Fast Response

School of Health Care Education

PALS Study Guide

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School of Health Care Education

Dear PALS Student:

Please read this letter carefully

This letter is to confirm your registration in our Pediatric Advanced Life Support (PALS) course. Thank you for choosing Fast Response. We appreciate the opportunity to provide you with your clinical and professional educational needs.

Please plan to be on time because it will be difficult for late students to catch up once we start. All classes start at 9:00 am sharp. If you are more than 15 minutes late, you may be turned away, as required by the American Heart Association. Students are expected to attend and participate in the entire course.

As you may be aware, changes were made in the AHA's Guidelines for CPR and Cardiovascular Care in October of 2010. Implementation of these guidelines by Training Centers began April 1, 2011, and all of the 2010 PALS materials are available which reflect these changes.

It is essential that you bring your 2010* PALS Provider Manual *to class; you will need it during each lesson in the course.

You may refer to the *2010 Handbook of Emergency Cardiovascular Care for Healthcare Providers* (optional), and you may bring it to the course to use as a reference during some of the stations in the course.

The PALS Provider Course does not teach CPR, ECG rhythm identification, PALS pharmacology, or algorithms. ***If you do not review CPR and if you do not learn and understand the ECG and pharmacology information in the Precourse Self-Assessment, it is unlikely that you can successfully complete the PALS Provider Course.***

Precourse Requirements

The PALS Provider Course is designed to teach you the lifesaving skills required to be both a team member and a team leader in either an in-hospital or an out-of-hospital setting. Because the PALS Provider Course covers extensive material in a short time**, you will need to prepare for the course beforehand.**

You will not be taught how to read or interpret ECG rhythm strips in the course, nor will you be taught details about PALS pharmacology. You must know this in advance.

You should prepare for the course as follows:

1. *Precourse Preparation Checklist:* Please complete the precourse checklist that came with your *PALS Provider Manual*.

2. *BLS competency*: **Be prepared to pass the 1- and 2- Rescuer Child BLS with AED and 1- and 2- Rescuer Infant BLS Skills Tests.** You will not be taught how to do CPR or how to use an AED during the course. You must know this in advance. The resuscitation scenarios require that your BLS skills and knowledge are current. Please review and understand all 2010 BLS guidelines, especially as they relate to pediatric patients. You may find this information in the *BLS for Healthcare Providers Student Manual* or in other publications based on the *2010 AHA Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care* (see **www.heart.org/cpr**).

Please note that we are unable to provide or renew your BLS card based on the CPR test, which is a requirement of the PALS Course itself.

3. *Review the Fast Response PALS Study Guide:* Available on our website **www.fastresponse.org** or mailed to you if requested.
4. *Precourse Self-Assessment (required):* **Complete the Precourse Self-Assessment on the Student Website and print your score; bring the printout of your score with you to the PALS Course**. This test consists of 3 sections: ECG rhythm identification, pharmacology, and practical application. Use this assessment to identify areas where you need to increase your knowledge.
5. *PALS algorithms and flowcharts:* Be familiar with the PALS algorithms and flowcharts so that you can apply them to clinical scenarios. Note that the PALS Course does not present the details of each algorithm.
6. *Supplement your knowledge:* Review and understand the information in the *PALS Provider Manual* and on the Student Website. Pay particular attention to the systematic approach to pediatric assessment, the evaluate-identify-intervene model, and the management of respiratory and circulatory abnormalities.

What to Bring and Wear

Please bring your 2010 PALS Provider Manual and your completed Pre-Course Assessment to class.

Please wear loose, comfortable clothing to class. You will be practicing skills that require you to work on your hands and knees, and the course requires bending, standing, and lifting. If you have any physical conditions that might prevent you from engaging in these activities, please tell an instructor. The instructor may be able to adjust the equipment if you have back, knee, or hip problems.

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All renewal (1-day) participants must bring their current American Heart Association-issued PALS card to class.

There are no exceptions for expired cards. PALS cards and Continuing Education Units (CEU's) issued at the end of class.

Please be aware:

Reschedule Policy

- **No refunds will be issued**. **All registrations are final.**
- You may reschedule your course by calling us at least 2 business days prior to your scheduled course date. **You will be charged a rescheduling fee of $5.00.**
- If you reschedule your course fewer than 2 business days prior to the course start date, **you will be charged a rescheduling fee of 50% of the course fee**.
- **If you "no show" to your scheduled class, you will be charged 50% of the course cost to reschedule.**
- Course must be rescheduled and attended within 30 days from the original start date. No additional rescheduling requests will be honored.
- Only one reschedule request will be honored per course.
- Our Administrative Offices are closed on weekends and holidays. We do not accept rescheduling requests on weekends or holidays.
- We do not accept requests left on the answering machine.

Cancellation Policy

- **We do not issue refunds for course fees. All registrations are final.**
- If you cancel or do not attend the class you have registered for, you will forfeit your entire course fee.

Late Arrival

- Our classes start on time. Please plan your trip accordingly and remember to allow time for parking.
- If you are late for your scheduled class, you will be not be admitted into class and you must reschedule. **You will be charged a $5.00 rescheduling fee**.

We look forward to welcoming you at the course. Please feel free to call with any questions. We at Fast Response hope you find the PALS Course interesting, fun, and educational!!

Lisa Dubnoff, MICP / RN
ALS Program Director

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Dear Student,

In order for us at Fast Response to be able to provide you with a quality program, there are strict American Heart Association guidelines that we must follow. Outlined below are the Fast Response policies that enact the AHA's requirements for possession of student manuals.

Each student must **have 2010 PALS Provider Manual** available to them before, during, and after the course in order to comply with AHA guidelines. The 2010 PALS Provider Manual is available at http://www.emergencystuff.com for a discounted rate. If you arrive at your class without the required manual, there are two options:

A: You must purchase the book to attend the class. Books can be purchased at the reception desk. The current cost (as of July 2011) is $48.51 + Alameda County sales tax for the Advanced Cardiac Life Support provider manual.

B: You may reschedule of a $5 fee. To attend your rescheduled class, you must purchase the book. If you arrive to your rescheduled class without the book, you will be asked to purchase the book or be turned away from class.

If you are attending this class from a contracted hospital provider, you are required to obtain the ACLS Provider Manual from your education department, if possible. If you failed to do this, you will be required to purchase the book prior to being granted entrance into class.

The 2010 ECC Handbook is recommended but not required. This guide can be ordered at: http://www.emergencystuff.com/901000.html

Fast Response would like to apologize for any inconvenience this may cause, but the guidelines set forth by the AHA are very specific in how the class literature must be handled.

Thank you,
John Greene, NREMT-P
Director of Continuing Education
Fast Response School of Health Care Education

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PALS Course Agenda – Provider
Day 1

0900-0915 Introductions / Course Overview

0915-0920 Pre-course Self-Assessment Review

0920-0930 PALS Course Overview Video

0930-0950 Overview of PALS Science Video

0950-1040 Respiratory Emergencies (Group 1)
CPR Practice / Competency Testing (Group 2)

1040-1050 Break

1050-1140 Respiratory Emergencies (Group 2)
CPR Practice / Competency Testing (Group 1)

1140-1200 Vascular Access Video

1200-1300 Lunch

1300-1320 1st Rotation Rhythm Disturbances/Electrical Therapy and Vascular Access

1320-1340 2nd Rotation Rhythm Disturbances/Electrical Therapy and Vascular Access

1340-1355 Pediatric Assessment Video

1355-1415 Resuscitation Team Video

1415-1425 Cardiac Cases: Video and Discussion

1425-1625 Cardiac Cases Core Case Simulations

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PALS Course Agenda – Provider
Day 2

0900-0920 Respiratory and Shock Cases: Video and Discussion

0920-1020 Respiratory Cases: Core Case Simulations

1020-1120 Shock Cases: Core Case Simulations

1120-1130 Break

1130-1230 Cardiac Cases: Testing

1230-1330 Lunch

1330-1430 Respiratory/Shock Cases: Testing

1430-1500 PALS Jeopardy

1500-1545 Written Exam

1545-1600 Wrap-up

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PALS Course Agenda
Renewal

0900-0910 Introductions / Course Overview

0910-0920 Pre-course Self-Assessment Review

0920-0940 Overview of PALS Science Video

0940-1030 Respiratory Emergencies (Group 1)
CPR Practice / Competency Testing (Group 2)

1030-1040 Break

1040-1130 Respiratory Emergencies (Group 2)
CPR Practice / Competency Testing (Group 1)

1130-1140 Pediatric Assessment Video

1140-1200 Resuscitation Team Concept Video

1200-1300 Lunch

1300-1320 Coping With Death (Video)

1320-1415 “Putting It All Together” Group Learning Stations

1410-1510 Cardiac Cases: Testing

1510-1605 Respiratory/Shock Cases: Testing

1605-1620 PALS Jeopardy

1620-1650 Written Exam

1650-1700 Wrap-up

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Pediatric Assessment

When treating a pediatric patient, you should use the **"Evaluate – Identify – Intervene"** model: **Evaluate** the child's condition, **Identify** the type and severity of the child's problem, and **Intervene** with appropriate actions within your scope of practice. Once you have completed this process, begin again by reassessing the patient, always seeking additional information that will help in determining the nature of illness or treatment of the patient. Your assessment process should include the following four stages:

1. Initial Impression: This first assessment is done within seconds of encountering the child. It is the initial visual and auditory observation of the child, and is used to rapidly evaluate the patient's initial complaints and level of stability by assessing the patient's level of consciousness, breathing and color. This information will assist you in identifying whether the patient's problem is likely to be cardiac, respiratory or shock.
2. Primary Assessment: This more extensive assessment evaluates the patient to better assess the nature of the illness: **A**irway (Clear, maintainable, not maintainable), **B**reathing (Rate, effort, lung sounds, O2 saturation), **C**irculation (Heart rate, cap refill, blood pressure), **D**isability (Level of consciousness, muscle tone), **E**xposure (temperature, injuries, rash).
3. Secondary Assessment: In addition to reassessing the patient's ABCDE's, the provider should obtain a focused history such as SAMPLE and perform a focused physical exam.
4. Diagnostic tests: These tests help detect and identify the presence and severity of respiratory and circulatory problems. Some of these tests may be conducted early like glucose testing. The timing of these tests is generally dictated by the clinical situation.

After each assessment/reassessment, you should Identify the nature and (if possible) severity of the problem in one (or more) areas:

- *Cardiac*: Either a life-threatening dysrhythmia or cardiac arrest.
- *Respiratory:* Either respiratory distress or respiratory failure.
- *Shock*: Either compensated shock or hypotensive shock.

As you provide treatment, **you must frequently reassess your patient** (especially after initiating a therapy or intervention). Then re-identify the patient based on the information available to you; what you first identify (correctly) as respiratory distress may turn out to be the result of a life-threatening dysrhythmia, so you would need to re-indentify the problem as cardiac once you identify the heart rhythm, and then treat the patient appropriately.

As you continue to gather information and assess the patient, you should try to determine the underlying cause or specific nature of the problem. The PALS course identifies the following specific cardiac, respiratory, and shock types, although providers need to be aware that these are not exhaustive lists:

- *Cardiac:* Common life-threatening dysrhythmias include Supraventricular Tachycardia or Bradycardia. Patients in cardiac arrest may be in Ventricular Fibrillation, Pulseless Ventricular Tachycardia, Asystole, or Pulseless Electrical Activity (PEA), which includes all other heart rhythms that present without a pulse. In pediatric patients, severely symptomatic bradycardia may require CPR.

- *Respiratory:* Respiratory problems can be broadly divided into Upper Airway Obstruction, Lower Airway Obstruction, Lung Tissue Disease, or Disordered Control of Breathing (which includes any ineffective respiratory rate, effort, or pattern.

- *Shock:* Shock (widespread inadequate tissue perfusion) can be Hypovolemic, Obstructive, Distributive (Septic), or Cardiogenic in nature.

If a patient's Initial Impression indicates that they may be unconscious, you should check for responsiveness. If the patient is **Unresponsive**, get help (send someone to call 911 and bring back an AED, call a code, etc.). The BLS Algorithm should then be followed – check for *Breathing*, and assess *Circulation*. If the patient is apneic, rescue breathing started; if the patient is pulseless (or if a pediatric patient has a heart rate less than 60 despite adequate oxygenation and ventilation rescuers should start CPR.

Respiratory Compromise

When treating a child, providers should be vigilant for signs of respiratory compromise. Often, symptoms of shock or cardiac distress are treated without regard to respiratory status, but in many cases a cardiac dysrhythmia or compensated shock can be completely resolved by aggressive oxygenation. Whenever a pediatric patient's heart rate is too slow, or is slowing, the first and primary treatment is to give assisted ventilations if the child's airway is not maintained or their work of breathing is not effective. For pediatric patients with any symptoms, always provide oxygen to maintain an oxygen sat of between 94-99%. Stable patients with a cardiac dysrhythmia but no respiratory distress can receive low-flow oxygen (up to 4 L/min.) via nasal cannula. Unstable cardiac patients, patients in shock (compensated or hypovolemic), or patients with respiratory distress should receive high-flow oxygen via non-rebreather mask, if they tolerate it. Patients in respiratory failure should receive assisted ventilations via bag-mask valve. O2 saturation monitoring is important, so pulse oximetry should be attached as soon as possible. It is critical that students correctly categorize the degree of respiratory compromise.

In **Respiratory Distress**, the patient will have an increased respiratory rate and effort. Be alert for patient position, nasal flaring, retractions, and accessory muscle use. Skin color may be normal or pale, and the patient may exhibit the beginnings of an Altered Level of Consciousness (ALOC). Adventitious breath sounds may or may not be present. Any patient in respiratory distress or an O2 sat lower than 94% should receive high-flow oxygen via non-rebreather mask, if they tolerate it.

In **Respiratory Failure**, the patient may have an increase in respiratory effort with increased *or* decreased respiratory rate. Be alert for patient position, nasal flaring, retractions, and accessory muscle use. Head bobbing, decreased respiratory effort, "seesaw" respiratory pattern, shallow respirations, cyanosis, difficulty speaking, and poor air movement (diminished or absent breath sounds) are signs of respiratory failure.

For any child in respiratory failure or severe respiratory distress, you should consider the following interventions: *Assisted Ventilations* (provide ventilations via Bag-valve Mask); *Advanced Airway* (consider Endotracheal Intubation); or *Mechanical Ventilations* (such as CPAP or BiPAP). When providing assisted ventilations, students should remember that hyperventilation (ventilating too often, too rapidly, or with too much volume) **will diminish the effectiveness of circulation**.

After assessing the severity of respiratory compromise, you should determine the cause. Increased heart rate with no increased work of breathing is often a sign of shock, but may be seen in the early stages of respiratory distress. Any increase in work of breathing, or any decrease in respiratory rate, indicates respiratory compromise. PALS divide respiratory problems into four types:

Upper airway obstruction: Caused by infection (e.g., croup); loss of consciousness; anaphylaxis; secretions; or foreign bodies. Characterized by poor air movement; stridor or snoring may be heard. Airway management (such as head-tilt/chin-lift maneuver, airway adjuncts, suctioning, and removal of foreign bodies) is critical.

Lower airway obstruction: is commonly caused by asthma or bronchiolitis. Characterized by poor air movement, and usually presents with coarse breath sounds or wheezing. Assisted ventilations *at a relatively slow rate* will often be necessary. Suctioning may also be required.

Parenchymal (lung tissue) disease: involves inflammation of or fluid accumulation in the lungs, with causes including pulmonary edema and pneumonia. Characterized by poor oxygenation even in the presence of good air movement; breath sounds often include crackles or grunting.

Disordered control of breathing: Caused by an ineffective breathing pattern or markedly decreased respiratory rate. Management of the airway and providing assisted ventilations (as needed) are critical early actions. Many patients with respiratory compromise will degenerate to disordered control of breathing as their muscles weaken.

	Respiratory Rate (Breath/min)
Age	**Rate**
Infant (up to 1 year old)	30 to 60
Toddler (1-3 years old)	24 to 40
Preschooler (4-5 years old)	22 to 34
School-age child (6-12 years old)	18 to 30
Adolescent (13-18 years old)	12 to 16

Shock

When treating a child with respiratory distress, cardiac dysrhythmia, or circulatory compromise, providers should be vigilant for any signs of shock. Often, symptoms of compensated shock go unnoticed as providers concentrate on the child's primary complaint, but you should remember that children can decompensate very quickly. If primary interventions do not quickly resolve the patient's symptoms, assessment and treatment of shock may be necessary.

It is extremely important for students to correctly categorize the severity of shock and to be able to recognize the *Therapeutic End Points of Shock*.

Compensated Shock, the patient will have a Blood Pressure in the normal range but will show signs of compensation – increased heart rate and respiratory rate (often without an increase in respiratory effort); weak or absent distal pulses with delayed capillary refill; and pale, cool, or mottled extremities. The patient may or may not have a decreased Level of Consciousness.

Hypotensive Shock, the patient will have a decreased Blood Pressure and will show signs of a weakening of compensatory mechanisms – absent distal pulses with delayed or absent capillary refill; a pale, mottled, or cyanotic core; lethargy or unconsciousness; and possibly a decreased heart rate or respiratory rate. Central pulses may be normal or weak.

Definition of Hypotension by Systolic Blood Pressure and Age

Age	Systolic Blood Pressure
Term Neonates (0 to 28 Days)	<60 mm Hg
Infants (1 to 12 months)	<70 mm Hg
Children (1 to 10 years) (5^{th} BP Percentile)	<70 mm + (age in years x2) Hg
Children >10 years	<90 mm Hg

After you assess the severity of shock, you should determine the type. Although this is done automatically, you should consciously consider the signs and symptoms, as the specific treatments for each type of shock differ, and ignoring signs may lead to incorrect or even dangerous treatments.

PALS categorize shock into four types:

1. **Hypovolemic shock**: Caused by reduced circulating fluid volume. Common causes among children are dehydration and trauma. The primary treatment is to provide 20 ml/kg of fluids.

2. **Obstructive shock:** Caused by a blockage of blood flow to or from the heart. Possible causes include *tension pneumothorax*, *cardiac tamponade*, *pulmonary embolism*, and *congenital heart lesions*. In the early stages, it is often indistinguishable from hypovolemic shock. Although rapid fluid administration is needed, the provider must identify and correct the cause of the obstruction.

3. **Distributive shock:** Causes relative hypovolemia by an inappropriate distribution of blood volume. Distributive shock often shows signs of high cardiac output and low systemic vascular resistance (such as bounding pulses or warm extremities), the opposite of other types of shock. Infusion of 20 ml/kg of fluids is the initial treatment. If distributive shock caused by sepsis, administer *antibiotics* as early as possible.

4. **Cardiogenic shock** is caused by a reduced ability of the heart to pump effectively. Central pulses may be weak; pulmonary edema may be present; and cyanosis and JVD may be noted. Fluid resuscitation should be conservative (limited to 5-10 ml/kg) to avoid overloading the heart. Early consideration of vasoactive drugs (like *Dopamine* or *Milrinone*) is important. Cardiac rhythm disturbances, if present, are a likely cause of cardiogenic shock, and treated rapidly.

Therapeutic End Points of Shock

No single resuscitative end point has been identified as a constant marker for adequate profusion. Although systolic Blood Pressure has traditionally used to measure a return to adequate perfusion, it is often insufficient on its own. Some examples of improvement include, Normal HR and BP, Normal Pulses, Capillary refill of less than 2 seconds, Warm Extremities, Normal Mental Status, and Urine output greater than 1 ml/kg /hr.

Management: Pediatric Bradycardia With a Pulse and Poor Perfusion Algorithm

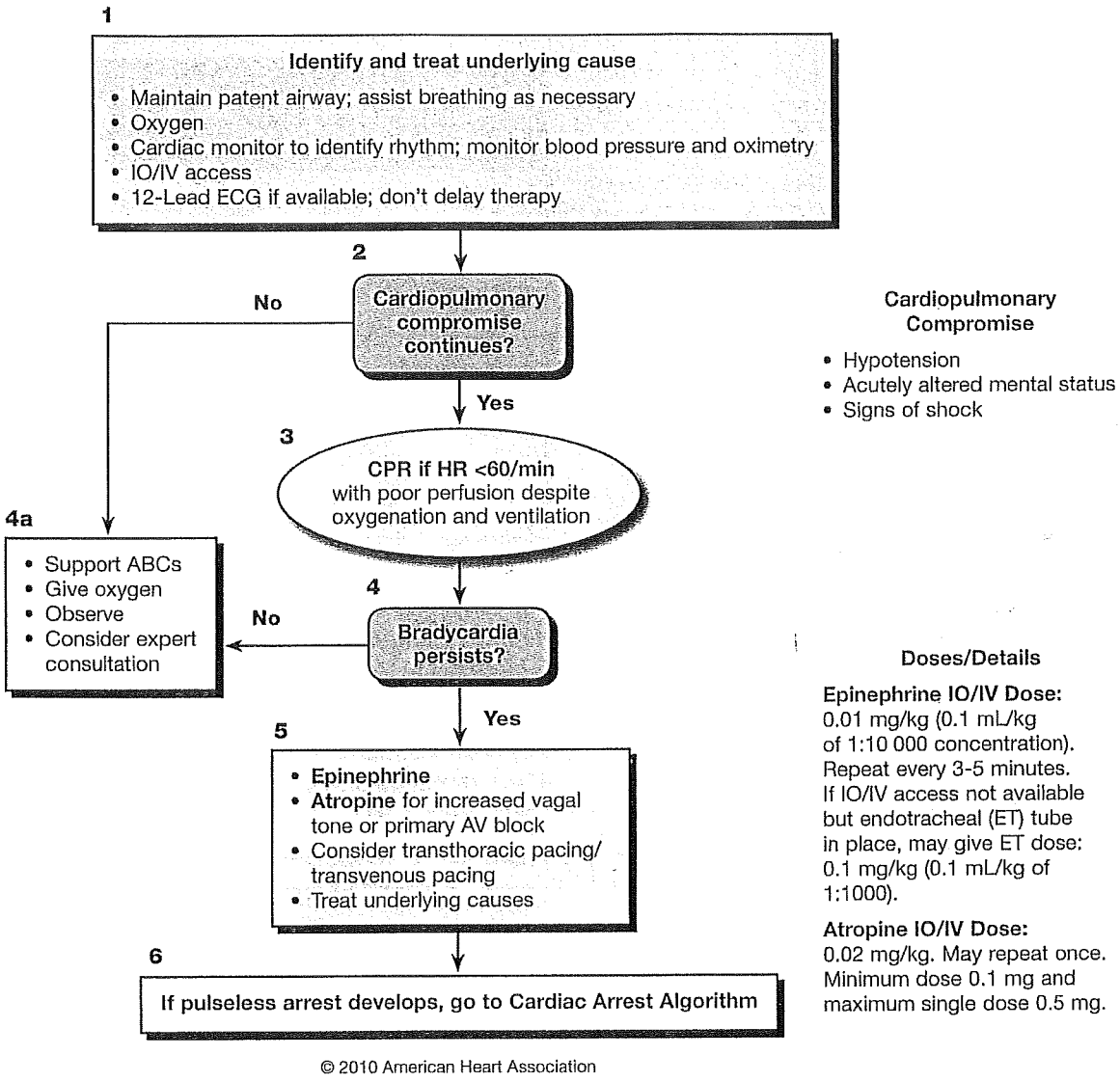


Figure 2. Pediatric Bradycardia With a Pulse and Poor Perfusion Algorithm.

The Pediatric Bradycardia Algorithm (Figure 2) outlines the steps for evaluation and management of the child presenting with symptomatic bradycardia (bradycardia with a pulse and poor perfusion). See the Critical Concept box in the "Definitions" section above for more information about symptomatic bradycardia and cardiopulmonary compromise. In the text that follows, box numbers refer to the corresponding boxes in this algorithm.

Pediatric Tachycardia With a Pulse and Poor Perfusion Algorithm

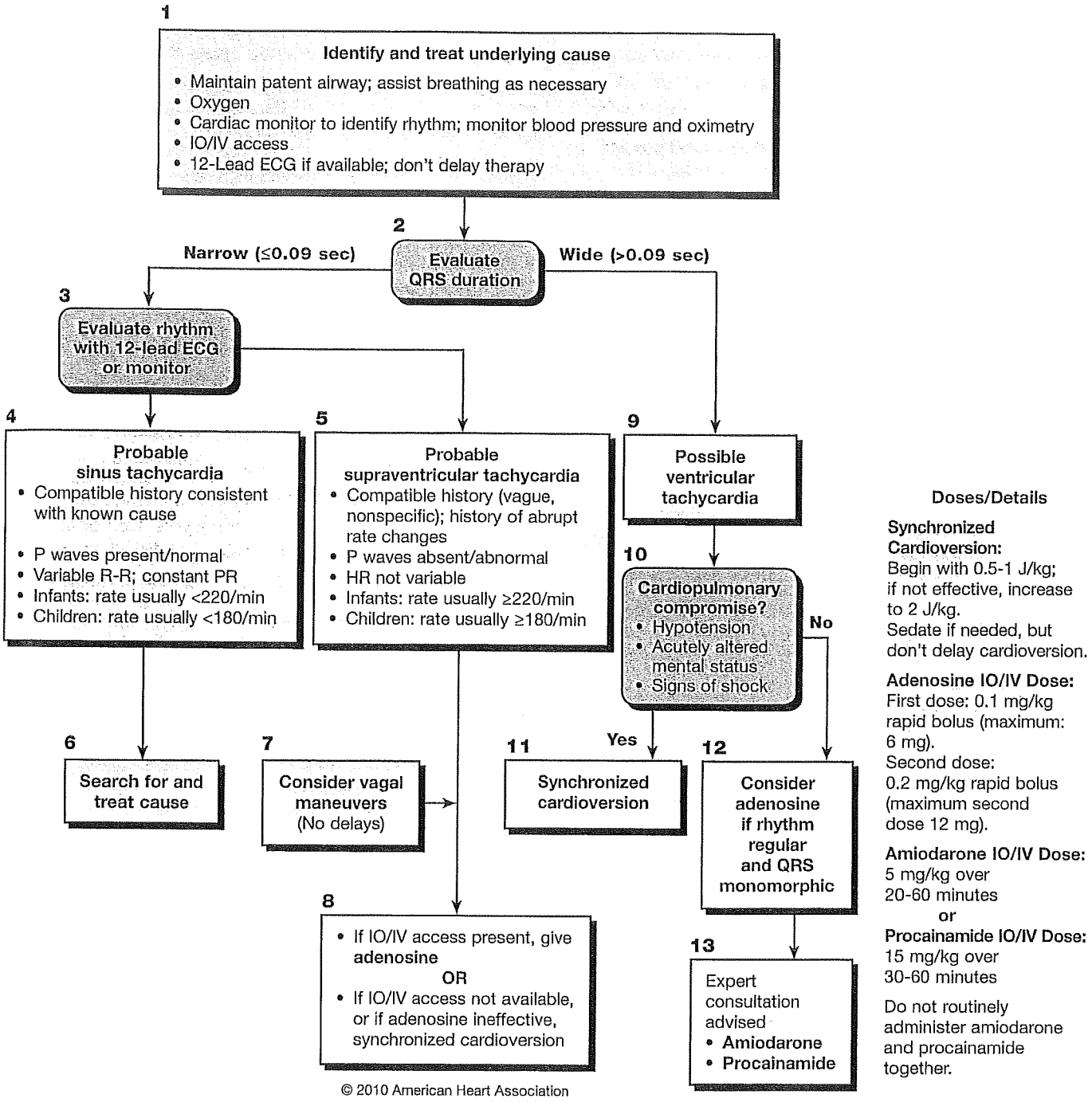
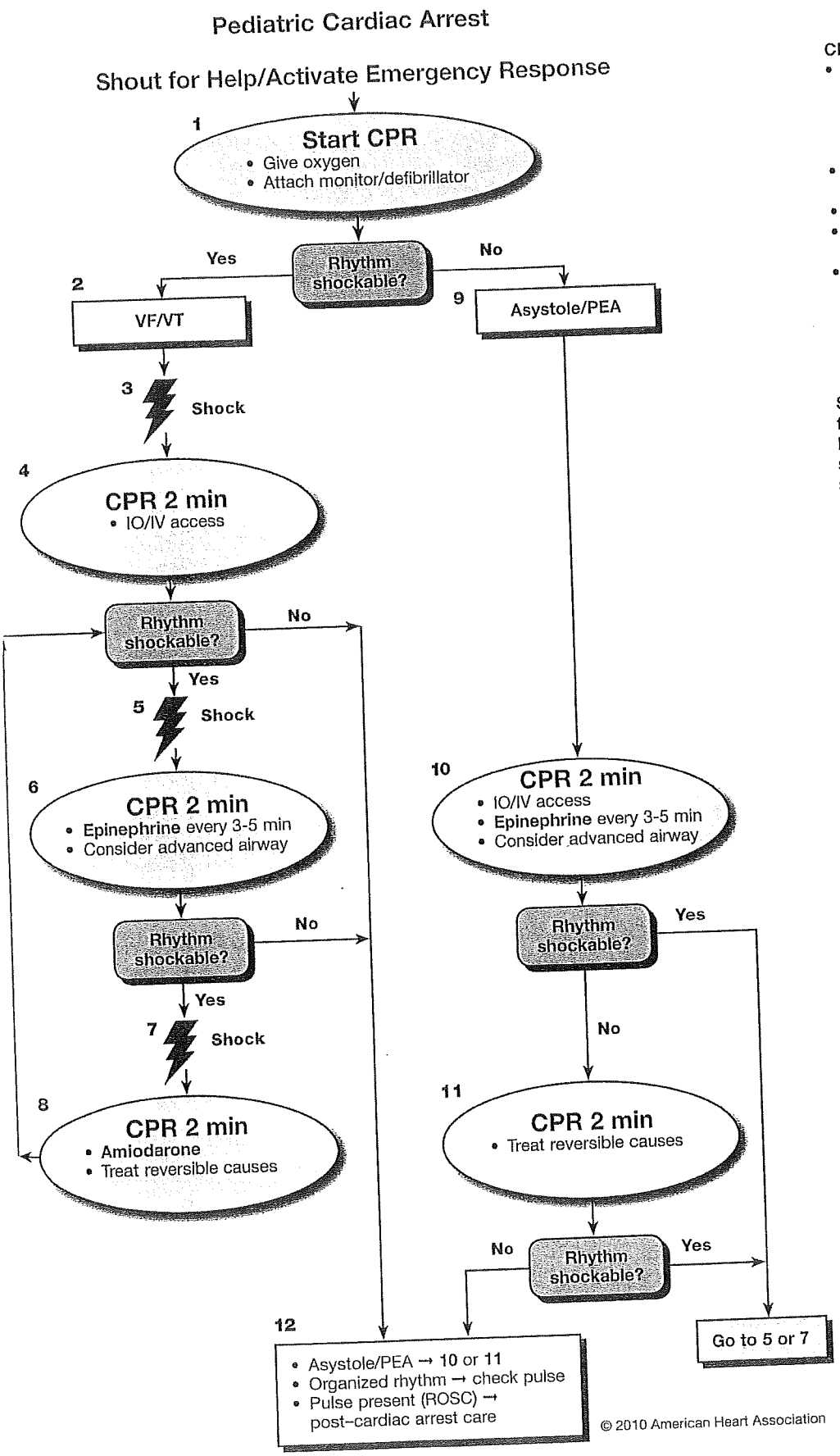


Figure 7. Pediatric Tachycardia With a Pulse and Poor Perfusion Algorithm.

The Pediatric Tachycardia With a Pulse and Poor Perfusion Algorithm (Figure 7) outlines the steps for assessment and management of the child presenting with symptomatic tachycardia and poor perfusion. Box numbers in the text refer to the corresponding boxes in the algorithm.



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
- Hypovolemia
- Hypoxia
- Hydrogen ion (acidosis)
- Hypoglycemia
- Hypo-/hyperkalemia
- Hypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary

Figure 7. Pediatric Cardiac Arrest Algorithm.

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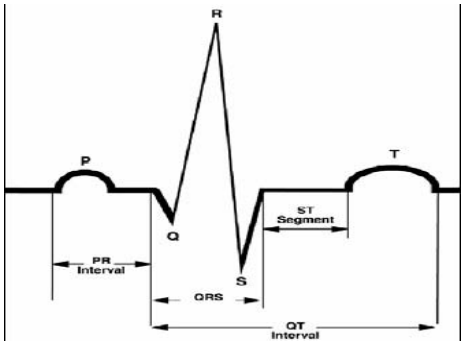
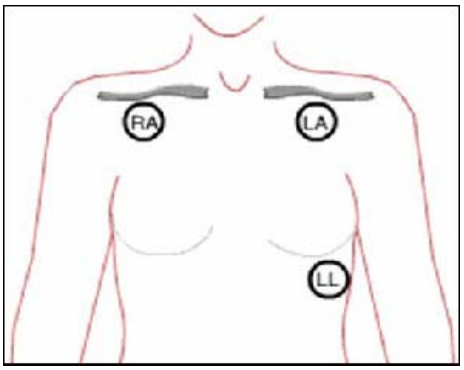
EKG and Electrical Therapy Review

The EKG tracing represents electrical activity through the heart. The **P wave** represents depolarization of the atria; the **QRS complex** represents depolarization of the ventricles; and the **T wave** represents the latter stage of repolarization of the ventricles. The interval from the first deflection of the P wave to the beginning of the QRS complex is the P-R Interval (PRI), and should be between 0.12 and 0.20 seconds. A pediatric patient's QRS complex has duration of 0.09 seconds or less; a longer duration (*wide QRS*) indicates delayed conduction through the ventricles, often as the result of a ventricular pacemaker focus. The horizontal axis of the EKG strip measures time. Each large box represents 0.20 seconds; each small box represents 0.04 seconds.





To obtain a 3-lead EKG tracing, place the white (RA) electrode on the right chest just below the clavicle; the black electrode (LA) on the left chest just below the clavicle; and the Red electrode (LL) laterally on the lower left abdomen. Pacer and defibrillation pads generally go in the anterior/posterior positions, although on older children, defibrillation pads can go on the upper right chest and lower left abdomen.

Rhythm Disturbances: Treat the patient, not the dysrhythmia. Always assess your patient for pulses, perfusion, and level of consciousness – is the patient *Stable*, *Unstable*, or *Pulseless*? Next, assess the rhythm: Is it fast or slow? Is it life-threatening? As you treat the patient, try to discover the cause of the dysrhythmia – for many patients, their only chance of survival is if you can identify and treat a **reversible cause**. There are many possible causes of rhythm disturbances, especially bradycardia or PEA. Some of the most common causes in children include hypoxia, drugs/toxins, hypovolemia, and intrinsic heart problems. Although lab draws can be useful, a history of the patient and the current event obtained from a parent or caregiver is often more useful.

Defibrillation (Unsynchronized Shock)

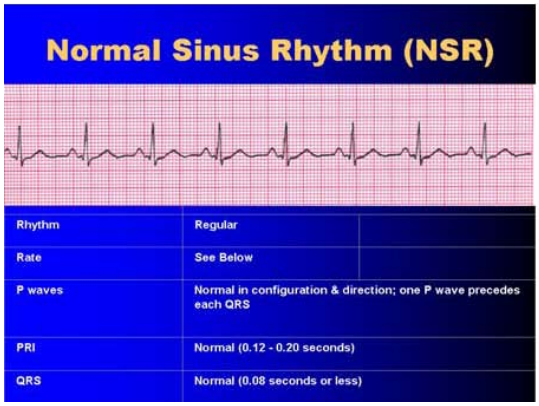
Fibrillation is a disorganized rhythm that, if present in the ventricles, is life-threatening. Immediate CPR combined with early defibrillation is critical to survival from sudden cardiac arrest. Defibrillation terminates all electrical activity in the pulseless heart in the hopes that it will resume beating in a coordinated fashion. A shock should be delivered about once every 2 minutes if the patient remains in Ventricular Fibrillation. With either a monophasic or a biphasic manual defibrillator, the recommendation is to deliver the first shock at 2 Joules/kg. The second shock is 4 J/kg, and subsequent defibrillation shocks are delivered at 4 J/kg or greater.

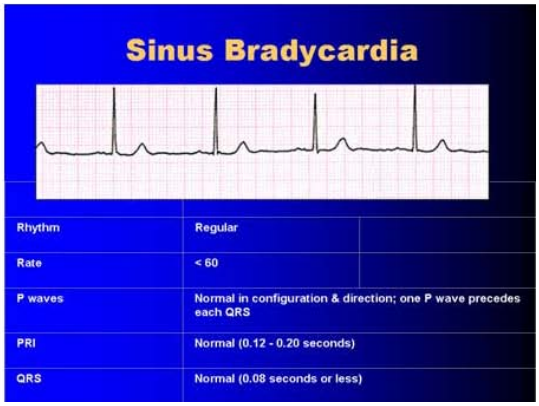
Synchronized Cardioversion

In pediatric patients, synchronized cardioversion is a secondary treatment. Patients with a narrow-complex tachycardia (i.e., SVT), attempt vagal maneuvers first and then adenosine. For patients with a wide-complex tachycardia, expert consultation is advised if the patient is stable enough to withhold treatment. If the patient is too unstable to attempt other treatments (of if other treatments are ineffective), consider synchronized cardioversion. The shock is timed by the monitor to be delivered in coordination with the QRS complex of the heart. If the patient is conscious, consider sedation prior to cardioversion; however, **synchronized cardioversion should not be delayed while waiting for sedation** in severely symptomatic patients. The initial shock is delivered at 0.5 to 1 J/kg regardless of the type of manual defibrillator used. If the initial shock fails to terminate the rhythm, with the second shock delivered at 2 J/kg.

Transcutaneous Pacing (TCP)

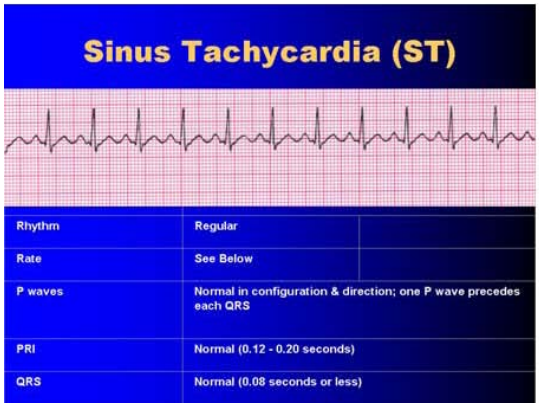
External cardiac pacing can be considered for pediatric bradycardia unresponsive to ventilation, oxygenation, CPR, and medications. Begin pacing at zero milliamps, slowly increasing until capture is achieved. A common protocol is to set the rate at 20 beats per minute above the monitored heart rate, with a minimum rate of 50 bpm.

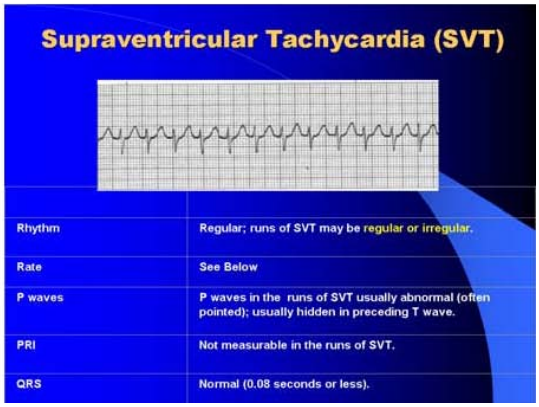




Age	Heart Rate
newborn to 3 mo.	80 - 205 bpm
3 months - 2 years	75 - 190 bpm
2 - 10 years	60 - 140 bpm
> 10 years	60 - 100 bpm

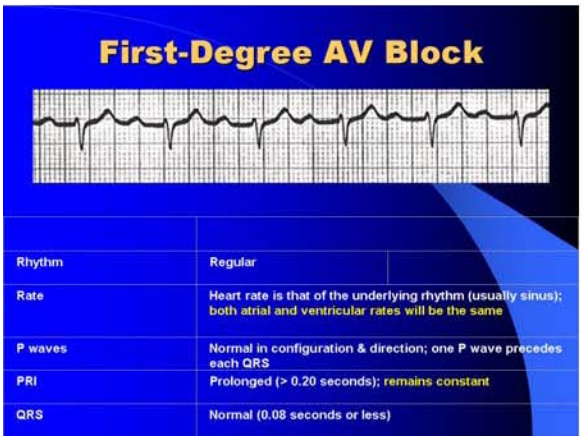
Age	Heart Rate
newborn to 3 mo.	< 100 bpm
3 months - 2 years	< 60 bpm
2 - 10 years	< 60 bpm
> 10 years	< 60 bpm

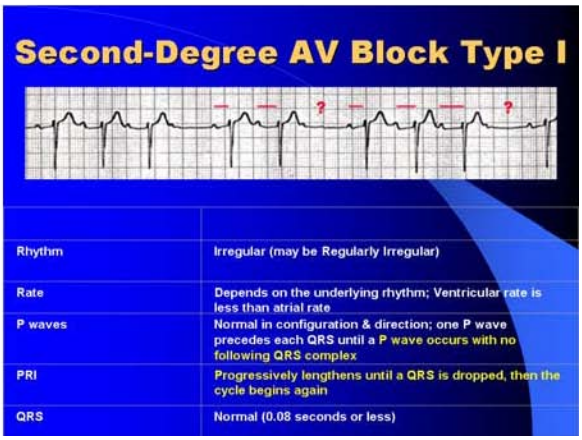




Age	Heart Rate
newborn to 3 mo.	205 - 225 bpm
3 months - 2 years	190 - 225 bpm
2 - 10 years	140 - 180 bpm
> 10 years	100 - 150 bpm

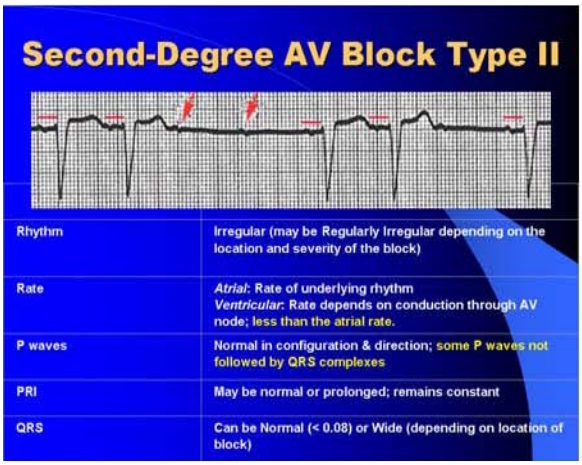
Age	Heart Rate
newborn to 3 mo.	> 225 bpm
3 months - 2 years	> 225 bpm
2 - 10 years	> 180 bpm
> 10 years	> 150 bpm

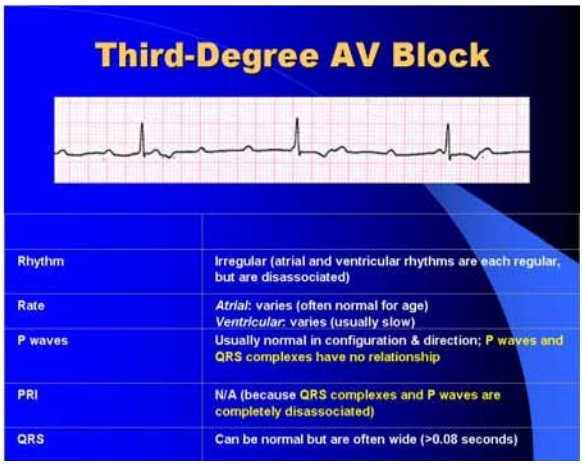




Age	Heart Rate
newborn to 3 mo.	Usually normal for age; may be slow.
3 months - 2 years	
2 - 10 years	
> 10 years	

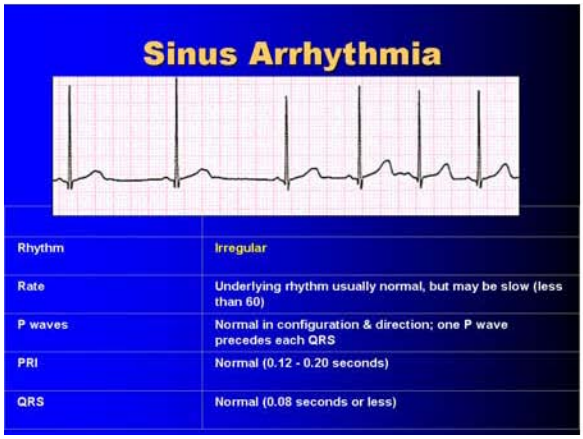
Age	Heart Rate
newborn to 3 mo.	Usually slow for age, especially with dropped QRS complexes.
3 months - 2 years	
2 - 10 years	
> 10 years	

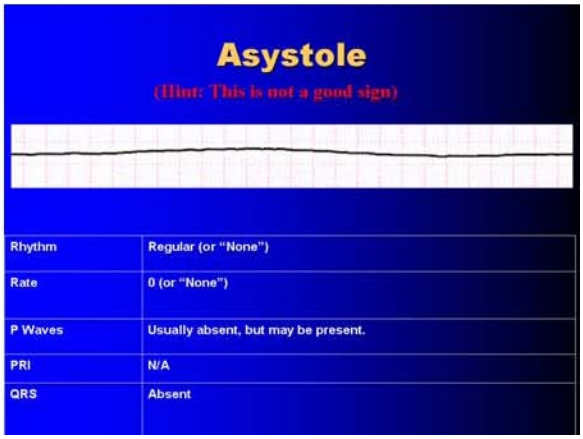




Age	Heart Rate
newborn to 3 mo.	Usually slow for age, especially with dropped QRS complexes.
3 months - 2 years	
2 - 10 years	
> 10 years	

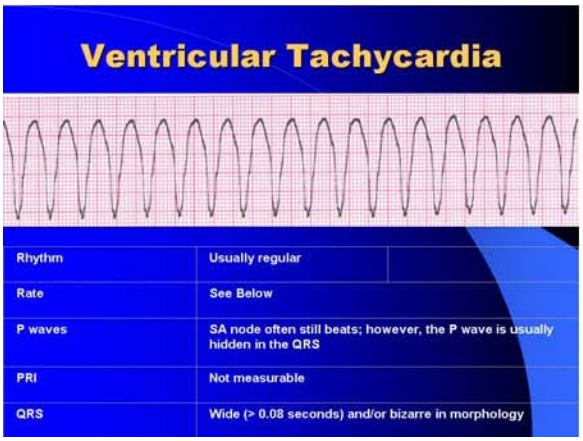
Age	Heart Rate
newborn to 3 mo.	Atrial rate may be slow or normal for age; ventricular rate usually 20 - 30 bpm.
3 months - 2 years	
2 - 10 years	
> 10 years	

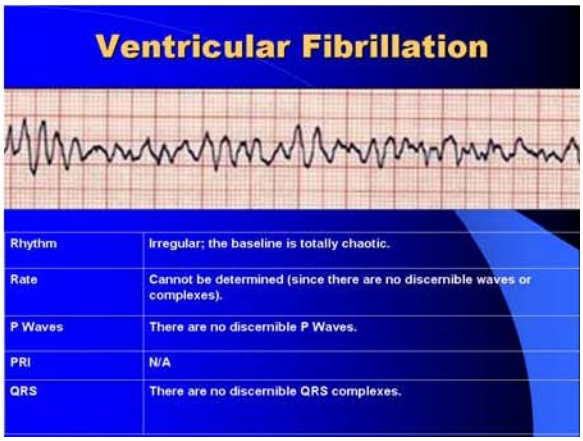




Age	Heart Rate
newborn to 3 mo.	Usually normal for age; may be slow.
3 months - 2 years	
2 - 10 years	
> 10 years	

Age	Heart Rate
newborn to 3 mo.	0 (may *occasionally* show P waves *only*, at normal or slow rate)
3 months - 2 years	
2 - 10 years	
> 10 years	





Age	Heart Rate
newborn to 3 mo.	usually > 140 bpm
3 months - 2 years	
2 - 10 years	
> 10 years	

Age	Heart Rate
newborn to 3 mo.	N/A (too fast to count)
3 months - 2 years	
2 - 10 years	
> 10 years	