflex. However, an airway that is too short may not work to maintain the airway and one that is to long may obstruct it. They may become easily obstructed because of the small diameter and require frequent suctioning.

Laryngeal Mask Airway (LMA) The LMA is the only supraglottic airway that has been studied in infants and children. It is acceptable to utilize it when BVM ventilation is not working or difficult and intubation is not possible. It is associated with a higher incidence of complications in young children compared with older children and adults.

Oxygen – can be used at 100% during CPR but once ROSC oxygen should be titrated to maintain 94% or greater oxygen saturation. Hyperoxia should be avoided. Adequate oxygen delivery requires not only arterial oxyhemoglobin saturation but also adequate hemoglobin concentration and cardiac output. Pulse oximetry must be monitored continually in perfusing patients, however keep in mind that it may be unreliable in patients with poor perfusion, carbon monoxide poisoning or several other conditions.

Pulse Oximetry – Pulse oximetry readings in patients with poor peripheral perfusion, carbon monoxide poisoning, or methemoglobinemia. Be careful to interpret pulse oximetry readings in conjunction with your clinical assessment and other signs, such as respiratory rate, respiratory effort, and level of consciousness. A child may be in respiratory distress yet maintain a normal O_2 saturation by increasing respiratory rate and effort, especially if supplemental oxygen is administered.

Bag Valve Mask Ventilation – can be as effective and may be safer than intubation for short periods during out of hospital resuscitation.

- Tidal volumes must be limited to the amount needed to cause chest rise
- Hyperventilation should be avoided
- If not intubated a pause should take place after every 30 compressions for ventilation.

- If two rescuers, then the patient should be ventilated at a rate of 15:2
- If perfusion rhythm one can use the mnemonic "squeeze-release-release" at a normal speaking rate to deliver a breath every 3-5 seconds or 12-20 times per minute
- May be more effective to utilize the BVM with two people when there are enough rescuers available. One to seal the mask and one to push the bag

Gastric inflation can be avoided by:

- Avoiding excessive peak inspiratory pressure by ventilating slowly and limiting tidal volume.
- Cricoid pressure by a third rescuer. Avoid excessive cricoids pressure so as not to obstruct the trachea
- Nasogastric or orogastic tube to relieve gastric inflation

INTUBATION

Intubation of infants and children requires special training. The pediatric airway differs from that of the adult. Complications are directly related to experience and training of the provider.

Rapid Sequence Intubation (RSI) – may be used by skilled, experienced providers to facilitate emergency intubation and reduce the incidence of complications. If RSI is being used, a secondary plan must be in place for airway management should intubation attempts fail.

Cuffed vs Uncuffed Tubes – either tube is acceptable. In the operating room, the use of cuffed tubes is associated with correct tube size selection more often. In intensive care units the numbers of complications from intubation were not affected by whether a cuffed or uncuffed tube was used.

Endotracheal Tube Size – the use of resuscitation tapes is more accurate than age based formulas for children up to 35kg. There should always be a tube 0.5mm larger and 0.5mm smaller available when intubation is being attempted.

- Uncuffed tube size (ID) = 4 + (Age/4)
- Cuffed Tube ID = 3.5 + (Age/4)

Verification of Tube Placement – no single method is reliable so both clinical assessment and confirmatory devices should be used to verify placement. Tube placement should be verified immediately after intubation, during transport and each time the patient is moved.

- Bilateral chest movement and equal breath sounds
- Listen for gastric insufflations sounds over the stomach
- Check for exhaled C02
- If perfusing rhythm, check saturation
- If uncertain, direct laryngoscopy and visualize the endotracheal tube to confirm that it lies between the vocal cords
- In hospital perform a chest x-ray.

Endotracheal tubes in infants and children are very easy to dislodge. If at any time after intubation, the patient's condition worsens the intubation should be evaluated based on the mnemonic **DOPE**.

D – Displacement of the tube

O – Obstruction of the tube

P – Pneumothorax (perform needle decompression for tension pneumothorax)

E – Equipment failure

Exhaled or End Tidal C02 Monitoring – recommended as confirmation of tube position for neonates, infants and children with perfusing rhythms in all settings. Color change or presence of capnography waveform confirms tube placement in the airway but does not rule out right mainstem intubation. The absence of C02 may reflect very low pulmonary flow during cardiac arrest rather than tube misplacement.

Colormetric Detectors may be inaccurate because of:

- Contamination with gastric contents
- IV bolus of Epinephrine which may reduce pulmonary blood flow
- Severe airway obstruction and pulmonary edema may impair C02 elimination below what can be detected
- Large glottis air leak may reduce exhaled tidal volume through the tube and dilute C02 concentration

Resuscitation of the Newly Born – is different than the resuscitation of infants. The compression to ventilation rate is 3:1. Newborns who require resuscitation outside of the hospital setting should receive CPR according to infant guidelines. It is reasonable to resuscitation newborns with a primary cardiac etiology arrest, regardless of location, according to infant guidelines with emphasis on chest compressions.

Monitoring the Cardiac Arrest Patient

Obviously, arrhythmia monitoring should begin at the earliest possible time and continue into and beyond the post arrest period. There may be limited indications for the use of echocardiography during arrest, but science does not support it either way.

End Tidal C02 (PETCO2)

If available, it can be very helpful in monitoring the efficiency of cardiac compressions. If PETCO2 remains <10-15mmHg, the efficacy of chest compressions must be evaluated and improved. It is also helpful in noting the return of spontaneous circulation (ROSC), so that a large increase in PETCO2 is a reliable indicator of ROSC and therefore repetitive interruptions in chest compressions for pulse checks are not necessary if end tidal C02 is monitored.

Vascular Access – is obviously a very important part of resuscitation. Given the difficulty of obtaining IV access in pediatrics, especially infants, little time should be wasted attempted IV access. Intraosseous (IO) access is easy and safe to achieve and should be used immediately if there is any concern about the ability to achieve vascular access. Following resuscitation, the IO needle can be replaced by IV peripheral or central access. All medications that can be given IV can be given via the IO route. In many cases blood samples can be drawn for laboratory analysis by this route.

Central venous access is NOT recommended during resuscitation due to the training and time required to place it. There is no scientific evidence that drugs or fluids given centrally during arrest are any more efficient than those given via the IO route.

If vascular access is not possible, lipid soluble medications may be given via the endotracheal tube, although not recommended unless this is the only possible route. Given the ease of placement of the IO needle, the ET route will rarely if even be necessary.

EMERGENCY MEDICATIONS AND FLUID RESUSCITATION

The child's weight can be very difficult to approximate and may be unknown particularly in the out of hospital setting. Tapes such as the Broslow tape is more accurate basing medications on body weight approximation using body length. When available they should be used rather than "approximating" the patient's weight. If the patient's weight is known, then drug doses should be calculated based on known weight. It is unknown whether drug doses must be adjusted when using length base tapes in obsess children.

The following medications are routinely used during infant and pediatric resuscitation and the healthcare provider should be familiar with all of them.

ADENOSINE works by blocking the conduction through the AV node. It has an extremely short half life (seconds) and therefore is a very safe drug. Because of its short half life it must be administered rapid bolus and followed with a bolus of saline. The result will be a prolonged pause in the rhythm followed by conversion to sinus rhythm if the rhythm being treated involves the AV node. It is used in the treated of narrow complex tachycardias.

Dosage: 0.1mg/kg (maximum of 6mg)
Second Dose: 0.2mg/kg (maximum of 12mg)

AMIODARONE works on a number of levels within the heart to terminate arrhythmias. It slows AV nodal conduction, prolongs the QT interval, slows ventricular conduction. Unless absolutely impossible it is recommended that expert consultation be sought prior to using Amiodarone in the perfusing pediatric patient.

The patient can become severely hypotension; therefore, BP and rhythm must be monitored closely. The rate must be decreased if the QRS complex widens by 50% or if heart block is noted. Because it prolongs QT interval, Amiodarone should not be combined with other medications that may cause QT prolongation such as procainamide.

Dosage: 5mg/kg (may repeat twice) up to 15mg/kg
Maximum dose: 300mg

ATROPINE – accelerates sinus or atrial pacemakers by blocking the influence of the parasympathetic system. It should be administered rapid IV/IO bolus as slow administration may result in a slowing of heart rate.

Dosage: 0.02mg/kg Minimum dose of 0.1mg and maximum single dose of 0.5mg.

EPINEPHRINE – is both alpha and beta and therefore increases diastolic pressure and coronary perfusion pressure. It is a drug which is critical to the success of resuscitation. If used to control bradycardia or blood pressure in the perfusing patient, the patient should be monitored or arrhythmias or signs of ischemia as a common side effect is tachycardia.

Dosage: 0.01mg/kg (0.1ml/kg) 1:10,000 IV/IO Dose may be repeated every 3-5 minutes

GLUCOSE – infants have a high demand for glucose and low store of glucose so glucose levels must be monitored closely in infants and children who have or are experiencing critical injury or illness. Hypoglycemia should be treated promptly.

Dosage: Newborn: 5-10ml/kg D10W
Infant and Children: 2-4ml/kg D25W
Adolescents: 1-2ml/kg D50W

LIDOCAINE – depresses automaticity and ventricular arrhythmias. As such it can have a negative effect on left ventricular function. It is not as effective as Amiodarone for improving return of spontaneous circulation or survival to hospital admission. Therefore, Lidocaine is only recommended if Amiodarone is unavailable for use during cardiac arrest resuscitation.

Dosage: 1mg/kg IV/IO

MAGNESIUM has a limited indication. It is indicated if the patient is documented hypomagnesemia or if the patient with known prolonged QT interval then goes into polymorphic ventricular tachycardia (torsades de pointe)

Dosage: 25-50mg/kg over 10-20 minutes (faster if in torsades de pointe)

SODIUM BICARBONATE – is not recommended during resuscitation (Class III, potentially harmful) Blood gases that are drawn during arrest are inaccurate for acid base balance and do not reflect tissue or venous acidosis. Excessive bicarbonate may impair oxygen delivery, cause hypokalemia, hypocalcemia, hypernatremia, and hyperosmolality. In addition, it may decrease the VF threshold and impair cardiac function. Acid base correction should not be done until perfusion has returned and accurate blood gases can be obtained.

The goal of pediatric resuscitation will always be to avoid cardiac arrest at all costs by recognizing the signs and symptoms of respiratory distress, respiratory failure, compensated and decompensated shock. When arrest occurs the resuscitation team must work together in an organized methodical manner to assure that all resuscitation steps are taken and that the patient is continually re-assessed for change in condition. Assessment is paramount to successful resuscitation and must occur frequently. The team must be ready to change interventions based on changes in the condition of the patient.

DEFIBRILLATION

The use of paddles and self adhesive pads appear to be equally effective. The largest pad or paddle should be used that can be placed on the patient's chest without touching. Usually an infant of one year of age is large enough to use adult pads or paddles. If pads are used, nothing need be applied to the chest. If paddles are used an electrode gel must be applied liberally.
Do not use saline soaked pads, bare paddles or alcohol pads.

Follow the package instructions for placement of adhesive pads. Paddles are placed with one over the right side of the upper chest and the other to the left of the nipple over the left lower ribs. Firm pressure must be applied so that there is no air between the chest wall and the paddle when the shock is delivered. There is no advantage to anterior-posterior placement in the pediatric patient.

The correct energy dose for pediatric defibrillation is unknown. It is reasonable to start with a dose of 2 joules/kg, doubled to 4 joules/kg for the second shock. For refractory ventricular fibrillation it is reasonable to increase to higher energy doses to a maximum of 10 joules/kg which is the adult dose. If an AED is being used it is best to utilize the pediatric pads as an energy attenuator is locating in the line of the pads. However, if pediatric pads or a manual defibrillator is not available, the adult combination pads from the AED may be used on both children and infants.

SYNCHRONIZED CARDIOVERSION

Synchronized shocks are used for cardioversion from SVT or FT with a pulse. If the shock is synchronized, shock delivery is timed to coincide with the R wave of the patient's QRS complex. The goal is to prevent VF that could result from delivery of the shock during the vulnerable period of the T wave. In general, cardioversion requires less energy than defibrillation. Start with an energy dose of 0.5 to 1 J/kg for cardioversion of SVT or VT. If the initial dose is ineffective, increase to a dose of 2 J/kg. Experienced providers may increase at smaller doses (eg, 0.5 J/kg, then 1 J/kg, followed by 2 J/kg). If the rhythm does not convert to sinus rhythm, reevaluate the interpretation of the rhythm (maybe ST instead of SVT).

SPECIAL RESUSCITATION SITUATIONS

SEPTIC SHOCK – is the most common form of distributive shock. It is caused by infectious organisms or their by-products that stimulate the immune system and trigger release or activation of inflammatory mediators. Because septic shock is triggered by an infection or its by-products, the child may have a fever or hypothermia, and the white blood cell (WBC) count may be decreased, normal, or increased.

- No difference in survival if treated with colloid or isotonic crystalloid solutions
- Monitoring central venous oxygenation saturation (SVC) is useful to titrate therapy in infants and children. Target Scv02 >70% associated with improved survival in severe shock
- Early assisted ventilation
- Etomidate has been shown to facilitate endotracheal intubation in infants and children without effecting hemodynamics

HYPOVOLEMIC SHOCK

- Isotonic crystalloid for resuscitation
- 20ml/kg even if blood pressure is normal over 5-10 minutes
- Additional boluses of 20ml/kg if systemic perfusion fails to improve
- Insufficient evidence in infants and children to make a recommendation about the best timing of volume resuscitation for children with hypovolemia following trauma

COMPENSATED SHOCK- If systolic blood pressure is within normal range but there are signs of inadequate tissue perfusion, the child is in compensated shock. When O_2 delivery is limited, compensatory mechanisms try to maintain blood flow to the brain and heart. These compensatory mechanisms are clues to the presence of shock and vary according to the type of shock.

POST RESUSCITATION STABILIZATION

Reassessment is key. The goal is to optimize perfusion to prevent organ injury and to preserve neurologic function. The cause of arrest must be diagnosed and treated.

Respiratory

- Data suggests that hyperoxemia (high Pa02) is associated with organ injury. The goal following arrest is to decrease the FI02 to the lowest level that will maintain an oxyhemoglobin saturation of 94% to 99%.
- Evaluate acid base balance and treat imbalances.
- Assist ventilation if significant respiratory compromise. If already intubated, verify tube placement and position. Consider arterial blood gases 10-15 minutes after establishing ventilator settings.

- Control pain and discomfort with analgesics and sedatives. Neuromuscular blocking agents with analgesia or sedation may improve oxygenation and ventilation
- Monitor exhaled C02, especially during transport and diagnostic procedures
- Insert a gastric tube to relieve and help prevent gastric inflation

Cardiovascular

- Monitor heart rate and blood pressure. Consider monitoring urine output with catheter. 12 Lead ECG may be helpful in discovering cause of cardiac arrest
- Remove IO access if used for resuscitation and establish venous catheters
- Monitor electrolytes, glucose and blood gases
- Drugs used to maintain cardiac output
    - Epinephrine
    - Dopamine
    - Dobutamine Hydrochloride
    - Sodium Nitroprusside
    - Inodilators (inamrinone and milrinone)

Neurologic

- Do not routinely provide excessive ventilation or hyperventilation. Has no benefit and may impair neurologic outcome by adversely affecting cardiac output and cerebral perfusion
- Therapeutic hypothermia may be considered for children who remain comatose after resuscitation from cardiac arrest.
    - The ideal method for cooling and re-warming is not known.
- Treat post ischemic seizures aggressively; search for a correctable cause

Pulseless Arrest Algorithm- PEDIATRIC

- BLS, call for help, start CPR
- Give oxygen when available
- Attach monitor/defibrillator when available

Check Rhythm
Shockable Rhythm?

Shockable → **VF/VT**

Not Shockable → **Asystole/PEA**

VF/VT

Give 1 shock
- AED or Manual (1st Shock 2j/kg) / (2nd shock 4j/kg) biphasic
- Subsequent shocks ≥ 4j/kg - maximum 10 j/kg or adult dose

Resume CPR (start with chest compressions)
Vascular Access: IV/IO

Check Rhythm
Shockable Rhythm?

Give 1 shock
- AED or Manual (1st Shock 2j/kg) / (2nd shock 4j/kg) biphasic
- Subsequent shocks ≥ 4j/kg - maximum 10 j/kg or adult dose

Resume CPR immediately after shock
Drug Therapy
- Epinephrine 0.01 mg/kg (0.1 mL/kg 1:10,000) q 3-5 min
- No IV/IO-ET route .01 mg/kg (0.1 mL/kg of 1:1000 concentration

Check Rhythm
Shockable Rhythm?

Give 1 shock
- AED or Manual (1st Shock 2j/kg) / (2nd shock 4j/kg) biphasic
- Subsequent shocks ≥ 4j/kg - maximum 10 j/kg or adult dose

Resume CPR immediately after shock
Antiarrhythmics
- Amiodarone 5mg/kg IV/IO - May repeat twice

Treat reversible causes

Asystole/PEA

Resume CPR
Vascular access
- Epinephrine 0.01 mg/kg (0.1 mL/kg 1:10,000) q 3-5 min
- No IV/IO-ET route .01 mg/kg (0.1 mL/kg of 1:1000 concentration

Check Rhythm
Shockable Rhythm?

YES – Follow shockable algorithm

NO – Continue Asystole/PEA

- Push hard and fast at least 100/min
- Compress at least 1/3 the AP diameter of the chest
- Ensure complete chest recoil
- Minimize interruptions in chest compressions
- Atropine no longer used in Asystole/PEA
- After advanced airway no longer synchronize CPR

Look for reversible causes:

Hypovolemia	Toxins
Hypoxia	Tamponade Cardiac
Hydrogen ion (acidosis)	Tension Pneumothorax
Hypoglycemia	Thrombosis
Hypothermia	Trauma

This algorithm is an abbreviated guide. Please consult your course book for complete algorithm.

Pediatric Bradycardia Algorithm

(With pulse and poor perfusion)

Identify and treat underlying cause

- Maintain patent airway; assist breathing if necessary
- Oxygen
- Cardiac monitor to identify rhythm; monitor blood pressure and oximetry
- IV/IO Access
- 12-Lead ECG if available; don't delay therapy

Cardiopulmonary Compromise Continues

NO

- Support ABC's
- Give Oxygen
- Observe
- Consider Expert Consultation

YES

CPR if HR < 60 BPM
With poor perfusion despite oxygenation and ventilation

YES

Bradycardia Persist?

- **Epinephrine**
- **Atropine** for increased vagal tone or primary AV block
- Consider Transthoracic pacing/Tranvenous pacing
- Treat underlying cause

If pulseless arrest develops, go to Cardiac Arrest Algorithm

Cardiopulmonary Compromise

- Hypotension
- Acutely altered mental status
- Signs of shock

Dosage / Details

Epinephrine IV/IO Dose:

0.01mg/kg (.01ml/kg of 1:10,000 concentration)

Repeat every 3-5 minutes.

IV/IO not access not available but endotracheal (ET) tube in place, may give ET dose: 0.1 mg/kg (0.1ml/kg of 1:1,000).

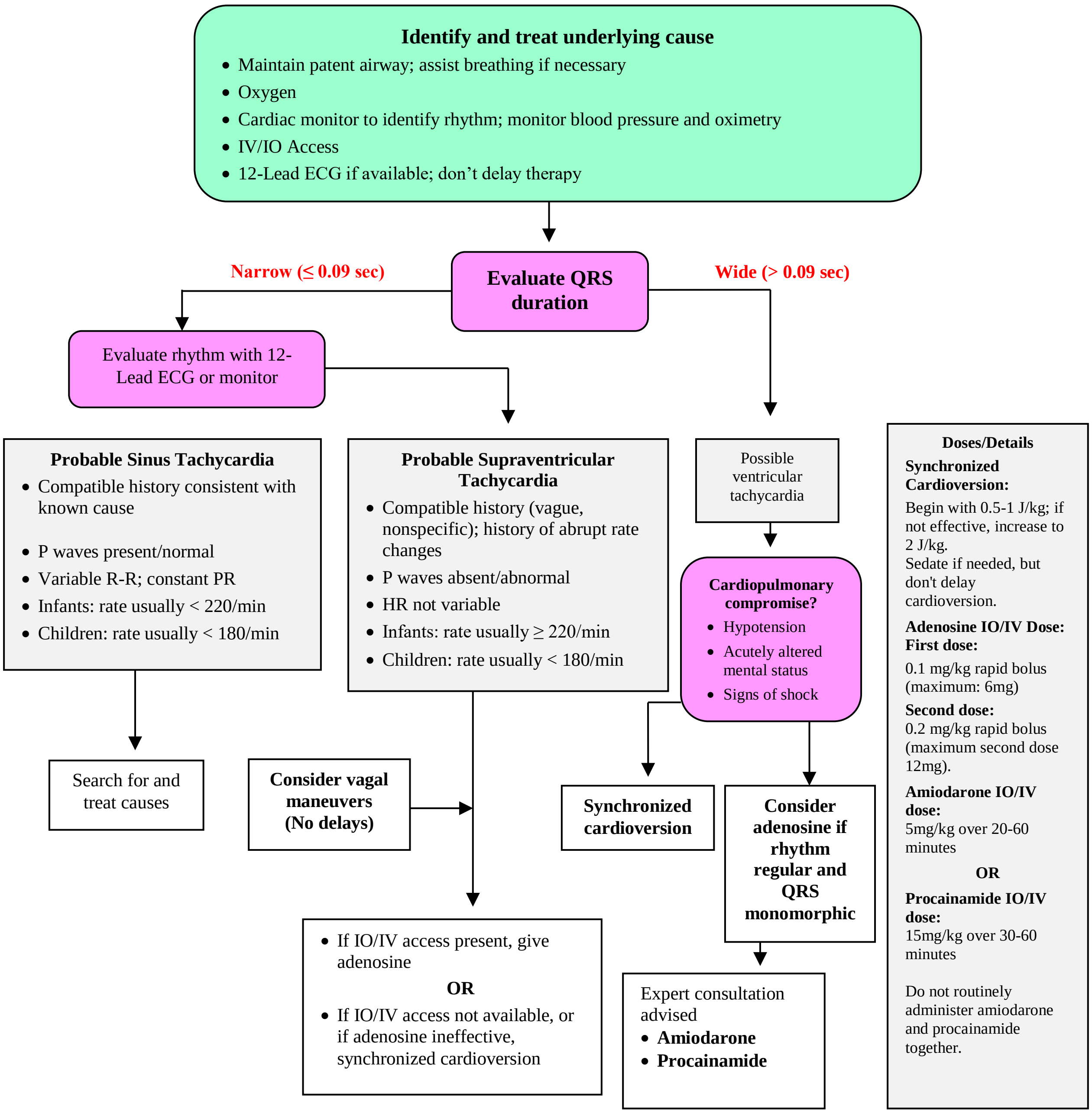
Atropine IV/IO dose:

0.02 mg/kg. May repeat once. Minimum dose 0.1mg and maximum single dose 0.5 mg

This algorithm is a summary and should be used only as a guide in conjunction with the course book.

Pediatric Tachycardia Algorithm

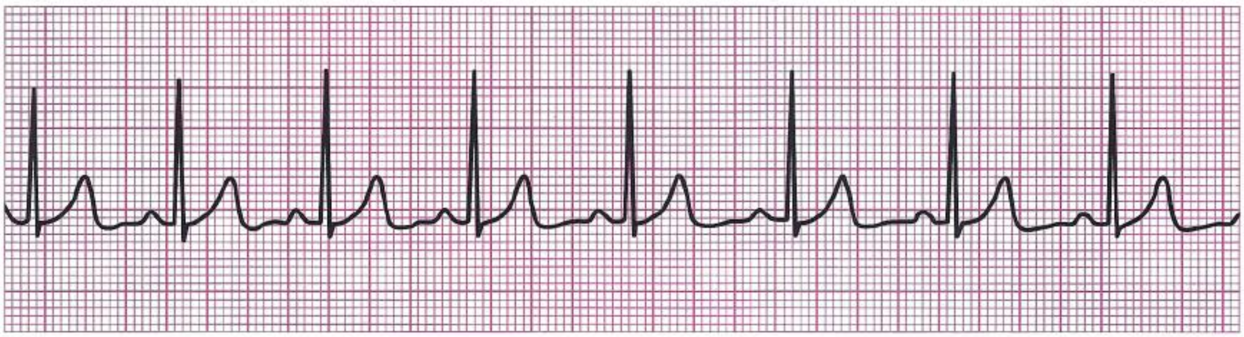
(With a pulse and poor perfusion)



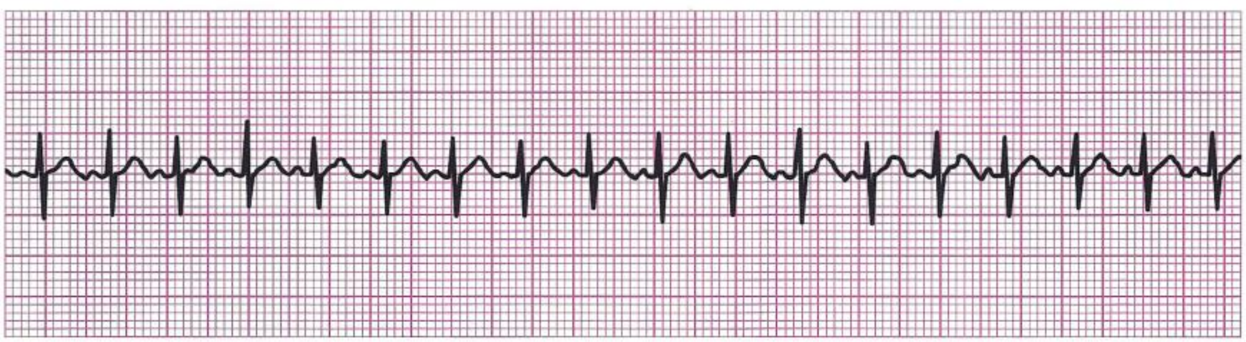
This algorithm is a summary and should be used only as a guide in conjunction with the course book.

ECG Rhythms

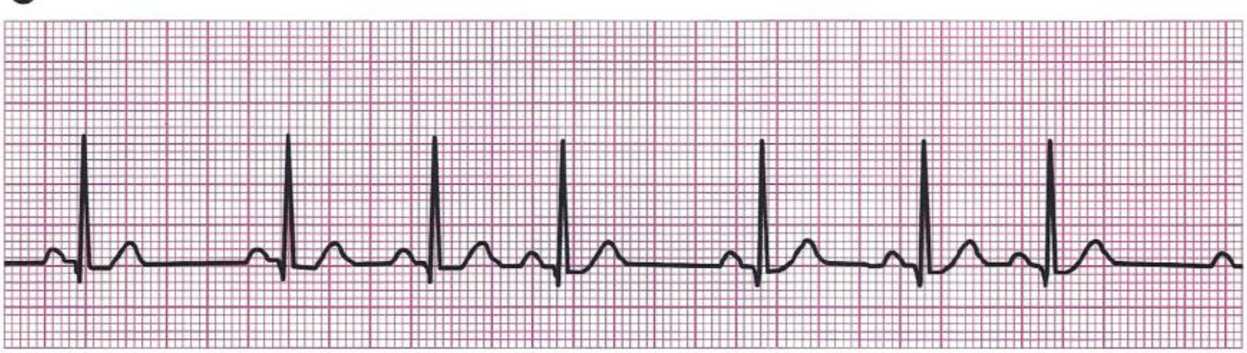
A



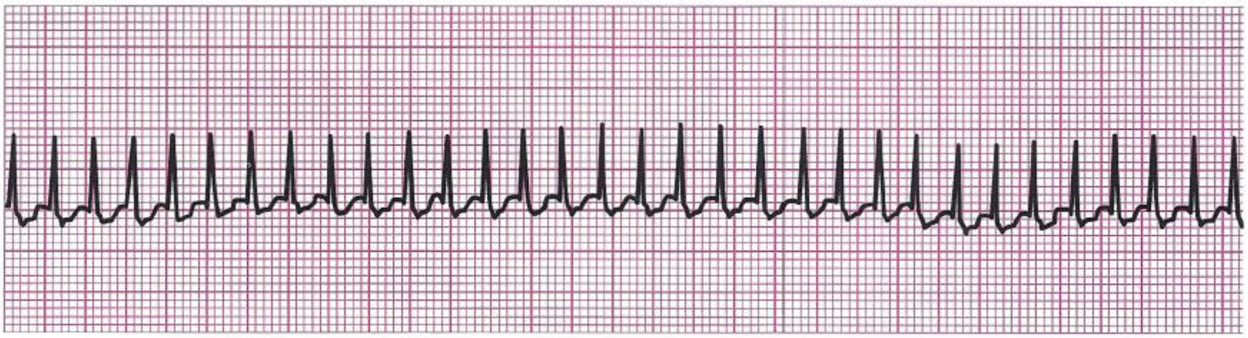
B



C

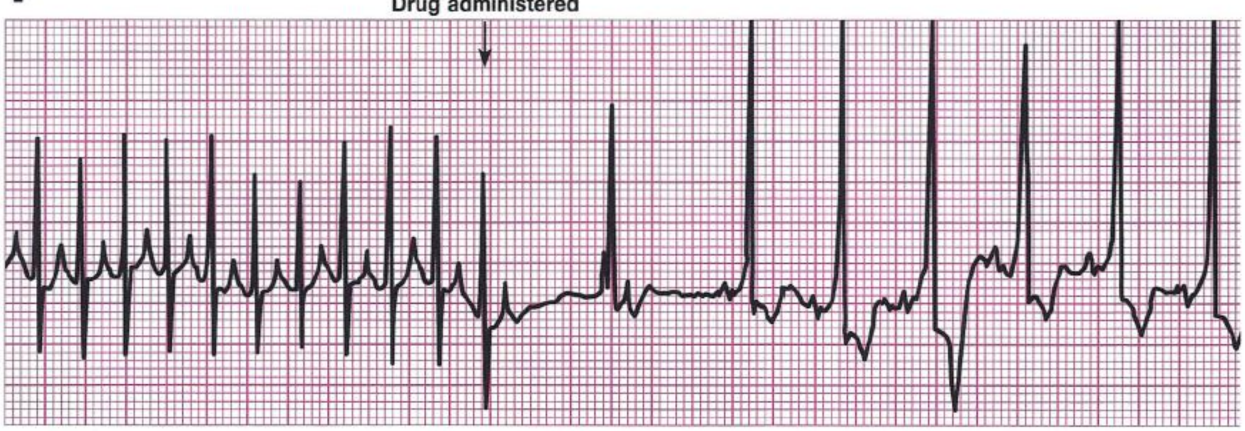


D

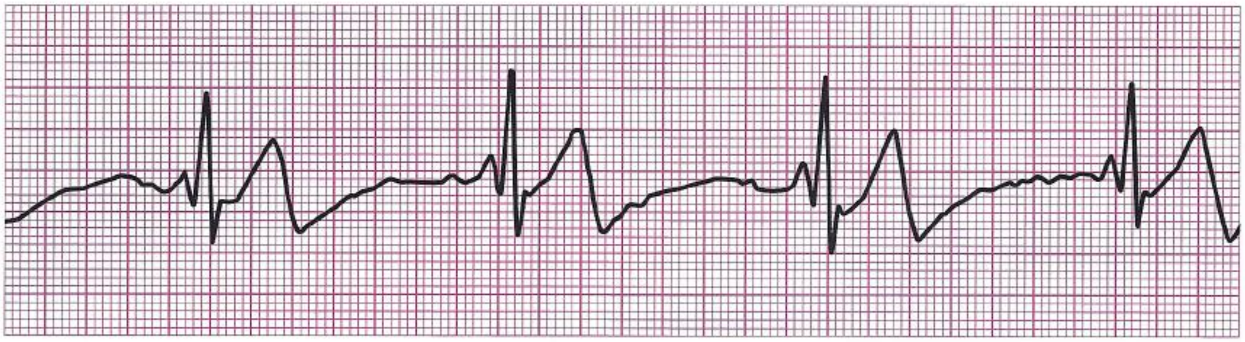


E

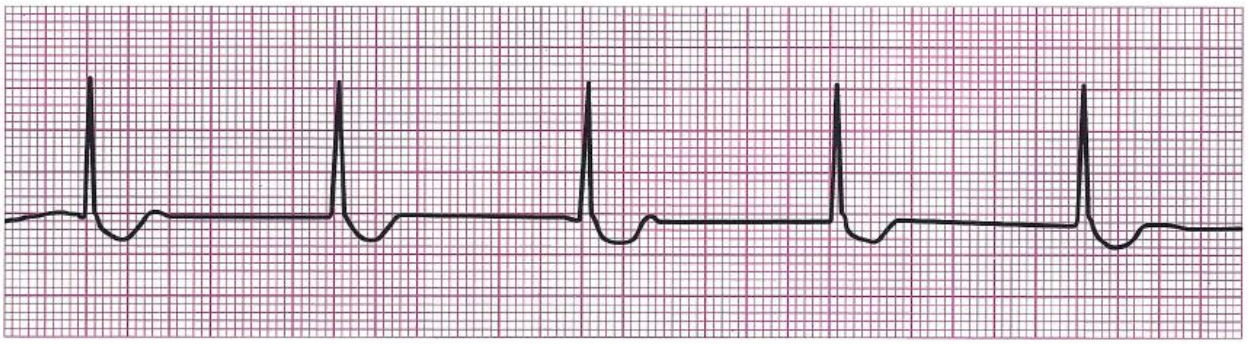
F



G

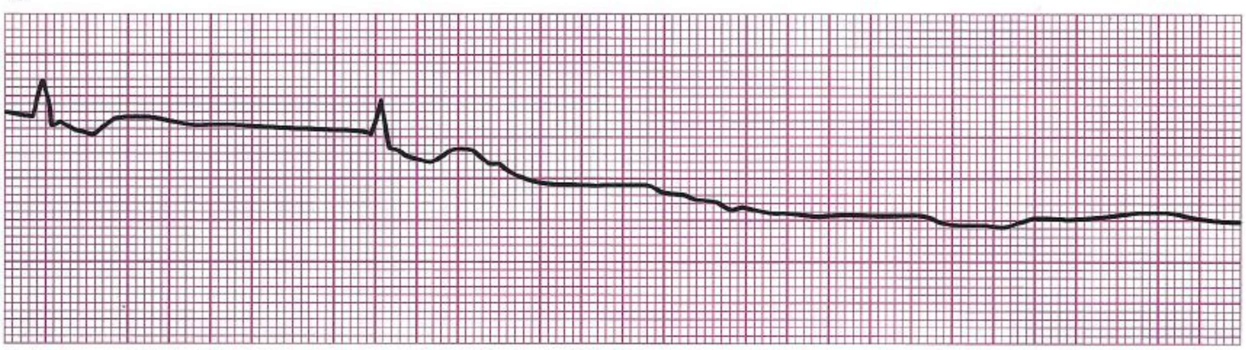


H



I

J



Answers to Rhythms

A. Sinus Rhythm
B. Sinus Tachycardia
C. Sinus Arrhythmia
D. Narrow-complex Tachycardia
E. Wide-complex Tachycardia
F. SVT converting to sinus rhythm with adenosine administration
G. Sinus bradycardia
H. Junctional bradycardia
I. Complete heart block with ventricular escape rhythm (3rd degree)
J. Agonal rhythm progressing to asystole