

## ACLS STUDY GUIDE 2015

WE HIGHLY RECOMMEND REVIEWING THE NEW ALGORITHMS FOUND IN THE **2010 ACLS Textbook** available through AHA and other retail outlets.

The AHA also requests the following in preparation for your ACLS course:

1. CPR/AED competency (this will be practiced and evaluated in the ACLS course).
2. Understand the 10 cardiac cases found in the ACLS Provider Manual
3. Understand the ACLS algorithms for the cases in the ACLS Provider Manual
4. Complete the online ACLS Pre-course Self-Assessment on ACLS ECGs and pharmacology (ACLS Student Website [www.heart.org/eccstudent](http://www.heart.org/eccstudent) )

To successfully pass the ACLS course, AHA requires you successfully manage a mega-code. A mega-code is hands-on, dynamic, in real time practice of treating a life-threatening cardiac emergency. The cardiac emergency will include that may include ventricular fibrillation, ventricular tachycardia with or without pulses, asystole, pulseless electrical activity, bradycardia and more. In addition, you're required to pass a written exam with a score of  $\geq 84\%$ .

In managing a code or cardiac arrest, you will be required to recognize and correctly identify basic life-threatening rhythms or arrhythmias. You'll be required to assess the patient's general condition and effectively treat the patient according to ACLS algorithms and recommendations using the defibrillator and basic cardiac drugs.

During this course, you will have to perform roles that may be outside your standard scope of practice during the mega-code practice and testing portion of the class. You'll be required to be a "team leader" in managing the code, requesting defibrillation, synchronized cardioversion, CPR, and the correct cardiac drug and dosage when indicated according to ACLS guidelines. In managing the mega-code, the team leader will assign their team members to specific roles and responsibilities including: CPR, respiratory management, use of the defibrillator/monitor, selecting drugs out of the code cart, recorder, etc.

Though you'll have sufficient time to practice running mega-codes and you'll watch audio-visual programs presented by the AHA, course preparation is highly recommended to make your experience valuable toward your education and your successful completion of the

class. You're encouraged to purchase or borrow an ACLS Provider Manual that offers direction to a web site and a pre-course assessment. The online pre-course assessment has shown to be of high value by those who have attended our classes. In addition, the provider manual will provide you with ACLS algorithm pocket guides that can be used during your mega-code testing as a reference. The textbook itself is also a great resource in preparation for your course and the written exam.

**This is not to be considered a replacement for the ACLS Student Manual, the online pre-course assessment and other resources offered by the AHA.** Again—we highly encourage you to get a provider manual and access the website found in the manual for study.

## BLS CPR

BLS CPR changed in 2010. The primary change is from the "ABC" format to "CAB." After establishing unresponsiveness and calling for a code, check for a pulse in 5 to 10 seconds then begin compressions immediately, within 10 seconds of arriving at the patient's side. After thirty compressions, give your first two breaths. The 30:2 ratio then will continue. "Look, listen and feel" for breathing has been removed from the new guidelines. One other significant change in 2010, the use of an AED is now indicated for infants.

Here are the basic steps in BLS:

1. Check for responsiveness
2. Call for help and an AED
3. Check for pulse and simultaneously scan the chest for breathing.
4. Begin the thirty compressions (within 10 seconds of arriving at the patient)
5. Give two breaths—continue 30:2 ratio.
6. Apply the AED as soon as it arrives

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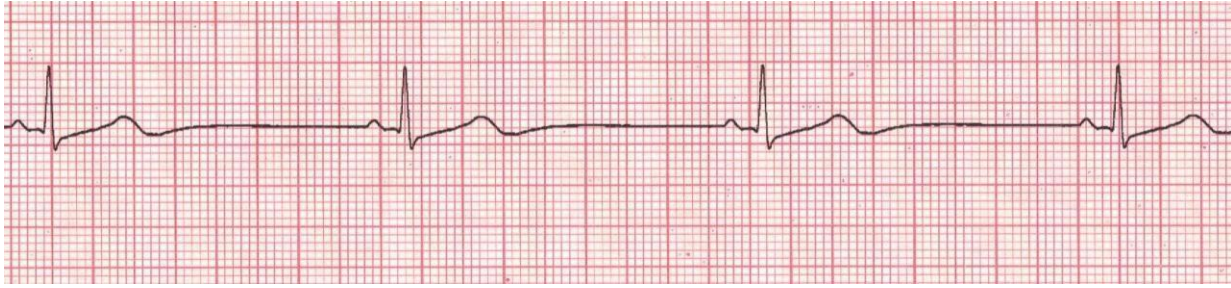
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## Sinus Bradycardia (sinus rhythm with a rate less than **50**)



- Is your patient stable or unstable?
- Stable- monitor closely
- Unstable/ Symptomatic – this patient is showing signs of poor perfusion (their heart rate is not fast enough to deliver an adequate volume of blood to the body and requires treatment/ intervention) for example: hypotensive feels faint, decreased or altered mental status, cool or clammy/diaphoretic.
  - ♥ Administer 0.5mg Atropine. If **Atropine** is ineffective you now have three options:
    - administer **Dopamine** 2-10 mcg/kg/minute **OR**
    - Administer **Epinephrine** infusion: 2 – 10 mcg per minute
    - Prepare and provide external transcutaneous pacing.
      - Note: if the patient is severely hypotensive, transcutaneous pacing may or may not capture and not be able to produce an adequate perfusing pressure. The epinephrine drip or dopamine drip with *transvenous* pacing with expert consultation should now be considered.

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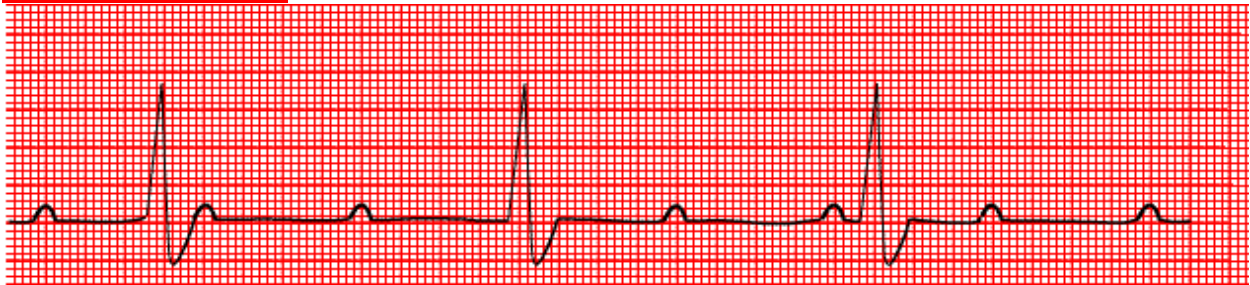
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## Heart Blocks



- Is your patient stable or unstable?
- Stable- monitor closely, seek expert consultation
- Unstable/ Symptomatic – this patient is showing signs of poor perfusion (their heart rate is not fast enough to deliver an adequate volume of blood to the body and requires treatment/ intervention) for example: low B/P, feels faint, decreased or altered mental status, cool or clammy/diaphoretic
  - ♥ Administer 0.5mg **Atropine**. But don't rely on atropine in Mobitz type II, second-degree block or third-degree block with a new wide QRS complex.
  - ♥ For an unstable Mobitz type II second-degree or third-degree heart block patient be prepared for transcutaneous pacing

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## Supraventricular Tachycardia- SVT (SUSTAINED rapid

narrow complex tachycardia with a rate greater than 150)



- Is your patient stable or unstable?
- Stable- Attempt vagal maneuvers like bearing down or a good hard cough. If you're a physician, try carotid massage.
- If vagal maneuvers aren't successful in slowing their heart rate, administer 6 mg. of **Adenosine**. What is unique about administering Adenosine is that it is a fast-push and fast-acting drug. It may cause a second or two of asystole. Patient also must be monitored.
- If the first dose of 6 mg isn't successful, ACLS allow you to repeat the Adenosine providing 12 mg the second and third time if needed.
- Unstable/ Symptomatic – this patient is showing signs of poor perfusion (low B/P, feels faint, decreased or altered mental status, cool or clammy/diaphoretic) it may be due to their heart rate is too fast to deliver an adequate volume of blood to the body and requires rapid treatment/ intervention. Provide synchronized cardioversion of 50 – 100 joules.

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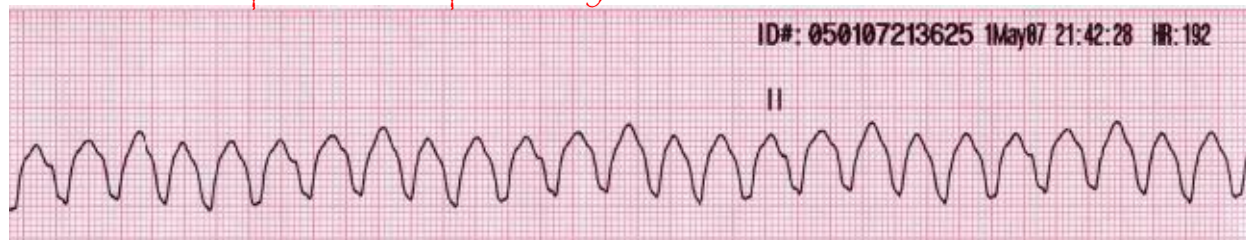
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## Monomorphic Ventricular Tachycardia-VT (SUSTAINED)

>30 seconds rapid wide complex tachycardia)



- First and important question: Does your patient have a pulse with this rhythm?
- If yes, he/she does have a pulse, then is you patient stable?
  - With a PULSE and UNSTABLE (low b/p, weak, clammy, cold, ashen, unresponsive or lethargic)
    - Deliver immediate synchronized cardioversion at 100J.
    - Evaluate the rhythm post cardioversion and consider a second attempt at a higher energy level if needed.
  - ♥ With a PULSE and STABLE, treat with adenosine only if regular and monomorphic.
  - ♥ Consider antiarrhythmic infusion i.e. Procainamide or Amiodarone IV drip.

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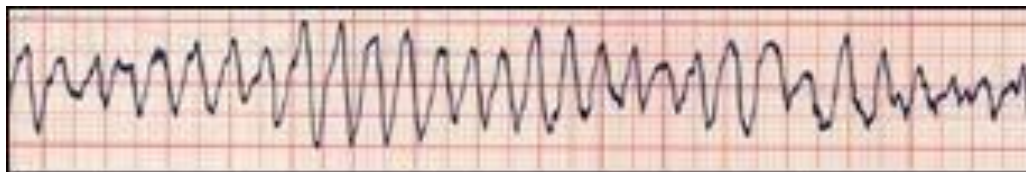
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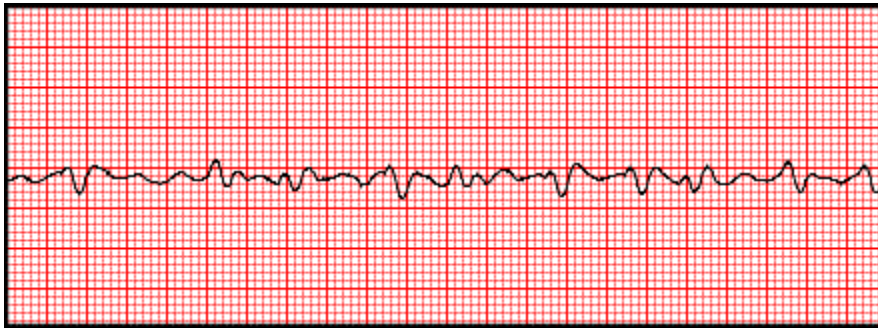
## Polymorphic Ventricular Tachycardia- VT



Torsades  
de Pointes

- Arrhythmias with a polymorphic QRS appearance, torsades de pointes for example, will usually not permit synchronization. The patient will have to be treated as V-fib: defibrillate at 200 joules.
- If there is doubt about whether an unstable patient has monomorphic or polymorphic VT, do not delay treatment for further rhythm interpretation. Provide defibrillation (not synchronized cardioversion) at 200 joules.

# VENTRICULAR FIBRILLATION-



- VFib is a chaotic and disorganized rhythm that generates absolutely no perfusion! The heart is quivering as it is dying and requires IMMEDIATE defibrillation...do not delay! The sooner the heart in VF can be defibrillated, the higher the chances of successfully converting to an organized rhythm.
- Quickly....
  - ♥ Rapidly assemble your team
  - ♥ Begin chest compressions
  - ♥ Apply defibrillator (hands-free) pads to patient, clear your co-workers from touching the patient or the bed and deliver 200J shock as quickly as you can.
  - ♥ Immediately after the shock is delivered, resume compressions and bag mask ventilations. (CPR should not stop for more than 10 seconds.)
  - ♥ You will continue CPR for 2 minutes (make sure your timer/recorder is tracking this for you) and prepare your first drug – your first medication will be **Epinephrine** 1mg, but do not administer it yet. This is also a good time to get IV or IO access if not already established.
  - ♥ At 2 minutes clear to reevaluate your rhythm- if VF persists charge and defibrillate a second time at 200J, clear the patient and deliver the shock. Immediately resume compressions (make sure to rotate compressor and person bagging every 2 minutes for optimal compressions- you will get tired quickly)
  - ♥ During this 2 minute cycle administer the **Epinephrine** and prepare the second medication- **Amiodarone 300mg**.



- ♥ Again at the 2 minute mark clear to reevaluate your rhythm- if VF persists charge and defibrillate at 200J, again resume compressions immediately after the shock is delivered.
- ♥ During this 2 minute cycle administer the **Amiodarone** 300mg and prepare your next dose of **Epinephrine, 1 mg**.
- ♥ These 2 minute cycles of ***rhythm check- shock if indicated- CPR- administer med*** will continue as long as VF or pulseless VT persists.

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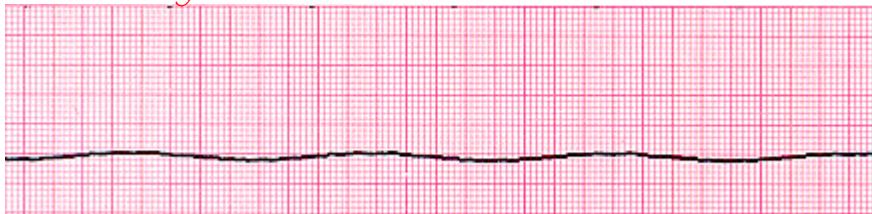
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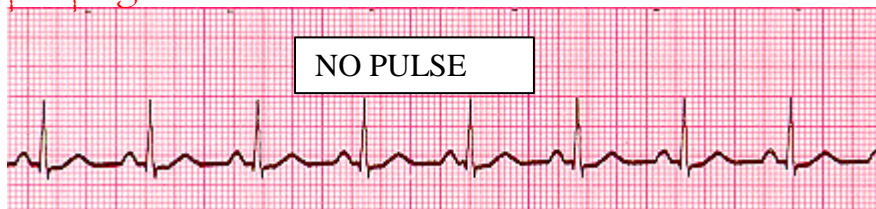
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Asystole- Ventricular Standstill - Absolutely no electrical or mechanical activity!



- Asystole requires immediate intervention
  - ♥ Begin compressions and airway management, good CPR.
  - ♥ Administer **Epinephrine 1mg** IVP as soon as it's available.
  - ♥ 1 mg of Epinephrine (1:10,000 used in cardiac arrest) is giving every 3-5 minutes and there is no maximum dose.
  - ♥ A critical step to restoring a perfusing rhythm is to quickly identify one of the underlying/reversible causes that most frequently lead to asystole. The most common are known as the H's & T's! As a team leader you should run through the list for consideration.
    - H's & T's are as follows: Hypoxia, Hypothermia, Hypo/Hyperkalemia, Hydrogen Ion (acidosis), Hypovolemia, Toxins, Tension Pneumothorax, Tamponade, Thrombus (coronary or pulmonary)

Pulseless Electrical Activity (PEA) - Electrical Activity without mechanical contractility, you have an organized rhythm, but the heart isn't pumping.



- What do you do if you are in a code and you find an organized rhythm on the monitor?
  - ♥ CHECK FOR A PULSE! If you have a rhythm and no pulse you are in PEA
  - ♥ Begin compressions and airway management / good CPR at a ratio of 30:2.
  - ♥ Administer Epinephrine 1:10,000 1mg IVP
  - ♥ A critical step to restoring a perfusing rhythm is to quickly identify one of the underlying/reversible causes that most frequently lead to PEA. The most common are known as the H's & T's! As a team leader you should run through the list for consideration.
  - ♥ H's & T's are as follows: Hypoxia, Hypothermia, Hypo/Hyperkalemia, Hydrogen Ion (acidosis), Hypovolemia, Toxins, Tension Pneumothorax, Tamponade, Thrombus (coronary or pulmonary)
  - ♥ Remember- PEA is not always a Sinus Rhythm and it is not always a slow PEA. It can look like any organized rhythm.

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During class you will have opportunity to get hands-on practice with each of these rhythms and their appropriate algorithms. If you study the content the application in the simulation labs will pull it all together for you and your instructor will help tie it all together and answer any additional questions you may have.

***This content is not intended to replace your ACLS provider manual- you are still highly encouraged to have the manual or borrow one provided by your department in preparation for and while attending class.***

# ACLS Pharmacology

## Drugs for Pulseless Arrest VF/VT

Epinephrine 1:10,000: 1mg IV/IO followed by 20 ml flush; repeat throughout code every 3-5 minutes. There is no maximum dose.

*When is Epi administered? Asystole, PEA, VF, Pulseless VT....in other words....when there isn't a pulse, this is the first drug given. .*

Vasopressin: 40 units can replace the first or second dose of Epinephrine.

Amiodarone: 300mg IV/IO push. Second dose (if needed) 150 mg IV/IO push.

*-Antiarrhythmic medication that has been shown to increase chance of return of pulse after defibrillation of a shockable rhythm, VF or pulseless VT.*

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## Drugs for Pulseless Arrest PEA or Asystole

Epinephrine: 1mg IV/IO followed by 20ml flush; repeat throughout code every 3-5 minutes. There is no maximum dose.

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## Drugs for Bradycardia

Atropine: 0.5mg IV/IO followed by 20ml flush; repeat every 3-5 minutes to a maximum total dose of 3mg.

*-Increases heart rate*

Dopamine drip: second line drug for Bradycardia, 2-10mcg/kg/min as an IV Infusion on an infusion pump **only**. Titrate to patient response.

**- NEVER GIVE IV PUSH**

*-Increases heart rate at lower doses, and increases B/P at higher doses*

Epinephrine drip: Dilute 1mg Epinephrine in 500ml NS and run as an IV Infusion on an infusion pump at a rate of 2-10mcg/min.

*-Titrate to patient response.*

*-Increases heart rate and B/P*

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## Drugs for Supraventricular Tachycardia and Stable Wide Complex VT

Adenosine: 6mg rapid IV push followed by an immediate 2 ml flush; may repeat with a 12mg dose twice if needed.

*-fast push and fast acting drug that may cause a short period of asystole.*

*-Allows heart to return to a normal rhythm*

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## Drugs for ACS (Acute Coronary Syndromes)

MONA

M = Morphine

O = Oxygen (for oxygen saturation less than 94%)

N = Nitrates

A = Aspirin

It is preferable to do a 12 Lead ECG, if available, prior to the administration of nitroglycerin to verify your patient's cardiac rhythm status.

Morphine: Initial dose is 2 to 4 mg IV over 1 to 5 minutes, administer slowly and only titrate to effect

- May administer to patients with suspected ischemic pain unresponsive to oxygen and nitrates
- Before administering morphine, be sure that the patient's systolic blood pressure is >90 mm Hg and they are not hypovolemic
- Remember to reassess and repeat vital signs between doses
- Fentanyl may be an alternative pain medication to morphine for the unstable patient (ie, systolic blood pressure <90 mm Hg, hypovolemia, bradycardia, etc.)

Nitroglycerin: 1 spray sublingually every 3-5 minutes up to a total of 3 sprays

- Indications — Standard therapy for all patients with new pain/discomfort suggestive of ACS
- Give within minutes of arrival
- Nitroglycerin decreases pain in ischemia and is a vasodilator.
- Before administering nitroglycerin, be sure that the patient's systolic blood pressure is >90 mm Hg and they should not have bradycardia or tachycardia.
- Do not give nitroglycerin if the patient has had an erectile dysfunction drug within the past week.

Aspirin: 160 to 325 mg given as soon as possible, non-coated baby or adult aspirin may be used

- Indications — Standard therapy for all patients with new pain/discomfort suggestive of ACS
- Give within minutes of arrival
- Aspirin irreversibly binds to platelets and partially inhibits platelet function.
- Before administering aspirin, make sure patient does not have an aspirin allergy, or recent or active GI bleeding.

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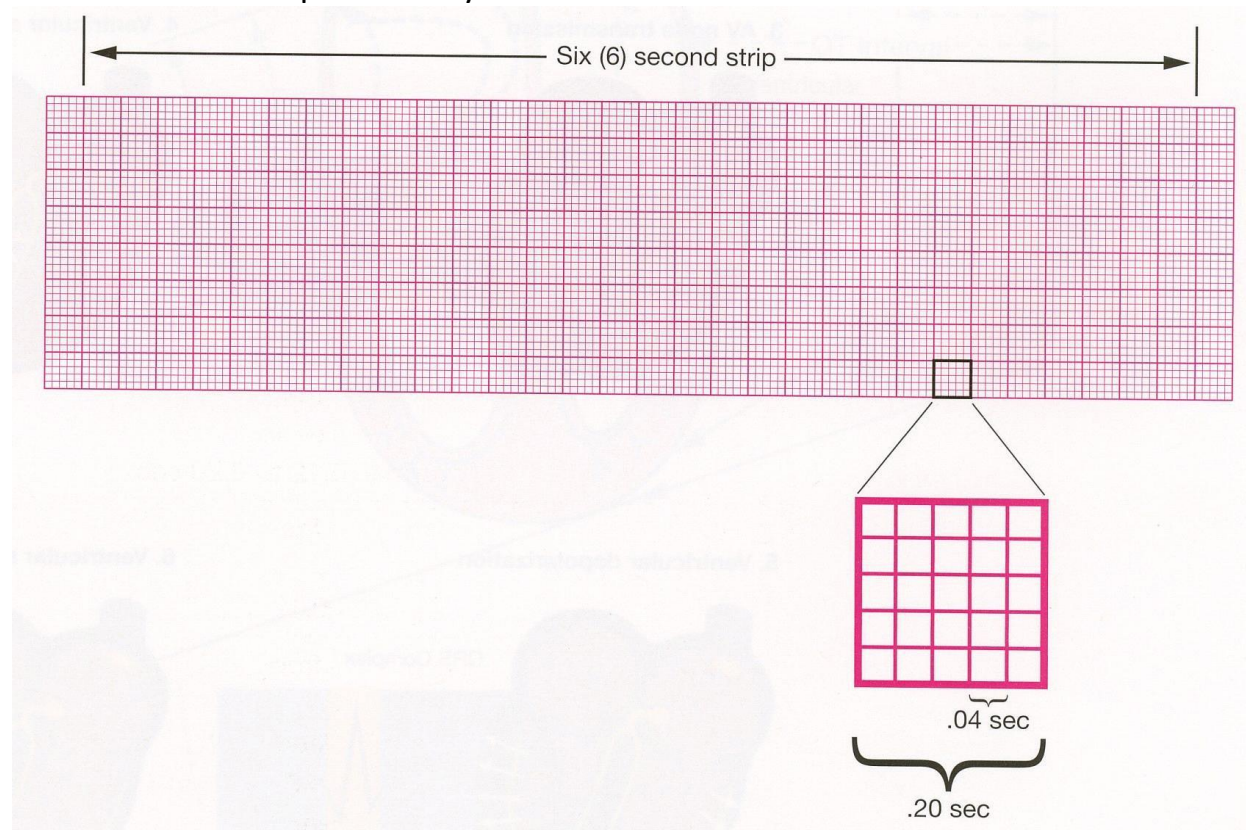


# How to Calculate the EKG ♥ Rate

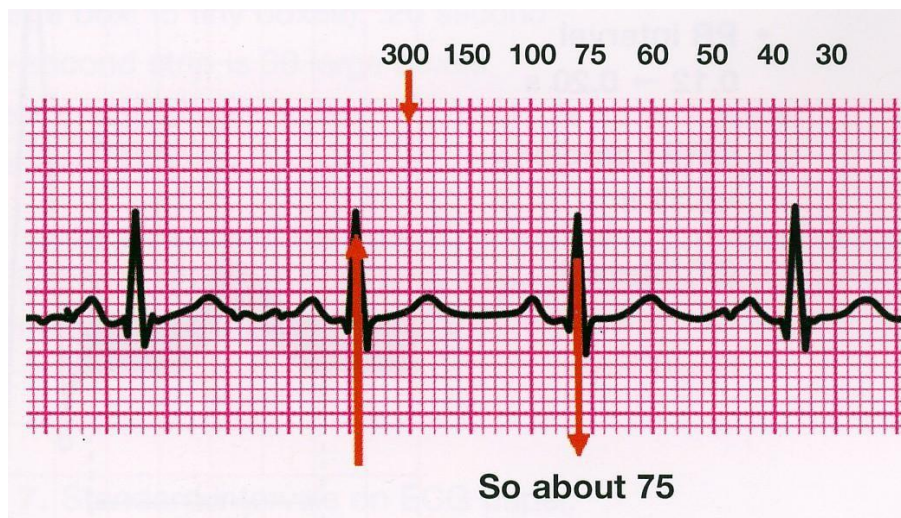
In preparation for your ACLS it is not only important for you to be able to identify the rhythms but determine the rate as well. Here is the nitty gritty to help you accomplish this task.

EKG paper is comprised of many boxes: each of the following can be used in different methods to calculate a strips correct rate.

- ♥ 1 tiny box=0.04 second
- ♥ 1 large box=(5 tiny boxes)0.20 second
- ♥ 6 second strip=30 large boxes
- ♥ 1 minute strip=300 large boxes
- ♥ 1 minute strip=1500 tiny boxes



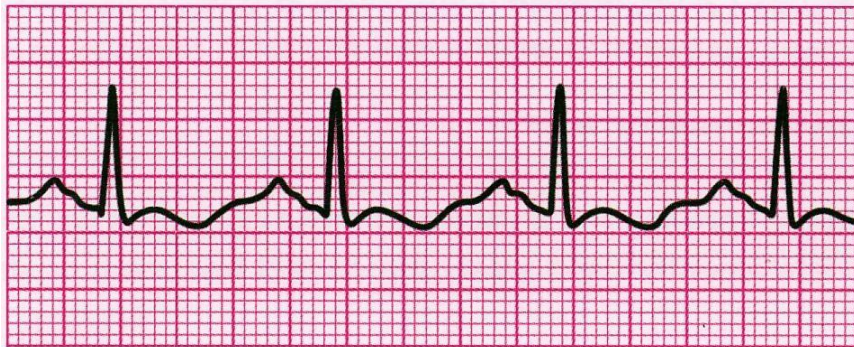
The Countdown Method: This does not require a 3-second or 6-second strip and can be used easily at the bedside. It is accomplished by memorizing this sequence: 300, 150, 100, 75, 60, 50, 40, and 30. You find a QRS complex that falls close to a heavy line and count large boxes between the QRS complexes using these numbers. See example below. This method only works for regular rhythms.



The 1500 Method: Count the tiny squares between identical points on 2 consecutive QRS complexes. Then divide 1500 by the number of tiny boxes to obtain the heart rate.

The 300 Method: Count the number of large squares between 2 consecutive QRS complexes...then divide 300 by the number of large boxes to obtain the heart rate.

The 3 Second Strip Method: Using a 3 second strip (15 large squares=3 seconds), count the number of QRS complexes and multiply by 20 to obtain the heart rate.



The 6 Second Strip Method: Using a 6 second strip (30 large squares=6 seconds), count the number of QRS complexes and multiply by 10 to obtain the heart rate.



## References

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## ACLS GUIDELINES VERSION 2

This study guide is an outline of content that will be taught in the American Heart Association Accredited Advance Cardiac Life Support (ACLS) Course. It is intended to summarize important content, but since all ACLS content cannot possibly be absorbed in a class given every two years, it is expected that the student will have the 2010 Updated ECC Handbook readily available for review as a reference. The student is also required to have the AHA ACLS Textbook available for reference and study for more in depth content.

### Evidence Based Updates

Approximately every 5 years the AHA updates the guidelines for CPR and Emergency Cardiovascular Care. These updates are necessary to ensure that all AHA courses contain the best information and recommendations that can be supported by current scientific evidence experts from outside the United States and outside the AHA. The guidelines were then classified as to the strength of evidence that supports the recommendation.

### **Critical Concepts – High Quality CPR**

- Compress the chest hard and fast
- Allow complete chest recoil after each compression
- Minimize interruptions in compressions (10 seconds or less)
- Switch providers about every 2 minutes to avoid fatigue
- Avoid excessive ventilation

### **The BLS Survey**

### **C - A - B**

<b>Assess</b>		<b>Assessment Technique and Action</b>
1	Check Responsiveness	<ul style="list-style-type: none"> <li>• Tap and shout, "Are you all right?"</li> <li>• Check for absent or abnormal breathing (no breathing or only gasping) by looking at or scanning the chest for movement (about 5 to 10 seconds)</li> </ul>
2	Activate the Emergency Response System /get AED	<ul style="list-style-type: none"> <li>• Activate the emergency response system and get an AED if one is available or send someone to activate the emergency response system and get an AED or defibrillator</li> </ul>
3	Circulation	<ul style="list-style-type: none"> <li>• Check the carotid pulse for 5 to 10 seconds</li> <li>• If no pulse within 10 seconds, start CPR (30:2) beginning with chest compressions</li> <li>• Compress the center of the chest (lower half of the sternum) hard and fast with at least 100 compressions per minute at a depth of at least 2 inches</li> <li>• Allow complete chest recoil after each compression</li> <li>• Minimize interruptions in compressions (10 seconds or less)</li> <li>• Switch providers about every 2 minutes to avoid fatigue</li> <li>• Avoid excessive ventilation</li> <li>• If there is a pulse, start rescue breathing at 1 breathe every 5 to 6 seconds (10 to 12 breaths per minute). Check pulse about every 2 minutes.</li> </ul>
4	Defibrillation	<ul style="list-style-type: none"> <li>• If no pulse, check for a shockable rhythm with an AED/defibrillator as soon as it arrives</li> <li>• Provide shocks immediately with CPR, beginning with compressions</li> </ul>

## The ACLS Survey

For unconscious patients in arrest (cardiac or respiratory):

- Healthcare providers should conduct the ACLS Survey after completing the BLS survey.

For conscious patients who may need more advanced assessment and management technique:

- Health providers should conduct the ACLS Survey first.

An important component of this survey is the differential diagnosis, where identification and treatment of the underlying causes may be critical to patient outcome.

## Effective Resuscitation Team Dynamics

**Role of the Team Leader** – is multifaceted. The team leader

- Organizes the group
- Monitors individual performance of team members
- Back up team members
- Models excellent team behavior
- Trains and coaches
- Facilitates understanding
- Focuses on comprehensive patient care

**Role of Team Member** – must be proficient in performing the skills authorized by their scope of practice.

- Clear about role assignment
- Prepared to fulfill their role responsibilities
- Well practiced in resuscitation skills
- Knowledgeable about the algorithms
- Committed to success

❖❖ **Closed – Loop Communications** – When communicating with resuscitation team members, the team leader should use closed – loop communication by taking these steps

- The team leader gives a message, order, or assignment to a team member
- By receiving a clear response and eye contact, the team leader confirms that the team member heard and understood the message
- The team leader listens for confirmation of task performance from the team before assigning another task.



- ❖❖ **Clear Messages** – Clear messages consist of concise communication spoke with distinctive speech in a controlled tone of voice. All healthcare providers should deliver messages and order in a calm and direct manner without yelling or shouting. Unclear communication can lead to unnecessary delays in treatment or to medication errors.
- ❖❖ **Clear Roles and Responsibilities** – Every member of the team should know his or her role and responsibilities. Just as different shaped pieces make up a jigsaw puzzle, each team member's role is unique and critical to the effective performance of the team. When roles are unclear, team performance suffers. Signs of unclear roles include:
  - Performing the same task more than once
  - Missing essential tasks
  - Freelancing of team members
- ❖❖ **Knowing One's Limitations** – Not only should everyone on the team know his or her own limitations and capabilities, but the team leader should also be aware of them. This allows the team leader to evaluate team resources and call for backup of team members when assistance is needed.
- ❖❖ **Knowledge Sharing** – Sharing information is a critical component of effective team performance. Team leaders may become trapped in a specific treatment or diagnostic approach; this common human error is called a fixation error.
- ❖❖ **Constructive Intervention** – During a resuscitation attempt the team leader or a team member may need to intervene if an action that is about to occur may be inappropriate at the time. Although constructive intervention is necessary, it should be tactful.
- ❖❖ **Reevaluation and Summarizing** – An essential role of the team leader is monitoring and reevaluating
  - The patient's status
  - Interventions that have been performed
  - Assessment findings
- ❖❖ **Mutual Respect** – The best teams are composed of members who share a mutual respect for each other and work together in a collegial, supportive manner. To have a high-performing team, everyone must abandon ego and respect each other during the resuscitation attempt, regardless of any additional training or experience that the team leader or specific team member may have.

## System of Care

### Medical Emergency Teams (METs) and Rapid Response Teams (RRTs)

- ❖❖ Many hospitals have implemented the use of METs or RRTs. The purpose of these teams is to improve patient outcomes by identifying and treating early clinical deterioration. In-hospital cardiac arrest is commonly preceded by physiologic changes. In one study nearly 80% of hospitalized patients with cardiorespiratory arrest had abnormal vital signs documented for up to 8 hours before the actual arrest. Many of these changes can be recognized by monitoring routine vital signs. Intervention before clinical deterioration or cardiac arrest may be possible.
- ❖❖ Consider this question: “Would you have done anything differently if you knew 15 minutes before the arrest that ....?”

### The ACLS Survey

**Airway Management in Respiratory Arrest** – If bag-mask ventilation is adequate, providers may defer insertion of an advanced airway. Healthcare providers should make the decision to place an advanced airway during the ACLS Survey.

Advanced airway equipment includes the laryngeal mask airway, the laryngeal tube, the esophageal-tracheal tube and the ET tube. If it is within your scope of practice, you may use advanced airway equipment in the course when appropriate and available.

### Basic Airway Adjuncts: Oropharyngeal Airway

The OPA is used in patients who are at risk for developing airway obstruction from the tongue or from relaxed upper airway muscle. This J-shaped device fits over the tongue to hold it and the soft hypopharyngeal structures away from the posterior wall of the pharynx.

Quantitative waveform  
capnography (if PETCO<sub>2</sub> is <10mm  
Hg, attempt to improve CPR quality)

The OPA is used in unconscious patients if procedures to open the airway fail to provide and maintain a clear, unobstructed airway. An OPA should not be used in a conscious or semiconscious patient because it may stimulate gagging and vomiting. The key assessment is to check whether the patient has an intact cough and gag reflex. If so, do not use an OPA.

### Basic Airway Adjuncts: Nasopharyngeal Airway

The NPA is used as an alternative to an OPA in patients who need a basic airway management adjunct. The NPA is a soft rubber or plastic uncuffed tube that provides a conduit for airflow between the nares and the pharynx.

Unlike oral airway, NPAs may be used in conscious or semiconscious patients (patients with an intact cough and gag reflex). The NPA is indicated when insertion of an OPA is technically difficult or dangerous.

### Suctioning

Suctioning is an essential component of maintaining a patient's airway. Providers should suction the airway immediately if there are copious secretions, blood, or vomit.

Monitor patient's heart rate, pulse oxygen saturation, and clinical appearance during suctioning. If bradycardia develops, oxygen saturation drops, or clinical appearance deteriorates, interrupt suctioning at once. Administer high-flow oxygen until the heart rate return to normal and clinical condition improves. Assist ventilation as needed.

**Suctioning attempted should not exceed 10 seconds.** To avoid hypoxemia, precede and follow suctioning attempts with a short period of administration of 100% oxygen.

#### SELECTING THE PROPER SIZE OPA

Place the OPA against the side of the face. When the tip of the OPA is at the corner of the mouth, the flange is at the angle of the mandible. A properly sized and inserted OPA results in proper alignment with the glottis opening.

## Providing Ventilation with an Advanced Airway

Selection of an advanced airway device depends on the training, scope of practice, and equipment of the providers on the resuscitation team. Advanced Airway includes:

- ❖❖ **Laryngeal mask airway** – is an advanced airway alternative to endotracheal intubation and provides comparable ventilation. It is acceptable to use the laryngeal mask airway as an alternative to an ET tube for airway management in cardiac arrest.
- ❖❖ **Laryngeal tube** – The advantages of the laryngeal tube are similar to those of the esophageal-tracheal tube; however, the laryngeal tube is more compact and less complicated to insert.
- ❖❖ **Esophageal-tracheal tube** – The esophageal-tracheal tube is an advanced airway alternative to endotracheal intubation. This device provides adequate ventilation comparable to an ET tube.
- ❖❖ **Endotracheal tube** – A brief summary of the basic steps for performing endotracheal intubation is given here to familiarize the ACLS provider who may assist with the procedure.
  - Prepare for intubation by assembling the necessary equipment
  - Perform endotracheal intubation
  - Inflate cuff or cuffs on the tube
  - Attach the ventilation bag
  - Confirm correct placement by physical examination of a confirmation device. Continuous waveform capnography is recommended (in addition to clinical assessment) as the most reliable method of confirming and monitoring correct placement of an ET tube.
  - Secure the tube in place
  - Monitor for displacement

Cricoid pressure in nonarrest patients may offer some measure of protection to the airway from aspiration and gastric insufflation during bag-mask ventilation. However, it also may impede ventilation and interfere with placement of a supraglottic airway or intubation.

**Cricoid Pressure is NOT recommended**

## Purpose of Defibrillation

Defibrillation does not restart the heart. Defibrillation stuns the heart and briefly terminates all electrical activity, including VF and VT. If the heart is still viable, its normal pacemaker may eventually resume electrical activity (return of spontaneous rhythm) that ultimately results in a perfusing rhythm (ROSC).

## Principle of Early Defibrillation

● ● ●  
If the AED does not promptly analyze the rhythm, do the following:

- Resume high-quality chest compressions and ventilations
- Check all connections between the AED and the patient to make sure that they are intact.
- NEVER delay chest compressions to troubleshoot the AED

● ● ●

The earlier defibrillation occurs, the higher the survival rate. When VF is present, CPR can provide a small amount of blood flow to the heart and brain but cannot directly restore an organized rhythm. The likelihood of restoring a perfusing rhythm is optimized with immediate CPR and defibrillation within a few minutes of the initial arrest.

Restoration of a perfusing rhythm requires immediate CPR and defibrillation within a few minutes of the initial arrest.

### Delivering Shock

The appropriate energy dose is determined by the identity of the defibrillator – monophasic or biphasic.

If you are using a monophasic defibrillator, give a single 360-J shock. Use the same energy dose of subsequent shocks.

Biphasic defibrillators use a variety of waveforms, each of which is effective for terminating VF over a specific dose range. When using biphasic defibrillators, providers should use the manufacturer's recommended energy dose (eg, initial dose of 120 to 200 J). Many biphasic defibrillator manufacturers display the effective energy dose range on the face of the device.

To minimize interruptions in chest compressions during CPR, continue CPR while the defibrillator is charging. Immediately after the shock, resume CPR, beginning with chest compressions. Give 2 minutes (about 5 cycles) of CPR. A cycle consists of 30 compressions followed by 2 ventilations in the patient without an advanced airway.

## Synchronized vs. Unsynchronized Shocks

### Synchronized

- Cardioversion uses a sensor to deliver a shock that is synchronized with a peak of the QRS complex
- Synchronized cardioversion uses a lower energy level than attempted defibrillation.
- When to use synchronized shock
  - Unstable SVT
  - Unstable Atrial Fibrillation
  - Unstable Atrial Flutter
  - Unstable regular monomorphic tachycardia with pulse

### Unsynchronized

- Means that the electrical shock will be delivered as soon as the operator pushes the SHOCK button to discharge the device.
- May fall randomly anywhere within the cardiac cycle.
- When to use Unsynchronized Shocks
  - For a patient who is pulseless
  - For a patient demonstrating clinical deterioration (in prearrest), such as those with severe shock or polymorphic VT, you think a delay in converting the rhythm will result in cardiac arrest.

### Foundational Facts:

- Be sure oxygen is not flowing across the patients' chest when delivering shock

The pause in chest compressions to check the rhythm should not exceed 10 seconds

- Perform a pulse check – preferably during rhythm analysis – only if an organized rhythm is present.

After you have completed your first 2-minute period of CPR, have a team member attempt to palpate a carotid pulse.

- If the PETCO<sub>2</sub> is
- <10 mm Hg during CPR, it is reasonable to try to improve chest compressions and vasopressor therapy.





- When you are unsure whether monomorphic or polymorphic VT is present in the unstable patient.

## Routes of Access for Drugs

Historically in ACLS, providers have administered drugs via either the IV or endotracheal route. Endotracheal absorption of drugs is poor and optimal drug dosing is not known. For this reason, the IO route is preferred when IV access is not available. Priorities for vascular access are:

- IV Route - A peripheral IV is preferred for drug and fluid administration unless central line access is already available. Central line access is not necessary during most resuscitation attempts.
- IO Route - Drugs and fluids during resuscitation can be delivered safely and effectively via the IO route if IV access is not available. Important points about IO access are:

## ACLS Algorithm Review

### ACUTE CORONARY SYNDROME

The ACLS provider Course presents only basic knowledge focusing on early treatment and the priority of rapid reperfusion, relief of ischemic pain, and treatment of early life-threatening complications. Reperfusion may involve the use of fibrinolytic therapy or coronary angiography with PCI (ie, balloon angioplasty/stenting).

Symptoms Suggestive of Ischemia or Infarction

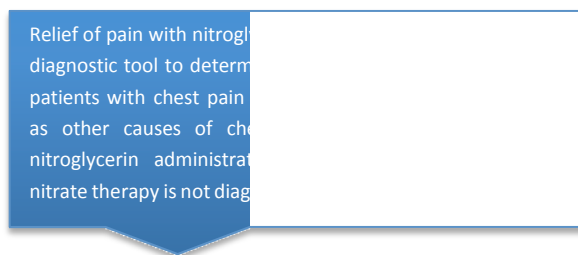
- EMS assessment and care and hospital preparation:
  - Monitor, support ABCs. Be prepared to provide CPR and defibrillation
  - Administer aspirin and consider oxygen, nitroglycerin, and morphine if needed
  - Obtain 12-lead ECG; if ST elevation:
  - Notify hospital should mobilize hospital resources to respond to STEMI
  - If considering prehospital fibrinolysis, use

#### IMMEDIATE ED GENERAL TREATMENT

- IF O2 SAT <94% START  
OXYGEN AT  
4L/MIN, TITRATE
- ASPIRIN 160 TO 325 MG  
(IF NOT GIVEN BY EMS)
- NITROGLYCERIN  
SUBLINGUAL OR SPRAY
- MORPHINE IV IF  
DISCOMFORT NOT  
RELIEVED BY  
NITROGLYCERIN

fibrinolysis checklist.

- Concurrent ED assessment (<10 minutes)
  - Check vital signs; evaluate oxygen saturation
  - Establish IV access
  - Perform brief, targeted history, physical exam
  - Review/complete fibrinolytic checklist; check contraindications
  - Obtain initial cardiac marker level, initial electrolyte and coagulation studies
  - Obtain portable chest x-ray (<30 minutes)



The 12-lead ECG is at the center of the decision pathway in the management of ischemic chest discomfort and is the only means of identifying STEMI

General Group	Description
STEMI	ST elevation in or more contiguous leads or new LBBB. Threshold values for ST-segment elevation consistent with STEMI are J-point elevation greater than 2mm (0.2mV) in leads V2 and V3 and 1mm or more in all other leads or by new or presumed new LBBB. 2.5mm in men >40 years; 1.5 mm in all women
High-risk UA/NSTEMI	ST depression or dynamic T-wave inversion – is characterized by ischemic ST-segment depression (0.05mV) or dynamic T-wave inversion with pain or discomfort.
Intermediate/low-risk UA	Normal or nondiagnostic ECG – Serial cardiac studies and functional testing are appropriate. Note that additional information (troponin) may place the patient into a higher risk classification after initial classification.

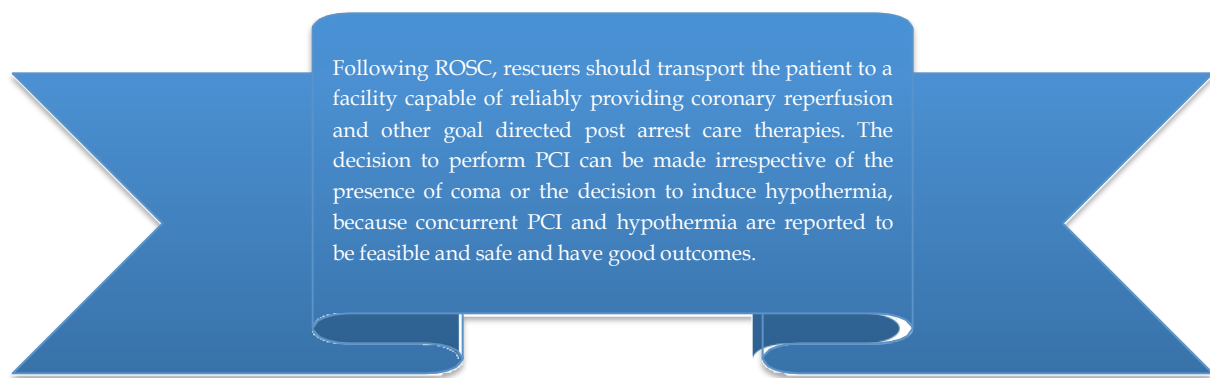
### Use of Fibrinolytic Therapy

A fibrinolytic agent or “clot buster” is administered to patients with J-point ST-segment elevation greater than 2mm (0.2mV) in leads V<sub>2</sub> and V<sub>3</sub> and 1mm or more in all other leads or by new or presumed new LBBB without contraindication.

## Use of PCI

The most commonly used form of PCI is coronary intervention with stent placement. Primary PCI is used as an alternative to fibrinolytics. Rescue PCI is used early after fibrinolytics in patients who may have persistent occlusion of the infarct artery (failure to reperfusion with fibrinolytics).

### Immediate Coronary Reperfusion with PCI



## Adjunction Treatment

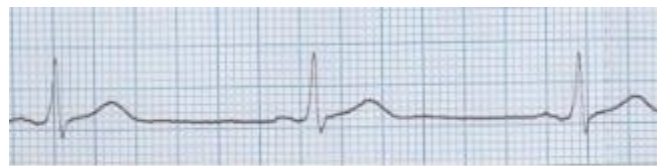
Other drugs are useful when indicated in addition to oxygen, sublingual or spray nitroglycerin, aspirin, morphine, and fibrinolytic therapy. These include:

- IV nitroglycerin
- Heparin
- Clopidogrel
- B-Blockers
- ACE inhibitors
- HMG-CoA reductase inhibitor therapy (statin)

## Bradycardia

Bradycardia occurs when the heart is beating too slow (<50 beats per minute). If symptomatic, provide oxygen, given Atropine 0.5mg up to 3mg and call for the transcutaneous pacemaker.

In Sinus Bradycardia, the SA node fires at a rate slower than normal for a person's age. Athletes may have heart rates less than 50 due to their physical conditioning. Obviously, they would not need treatment. It is possible for patient to have a heart rate of 50 and be asymptomatic; however, if a patient with a heart rate of less than 50 has signs of poor perfusion, begin treatment with oxygen and Atropine 0.5mg



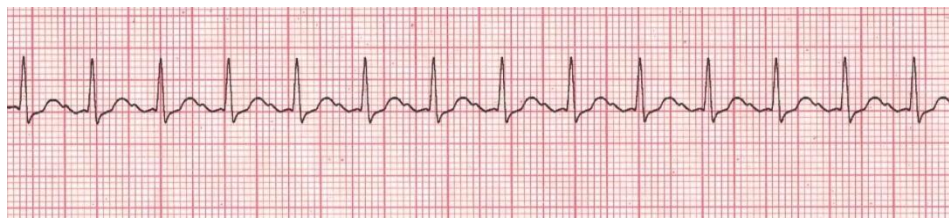
Sinus Bradycardia

### Treatment

Give atropine as first-line treatment	Atropine 0.5 mg IV - may repeat to a total dose of 3 mg	
If atropine is ineffective		
Transcutaneous pacing	OR	<ul style="list-style-type: none"><li>• Dopamine 2 to 10 mcg/kg per minute (chronotropic or heart rate dose)</li><li>• Epinephrine 2 to 10 mcg/min</li></ul>

## Sinus Tachycardia

Sinus tachycardia occurs when the SA node is firing at a rate that is faster than normal for a person's age. The rate is generally 101 to 150 bpm. The key to sinus tachycardia is that all components of a normal ECG are present, P wave, QRS complexes, and T wave. Sinus tachycardia generally starts and stops gradually. There is often a cause such as pain, fever, or agitation that can be identified and treated.



## Supraventricular Tachycardia

Supraventricular Tachycardia (SVT) includes any rhythm that begins above the bundle branches. This includes rhythm that begins in the SA node, atrial tissue, or the AV junction. Since the rhythms arise from above the bundle branches, they are characterized by narrow QRS complexes. A supraventricular tachycardia is not the name of a specific arrhythmia. It is a term used to describe a category of regular arrhythmias that cannot be identified more accurately because they have indistinguishable P waves due to their fast rate – usually greater than 150 bpm. The P waves are often indistinguishable because they run into the preceding T waves. The most common SVT rhythms are atrial tachycardia and junctional tachycardia, although Sinus Tachycardia and Atrial Flutter can sometimes also fit into their category with indistinguishable P waves.



*Treatment Question #1 – Stable vs. Unstable*

***If Unstable – Cardiovert***

*If Stable, answer question #2      Treatment*

*Questions #2 – Regular vs. Irregular Rhythm*

*Regular (SVT or Junctional) = Vagal maneuvers*

***Adenosine (1<sup>st</sup> dose = 6mg)***

***Adenosine (2<sup>nd</sup> dose = 12mg)***

*Irregular (A---Fib, A---Flutter, Multi---focal A---Tach) =*

*Calcium Channel Blockers or Beta Blockers*

***A*** = A---fib, A---Flutter

***B*** = Beta Blockers

***C*** = Calcium Channel Blockers (usually used 1<sup>st</sup> to slow the rate)



## FYI 2010 Guidelines

*NO ATROPINE DURING ASYSTOLE  
or PEA*

*Although there is no evidence that atropine has a detrimental effect during bradycardic or asystolic cardiac arrest, routine use of atropine during PEA or asystole is unlikely to have a therapeutic benefit. **The AHA removed atropine from the Cardiac Arrest Algorithm.***

*Interruption of chest compression to conduct a rhythm check should not exceed 10 seconds.*

*Available scientific studies demonstrate that in the absence of mitigating factors, prolonged resuscitative efforts are unlikely to be successful. The final decision to stop resuscitative efforts can never be as simple as an isolated time interval.*

## Ventricular Fibrillation

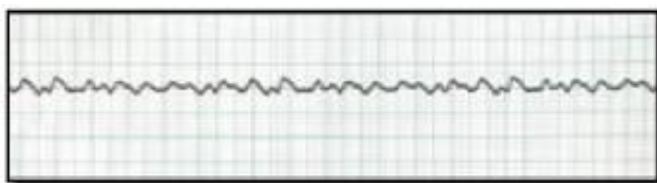
Ventricular Fibrillation (V---Fib or VF) is the most common rhythm that occurs immediately after cardiac arrest. In this rhythm, the ventricles quiver and are unable to uniformly contract to pump blood. It is for this reason that early defibrillation is so imperative. A victim's chance of survival diminishes rapidly over time once the heart goes into V---Fib; therefore, each minute counts when initiating defibrillation.

When defibrillating, heart stops  
hoping that the heart is viable for  
normal pacemaker to initiate a

There are two types of VF, fine and course. Course VF usually occurs immediately after a cardiac arrest and has a better prognosis with defibrillation. Fine VF has waves that are nearly flat and look similar to asystole. Fine VF often develops after more prolonged cardiac arrest and is much more difficult to correct.



Course VF



Fine VF

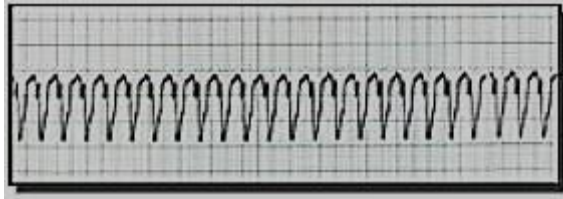




## Ventricular Tachycardia

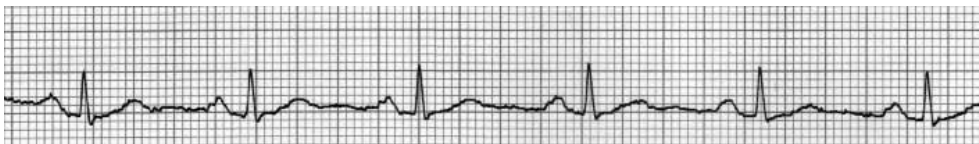
- Stable vs Unstable
- Pulse vs No Pulse

Ventricular Tachycardia (VT) can present itself with or without a pulse. When a VT is present and the victim has no pulse, the treatment is the same as the VF. High dose shocks for defibrillation will give the best chance for converting the patient out of pulseless VT.



## Pulseless Electrical Activity

Pulseless Electrical Activity (PEA) occurs when the heart is beating and has a rhythm, it can be any rhythm, but the patient does not have a pulse. Always treat the patient, not the rhythm.



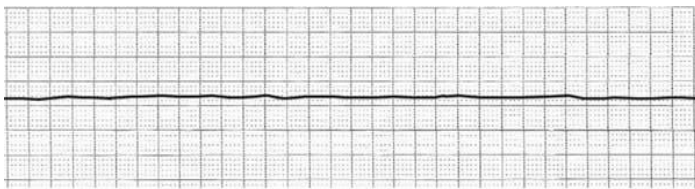
1. Problem or Possible correctable causes (H's & T's)
2. Epinephrine 1mg 1:10,000 – give to anyone WITHOUT a pulse

In order to treat pulseless rhythm, bradycardia, or tachycardia, identification of the possible underlying causes is essential.



## Asystole

Asystole is when there is no detectable cardiac activity on EKG. It may occur immediately after cardiac arrest or may follow VF or PEA. Asystole may also follow a third degree heart block. Treatment of asystole is the same as PEA. The American Heart Association recommends that if a patient is in sustained Asystole for 15 minutes, it is reasonable to call the code, but involve the family in the decision if they are available.



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

## Confirming Asystole

- Give priority to IV/IO access. Do not routinely insert an advanced airway unless ventilations with a bag mask are ineffective. Do not interrupt CPR while establishing IV or IO access.

## Terminating Resuscitation Efforts

If rescuers cannot rapidly identify a reversible cause and the patient fails to respond to the BLS and ACLS Surveys and subsequent interventions, termination of all resuscitative efforts should be considered.

The decision to terminate resuscitative efforts rests with the treating physician in the hospital and is based on consideration of many factors, including:

- Time from collapse to CPR
- Time from collapse to first defibrillation attempt
- Comorbid disease
- Prearrest state
- Initial arrest rhythm
- Response to resuscitative measures

None of these factors alone or in combination is clearly predictive of outcome. However, the duration of resuscitative efforts is an important factor associated with poor outcome. The chance that the patient will survive to hospital discharge and be neurologically intact diminishes as resuscitation time increases. Stop the resuscitation attempt when you determine with a high degree of certainty that the patient will not respond to further ACLS.



## Application of the Immediate Post-Cardiac Arrest Care Algorithm

To protect the brain and other organs, the resuscitation team should induce therapeutic hypothermia in adult patients who remain comatose (lack of meaningful response to verbal commands) with ROSC after out-of-hospital VF Cardiac Arrest.

- Healthcare provider should cool patients to a target temperature of 32C to 34 C for a period of 12 to 24 hours.
- In comatose patients who spontaneously develop a mild degree of hypothermia (>32C) after resuscitation from cardiac arrest, avoid active rewarming during the first 12 to 24 hours after ROSC.
- Therapeutic hypothermia is the only intervention demonstrated to improve neurologic recovery after cardiac arrest.
- Induced hypothermia should not affect the decision to perform PCI, because concurrent PCI and hypothermia are reported to be feasible and safe.

### Issues to anticipate during Therapeutic Hypothermia:

1. **Hypokalemia** (due both to intracellular shift and cold diuresis). Will at least partially correct during rewarming due to ion shift, so do NOT aggressively replace potassium during cooling (replace when K < 3.4 mEq/L, recheck).
2. **Magnesium, Calcium and Phosphate** may also need replacement due to cold diuresis.
3. Consider EEG if neuromuscular blockers (paralysis) required, as risk of **seizure** during hypothermia. If shivering occurs, try narcotics for shivering control before using neuromuscular blockers.
4. Anticipate **Brady dysrhythmias** during hypothermia.
5. **Blood pressure** may be elevated during hypothermia (vasoconstriction), or may decrease secondary to cold diuresis. Anticipate hypotension during re-warming secondary to vasodilation.
6. **Hyperglycemia** is common during hypothermia. Vasoconstriction may cause finger-stick accuchecks to be inaccurate.
7. Rapid rewarming may lead to **SIRS and hyperthermia**; **avoid warming more than 0.5 degrees C per hour, do not overshoot 36.5 C.**
8. Anticipate **ileus** during hypothermia. Incidental elevations of amylase/lipase have also been reported.
9. Do NOT administer any **medications labeled "do not refrigerate"** to patient. This includes **Mannitol**, which may precipitate if cooled.
10. **The most serious complications of hypothermia are Infection and Coagulopathy!**



## ACUTE STROKE

It refers to acute neurologic impairment that follows interruption in blood supply to a specific area of the brain.

### Two types of Strokes

- Ischemic Stroke – accounts for 87% of all strokes and is usually caused by an occlusion of an artery to a region of the brain
- Hemorrhagic Stroke – accounts for 13% of all strokes and occurs when a blood vessel in the brain suddenly ruptures into the surrounding tissue.

**ALL PATIENTS ARE CONSIDERED NPO**

Before giving anything (medication or food) by mouth, you **MUST** perform bedside swallow screening.

The goal of stroke care is to minimize brain injury and maximize the patient's recovery.

- Rapid Recognition and reaction to stroke warning signs
- Rapid EMS dispatch
- Rapid EMS system transport and prearrival notification to the receiving hospital
- Rapid diagnosis and treatment in the hospital

### Foundational Facts

The 8D's of Stroke Care

The 8 D's of Stroke Care highlight the major steps of diagnosis and treatment of stroke and key points at which delays can occur:

- **Detection:** Rapid recognition of stroke systems
- **Dispatch:** Early activation and dispatch of EMS by 911
- **Delivery:** Rapid EMS identification, management, and transport
- **Door:** Appropriate triage to stroke center
- **Data:** Rapid triage, evaluation, and management within the ED
- **Decision:** Stroke expertise and therapy selection
- **Drug:** Fibrinolytic therapy, intra-arterial strategies
- **Disposition:** Rapid admission to the stroke unit or critical Care Unit

Patients with stroke who require hospitalization should be admitted to a stroke unit when a stroke unit with a multidisciplinary team experienced in managing stroke is available within a reasonable transport interval.

**The goal of the stroke team, emergency physician, or other experts should be to assess the patient with suspected stroke within 10 minutes of arrival in the ED: "TIME IS BRAIN"**

The CT scan should be completed within 25 minutes of the patient's arrival in the ED and should be read within 45 minutes from performance: "TIME IS BRAIN"



## Cincinnati Prehospital Stroke Scale

Test	Findings
<b>Facial Droop:</b> Have patient show teeth or smile	<b>Normal</b> – Both sides of face move equal <b>Abnormal</b> – one side of face does not move as well as the other side
<b>Arm Drift:</b> Patient closes eyes and extends both arms straight out, with palms up, for 10 seconds	<b>Normal</b> – both arms move the same or both arms do not move at all (other findings, such as pronator drift, may be helpful) <b>Abnormal</b> – one arm does not move or one arm drifts down compared with the other.
<b>Abnormal Speech:</b> Have patient say “you can’t teach an old dog new tricks”	<b>Normal</b> – patient uses correct words with no slurring <b>Abnormal</b> – patient slurs words, uses the wrong words, or is unable to speak
<i>Interpretation: If any 1 of these 3 signs is abnormal, the probability of a stroke is 72%. The presence of all 3 findings indicate that the probability of stroke is &gt;85%.</i>	

The American Heart Association strongly promotes knowledge and proficiency in BLS, ACLS, and PALS and has developed instructional materials for this purpose. Use this materials in an educational course does not represent course sponsorship by the American Heart Association.

### *Credits:*

*All diagram and lingo taken from  
American Heart Association  
textbooks: ACLS for Healthcare  
Providers 2010)*



# ACLS Study Guide 2010 Revised August 2013

See [www.heart.org/eccstudent](http://www.heart.org/eccstudent). The code is found in the ACLS Provider Manual page ii.

The ACLS Provider exam is 50-multiple-choice questions. Passing score is 84%. Student may miss 8 questions. For students taking ACLS for the first time or renewing students with a current card, exam remediation is permitted should student miss more than 8 questions on the exam. Viewing the ACLS book ahead of time with the online resources is very helpful. The American Heart Association link is [www.heart.org/eccstudent](http://www.heart.org/eccstudent) and has an ACLS Precourse Self-Assessment, supplementary written materials and videos. **The code for the online resources is on the ACLS Provider Manual page ii.** Basic Dysrhythmias knowledge is required in relation to asystole, ventricular fibrillation, tachycardias in general and bradycardias in general. Student does not need to know the ins and outs of each and every one. For Tachycardias student need to differentiate wide complex (ventricular tachycardia) and narrow complex (supraventricular tachycardia or SVT).

## BLS Overview – CAB



Push Hard and Fast-Repeat every 2 minutes

Defibrillation is part of the BLS Survey

Anytime there is no pulse or unsure - COMPRESSIONS

### Elements of good CPR

- Rate-at least 100, at least 2 inches depth, recoil
- Compression depth at least 2 inches
- Minimize interruptions (less than 10 seconds)
- Avoid excessive ventilation
- Switch compressors every 2 min or 5 cycles
- Compressions during VF produces a small amount of blood flow to the heart.
- If AED doesn't promptly analyze rhythm: compressions.
- Fatal mistake to interrupt compressions – can compress while charging.
- If you see an organized rhythm, after 2 minutes of CPR have a team member assess carotid pulse.

## Stroke

- Cincinnati Pre-Hospital Stroke Scale
- Facial Droop, Arm Drift, Abnormal Speech
- rtPA can be given within 3 hours from symptom onset
- Important to transport patient to an appropriate hospital with CT capabilities. If CT not available divert to the closest hospital (i.e. 15 min away) with CT

## Acute Coronary Syndromes

Vital signs, O<sub>2</sub>, IV,

12 Lead for CP, epigastric pain, or rhythm change

Recommended dose of aspirin – 160 – 325 mg

## Bradycardia

Need to assess stable versus unstable. If stable, monitor, observe, and obtain expert consultation

**If unstable . . .**

- Atropine 0.5mg IV. Can repeat Q 3-5 minutes to 3 mg Maximum dose is 3mg (Including heart blocks)
- If Atropine ineffective
  - Dopamine infusion (2-10mcg/kg/min)
  - Epinephrine infusion (2-10mcg/min)
  - Transcutaneous pacing

## Tachycardia with a Pulse

- If unstable (wide or narrow)-go straight to synchronized cardioversion (sedate first)
- If stable narrow complex
  - Obtain 12 lead
  - Vagal maneuvers
  - Adenosine 6mg RAPID IVP, followed by 12mg

## Pulseless Rhythms - Cardiac Arrest - CPR

Oxygen, monitor, IV, Fluids, Glucose Check

- 2 minute cycles of compressions, shocks (if VF/VT), and rhythm checks
- Epi 1 mg every 3-5 minutes (preferred method peripheral IV) or 1 time dose of Vasopressin 40 IU
- Infuse IV/IO drugs rapidly during compressions
- NO MORE ATROPINE for Asystole and PEA
- Ventilations •30:2 Ratio
- Rescue breathing •1 breath every 5-6 sec
- If advanced airway •8-10 ventilations/minute

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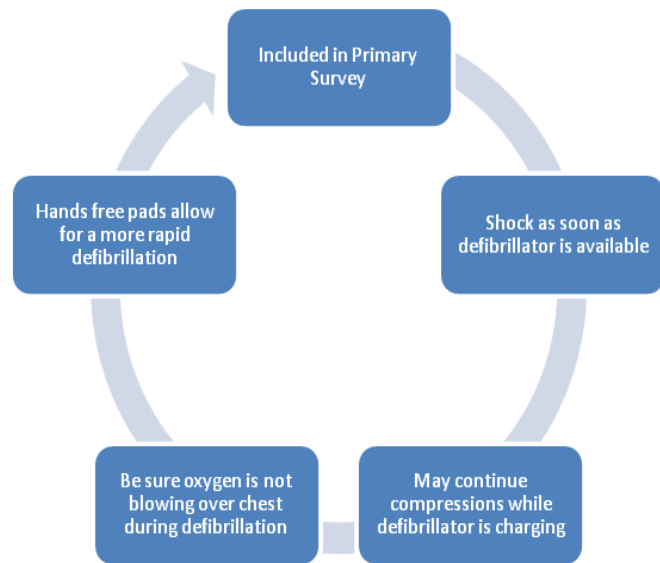
## Shockable Rhythms

- Ventricular Fibrillation (VF)
  - Ventricular Tachycardia (VT) without pulse
- Biphasic: 120-200J    Monophasic: 360J  
Refractory    Amiodarone 300 mg, then 150 mg

## Non-Shockable Rhythms

- PEA                      -Asystole

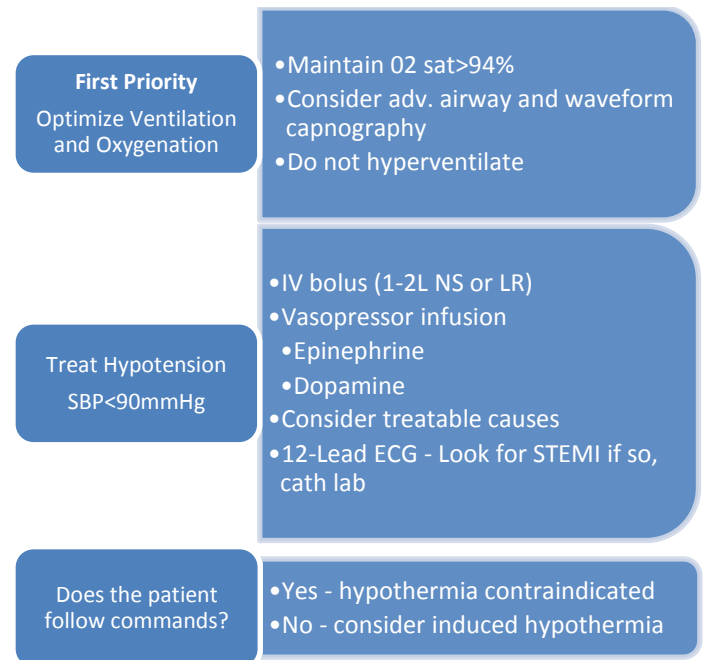
## Defibrillation



## Return of Spontaneous Circulation (ROSC)

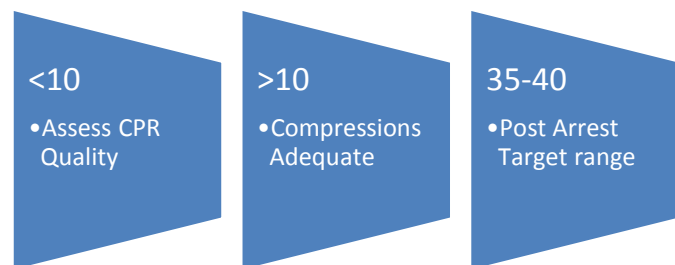
### Post Resuscitation Care

- 12 Lead
- Hypothermia if DOES NOT follow verbal commands (32 – 34 degrees C)



## Waveform Capnography in ACLS (PETCO2)

- Allows for accurate monitoring of CPR
- Most reliable indicator for ETT placement



## Treat Reversible Causes (H's and T's)

- Hypoxia or ventilation problems
- Hypovolemia
- Hypothermia
- Hypo /Hyper kalemia
- Hydrogen ion (**acidosis**)
- Tamponade, cardiac
- Tension pneumothorax
- Toxins – poisons, drugs
- Thrombosis – coronary (AMI) – pulmonary (PE)

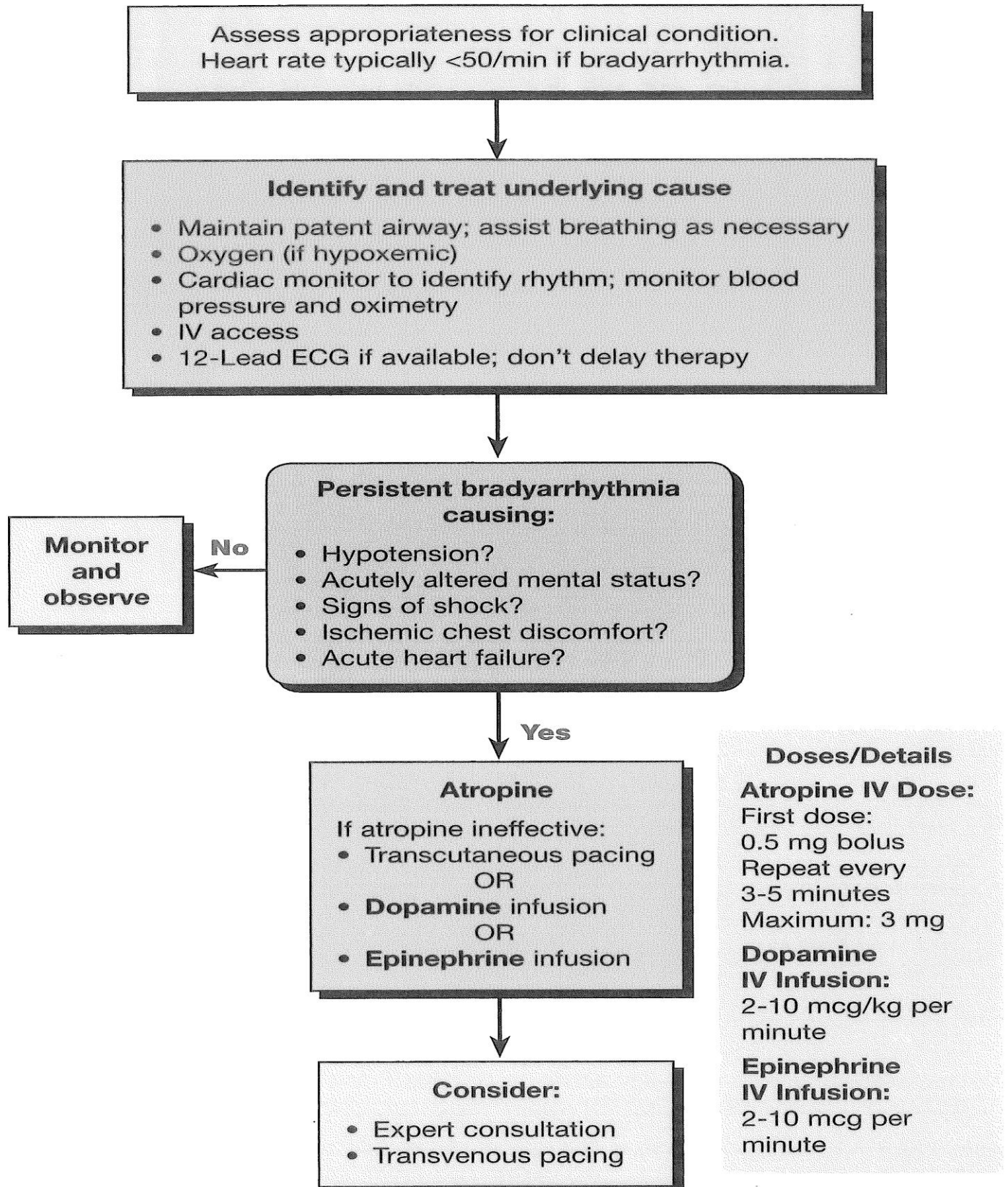
## Points to Ponder

- COMPRESSIONS are very important
- ROSC – return of spontaneous circulation. With out of hospital arrest transfer to facility with PCI
- Simple airway maneuvers, such as a head-tilt, may help
- The Medical Emergency Teams (MET)/ Rapid Response Teams (RRT) can identify and treat pre-arrest situations
- Consider terminating efforts after deterioration to asystole and prolonged resuscitation time and/or safety threat to providers
- OPA – measure from corner of mouth to angle of the mandible
- Minimal systolic blood pressure is 90
- IV fluids 1 to 2 liters NS, Crystalloid, Isotonic
- Don't suction for more than 10 seconds
- Cricoid pressure is not recommended for routine use during cardiac arrest
- High levels of oxygen can cause oxygen toxicity

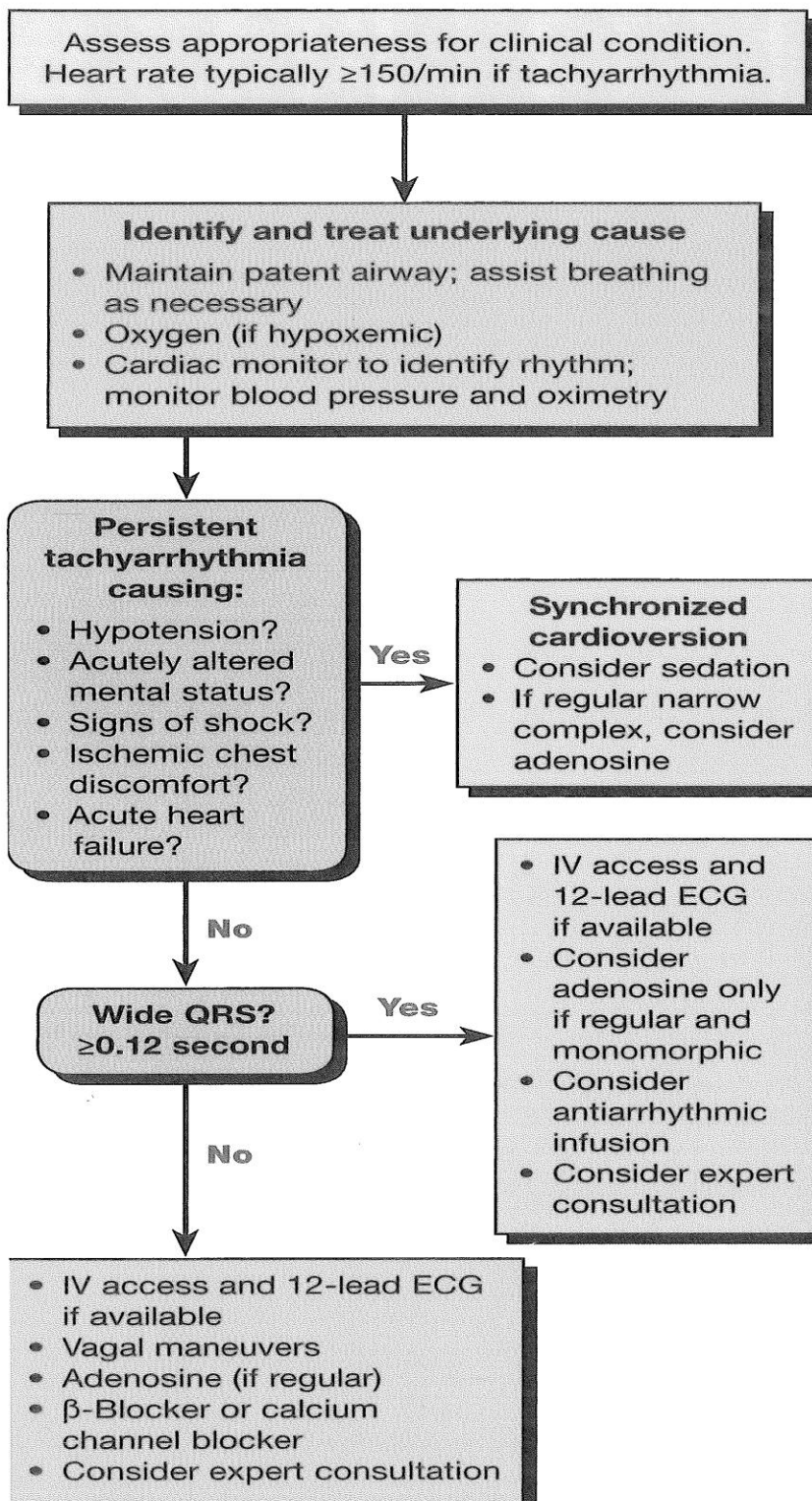
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## Bradycardia With a Pulse Algorithm



# Tachycardia With a Pulse Algorithm



## Doses/Details

### Synchronized Cardioversion

Initial recommended doses:

- Narrow regular: 50-100 J
- Narrow irregular: 120-200 J biphasic or 200 J monophasic
- Wide regular: 100 J
- Wide irregular: defibrillation dose (NOT synchronized)

### Adenosine IV Dose:

First dose: 6 mg rapid IV push; follow with NS flush.  
Second dose: 12 mg if required.

### Antiarrhythmic Infusions for Stable Wide-QRS Tachycardia

#### Procainamide IV Dose:

20-50 mg/min until arrhythmia suppressed, hypotension ensues, QRS duration increases  $>50\%$ , or maximum dose 17 mg/kg given. Maintenance infusion: 1-4 mg/min. Avoid if prolonged QT or CHF.

#### Amiodarone IV Dose:

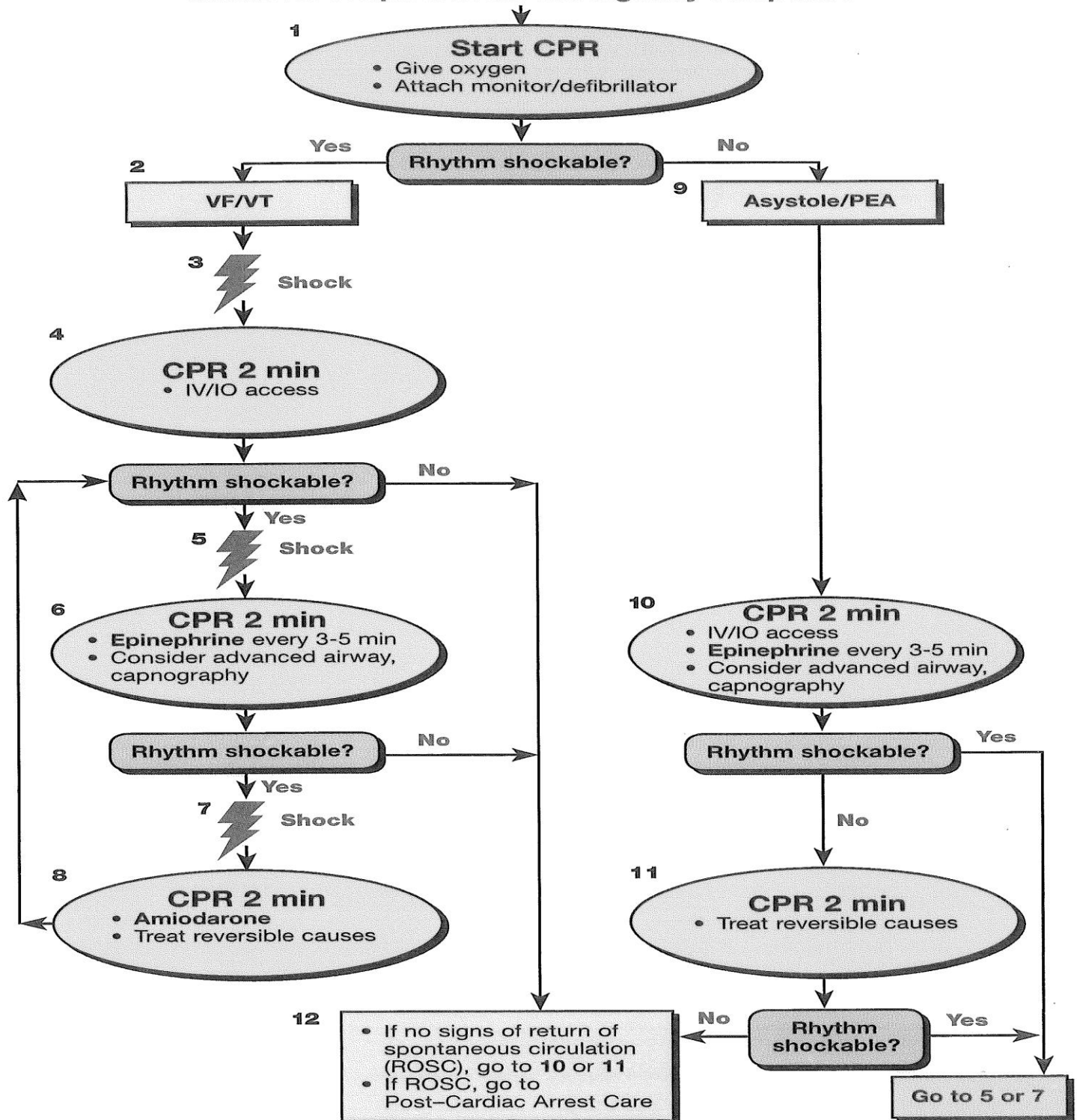
First dose: 150 mg over 10 minutes. Repeat as needed if VT recurs. Follow by maintenance infusion of 1 mg/min for first 6 hours.

#### Sotalol IV Dose:

100 mg (1.5 mg/kg) over 5 minutes. Avoid if prolonged QT.

# Cardiac Arrest Algorithm

Shout for Help/Activate Emergency Response





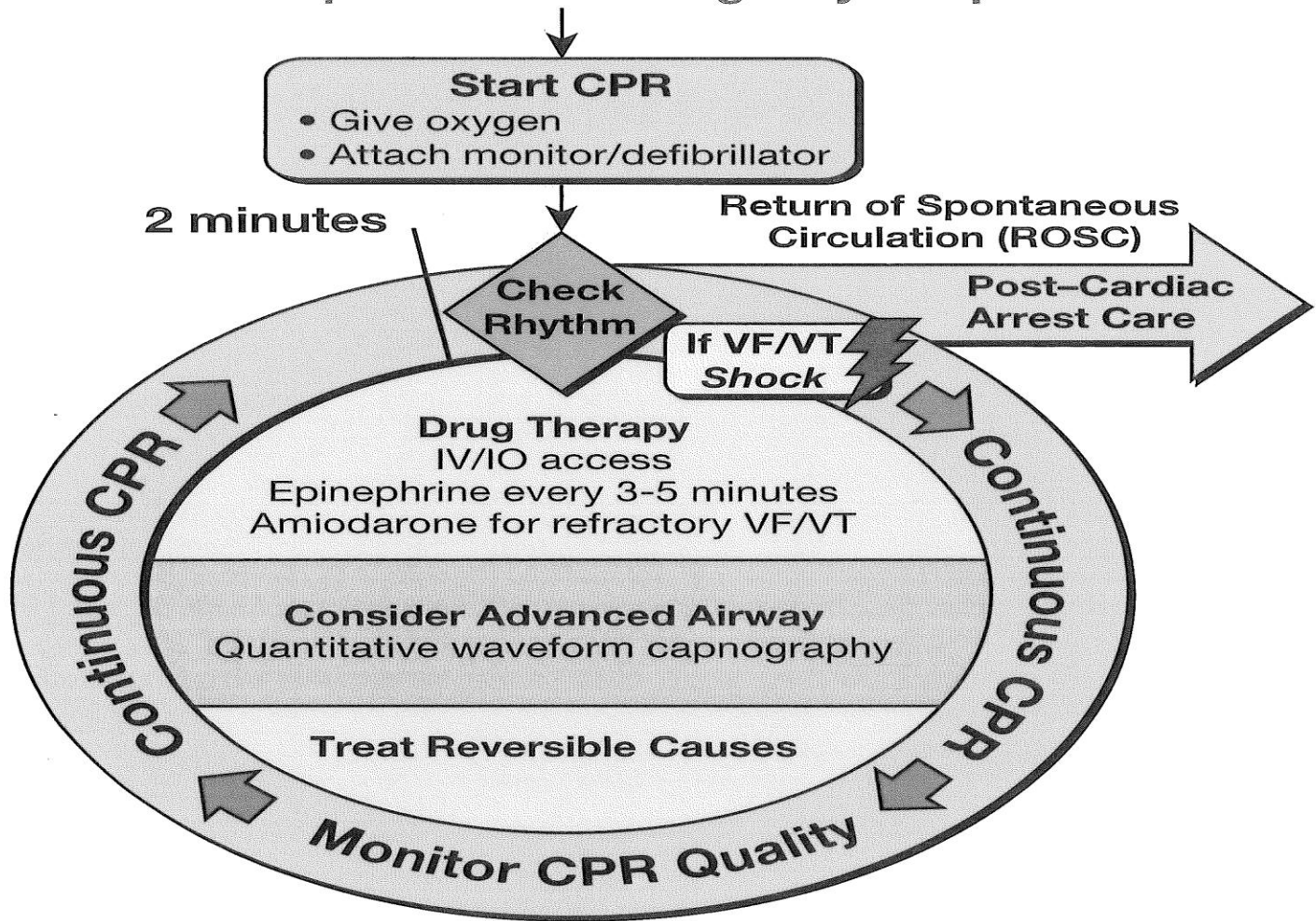


# ACLS

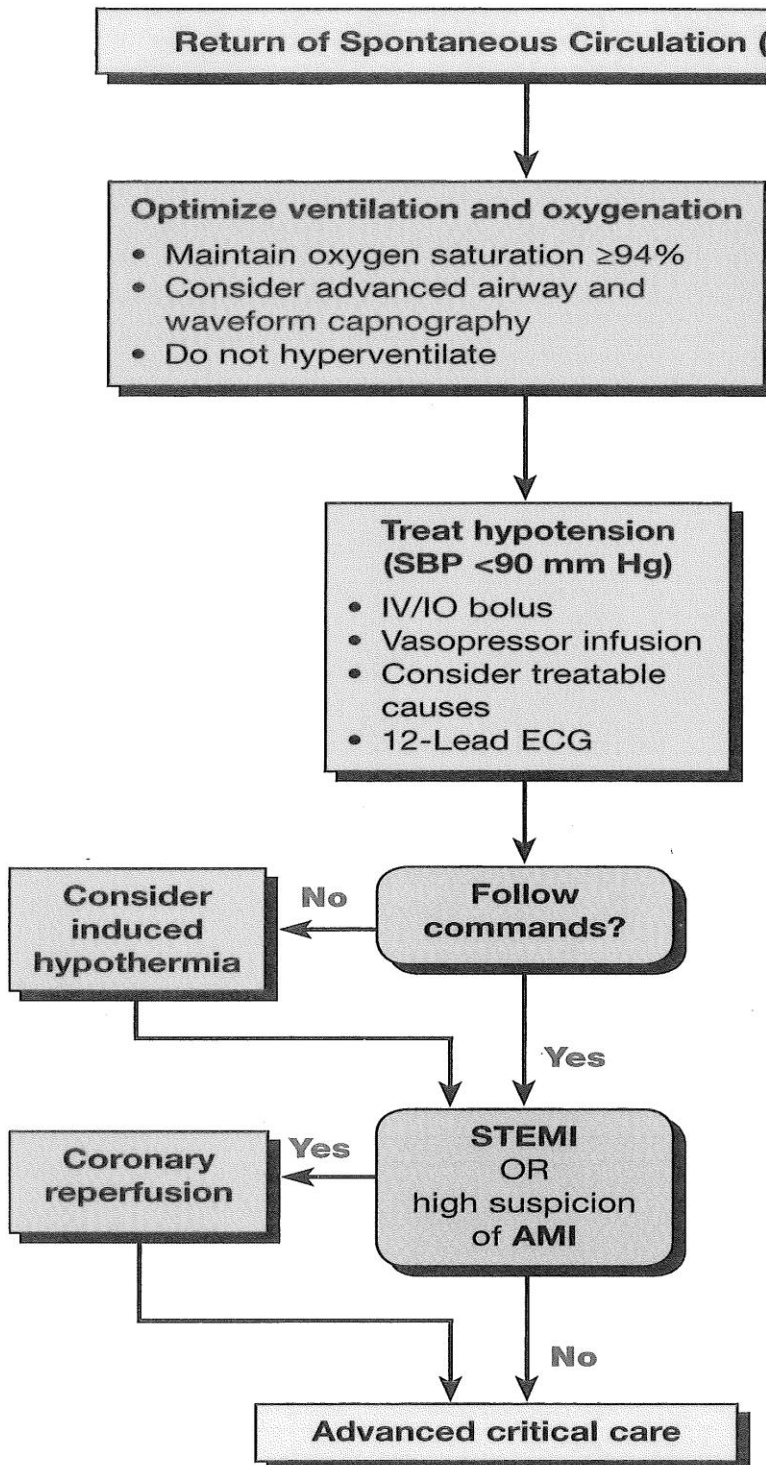
## Cardiac Arrest, Arrhythmias, and Their Treatment

### Cardiac Arrest Circular Algorithm

Shout for Help/Activate Emergency Response



# Immediate Post-Cardiac Arrest Care Algorithm



## Doses/Details

### Ventilation/Oxygenation

Avoid excessive ventilation. Start at 10-12 breaths/min and titrate to target PETCO<sub>2</sub> of 35-40 mm Hg. When feasible, titrate FIO<sub>2</sub> to minimum necessary to achieve SpO<sub>2</sub>  $\geq 94\%$ .

### IV Bolus

1-2 L normal saline or lactated Ringer's. If inducing hypothermia, may use 4°C fluid.

### Epinephrine IV Infusion:

0.1-0.5 mcg/kg per minute (in 70-kg adult: 7-35 mcg per minute)

### Dopamine IV Infusion:

5-10 mcg/kg per minute

### Norepinephrine

#### IV Infusion:

0.1-0.5 mcg/kg per minute (in 70-kg adult: 7-35 mcg per minute)

### Reversible Causes

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

# ECG REVIEW

1



Rhythm SINUS TACH

2



a. Rhythm Sinus Rhythm

3



Rhythm SVT



4

a. Rhythm : Atrial Flutter

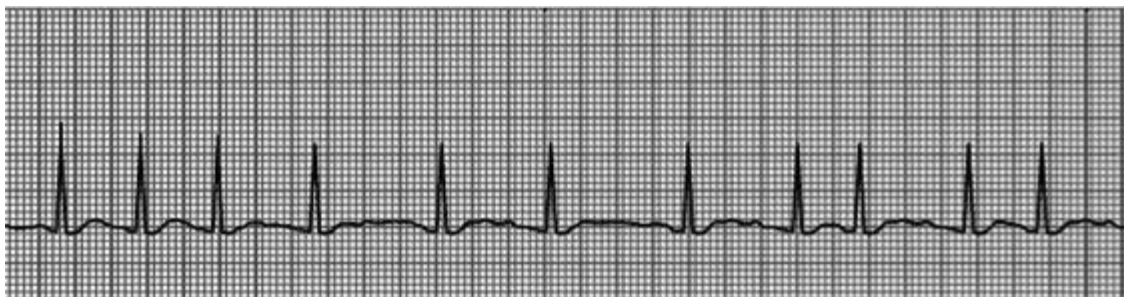
5



a. Rhythm: Sinus Brady



6



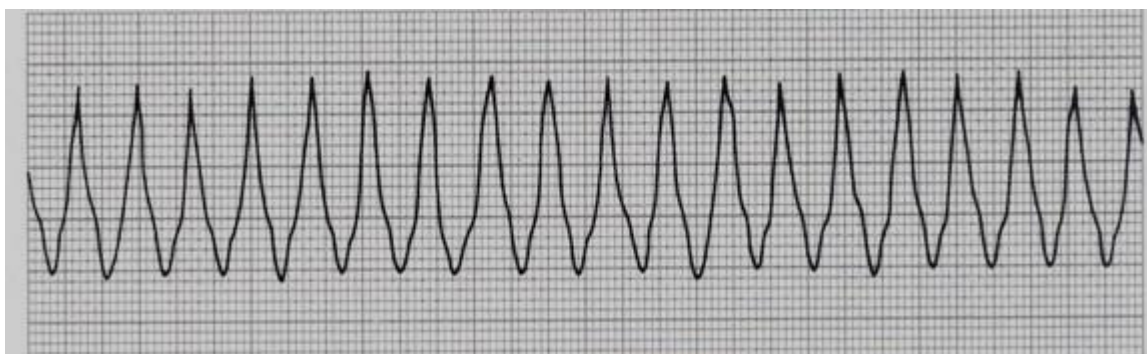
**Rhythm : Atrial Fibrillation ( No regular Ps, variable rate and fibrillatory baseline)**

7



**Rhythm : Junctional Rhythm.~ 60 bpm**

8



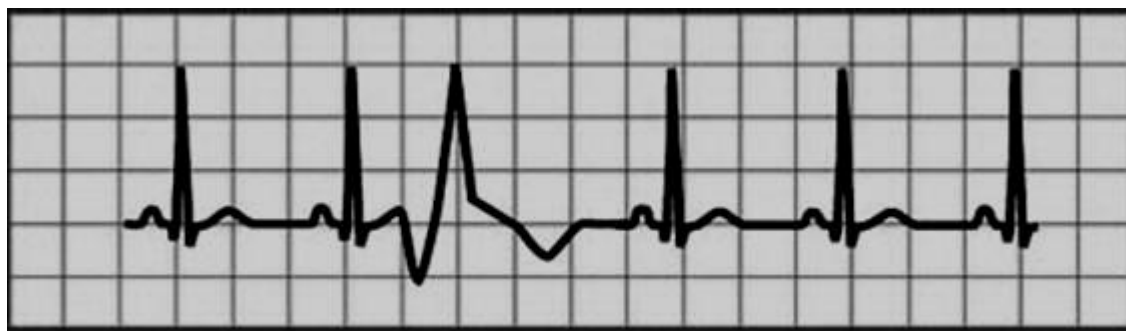
**Rhythm : Monomorphic V-Tach**

9



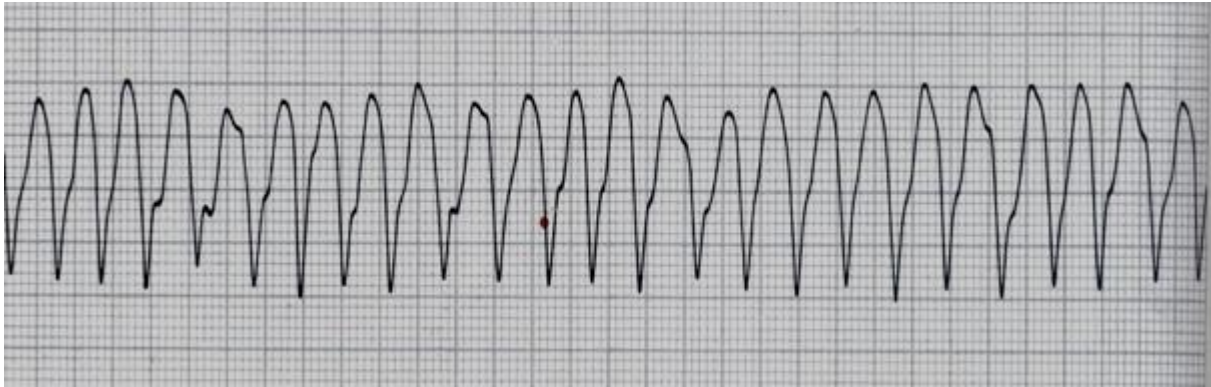
**Rhythm : Sinus Rhythm W/ multifocal PVC's**

10



**Rhythm: Sinus Rhythm W/ PVC**

11



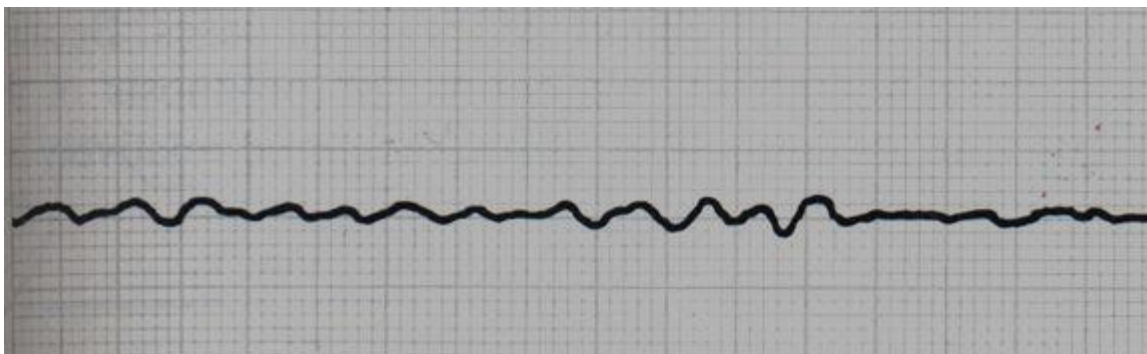
**Rhythm : Polymorphic V-Tach (Probably normal QT)**

12



**a. Rhythm: 2nd Degree type II**

13



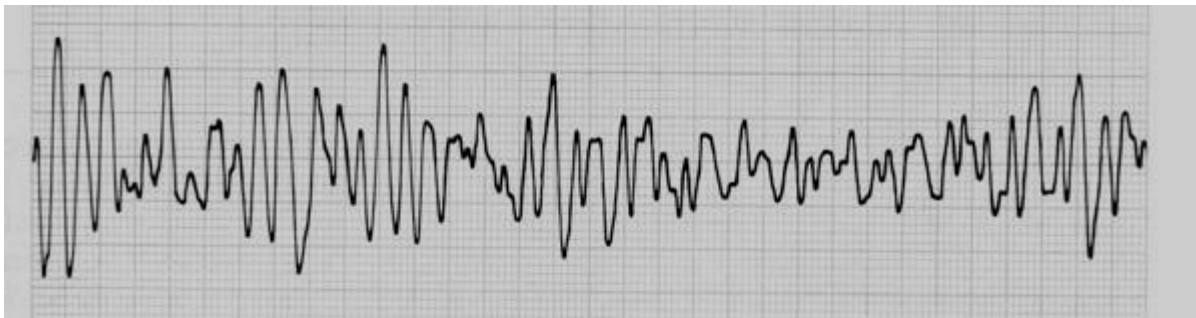
**Rhythm : Fine V-Fib**

14



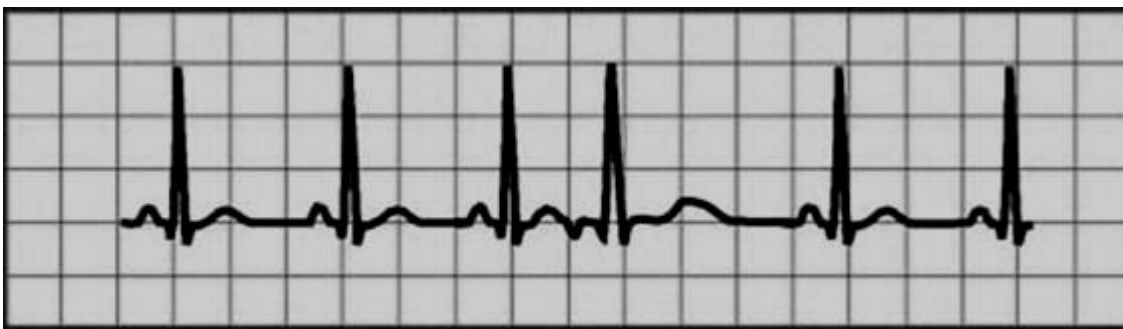
a. Rhythm : 1 Degree AVB

15



**Rhythm: Coarse V-Fib**

16



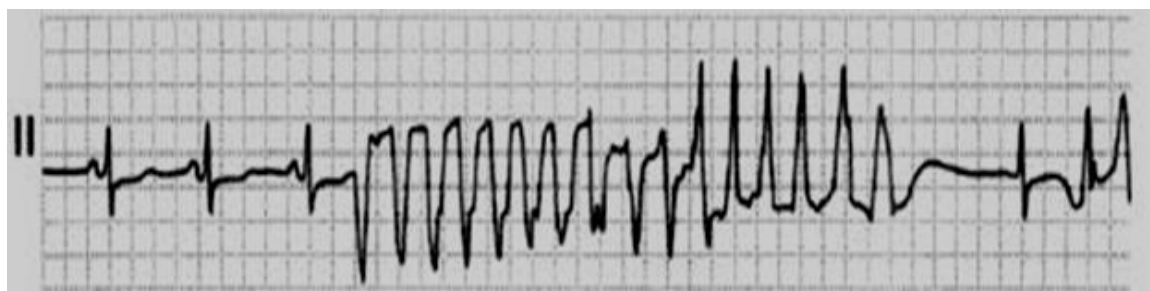
**Rhythm : Sinus Rhythm W/PAC**

17



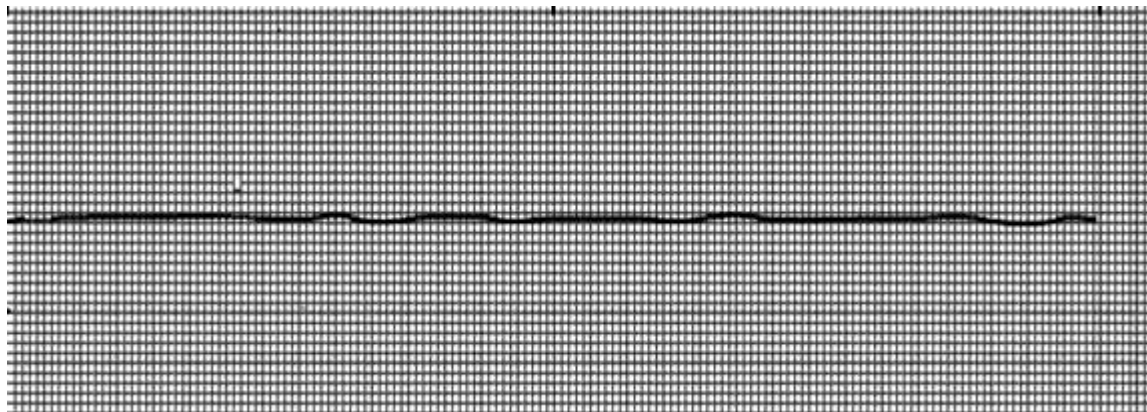
**Rhythm: 2nd Degree type I**

18



**Rhythm: Polymorphic V-Tach / Torsades de Points**

19



Rhythm: Asystole

20



Rhythm: 3rd Degree



## Doses/Details for the Cardiac Arrest Algorithms

### CPR Quality

- Push hard ( $\geq 2$  inches [5 cm]) and fast ( $\geq 100$ /min) and allow complete chest recoil
- Minimize interruptions in compressions
- Avoid excessive ventilation
- Rotate compressor every 2 minutes
- If no advanced airway, 30:2 compression-ventilation ratio
- Quantitative waveform capnography
  - If  $PETCO_2 < 10$  mm Hg, attempt to improve CPR quality
- Intra-arterial pressure
  - If relaxation phase (diastolic) pressure  $< 20$  mm Hg, attempt to improve CPR quality

### Return of Spontaneous Circulation (ROSC)

- Pulse and blood pressure
- Abrupt sustained increase in  $PETCO_2$  (typically  $\geq 40$  mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

### Shock Energy

- **Biphasic:** Manufacturer recommendation (eg, initial dose of 120-200 J); if unknown, use maximum available. Second and subsequent doses should be equivalent, and higher doses may be considered.
- **Monophasic:** 360 J

### Drug Therapy

- **Epinephrine IV/IO Dose:**  
1 mg every 3-5 minutes
- **Vasopressin IV/IO Dose:**  
40 units can replace first or second dose of epinephrine
- **Amiodarone IV/IO Dose:**  
First dose: 300 mg bolus.  
Second dose: 150 mg.

### Advanced Airway

- Supraglottic advanced airway or endotracheal intubation
- Waveform capnography to confirm and monitor ET tube placement
- 8-10 breaths per minute with continuous chest compressions

### Reversible Causes

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



## BLS for Healthcare Provider – STUDY GUIDE

	Adult (puberty - above)	Child (1 yr - puberty)	Infant (< 1 yr)
<b>Determine response</b> *	Tap and shout - look for normal or not normal breathing	Tap and shout - look for normal or not normal breathing	Flick feet - look for normal or not normal breathing
<b>Activate EMS</b> *	Immediately - Call for help/AED	<b>Witnessed</b> - Immediately - Call for help/AED <b>Unwitnessed</b> - perform 5 cycles of CPR first	<b>Witnessed</b> - Immediately - Call for help/AED <b>Unwitnessed</b> - perform 5 cycles of CPR first
<b>Check Pulse (C)</b> *	<b>5-10 secs, no pulse</b> begin CPR with compressions	<b>5-10 secs, no pulse or pulse &lt; 60 bpm</b> w/poor perfusion, begin CPR with compressions	<b>5-10 secs, no pulse or pulse &lt; 60 bpm</b> w/poor perfusion, begin CPR with compressions
<b>Open Airway (A)</b> *	Head tilt-chin lift- No trauma Modified jaw thrust- Trauma	Head tilt-chin lift- No trauma Modified jaw thrust- Trauma	Head tilt chin lift / neutral sniff position
<b>Breathing (B)</b> *	Give 2 breaths, look for chest rise	Give 2 breaths, look for chest rise	Give 2 puffs, look for chest rise
<b>Ratio</b> (compression to breathing)	30:2 (1 or 2 Rescuer)	30:2 (1 rescuer) or <b>15:2 (2 rescuer)</b>	30:2 (1 rescuer) or <b>15:2 (2 rescuer)</b>
<b>Depth of Compression</b> *	<b>At least 2 inches</b>	<b>At Least 1/3 the depth of the chest (approx. 2 inches)</b>	<b>At least 1/3 the depth of the chest (approx. 1 1/2 inches)</b>
<b>Rate of Compressions</b> *	100 compressions/min	100 Compressions/min	100 Compressions/min
<b>AED / Defibrillation</b> *	Use AED asap; resume compressions (CAB) immediately after each shock. 8 yrs and older, adult pad	Use AED asap; resume compressions (CAB) immediately after each shock. 1-8 yrs or < 55 lbs, pediatric pad	Use AED asap; resume compressions (CAB) immediately after each shock. < 1 yr, pediatric pad (manual defib preferred)
<b>Rescue Breathing</b> *	<b>1 breath every 5 seconds</b>	<b>1 breath every 3 seconds</b>	<b>1 breath every 3 seconds</b>
<b>Advanced Airway CPR</b> *	Asynchronous CPR - Do not stop compressions while breaths are given every <b>6-8 secs (8-10 breaths/min)</b> .		

**Additional Information**

Agonal Gasps are "Death Breaths" and NOT considered normal breathing, check for a pulse and begin CPR (CAB).

Do not reassess unless, advanced life support is on scene or victim shows signs of life.

Recoil - Take weight or pressure off the chest and allow chest to return to normal position.

Witnessed - unresponsiveness was witnessed by the health care provider, NOT by a family member or bystander.