CMEs Training

Presents

Pediatric Advanced Life Support - PALS

Pre-Course Study Guide

2015 Guidelines

FBON: 50-12259

CMEs Training

Table of contents:

CMEs Training

This packet is intended for use as a supplement PRIOR to attending an Pediatric Advanced Cardiac Life Support Course.

Welcome to CMEs Training pre-course study packet. Critical Medical Education & Training, Inc., (CMEs Training), is committed to improving the quality of healthcare by providing new skills and knowledge as it becomes available through continuing education. Whatever your goal – whether it be career enhancement, personal or re-licensure, CMEs Training will provide continuing education to the disciplines it supports through **Professionalism, Respect, Integrity, Dependability and Evaluation, (PRIDE).**

CMEs Training recognizes that balancing home and career can be difficult so we have developed learning opportunities that are flexible and present themselves not only in the traditional classroom setting but as a convenient alternative, via on-line programs. Additionally, we can customize any curriculum to fit the needs of your company and bring it to you!

Critical Medical Education & Training Incorporated is a state-of-the-art educational and training institution committed to providing the highest level of instruction available for a wide variety of medical disciplines. CMEs Training offers on-line classes and satellite facilities in the following cities: Tampa, Jacksonville, Orlando, Washington DC, Maryland, Ohio, Virginia with additional sites being added in 2017. In addition to the above facilities CMEs Training will provide instruction at medical institutions, fire training facilities and private businesses.

CMEs Training is approved by the American Heart Association, Florida Board of Nursing and Florida Department of Emergency Medicine to offer a wide variety of courses to fit almost any medical educational need.

CMEs Training instructors come to us with very diversified backgrounds within the medical and fire rescue community and have extensive experience educating medical professionals from a variety of disciplines. All are fully licensed and American Heart Association compliant, have attained a high level of respect professionally, many with twenty to over thirty years of experience in their respective disciplines and have received professional recognition and awards prior to becoming instructors at CMEs Training.

The AHA has set the GOLD STANDARDS FOR RESUSCITATION GUIDELINES AND continues to lead the field in Emergency Cardiac RESUSCITATION for all medical professionals.

The AHA recognizes only those institutions that can provide the required initial and recertification courses as mandated by the AHA.

CMEs Training provides these Gold Standards of Resuscitation guideline courses in a format that is stress-free, flexible to the needs of the student and with the latest power point and visual teaching aids. CEUs are no longer available for recertification of BLS, ACLS or PALS.

Thank you for choosing CMEs Training for your educational needs. NOW LET'S GET STARTED!

CMEs Training

PALS Study Guide

Pre Course Study Material for you to review

Guidelines have recently changed and certain American Heart Association (AHA) textbooks, materials and handbooks are available now at our bookstore. Please check with your educator to library AHA textbooks or order materials by calling Channing Bete at 1-800-611-6083 or visit channingbete.com or Laerdal Medical at 877-523-7325 or laerdal.com

THE 2015 PRE-COURSE EXAM IS LOCATED ON-LINE AT www.heart.org/eccstudent

Enter Pass Code: pals15 AHA requires a minimum score of 70%

At the end of this course you must be able to demonstrate treatment of the following objectives during a simulated **VF** (Ventricular Fibrillation), **VT** (Ventricular Tachycardia) and PEA (Pulseless Electrical Activity) cardiac, respiratory, or shock arrest scenario:

Key changes in pediatric advanced life support, reflecting the new science from the 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care:

1- and 2-rescuer child CPR and AED use
1- and 2-rescuer infant CPR
Management of respiratory emergencies
Rhythm disturbances and electrical therapy
Vascular access
Resuscitation team concept
Cardiac, respiratory and shock case discussions and simulations
Systematic Approach to Pediatric Assessment

What happens if I do not do well in this course?

The Course Director or Lead Instructor will "remediate" (tutor) you and upon remediation you will be permitted to continue with the course.

Any questions please contact our office at:

877-850-2702 or 772-345-7522

or online at

www.CMEsTraining.com

PALS Sample Initial Course Agenda

Approximately 14 hours

Day 1:

- Registration
- Welcome; introduction
- Video introduction:
  - PALS Course Overview
  - Overview of PALS Science
- Practical sessions
  - Respiratory Emergencies
  - BLS and competency testing
- Practical sessions
  - Rhythm Disturbances/Electrical Therapy
  - Vascular access
- Lunch
- Resuscitation Team Concept
- Overview of Pediatric Assessment
- Overview of Learning Stations
- Practical sessions
  - Respiratory Cases 1 and 2
  - Respiratory Cases 3 and 4
  - Shock Cases 5 and 6

Day 2:

- Q & A
- Practical station
  - Shock Cases 7 and 8
  - Cardiac Cases 9 and 10
  - Cardiac Cases 11 and 12
- Putting it all together
- Lunch
- Course Summary and Testing Details
- Written evaluations (testing)
- PALS Core Case Testing
- Course evaluation/remediation
- Distribution of cards

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What is PALS?

This classroom, video-based, Instructor-led course uses a series of simulated pediatric emergencies to reinforce the important concepts of a systematic approach to pediatric assessment, basic life support, PALS treatment algorithms, effective resuscitation and team dynamics. The goal of the PALS Course is to improve the quality of care provided to seriously ill or injured children, resulting in improved outcomes

The PALS Course is for healthcare providers who respond to emergencies in infants and children. These include personnel in emergency response, emergency medicine, intensive care and critical care units such as physicians, nurses, paramedics and others who need a PALS course completion card for job or other requirements.

During the course you will actively participate in a series of simulated core cases. These simulations are designed to reinforce important concepts, including:

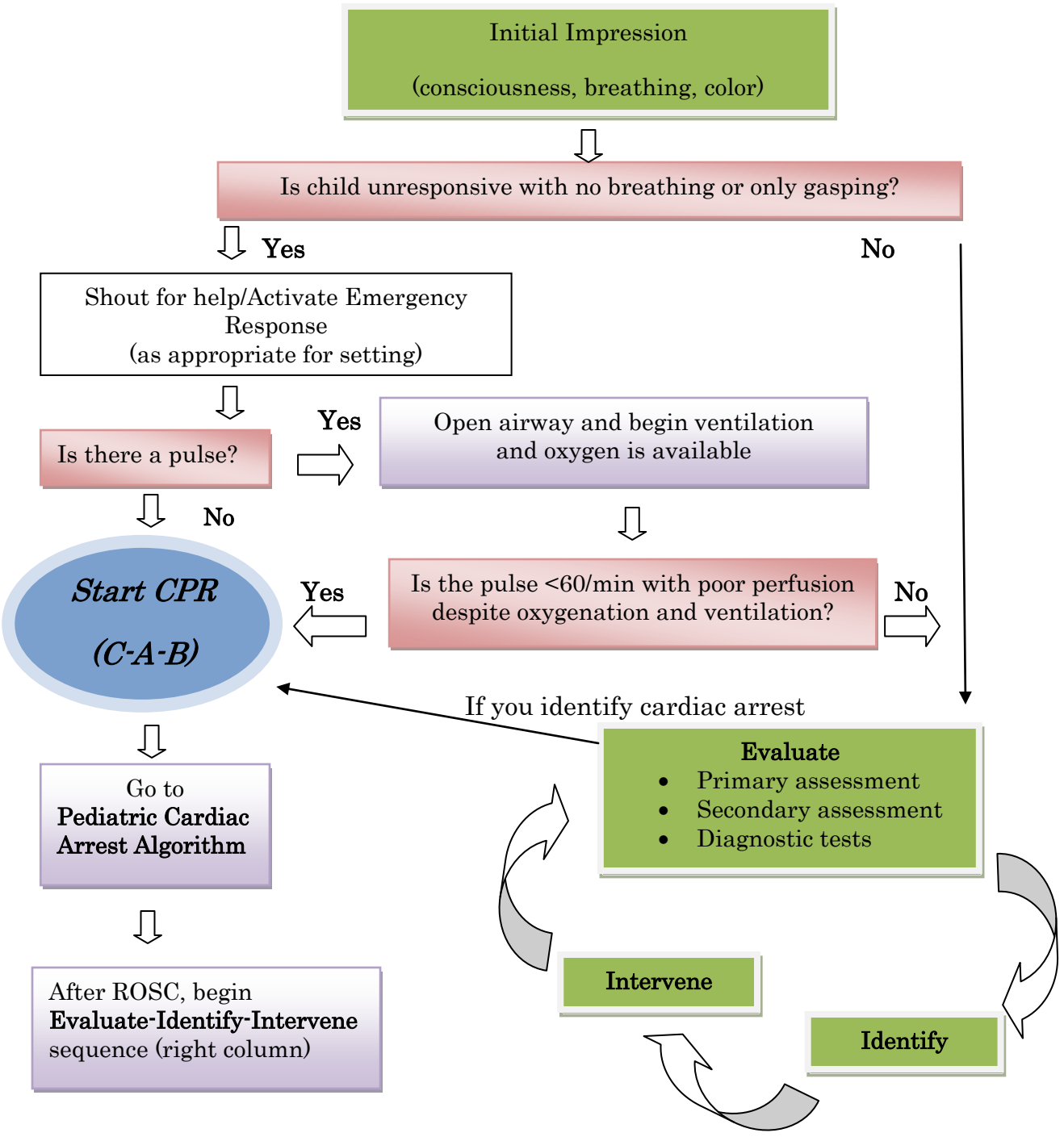
- Identification and treatment of problems that place the child at risk for cardiac arrest
- Application of a systematic approach to pediatric assessment (next page)
- Use of the "evaluate-identify-intervene" sequence (next page)
- Use of PALS algorithms and flow charts
- Demonstration of effective resuscitation team dynamics

For the purposes of these guidelines

Infant BLS guidelines apply to infants<approximately 1 year of age.

Child BLS guidelines apply to children approximately 1 year of age until puberty. For teaching purposes puberty is defined as breast development in females and the presence of axillary hair in males.

PALS Systematic Approach Algorithm



CMEs Training

ABCD's of pediatrics

Airway: **Open and hold** with head tilt-chin lift (assess for effectiveness)

Breathing: present or absent?
Is the rate normal or too slow or too fast?
Is the pattern regular or irregular or gasping?
Is the depth normal or shallow or deep?
Is there nasal flaring or sternal retractions or accessory muscle use?
Is there stridor or grunting or wheezing?

Pediatric Respiratory Rates

Age	Rate
Infant	30-60
Toddler	24-40
Preschooler	22-34
School-aged child	18-30

Circulation: Is central pulse present or absent?
Is the rate normal or too slow or too fast?
Is the rhythm regular or irregular?
Is the QRS narrow or wide?

Pediatric Heart Rates

Age	Sleeping	Awake
< 3 months	80	205
3 months – 2 years	75	190
2-10 years	60	140
10 + years	50	100

IS CPR NEEDED?

Defibrillation:

For pediatric patients defibrillation will be delivered @ 2j/kg followed by 4j/kg with a maximum of 10j/kg for Ventricular Fibrillation and Pulseless Ventricular Tachycardia. Pads may be placed anterior/posterior

Chest compressions/Circulation check a pulse

Patient	Rate	Ratio	Depth of Compression
Adult	100 compressions per minute	30:2	2 inches or 5 cm
Child	100 compressions per minute	30:2 for one rescuer (5 cycles) and 15:2 two rescuer (10 cycles)	2 inches/ 5 cm or 1/3 the circumference of the chest
Infant	At least 100 compressions per minute	30:2 for one rescuer (5 cycles) and 15:2 for two rescuer (10 cycles)	1.5 inches/ 4 cm or 1/3 the circumference of the chest

In contrast to adults, cardiac arrest in infants and children does not usually result from a primary cardiac cause. More often it is the terminal result of progressive respiratory failure or shock, also called an asphyxial arrest. Asphyxia begins with a variable period of systemic hypoxemia, hypercapnea, and acidosis, progresses to bradycardia and hypotension, and culminates with cardiac arrest.[1]

Another mechanism of cardiac arrest, ventricular fibrillation (VF) or pulseless ventricular tachycardia (VT), is the initial cardiac rhythm in approximately 5% to 15% of pediatric in-hospital and out-of-hospital cardiac arrests;[2,–,9] it is reported in up to 27% of pediatric in-hospital arrests at some point during the resuscitation.[6] The incidence of VF/pulseless VT cardiac arrest rises with age.[2,4] Increasing evidence suggests that sudden unexpected death in young people can be associated with genetic abnormalities in myocyte ion channels resulting in abnormalities in ion flow

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PALS Assessment/ Secondary ABCD's:

Airway: Head Tilt / Chin Lift

- Use Bag mask with 2 person CPR
- Provide each breath over 1 second each
- Compressor pauses to allow the 2 breaths
- Consider inserting an advanced airway (see advanced airway page)

Breathing: Look for visible chest rise during each breath

- Confirm advanced airway tube placement (see advanced airway page)
- Secure the airway tube
- Compressor now gives 100 continuous compressions per minute
- Ventilator gives 8-10 breaths per minute (one every 6-8 seconds)

	Adult	Pediatric	Infant
BLS Airway	1 breath every 5-6 seconds	1 breath every 3-5 seconds	1 breath every 3-5 seconds
ALS Airway in place	1 breath every 6-8 seconds max 8-10 breaths/min	1 breath every 3-5 seconds	1 breath every 3-5 seconds

Circulation:

- Obtain vascular access with an IV (Intravenous) or IO (Intraosseous) Cannulation
- Give medication as recommended per algorithm

Differential Diagnosis: "Why is this patient in this rhythm?" Look for possible causes:

6 H's	6 T's
Hypoxia Hypovolemia Hypothermia Hypo/Hyperkalemia Hydrogen Ion (acidosis)	Tamponade Tension Pneumothorax Toxins-poisons, drugs Thrombosis-coronary (AMI) –Pulmonary (PE)

CMEs Training

Airway Skills

During this course you will be expected to participate in manikin practice and demonstrate proficiency in the below skills:

Basic Airway: (BLS)

Oxygen: To use or not to use

- Open the airway
  - Use the head tilt – chin lift when assessing for adequate breathing
  - Use a jaw thrust for unresponsive, trauma or drowning
  - If unable to open the airway with a jaw thrust, use head tilt – chin lift
- Maintain the airway
  - Insert an oropharyngeal airway when unconscious with no cough or gag reflex
  - Insert a nasopharyngeal airway when a cough or gag reflex is present (better tolerated)
- Ventilate Give a breath over 1 second using providing enough volume to see the chest rise
  - 2 rescuer CPR: give 2 breaths during the pause following the 15 compressions
  - Rescue breathing: when a pulse, give 10-12 breath/minute 1 every 3-5 seconds **Refer back to page 11**

Advanced Airway:

Supraglottic Airway (Bridge Device) #1 requires the least training for insertion

- Inserts blindly into the hypo pharynx
- Regurgitation and aspiration are reduced but not prevented
- Confirm placement: See chest rise and listen for breath sounds over the lung fields
- Contraindications: gastric reflux, full stomach, pregnancy, or morbid obesity

Supraglottic Airway (Bridge Device) #2: requires more training for insertion than Bridge device #1

- Inserts blindly into esophagus (80% of the time) or the trachea
- Ventilation can occur whether the tube is in the esophagus or the trachea
- Confirm placement: clinical exam and a confirmation device (see below)

Endotracheal Tube (ETT): requires the most training, skill and frequency to retain insertion techniques

- Insert by direct visualization of vocal cords
- Isolates the trachea, greatly reduces risk of aspiration, and provides reliable ventilation
- High risk of tube displacement or obstruction whenever patient is moved
- Confirmed placement: clinical exam and a confirmation device

**Immediately confirm tube placement by clinical assessment and a device!

A cuffed or uncuffed Endotracheal Tube (ET) may be used on Infants and children.

To estimate tube size:
Uncuffed = (Age in years ÷ 4) + 4.
Example: (4 years ÷ 4) = 1 + 4 = 5
Cuffed = (Age in years ÷ 4) + 3.
Example: (4 years ÷ 4) = 1 + 3 = 4

Clinical Assessment:

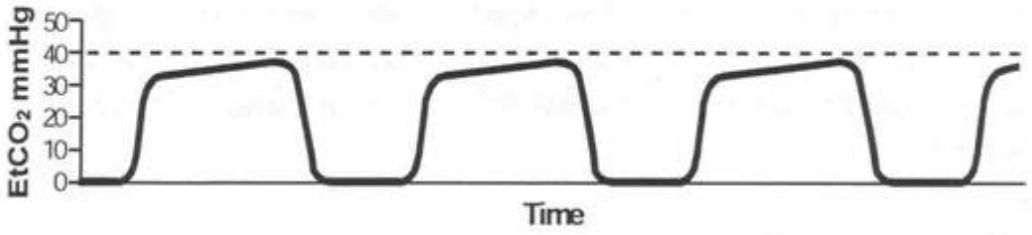
- Look for bilateral chest rise and fall
- Listen for breath sounds over stomach and the 4 lung fields (left and right anterior chest wall and mid axillary)
- Look for water vapor in the tube (if seen this is helpful but not definitive)

Devices

- End-tidal CO2 Detector (ETD) if weight > 2 kg
- Attaches between the ET and resuscitation bag BVM
- Litmus paper center should change color with each inhalation and each exhalation
- Original color on inhalation = Okay O2 is being inhaled: expected
- Color change on exhalation = CO2! ETT is in the trachea
- Original color on exhalation = Oh – Oh! Litmus paper is wet: replace ETD
- If tube is not in the trachea: remove ETT. Cardiac output is low during CPR

Capnography

- Measures exhaled CO2 in a digital or waveform format
- Allows the provider instant feedback on respiration of your patient not just ventilation
- Standard treatment for all intubated patients
- If no or limited CO2 is being exhaled, the patient is no longer exchanging gases and/or the ETT is not in the correct place



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Electrical Therapy (Defibrillation)

During this course you will practice and then demonstrate safe, effective techniques for defibrillation including indications for use

Defibrillation

- Recommended shock dose: Biphasic = 2-4 joules/kg (manufacturer)

Synchronized Cardioversion: Timed low energy shocks

- Timed to QRS to reduce risk of "R on T", a shock that hits the T wave may cause VF

Transcutaneous pacing: Noninvasive emergent bedside pacing (8 years and older)

- Apply pacer pads
- Verify pacer capture

The lowest energy dose for effective defibrillation and the upper limit for safe defibrillation in infants and children are not known; more data are needed. It has been observed that in children with VF, an initial monophasic dose of 2 J/kg is only effective in terminating ventricular fibrillation 18% to 50% of the time,[269,270] while similar doses of biphasic shocks are effective 48% of the time.[268] Children with out-of-hospital VF cardiac arrest often receive more than 2 J/kg,[271,272] and one in-hospital cardiac arrest study[268] showed that children received doses between 2.5 and 3.2 J/kg to achieve ROSC. Energy doses >4 J/kg (up to 9 J/kg) have effectively defibrillated children[272,–,274] and pediatric animals[275] with negligible adverse effects. Based on data from adult studies[276,277] and pediatric animal models,[278,–,280] biphasic shocks appear to be at least as effective as monophasic shocks and less harmful.

It is acceptable to use an initial dose of 2 to 4 J/kg (Class IIa, LOE C), but for ease of teaching an initial dose of 2 J/kg may be considered (Class IIb, LOE C). For refractory VF, it is reasonable to increase the dose to 4 J/kg (Class IIa, LOE C). Subsequent energy levels should be at least 4 J/kg, and higher energy levels may be considered, not to exceed 10 J/kg or the adult maximum dose (Class IIb, LOE C).

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Vascular Access

Peripheral IV: Preferred in arrest: Due to easy access and no interruptions in CPR

- Use a large bore IV catheter
- Attempt large veins: Antecubital, external jugular, femoral vein
- Can take 1-2 minutes for IV drugs to reach central circulation

Intraosseous (IO): Inserts into a large bone and accesses the venous plexus

- May use if unable to obtain intravascular access
- Drug delivery is similar to a central line
- Safe access for fluids, drugs, and blood samples
- Drug doses are the same as when given IV

Central Line: Not needed in most resuscitations

- Insertion requires interruption of CPR
- If a central line is already in place and patent, it can be used

Endotracheal: Level three now NOT RECOMMENDED

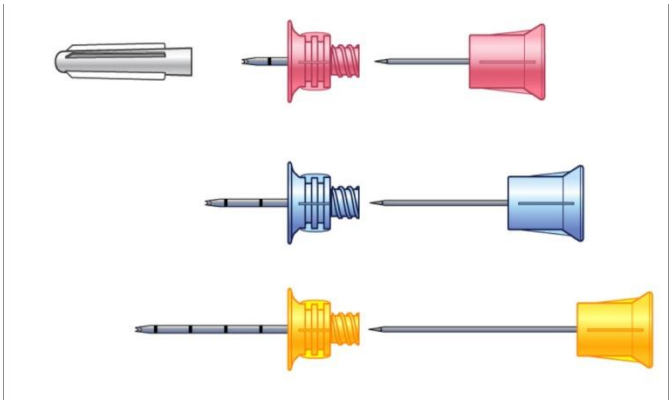
- Drug delivery is unproductive thus IV/IO delivery is preferred
- Drug – blood concentration stays lower than when given IV
- Increase dose given to 2 – 2.5 times the recommended IV dose
- Drugs that absorb via the trachea
    - Naloxone
    - Atropine
    - Vasopressin
    - Epinephrine
    - Lidocaine

CMEs Training

Vascular Access

Power Driver

- Drivers are sealed and not intended to be opened. Batteries are not replaceable.
- Follow the drivers directions for use when cleaning
- Do not use excessive force during insertion. Let the driver do the work

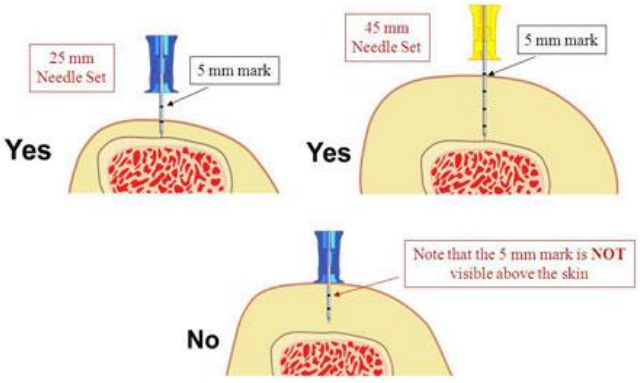


15 mm (pink) needle sets may be considered for patients 3-39 kg

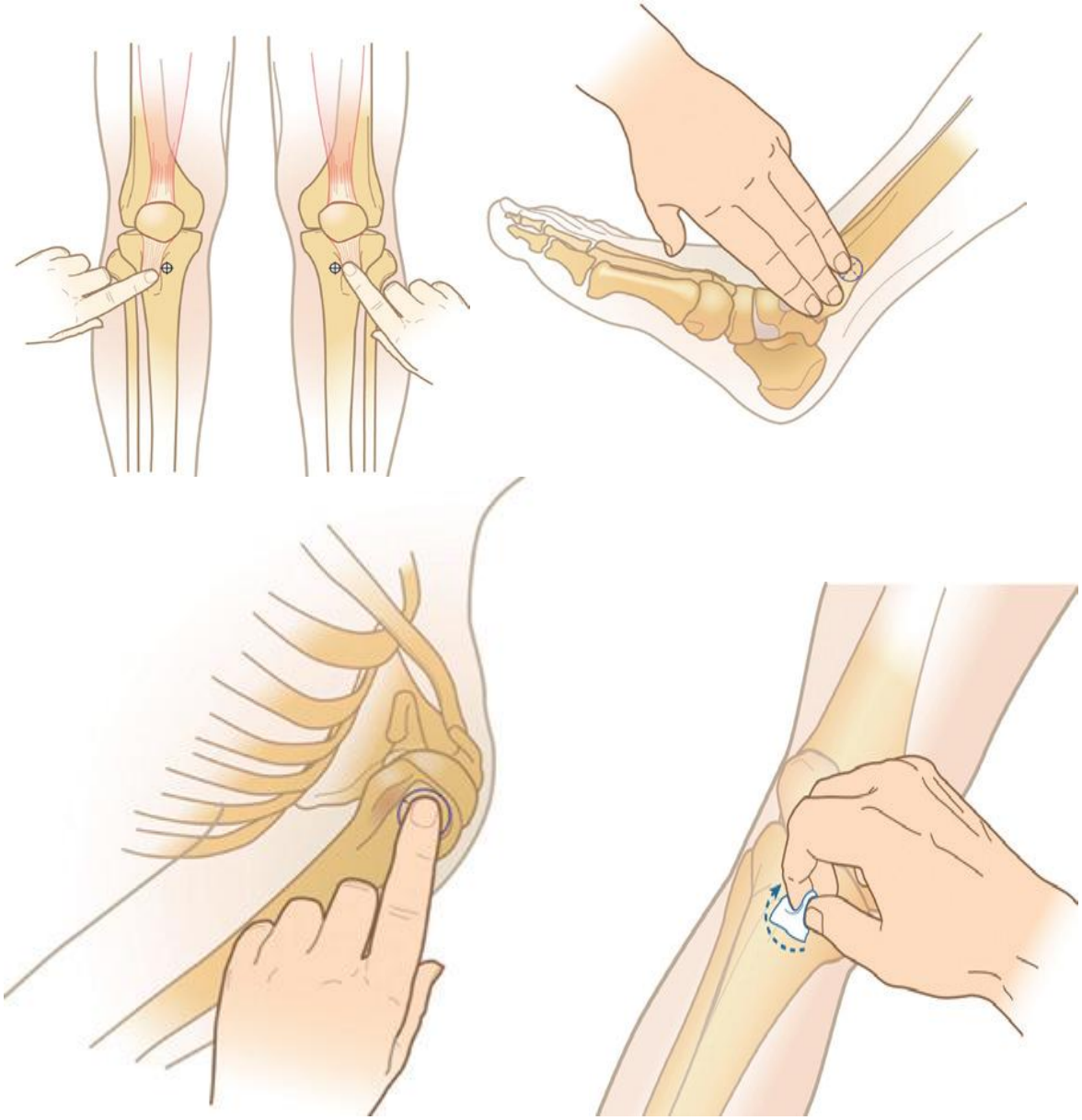
25 mm (blue) needle set may be considered for patients 40kg or greater

45mm (yellow) needle set should be considered for the proximal humerus, on patients greater than 40kg and patients with excessive tissue over other insertion sites

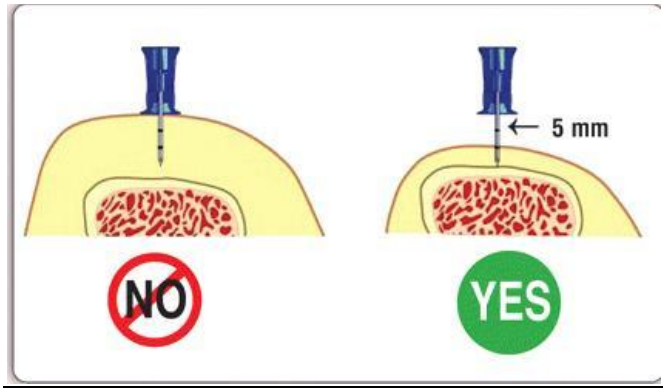
**To confirm appropriate needle selection, a black line on the needle must be visualized after insertion through the tissue.



Insertion sites

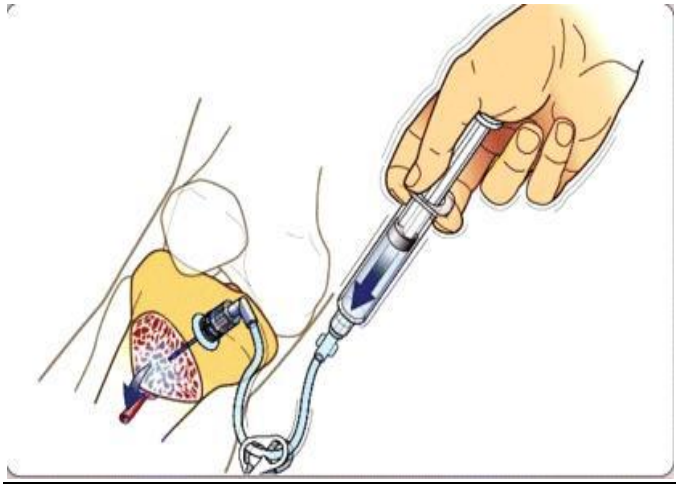


Steps



- Choose appropriate size needle. See manufacturer's recommendations depending on brand.

- Using aseptic techniques, insert needle into approved anatomical landmark by manufacturer



- Flush the site prior to infusing fluids and/or medication

Removal

- Remove within 24 hours
- Stabilize extremity
- Connect sterile luer-lock syringe
- Rotate clockwise while pulling straight up. Avoid rocking the needle on removal.
- Place removed catheter in an approved sharps container

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PALS Drugs

Look up drug dosages in the ECC Handbook. You may be allowed to use it as a reference in class

- The primary focus in cardiac arrest is effective CPR and early defibrillation
- Drug administration is secondary and should NOT interrupt CPR
- Know the timing of drug administration in CPR as shown:
- The class of recommendation number denotes potential benefit vs. risk

General Statements:

Pulseless arrest: Give a vasopressor type drug – Epinephrine

Vasopressors cause peripheral vasoconstriction, which stunts increased blood flow to the heart and brain.

Pulseless ventricular rhythms: consider antiarrythmics – Amiodarone,

May make myocardium easier to defibrillate and/or more difficult for it to again fibrillate and convert.

Bradycardia: Give a "speed up" drug Epinephrine

Epinephrine may increase heart rate but also increase myocardial oxygen demand. Consider; Atropine blocks vagal input and stimulates the SA node, which can increase heart rate.

Tachycardia, reentry SVT: Give a drug to interrupt the rhythm – Adenosine, Amiodarone, Procainamide. Adenosine blocks the AV node for a few seconds, which may break re-entry pattern

Tachycardia : Stable – to convert rhythm Amiodarone or Adenosine, synchronized cardioversion.

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Medication Review

Medication	Condition
Activated Charcoal Antidote (Toxicological Agent)	Ingested poison and drug overdose
Adenosine Troposphere (Antidysrhythmic) Prototype Procainamide	Narrow complex paroxysmal PSVT refractory to vagal maneuvers Restores normal sinus rhythm
Albuterol (sympathomimetic bronchodilator)	Bronchospasm, asthma, COPD, smooth muscle relaxant
Amrinone (Name changed in 2000 to Inamarinone Lactate Cardiac inotrope, vasodilator	Cardiac output in CHF, children in septic shock, myocardial dysfunction, afterload and preload by relaxant effect on vascular smooth muscle
Atropine Sulfate (parasympatholytic)	Bradycardia, Antidote for certain poisonings
Calcium Chloride (Electrolyte Prototype) Calcium Gluconate	Hyperkalemia, hypocalcemia, hypermagnesemia, an effective cardiac stabilizer of hyperkalemia or resuscitation
Dextrose D25W (Carbohydrate)	Hypoglycemia
Diazepam (Antianxiety/ Hypnotic) Anti-convulsant, Sedative	Seizures, Premedication for cardioversion, facilitate intubation, muscle tremors
Diphenhydramine (Antihistamine)	Allergic reaction, anaphylaxis, dystonic reactions

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Medication Review Continued

Medication	Condition
Epinephrine 1:1,000 – 1:10,000 (Hydrochloride sympathomimetic)	Restore rhythm, VF, Pulseless VT, PEA, strengthens myocardial contraction, increases cardiac rate and cardiac output
Ipratropium Bromide (Anticholinergic) Prototype: Atropine (Bronchodilator)	Bronchospasm in asthma, emphysema, COPD, chronic bronchitis, pneumonia
Ketorolac Tromethamine (Anti-pyretic, anti-inflammatory NSAID) Prototype: Ibuprofen	Mild to moderate pain from post operative care
Lorazepam (Anti-anxiety, hypnotic, sedative)	Cardioversion, status epilepticus
Magnesium Sulfate (Electrolyte replacement agent) Prototype: Hydroxide	Acute Bronchospasm
Methylprednisolone (Hormones, synthetic substance anti-inflammatory) Prototype: Prednisone	Spinal cord injury, asthma, COPD, severe anaphylaxis
Midazolam Hydrochloride (Hypnotic sedative, anticonvulsant)	Prior to cardioversion, intubation, calms patient and relaxes skeletal muscles
Naloxone Hydrochloride (Narcotic antagonist)	Narcotic overdose, coma of unknown origin, reverses the effects of opiates, results in RR depression, sedation, and hypotension
Oral Glucose (Gel)	Hypoglycemia, AMS
Oxygen (Oxidizing agent gas)	Hypoxia, medical/trauma patient to improve RR efficiency
Procainamide Hydrochloride (Antiarrythmics)	VF, Pulseless VT, slows the speed of conduction in the atria and ventricles thereby effectively slowing the heart rate
Sodium Bicarbonate (Alkalizing agent)	Tricyclic anti-depressant overdose, barbiturate overdose, refractory acidosis, hyperkalemia rapidly neutralizes gastric acid or systemic acidosis

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PALS Scenarios

Study the algorithms and drugs in the ECC Handbook.

The following are "typical scenarios within the PALS Course

1. Respiratory arrest case
    a. The skills listed within the study guide will be practices in most case scenarios.
2. VF treated with CPR and AED case scenarios
    a. Assess:
        i. Tap, ask: "are you ok?"
        ii. No movement or response, call 911 and get an AED! Or if a second rescuer is present, send them to call 911 and get an AED
    b. Primary CAB
        i. Begin CPR if a pulse is not detected within 5-10 seconds
        ii. Push fast: at least 100 compressions per minute
        iii. Allow the chest wall to completely recoil (take weight off hands)
        iv. 30 compressions; 2 ventilations = 1 cycle (1 person) 15;2 (2 person)
        v. Push hard: Minimum 1 ½ inches for infant, 2 inches for child
        vi. Minimize interruptions no more than 10 seconds
    c. Recheck pulse after 5 cycles of CPR (approximately 2 minutes)
    d. 2-rescuer CPR, basic airway, pause compressions to ventilate
    e. Secondary ABCD Survey:
        i. Airway: Open and hold (head-tilt / Chin-lift or jaw thrust), look, listen and feel
            1. Avoid rapid or forceful breaths
        ii. Breathing: Give 2 breaths (1 second each) that makes the chest rise
            1. Avoid rapid or forceful breaths
        iii. Circulation: Check carotid pulse – at least 5 seconds but no longer than 10 seconds
            1. Recheck pulse after 5 cycles of CPR (approximately 2 minutes)

2. 2 rescuer CPR, basic airway, pause compressions to ventilate

iv. Differential Diagnosis

6 H's	6 T's
Hypoxia Hypovolemia Hypothermia Hypo/Hyperkalemia Hydrogen Ion (acidosis)	Tamponade Tension Pneumothorax Toxins-poisons, drugs Thrombosis-coronary (AMI) –Pulmonary (PE)

Unacceptable actions:

1. Did not provide effective CPR
2. Did not follow AED commands
3. Did not clear patient before shock (unsafe defibrillation)

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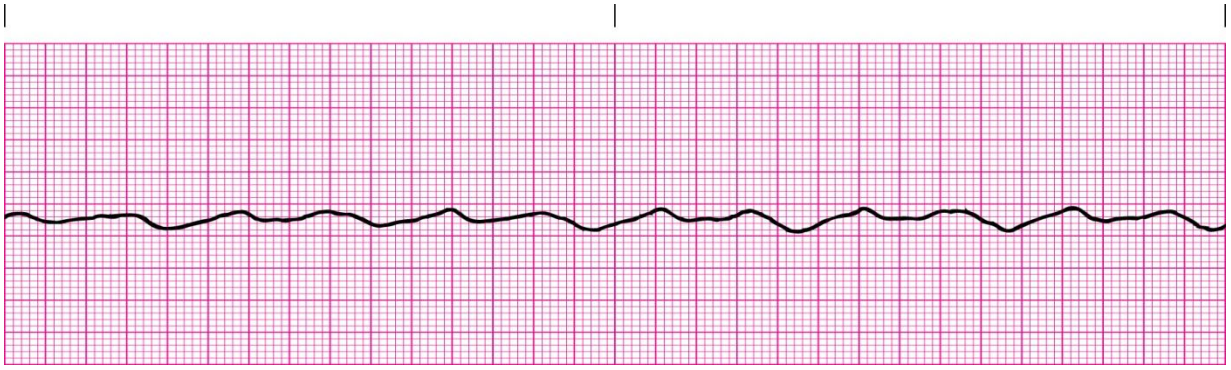
Case 1

You respond to a patient found unresponsive. You call for help and begin CPR (CAB). A team member arrives with the crash cart, which has a manual defibrillator and advanced airway equipment. The patient is attached to the monitor and you identify the following rhythm:



Primary D: Defibrillation – Shock #1

- After verifying the rhythm, resume CPR while the defibrillator is charging
- Once charged: "CLEAR" ensure no one is touching the patient or bed
- Give 1 shock: Biphasic defibrillation = Mfg recommendation, if unknown 2j /Kg
- Immediately resume CPR for 5 cycles
- After 5 cycles: check rhythm (shockable?) check a pulse 5-10 seconds

⇩

Secondary ABCD's survey: conducted between 1st and 2nd shock is ongoing

⇩

Airway

- BLS Airway as long as good chest rise and fall
- Consider advanced airway placement: Bridge Device or ETT

⇩

Breathing

- Check for visible chest rise with BVM
- Confirm advanced airway placement by exam and confirmation device
- Secure advanced airway in place with tape or commercial device
- Give 8-10 breaths/min and continuous compressions of at least 100 per minute

⇩

Circulation

- Establish vascular access via IV or IO
- Do not interrupt CPR for access

⇩

Differential Diagnosis – Use the H's and T's mnemonic

Defibrillation: Shock #2

- After 5 cycles of CPR: check rhythm (shockable) check pulse 5-10 seconds
- Resume CPR while defibrillator is charging
- Once charged: "CLEAR" ensure no one is touching the patient or bed
- Give 1 shock: Biphasic defibrillation = Mfg recommendation, if unknown 4j/kg
- Immediately resume CPR for 5 cycles

⇩

Medications:

- Administer; Given during CPR only
- Epinephrine 0.01 mg/kg of 1;10,000 mg IV/IO (every 3-5 minutes)

⇩

Defibrillation: Shock #3

- After 5 cycles of CPR, check rhythm (shockable?) check pulse, (5-10 seconds) once charged, "CLEAR" ensure that no one is touching the patient or bed
- Resume CPR for 2 minutes

⇩

Defibrillation: Shock #4

- Biphasic defibrillators = Mfg recommendation, if unknown 4j/Kg (Max 10j/Kg),
- Immediately resume CPR for 2 minutes

⇩

Medications:

- Consider antiarrythmic: give during CPR
  - Amiodarone 5mg/kg may repeat up to 2 times

Treat reversible causes

⇩

6 H's	6 T's
Hypoxia Hypovolemia Hypothermia Hypo/Hyperkalemia Hydrogen Ion (acidosis)	Tamponade Tension Pneumothorax Toxins-poisons, drugs Thrombosis-coronary (AMI) –Pulmonary (PE)

Unacceptable Actions

- Did not provide effective CPR
- Did not clear before shock
- Did not confirm advanced airway placement
- Did not give a vasopressor

YOU JUST TREATED VENTRICULAR FIBRILLLATION!!!

**Same algorithm would apply for pulseless Ventricular Tachycardia

CMEs Training

Case 2

You find a patient is unresponsive. You call for help and begin CPR (primary ABC/CAB survey). A team member arrives with the crash cart, which has a manual defibrillator and advanced equipment. The patient is attached to the monitor and you see the following

Primary CAB
Defibrillation: No shock advised
Secondary ABCD Survey: Ongoing

⇩

Airway

- BVM with 100% O2
- Consider advanced airway placement: LMA, combi-tube. Or ETT

⇩

Breathing

- Confirm for visible chest rise with BVM
- Confirm advanced airway placement by exam and confirmation device
- Secure advanced airway in place with tape or a commercial device
- Provide 8-10 breaths/minute and continuous compression at least 100 per minute

⇩

Circulation

- Establish vascular access via IV or IO
- Do not interrupt CPR for access

⇩

Medication

- Give a vasopressor
  - Epinephrine 0.01 mg/kg 1:10,000 IV/IO (repeat every 3-5 minutes)

⇩

Check Rhythm

- Check pulse after 2 minutes of CPR (5 cycles)

⇩

Differential Diagnosis – Use the H's and T's mnemonic

6 H's	6 T's
Hypoxia Hypovolemia Hypothermia Hypo/Hyperkalemia Hydrogen Ion (acidosis)	Tamponade Tension Pneumothorax Toxins-poisons, drugs Thrombosis-coronary (AMI) –Pulmonary (PE)

Unacceptable actions:

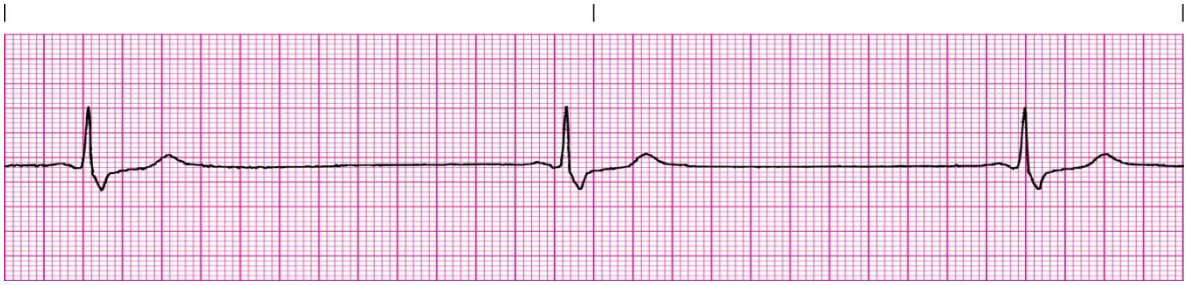
1. Did not provide effective CPR
2. Did not confirm advanced airway placement
3. Did not provide a vasopressor
4. Did not look for possible causes to treat
5. Attempted defibrillation
6. Attempted transcutaneous pacing

YOU JUST TREATED PEA!!

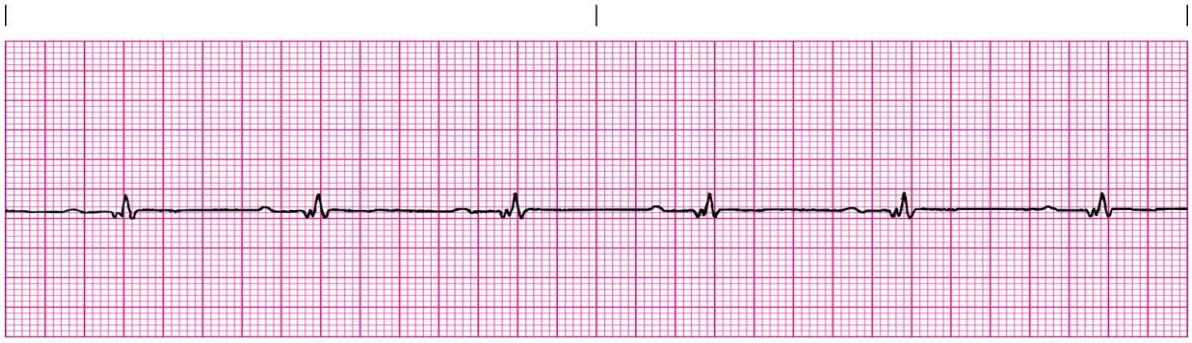
CMEs Training

ECG BASICS

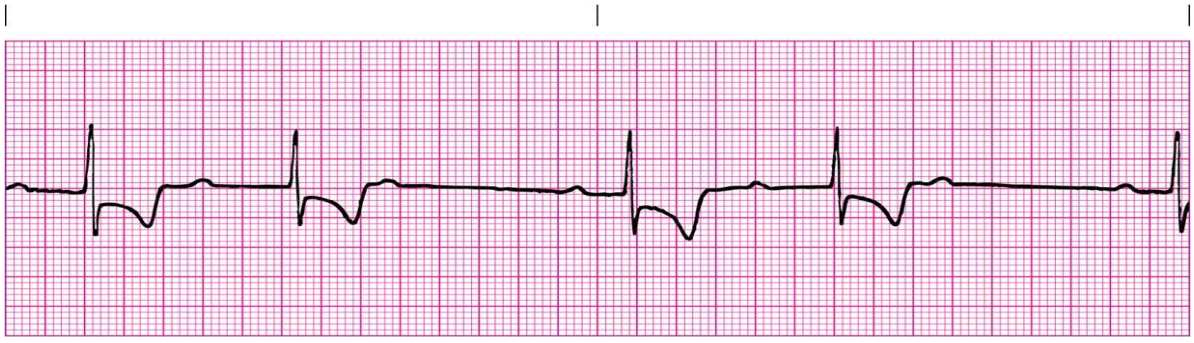
Rhythm	Properties	Algorithm	Treatment	Electrical Therapy
Normal Sinus Rhythm	Upright P wave, narrow QRS complex, rate of 60-100 bpm	N/A	IV, O2, reassess, transport. Treat the symptoms	N/A



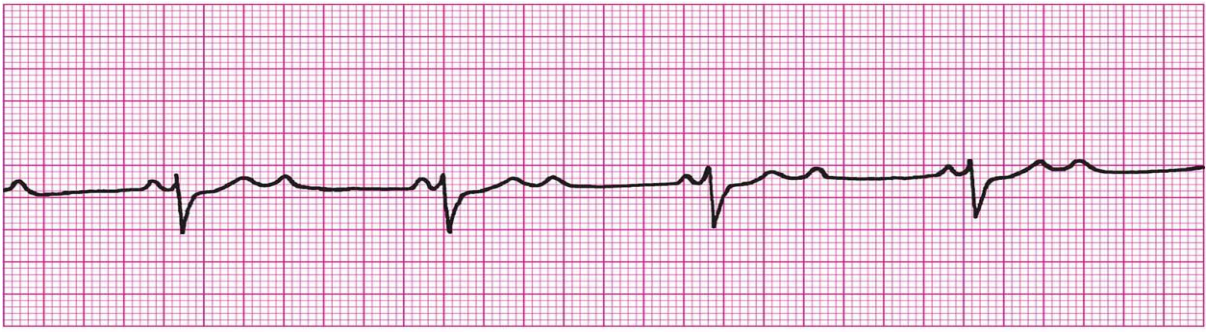
Rhythm	Properties	Algorithm	Treatment	Electrical Therapy
Sinus Bradycardia	Upright P wave, narrow QRS complex, rate is < 60bpm	Bradycardia	Epinephrine, CPR! If symptomatic	N/A



Rhythm	Properties	Algorithm	Treatment	Electrical Therapy
1st degree Heart Block	Prolonged P-R interval (>.20 seconds), rate usually less than 60 bpm	Bradycardia	Epinephrine, CPR! If symptomatic	N/A

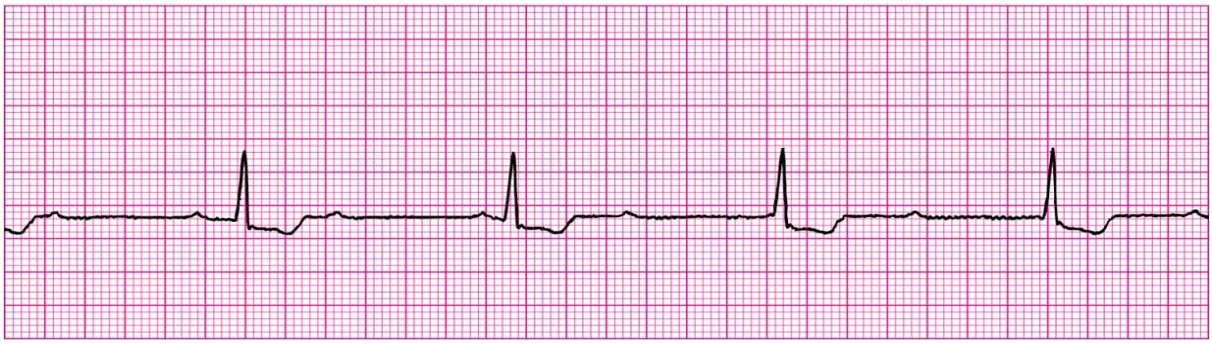


Rhythm	Properties	Algorithm	Treatment	Electrical Therapy
2nd degree Type 1Heart Block (Wenckebach)	Lengthening of P-R interval followed by a dropped QRS (longer, longer, longer drop), rate <60 bpm	Bradycardia	Epinephrine, CPR! If symptomatic	N/A

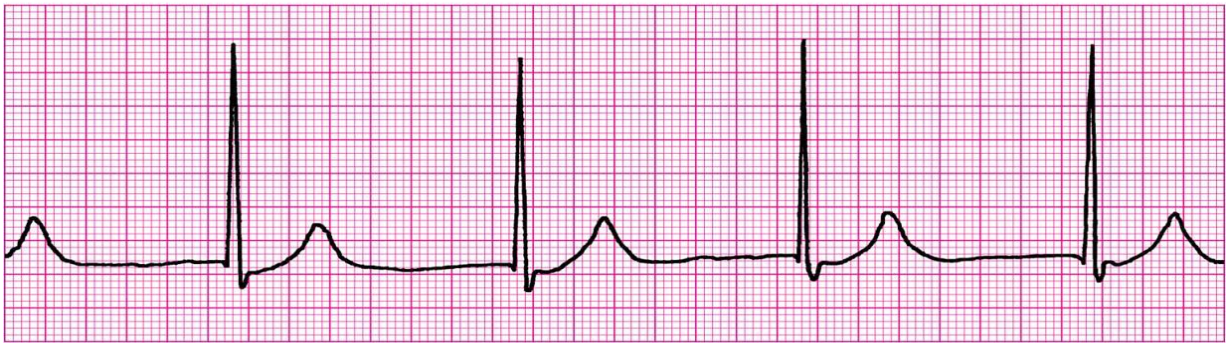


Type II Second Degree Heart Block

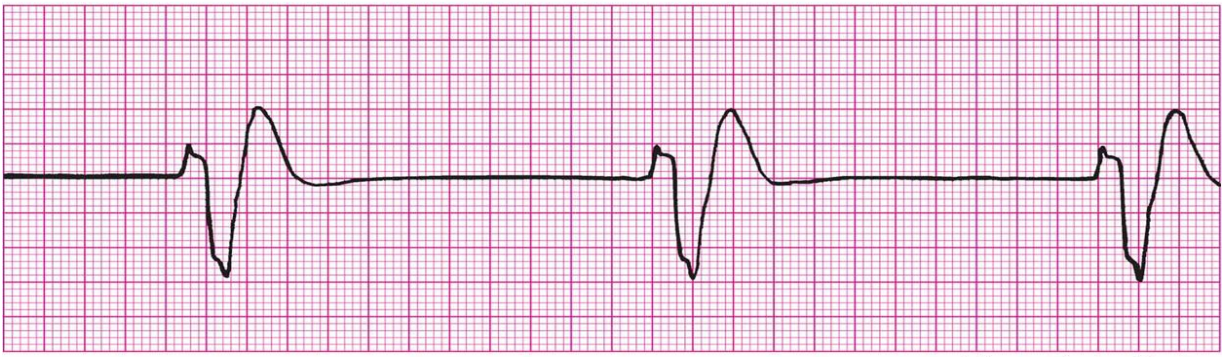
Rhythm	Properties	Algorithm	Treatment	Electrical Therapy
2nd degree Type 2Heart Block	P-R intervals do not change, but not every P wave has a corresponding QRS, rate < 60bpm	Bradycardia	Epinephrine, CPR! If symptomatic	N/A



Rhythm	Properties	Algorithm	Treatment	Electrical Therapy
3rd Degree	P waves and QRS complexes are not associated with each other, rate < 60bpm	Bradycardia	Epinephrine, CPR! If symptomatic	N/A

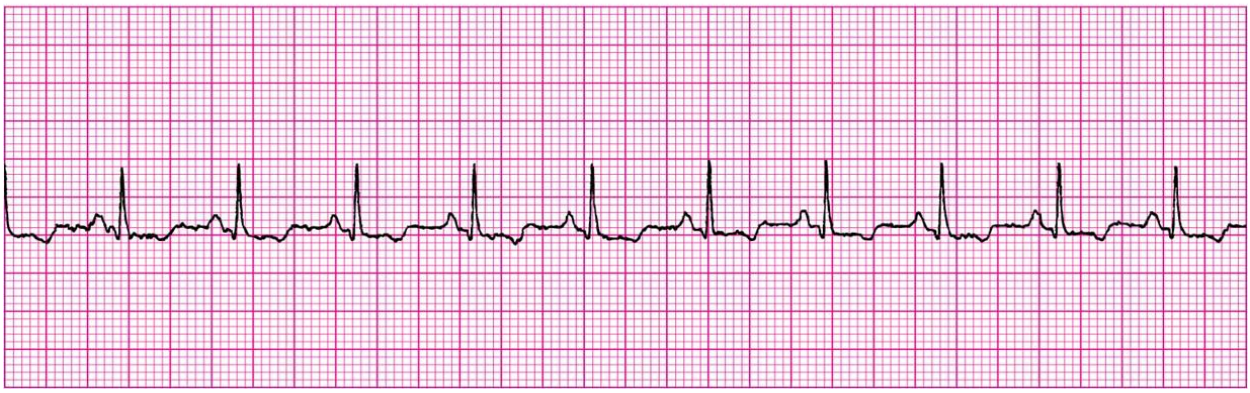


Rhythm	Properties	Algorithm	Treatment	Electrical Therapy
Junctional Rhythm	Inverted or absent P waves , rate 40-60 bpm	Bradycardia	Epinephrine, CPR! If symptomatic	N/A

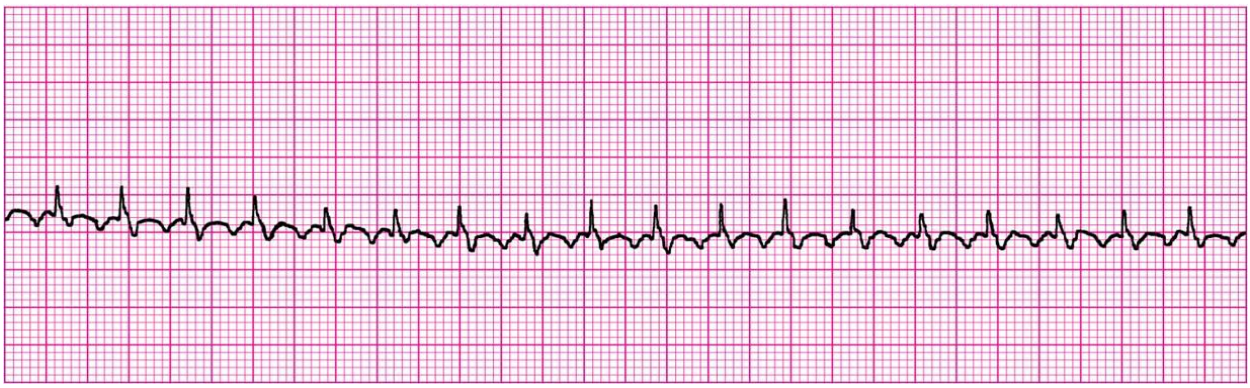


Idioventricular Rhythm

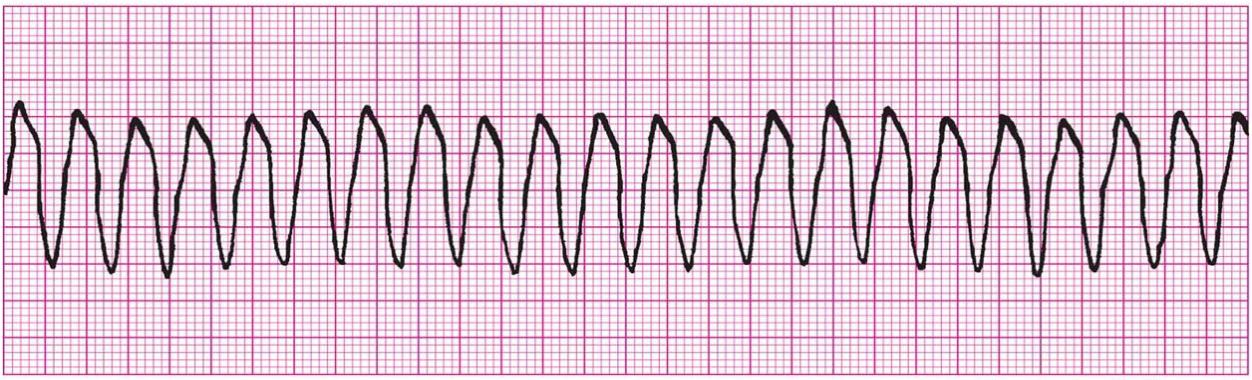
Rhythm	Properties	Algorithm	Treatment	Electrical Therapy
Idioventricular	Wide QRS complex rate 20-40 bpm	Bradycardia	Epinephrine, CPR! If symptomatic	N/A



Rhythm	Properties	Algorithm	Treatment	Electrical Therapy
Sinus Tachycardia	Upright P waves, narrow QRS complex, Rate is 101-149 bpm	Tachycardia with a pulse	IV, O2, Reassess, Transport. Treat the symptoms	N/A

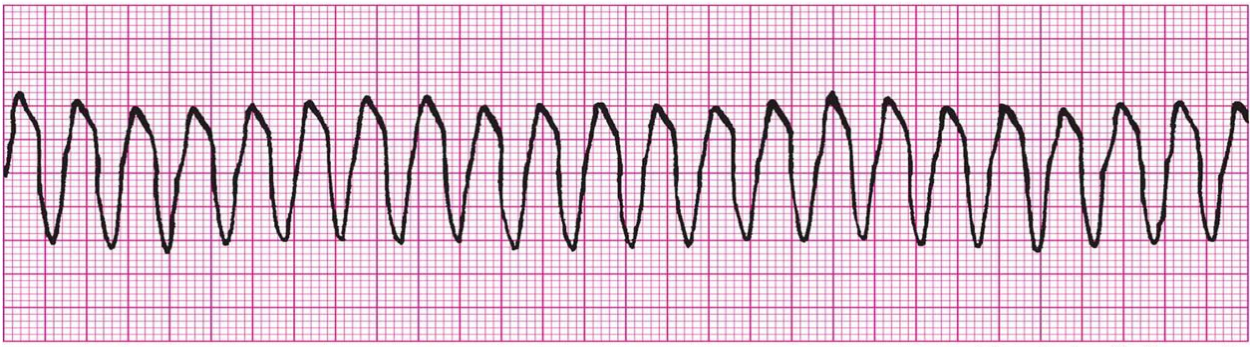


Rhythm	Properties	Algorithm	Treatment	Electrical Therapy
SVT	Rate usually >220 for infant and >180 for child QRS, P waves are present but embedded in previous complex	Tachycardia with a pulse	Vagal maneuver, Adenosine, Amiodarone Find cause	Synchronized Cardioversion



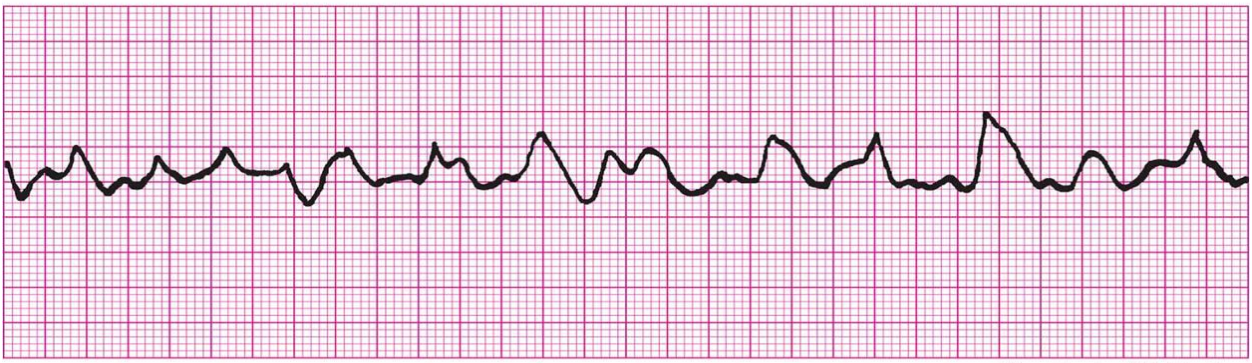
Ventricular Tachycardia

Rhythm	Properties	Algorithm	Treatment	Electrical Therapy
Ventricular Tachycardia W/ pulse	Wide QRS complex, rate is fast > 150 bpm	Tachycardia with a pulse	Amiodarone, Procainamide	Synchronized Cardioversion



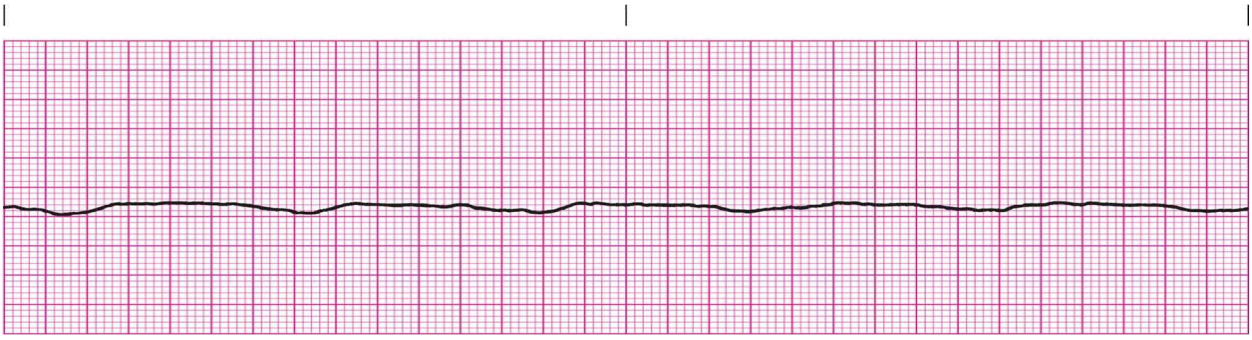
Ventricular Tachycardia

Rhythm	Properties	Algorithm	Treatment	Electrical Therapy
Ventricular Tachycardia pulseless	Wide QRS complex, rate is fast > 150 bpm, no pulse	Cardiac Arrest	Epi 1:10,000 consider causes H's and T's	CPR/ Defibrillation



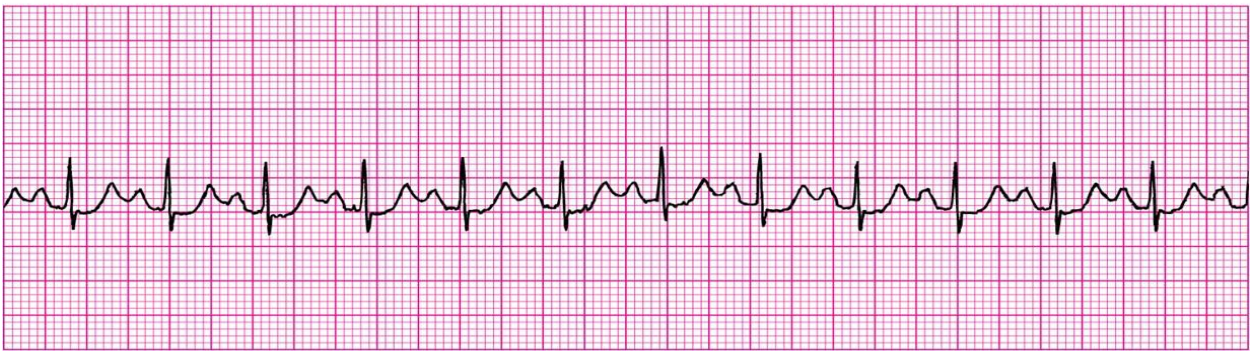
Ventricular Fibrillation

Rhythm	Properties	Algorithm	Treatment	Electrical Therapy
Ventricular Fibrillation	Chaotic in nature, height of rhythm > 3mm, no rhyme or reason	Cardiac Arrest	CPR Epi 1:10,000 consider causes H's and T's	Defibrillation



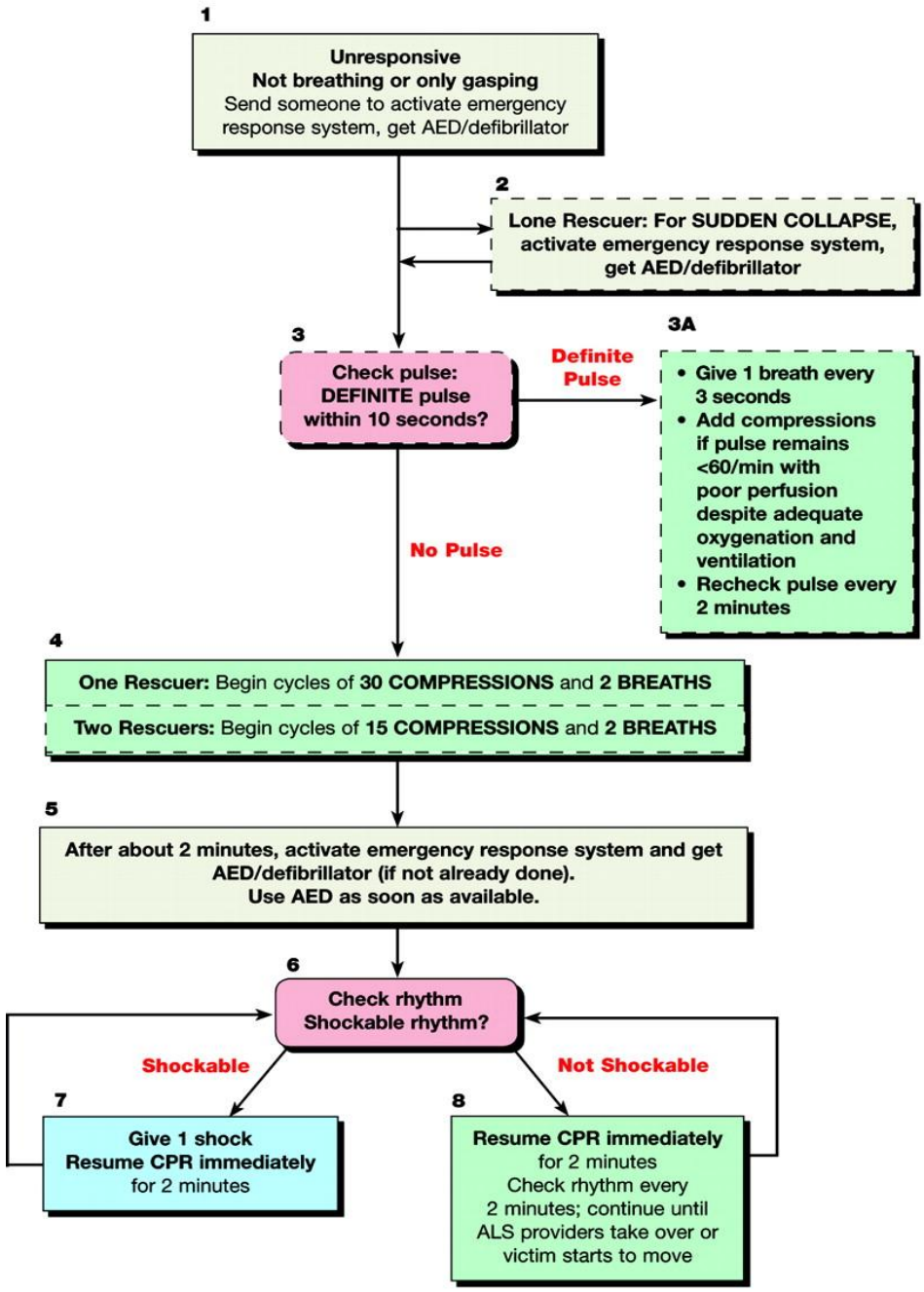
Rhythm	Properties	Algorithm	Treatment	Electrical Therapy
Asystole	Flat rhythm, confirm in 2 leads	Cardiac Arrest	Epi 1:10,000 CPR	N/A

Rhythm	Properties	Algorithm	Treatment	Electrical Therapy
PEA (slow)	Rate < 60 bpm, shows electrical activity on monitor but Pt. has no pulse	Cardiac Arrest	Epi 1:10,000,	N/A



Rhythm	Properties	Algorithm	Treatment	Electrical Therapy
PEA (fast)	Rate < 60 bpm, shows electrical activity on monitor but Pt. has no pulse	Cardiac Arrest	Epi 1:10,000,	N/A

Pediatric BLS Healthcare Providers

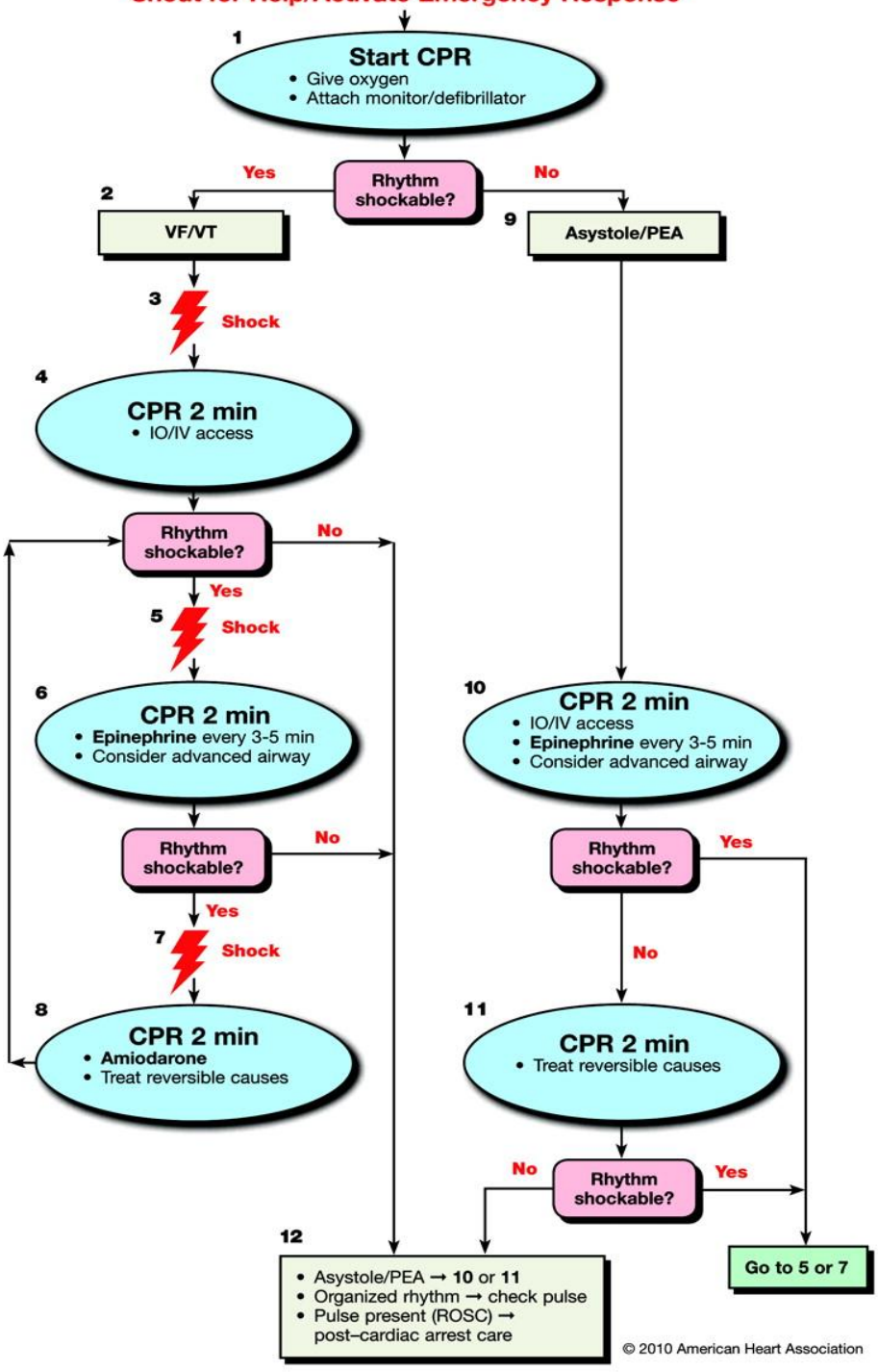


High-Quality CPR

- Rate at least 100/min
- Compression depth to at least ⅓ anterior-posterior diameter of chest, about 1½ inches (4 cm) in infants and 2 inches (5 cm) in children
- Allow complete chest recoil after each compression
- Minimize interruptions in chest compressions
- Avoid excessive ventilation

Note: The boxes bordered with dashed lines are performed by healthcare providers and not by lay rescuers

Pediatric Cardiac Arrest



Doses/Details

CPR Quality
- Push hard (≥1/3 of anterior-posterior diameter of chest) and fast (at least 100/min) and allow complete chest recoil
- Minimize interruptions in compressions
- Avoid excessive ventilation
- Rotate compressor every 2 minutes
- If no advanced airway, 15:2 compression-ventilation ratio. If advanced airway, 8-10 breaths per minute with continuous chest compressions

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.

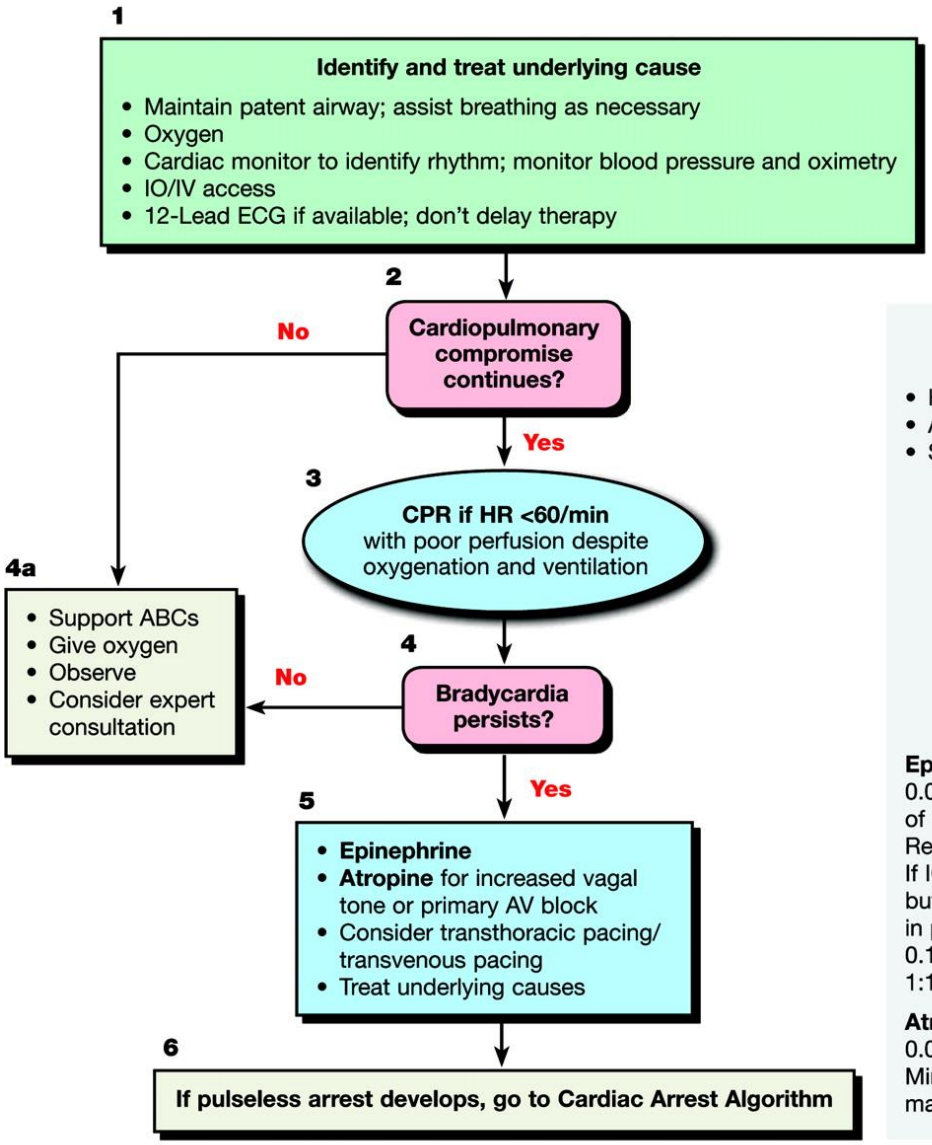
Drug Therapy
- **Epinephrine IO/IV Dose:** 0.01 mg/kg (0.1 mL/kg of 1:10 000 concentration). Repeat every 3-5 minutes. If no IO/IV access, may give endotracheal dose: 0.1 mg/kg (0.1 mL/kg of 1:1000 concentration).
- **Amiodarone IO/IV Dose:** 5 mg/kg bolus during cardiac arrest. May repeat up to 2 times for refractory VF/pulseless VT.

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 6-8 seconds (8-10 breaths per minute)

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

Pediatric Bradycardia
With a Pulse and Poor Perfusion



Cardiopulmonary Compromise

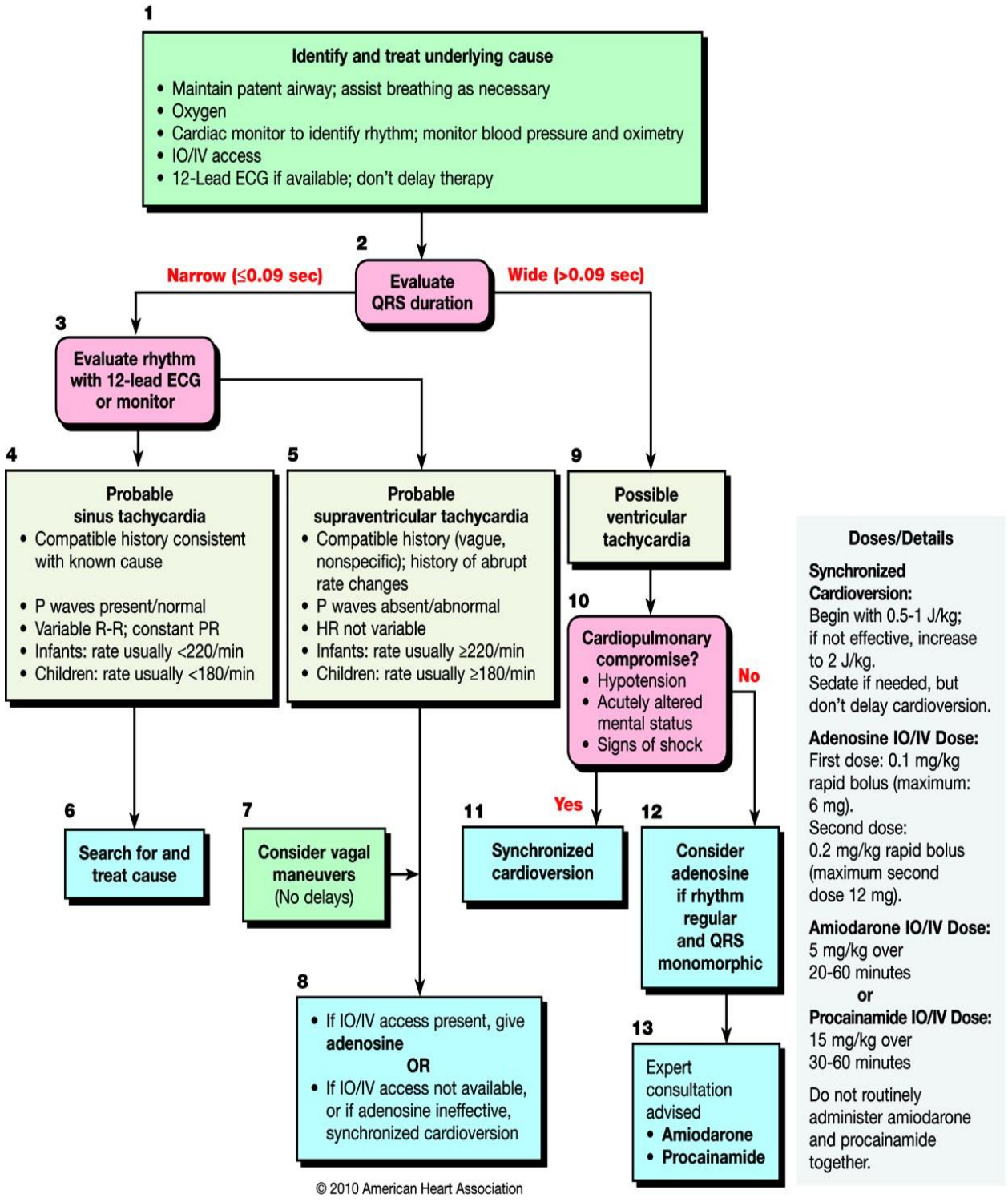
- Hypotension
- Acutely altered mental status
- Signs of shock

Doses/Details

Epinephrine IO/IV Dose: 0.01 mg/kg (0.1 mL/kg of 1:10 000 concentration). Repeat every 3-5 minutes. If IO/IV access not available but endotracheal (ET) tube in place, may give ET dose: 0.1 mg/kg (0.1 mL/kg of 1:1000).

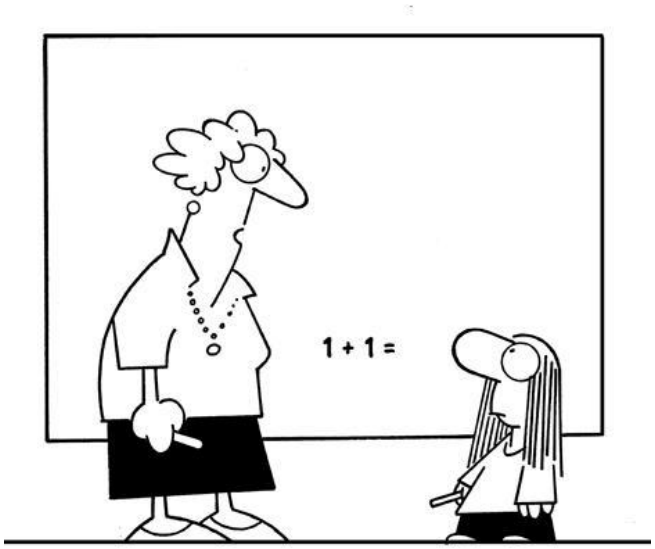
Atropine IO/IV Dose: 0.02 mg/kg. May repeat once. Minimum dose 0.1 mg and maximum single dose 0.5 mg.

Pediatric Tachycardia
With a Pulse and Poor Perfusion

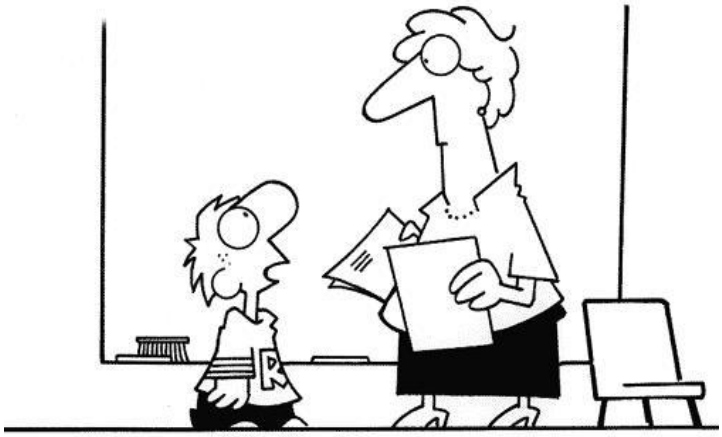


CMEs Training

OH NO!!! HERE COMES THE MATH!!



"Yes, this will be useful to you later in life."

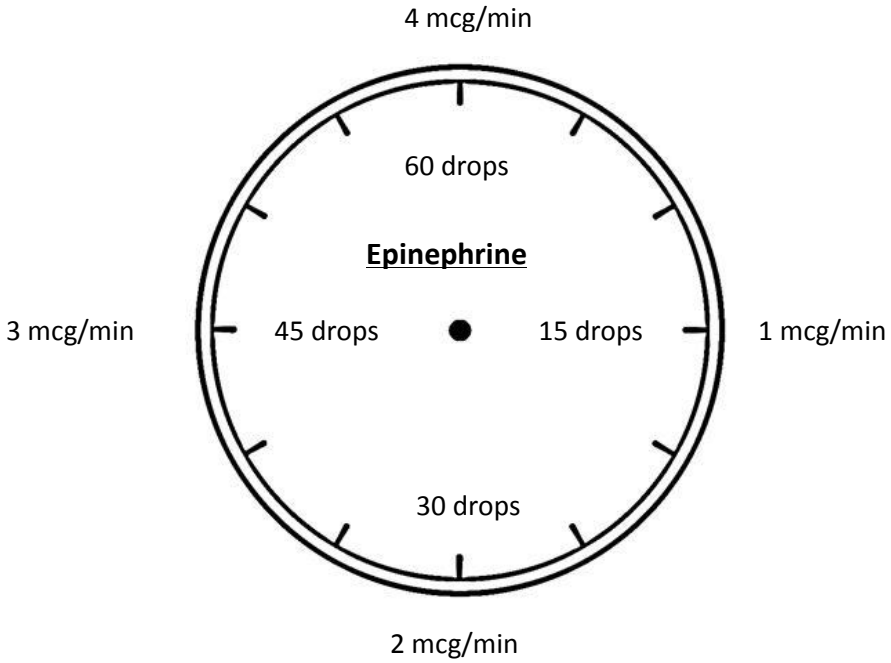


"I couldn't do my homework because my computer has a virus and so do all my pencils and pens."

"That's right, I've decided to give myself zero pay raise this year."

CMEs Training

Common Cardiac IV Infusions



Mix 1 mg in 250 cc of saline
Concentration will be 4mcg/ml

1 mcg/min = 15gtts/min
2 mcg/min = 30gtts/min
3 mcg/min = 45gtts/min
4 mcg/min = 60gtts/min

CMEs Training

IV Drip Calculations

1. Calculating a primary line drip rate – NOT on an IV pump

$$\frac{V \times T}{T} = \frac{\text{Volume to be infused (not on hand) X drip rate of tubing}}{\text{Time (in minutes) to be infused}}$$

$$= \text{Gtt/minute}$$

2. Calculating a piggy back secondary line drip rate – NOT on an IV pump

$$\frac{V \times T \times Kg \times gtt}{C} = \text{Gtts/min}$$

Volume on hand (not to be infused) X Dose ordered (gm, mg, mcg) X Kilograms (convert lbs) X Drip rate of tubing

Concentration of drug on hand

a. Converting pounds to kilograms
    a. Divide by 2.2 or 184 lbs / 2 = 92 subtract 10% = 83
    b. Make sure all drug equivalents are similar (Kg….gm….mg….mcg)