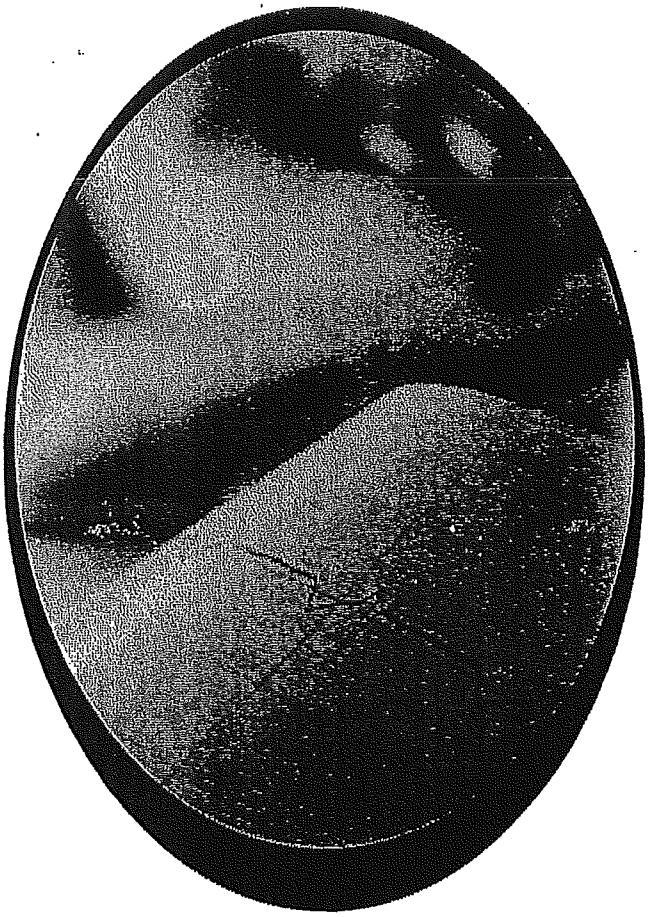
Fast Response

School of Health Care Education

ACLS Study Guide



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Fast Response
School of Health Care Education

Dear ACLS Student:

Please Read this letter carefully

This letter is to confirm your registration in the Advanced Cardiac Life Support (ACLS) course.

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 (AHA). Students are expected to attend and participate in the entire course.

As you are probably aware, changes were made in the AHA's Guidelines for CPR and Emergency Cardiovascular Care in October of 2010. Implementation of these guidelines by Training Centers began April 1, 2011. We are anticipating roll out of the new ACLS training materials in May to June of 2011.

Since these training materials are not yet published, we will be utilizing interim materials. **You will be required to bring the following to class:**

1. 2010 ECC Handbook (2010 algorithms needed during course)
http://www.emergencystuff.com/901000.html

2. 2010 Guidelines Highlights available at
http://static.heart.org/eccguidelines/guidelines-highlights.html

3. 2005 ACLS Provider Manual if you have one from a previous course

The ACLS Course does not teach CPR, ECG rhythm identification, pharmacology, or ACLS algorithms. **The course format requires all students to be fully prepared prior to coming to class. If you do not review CPR, understand ECG's or the pharmacology information in the Pre-course Assessment, it is unlikely that you can successfully complete the ACLS Course.** The Pre-course Assessment is included on the Student CD which is included in the 2005 ACLS Provider Manual. If you do not have a 2005 ACLS Provider Manual, we will gladly provide you with a Pre-course Assessment. Please let us know so we can provide you with one.

Fast Response offers the AHA's "ECG & Pharmacology" course as a preparatory class for ACLS; please call us for more information.

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Pre-course Requirements

The ACLS Course is designed to teach you the lifesaving skills required to be both a team member and a team leader in in-hospital and out-of-hospital settings. Because the ACLS Course covers extensive material in a short time, **you will need to prepare for the course beforehand.** You should prepare for the course by reviewing the following:

1. The 2010 ECC Handbook (2010 algorithms needed during course) http://www.emergencystuff.com/901000.html

2. The 2010 Guidelines Highlights available at. http://static.heart.org/eccguidelines/guidelines-highlights.html

You will not be taught how to interpret ECGs in the course, nor will you be taught details about ACLS pharmacology.

1. **Be prepared to pass the adult 1-rescuer CPR with AED skills test. Please note that we do not renew your BLS card based on this CPR test, which is a requirement of the ACLS course itself. All renewal (1-day) participants must bring their current American Heart Association-issued ACLS card to class. There are no exceptions for expired cards.**

2. You will not be taught how to perform CPR or use an AED during the course. You must know this in advance. Review and understand all BLS 2010 guidelines. You may review this using the information in The 2010 ECC Handbook and /or The 2010 Guidelines Highlights.

3. Be familiar with the ACLS algorithms so that you can apply them to scenarios. This information can be found in The 2010 ECC Handbook and /or The 2010 Guidelines Highlights. *Note*: the ACLS course does not present the details of each algorithm.

4. **Complete the Pre-course Assessment**. Use this assessment to identify areas where you need to increase your knowledge. If you need a copy

5. ACLS cards and Continuing Education Units (CEU's) will be issued at the end of the class.

What to Bring and What to Wear

You must bring your 2010 ECC Handbook to class as required by the AHA, your card will be held until you provide proof that you have the most current book. Please also bring your completed Pre-course Assessment to class.

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

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Please be aware:

Reschedule Policy

- **No refunds will be issued. All registrations are final.**
- You may reschedule your course by calling us at least 5 business days prior to your scheduled course date. **You will be charged a rescheduling fee of $25.**
- If you reschedule your course fewer than 5 business days prior to the course start date, **you will be charged 50% of the course fee.**
- **If you reschedule within fewer than 48 hours prior to the course start date, you will forfeit the entire course fee.**
- 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.

Lisa Dubnoff, R.N., EMT-P

Fast Response
School of Health Care Education

ALS Program Director

Dear Student,

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

1. Each student must have the **2010 American Heart Association ECC Handbook** available to them before, during, and after the course in order to comply with AHA guidelines. This book is available at http://www.emergencystuff.com/901000.html for a discounted rate. If you show up to your class without the required manual, there are two options:

2. If you are attending this class from a contracted hospital provider, you are required to obtain the 2010 ECC Handbook from your education department. If you failed to do this, you will be required to follow one of the above options.

The guidelines set forth by the AHA are very specific in how the class literature must be handled.

Thank you,
CEU Department
Fast Response School of Health Care Education

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ACLS Provider Manual Student CD FAQ

American Heart Association®
Learn and Live™

1. **I cannot access the ACLS Pre-course Self-Assessment Test or make the Self-Assessment Test work properly.**

   - Internet Explorer must be open before the CD is inserted. Remove the CD from the tray; close all other applications, then insert the CD.
   - If you have a pop-up blocker, remove the CD from the tray; re-insert the CD while holding down the "Ctrl" key so Macromedia Flash can run. OR you can go to My Computer > Right Click On the CD-ROM drive > Explore> Double Click on PC Start or MAC Start
   - Make sure you are using Internet Explorer 6.0 or higher (Not AOL, FireFox, Mozilla or Netscape)
   - Check to make sure Active X Controls are enabled by going to Internet Explorer> Tools> Internet Options> Security Tab> Custom Level> Active X Controls and Plug-ins> Enable
   - Check to make sure "Allow Active Content CDs to run on my Computer" is checked by going to Tools>Internet Options> Advanced Tab> Security
   - Download "**Adobe Flash Player**" from www.adobe.com if you do not have it already installed on your computer. Restart the computer after you have installed the Adobe Flash Player.

2. **I cannot play the CD more than "two, three, four times".**

   - Delete "Temp Files" Internet Explorer > Tools > Internet Options > General > Delete Files. Click on OK
   - Close other programs running in the background
   - Restart the Computer

3. **I cannot open any PDF files on the CD. What do I do?**

   - Make sure you have Adobe installed on your computer, otherwise download Adobe Acrobat Reader from www.adobe.com.

4. **I can't hear any sound. What do I do?**

   - Make sure the speakers are turned on and the volume is turned up.
   - Check the Volume and Mute settings on your computer. Make sure Mute is not checked, and adjust Volume as needed. There are multiple ways to check these settings:
     - Click on the speaker icon in your system tray.
     - Go to Start >Settings>Control Panel>Sounds and Audio Devices>Volume. Make sure Mute is not checked. Then go to Advanced. Adjust Volume if needed and make sure Mute is not checked.
     - Go to Start > Programs > Accessories > Entertainment > Volume Control.
   - Make sure the volume on the video clip is turned up. The Volume Control button is located at the bottom of the screen on the left.

American Heart Association
Learn and Live

American Heart Links

There are several resources available to you on the American Heart Association website at www.americanheart.org . Here are some helpful kinks:

- You can find statistics on cardiovascular diseases and risk factors at http://www.americanheart.org/presenter.jhtml?identifier=2007

- You can find out your risk for heart disease at http://www.americanheart.org/presenter.jhtml?identifier=3003500

- You can access information on the warning signs of heart attack and stroke at http://www.americanheart.org/presenter.jhtml?identifier=3053

- You can find out how to lead a healthy lifestyle at http://www.americanheart.org/presenter.jhtml?identifier=1200009

- You can also go to the Emergency Cardiovascular Care (ECC) website at http://www.americanheart.org/presenter.jhtml?identifier=3011764, where you can find out about other American Heart Association CPR or First Aid courses and even find a course in your area.

- To find any other topic, use the Heart and Stroke Encyclopedia at this link: http://www.americanheart.org/presenter.jhtml?identifier=10000056

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ACLS – Provider
Course Agenda
Day 1

0900-0930	Course Introductions Course overview Pre-course test review
0930-0940	BLS Primary and ALS Secondary; Video
0940-1000	Lecture; Importance of CPR
1000-1030	Lecture; EKG Review
1030-1040	Break
1040-1120	Respiratory Emergencies (Group 1) CPR with AED (Group 2)
1120-1200	Respiratory Emergencies (Group 2) CPR with AED (Group 1)
1200-1300	Lunch
1300-1335	Stroke; Video and Discussion
1335-1410	Resuscitation Team Concepts; Video and Discussion
1410-1420	Break
1420-1700	Learning Station; Pulseless Arrest Algorithm-VF/VT

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ACLS – Provider
Course Agenda
Day 2

0900-0935	Acute Coronary Syndromes; Video and Discussion
0935-1035	Learning Stations; Pulseless Arrest Algorithm-PEA/Asystole, Bradycardia, Tachycardia with Pulses.
1035-1045	Break
1045-1145	Learning Station; Megacode Practice
1145-1245	Lunch
1245-1445	Testing; Megacode
1445-1500	ACLS Review; Jeopardy
1500-1700	Testing; Written Exam

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ACLS – Renewal
Course Agenda

0900-0920	Introductions Course overview Pre-course test review
0920-0940	ACLS Science Update Video
0940-1010	Lecture; Importance of CPR
1010-1020	Break
1020-1100	Respiratory Emergencies (Group 1) CPR with AED (Group 2)
1100-1140	Respiratory Emergencies (Group 2) CPR with AED (Group1)
1140-1200	Stroke; Video
1200-1300	Lunch
1300-1330	Resuscitation Team Concepts; Video and Discussion
1330-1430	Learning Station; Megacode practice
1430-1440	Break
1440-1540	Testing; Megacode
1540-1600	ACLS Review; Jeopardy
1600-1700	Testing; Written

2010 Interim Materials
ACLS Provider Manual
Comparison Chart
Based on *2010 AHA Guidelines for CPR and ECC*

American Heart Association
GUIDELINES CPR ECC 2010

BLS Changes			
	New	**Old**	**Rationale**
CPR	Chest compressions, Airway, Breathing (C-A-B) New science indicates the following order for healthcare providers: 1. Check the patient for responsiveness and presence/absence of normal breathing or gasping. 2. Call for help. 3. Check the pulse for no more than 10 seconds. 4. Give 30 compressions. 5. Open the airway and give 2 breaths. 6. Resume compressions.	Airway, Breathing, Chest compressions (A-B-C) Previously, after responsiveness was assessed, a call for help was made, the airway was opened, the patient was checked for breathing, and 2 breaths were given, followed by a pulse check and compressions.	Although ventilations are an important part of resuscitation, evidence shows that compressions are the critical element in adult resuscitation. In the A-B-C sequence, compressions are often delayed.
	Take no longer than 10 seconds to check for a pulse. If a pulse is not detected within 10 seconds, begin chest compressions.	Compressions were to be given after airway and breathing were assessed, ventilations were given, and pulses were checked.	Although ventilations are an important part of resuscitation, evidence shows that compressions are the critical element in adult resuscitation. Compressions are often delayed while providers open the airway and deliver breaths. If a pulse is not detected within 10 seconds, do start compressions without further delay.
	Compressions should be given at a rate of at least 100/min. Each set of 30 compressions should take approximately 18 seconds or less.	Compressions were to be given at a rate of about 100/min. Each cycle of 30 compressions was to be completed in 23 seconds or less.	Faster compressions are required to generate the pressures necessary to perfuse the coronary and cerebral arteries.
	Compression depths are as follows: • Adults: **at least** 2 inches (5 cm) • Children: **at least** one third the depth of the chest, approximately 2 inches (5 cm) • Infants: **at least** one third the depth of the chest, approximately 1½ inches (4 cm)	Compression depths were as follows: • Adults: 1½ to 2 inches • Children: one third to one half the diameter of the chest • Infants: one third to one half the diameter of the chest	Deeper compressions are required to generate the pressures necessary to perfuse the coronary and cerebral arteries.

Airway and Breathing	Cricoid pressure is no longer routinely recommended for use with ventilations.	If an adequate number of rescuers were available, one could apply cricoid pressure.	Randomized studies have demonstrated that cricoid pressure still allows for aspiration. It is also difficult to properly train providers to perform the maneuver correctly.
	"Look, listen, and feel for breathing" has been removed from the sequence for assessment of breathing after opening the airway. Healthcare providers briefly check for breathing when checking responsiveness to detect signs of cardiac arrest. After delivery of 30 compressions, lone rescuers open the victim's airway and deliver 2 breaths.	"Look, listen, and feel for breathing" was used to assess breathing after the airway was opened.	With the new chest compression–first sequence, CPR is performed if the adult victim is unresponsive and not breathing or not breathing normally (ie, not breathing or only gasping) and begins with compressions (C-A-B sequence). Therefore, breathing is briefly checked as part of a check for cardiac arrest. After the first set of chest compressions, the airway is opened and the rescuer delivers 2 breaths.
AED Use	For children from 1 to 8 years of age, an AED with a pediatric dose-attenuator system should be used if available. If an AED with a dose attenuator is not available, a standard AED may be used. For infants (<1 year of age), a manual defibrillator is preferred. If a manual defibrillator is not available, an AED with a pediatric dose attenuator is desirable. If neither is available, an AED without a dose attenuator may be used.	This does not represent a change for the child. In 2005 there was not sufficient evidence to recommend for or against the use of an AED in infants.	The lowest energy dose for effective defibrillation in infants and children is not known. The upper limit for safe defibrillation is also not known, but doses >4 J/kg (as high as 9 J/kg) have provided effective defibrillation in children and animal models of pediatric arrest, with no significant adverse effects. AEDs with relatively high energy doses have been used successfully in infants in cardiac arrest, with no clear adverse effects.

ALS Changes			
	New	**Old**	**Rationale**
Airway and Breathing	Continuous quantitative waveform capnography is now recommended for intubated adult patients throughout the periarrest period. When quantitative waveform capnography is used for adults, applications now include recommendations for confirming endotracheal tube placement and for monitoring CPR quality and detecting ROSC based on end-tidal carbon dioxide (P_{ETCO_2}) values.	An exhaled carbon dioxide detector or an esophageal detector device was recommended to confirm endotracheal tube placement. The *2005 AHA Guidelines for CPR and ECC* noted that P_{ETCO_2} monitoring could be useful as a noninvasive indicator of cardiac output generated during CPR.	Continuous waveform capnography is the most reliable method of confirming and monitoring correct placement of an endotracheal tube. Although other means of confirming endotracheal tube placement are available, they are not more reliable than continuous waveform capnography. Providers should observe a persistent capnographic waveform with ventilation to confirm and monitor endotracheal tube placement.
	Once circulation is restored, arterial oxyhemoglobin saturation should be	No specific information about weaning the patient off supplementary oxygen was	In effect, the oxyhemoglobin saturation should be maintained at 94% to 99% when possible.

	monitored. It may be reasonable, when the appropriate equipment is available, to titrate oxygen administration to maintain the arterial oxyhemoglobin saturation ≥94%.	provided.	Although the ACLS Task Force of the 2010 International Consensus on CPR and ECC Science With Treatment Recommendations did not find sufficient evidence to recommend a specific weaning protocol, a recent study documented harmful effects of hyperoxia after ROSC.
	Supplementary oxygen is not needed for patients without evidence of respiratory distress or when oxyhemoglobin saturation is ≥94%.	Oxygen was recommended for all patients with overt pulmonary edema or arterial oxyhemoglobin saturation <90%. It was also reasonable to administer oxygen to all patients with ACS for the first 6 hours of therapy.	Emergency medical services providers administer oxygen during the initial assessment of patients with suspected ACS. However, there is insufficient evidence to support its routine use in uncomplicated ACS. If the patient is dyspneic, is hypoxemic, or has obvious signs of heart failure, providers should titrate oxygen therapy to maintain oxyhemoglobin saturation ≥94%.
Pharma-cology	Atropine is not recommended for routine use in the management of PEA/asystole and has been removed from the ACLS Cardiac Arrest Algorithm. The treatment of PEA/asystole is now consistent in the ACLS and pediatric advanced life support recommendations and algorithms.	Atropine was included in the ACLS Pulseless Arrest Algorithm: for a patient in asystole or slow PEA, atropine could be considered.	There are several important changes regarding the management of symptomatic arrhythmias in adults. Available evidence suggests that the routine use of atropine during PEA or asystole is unlikely to have a therapeutic benefit. For this reason, atropine has been removed from the Cardiac Arrest Algorithm.
	Adenosine may be considered in the initial diagnosis of stable, undifferentiated, regular, monomorphic, wide-complex tachycardia. It should not be used if the pattern is irregular.	In the Tachycardia Algorithm, adenosine was recommended only for suspected regular, narrow-complex reentry supraventricular tachycardia.	On the basis of new evidence of safety and potential efficacy, adenosine can now be considered in the initial assessment and treatment of undifferentiated regular, monomorphic, wide-complex tachycardia when the rhythm is regular to diagnose and treat patients with wide-complex tachycardias who actually have supraventricular tachycardia with aberrant conduction.
	For the treatment of adults with symptomatic and unstable bradycardia, chronotropic drug infusions are recommended as an alternative to pacing.	In the Bradycardia Algorithm, chronotropic drug infusions were listed in the algorithm after atropine and while awaiting a pacer or if pacing was ineffective.	For symptomatic or unstable bradycardia, intravenous infusion of chronotropic agents is now recommended as an equally effective alternative to external transcutaneous pacing when atropine is ineffective.
	Morphine should be given with caution to patients with unstable angina.	Morphine was the analgesic of choice for pain unresponsive to nitrates, but it was not recommended for use in patients with possible hypovolemia.	Morphine is indicated in STEMI when chest discomfort is unresponsive to nitrates. Morphine should be used with caution in unstable angina/non-STEMI, because morphine administration was associated with increased mortality in a large registry.

Defibrilla-tion	The recommended initial biphasic energy dose for cardioversion of atrial fibrillation is 120 to 200 J. The initial monophasic dose for cardioversion of atrial fibrillation is 200 J. Cardioversion of adult atrial flutter and other supraventricular rhythms generally requires less energy; an initial energy of 50 to 100 J with either a monophasic or a biphasic device is often sufficient. If the initial cardioversion shock fails, providers should increase the dose in a stepwise fashion.	The recommended initial monophasic energy dose for cardioversion of atrial fibrillation was 100 to 200 J. Cardioversion with biphasic waveforms was available, but the optimal doses for cardioversion with biphasic waveforms had not been established with certainty. Extrapolation from published experience with elective cardioversion of atrial fibrillation with the use of rectilinear and truncated exponential waveforms supported an initial dose of 100 to 120 J with escalation as needed. This initial dose has been shown to be 80% to 85% effective in terminating atrial fibrillation. Until further evidence becomes available, this information can be used to extrapolate biphasic cardioversion doses to other tachyarrhythmias.	The writing group reviewed interim data on all biphasic studies conducted since the *2005 AHA Guidelines for CPR and ECC* were published and made minor changes to update cardioversion dose recommendations. A number of studies attest to the efficacy of biphasic waveform cardioversion of atrial fibrillation with energy settings from 120 to 200 J, depending on the specific waveform.
	Adult stable monomorphic VT responds well to monophasic or biphasic waveform cardioversion (synchronized) shocks at initial energies of 100 J. If there is no response to the first shock, it may be reasonable to increase the dose in a stepwise fashion. No interim studies were found that addressed this rhythm, so the recommendations were made by writing group expert consensus.	There was insufficient evidence to recommend a biphasic dose for cardioversion of monomorphic VT. The *2005 AHA Guidelines for CPR and ECC* recommended use of an unsynchronized shock for treatment of the unstable patient with polymorphic VT.	The writing group agreed that it would be helpful to add a biphasic dose recommendation to the *2010 AHA Guidelines for CPR and ECC* for cardioversion of monomorphic VT but wanted to emphasize the need to treat polymorphic VT as unstable and as an arrest rhythm using an unsynchronized shock.

Algorithm Update	The conventional ACLS Cardiac Arrest Algorithm has been simplified and streamlined to emphasize the importance of high-quality CPR (including providing compressions of adequate rate and depth, allowing complete chest recoil after each compression, minimizing interruptions in chest compressions, and avoiding excessive ventilation) and the fact that ACLS actions should be organized around uninterrupted periods of CPR. A new circular algorithm has also been introduced.	The same priorities were cited in the *2005 AHA Guidelines for CPR and ECC*. The box-and-arrow algorithm listed key actions performed during the resuscitation in a sequential fashion.	For the treatment of cardiac arrest, ACLS interventions build on the BLS foundation of high-quality CPR to increase the likelihood of ROSC. Before 2005, ACLS courses assumed that excellent CPR was provided, and they focused mainly on added interventions of manual defibrillation, drug therapy, and advanced airway management, as well as alternative and additional management options for special resuscitation situations. Although adjunctive drug therapy and advanced airway management are still part of ACLS, in 2005 the emphasis in advanced life support returned to the basics, with an increased emphasis on what is known to work: high-quality CPR (providing compressions of adequate rate and depth, allowing complete chest recoil after each compression, minimizing interruptions in chest compressions, and avoiding excessive ventilation). The *2010 AHA Guidelines for CPR and ECC* continue this emphasis. The *2010 AHA Guidelines for CPR and ECC* note that ideally CPR is guided by physiologic monitoring (eg, continuous waveform capnography) and includes adequate oxygenation and early defibrillation while the ACLS provider assesses and treats possible underlying causes of the arrest. There is no definitive clinical evidence that early intubation or drug therapy improves neurologically intact survival to hospital discharge.

Patient Assessment

In ACLS, the specific treatment of a given dysrhythmia or condition depends on the patient's hemodynamic status. In general, patients can be divided into four categories to determine treatment priorities:

- **Asymptomatic**
- **Symptomatic – Stable**
- **Symptomatic – Unstable**
- **Pulseless**

Asymptomatic patients do not receive treatment, but should be monitored for changes in condition. Any patient with symptoms (even apparently mild symptoms such as palpitations) should be assessed to determine if they are Stable or Unstable. Determination of a patient's level of hemodynamic compromise can include several factors:

- ***General Appearance***: The first indication of hemodynamic status comes from a patient's general appearance, including skin signs, level of activity, and work of breathing. If a patient shows signs of compensation (such as pale, cool, or diaphoretic skin) or acute distress, they are unstable.

- ***Level of Consciousness***: Interaction with the patient allows the provider to evaluate the patient's level of consciousness based on the patient's activity, awareness of their surroundings, and ability to provide information. If a patient shows any level of mental deficit, family or friends should be consulted to determine if this state differs from the patient's baseline. If the mental deficit is acute, the patient should be considered unstable.

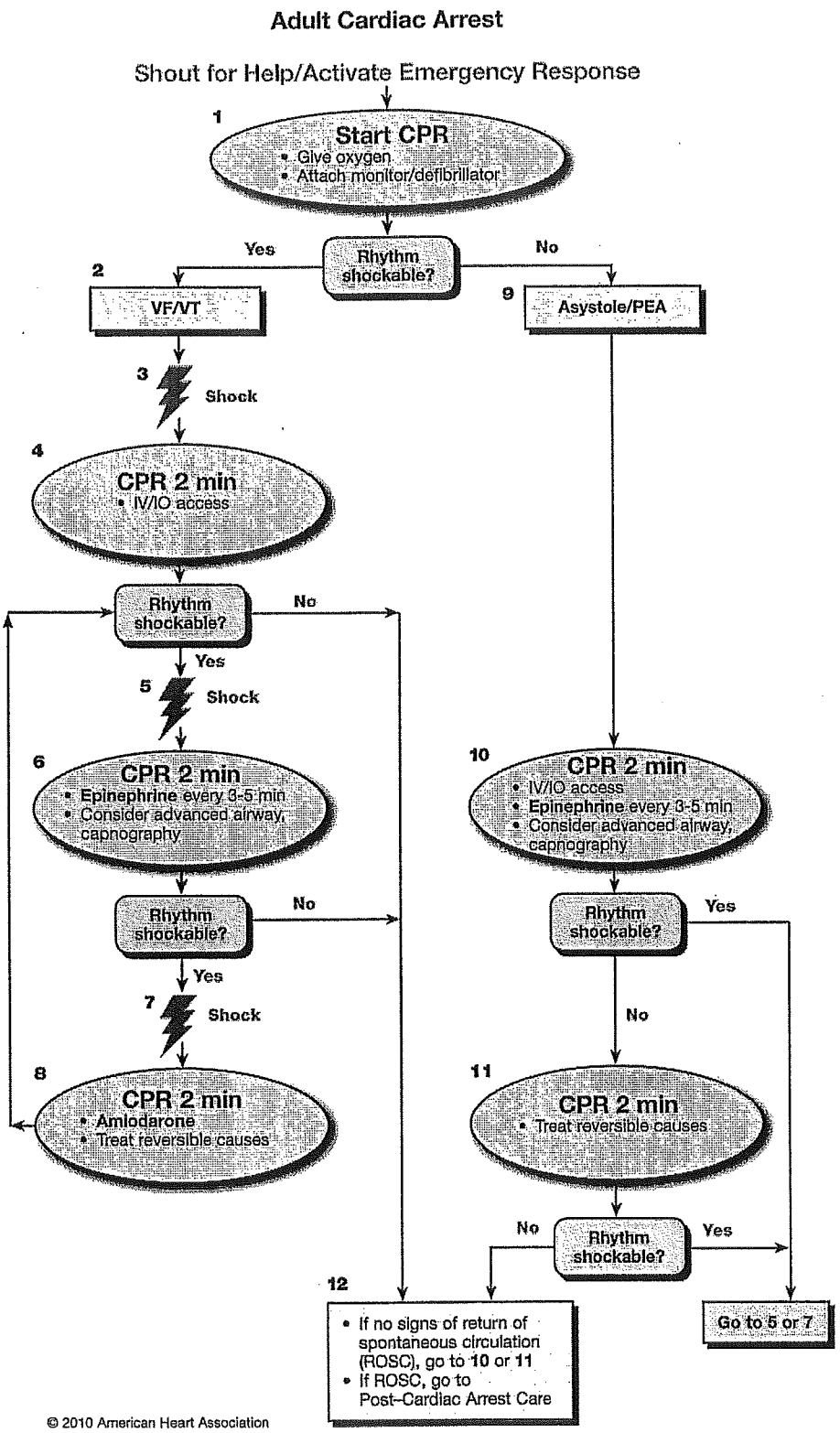
- ***Vital signs***: Vital signs provide a diagnostic evaluation of the patient. Blood Pressure is the primary indicator. A systolic blood pressure above 90 mm usually indicates that the patient is stable (although the provider should be alert for changes in blood pressure that might indicate an unstable patient even if blood pressure is normal). Other vital signs may be useful; however, the provider should remember that various conditions (CO_2 poisoning) can mask changes in blood oxygen levels, and that a high O_2 saturation may be present in unstable patients (those in shock). Additionally, heart rate is of no use in determining if a patient is stable or unstable – a patient with a heart rate of 80 can be severely unstable, while a patient with a heart rate of 210 can be stable if they are still perfusing well.

If a patient's **General Appearance, Level of Consciousness,** and **Vital Signs** are all normal, the patient is stable. If possible, treatment should be rendered starting with the least invasive **that is appropriate for that patient's hemodynamic status**. In ACLS, the preferential treatment for symptomatic, but stable patients is generally medications. The preferential treatment for unstable patients is generally Electrical Therapy.

Once treatment is rendered, **the provider must reassess the patient**. If the patient remains symptomatic, the appropriate treatment (medications or electricity) should be given again depending on the patient's heart rhythm and current hemodynamic status. Thus, if a patient was stable before, but becomes unstable after administration of a drug, the patient should receive electrical therapy to continue treating the dysrhythmia rather than additional doses of a medication.

If a patient's General Appearance indicates 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.). Then assess **Circulation**. If the patient is apneic, rescue breathing should be started; if the patient is pulseless, rescuers should begin CPR.

Once you determine that a patient is **Pulseless**, an AED or EKG monitor should be attached as soon as possible. CPR should be continued with minimal interruptions. After each rhythm check, the patient should be defibrillated if appropriate (rhythm Ventricular Fibrillation or Pulseless Ventricular Tachycardia). Regardless of the heart rhythm, medications should be given as soon as possible after CPR is resumed. The specific medication should be determined by the patient's exact status and heart rhythm.



CPR Quality
- Push hard (≥2 inches [5 cm]) and fast (≥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 P_{ETCO_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 P_{ETCO_2} (typically ≥40 mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

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

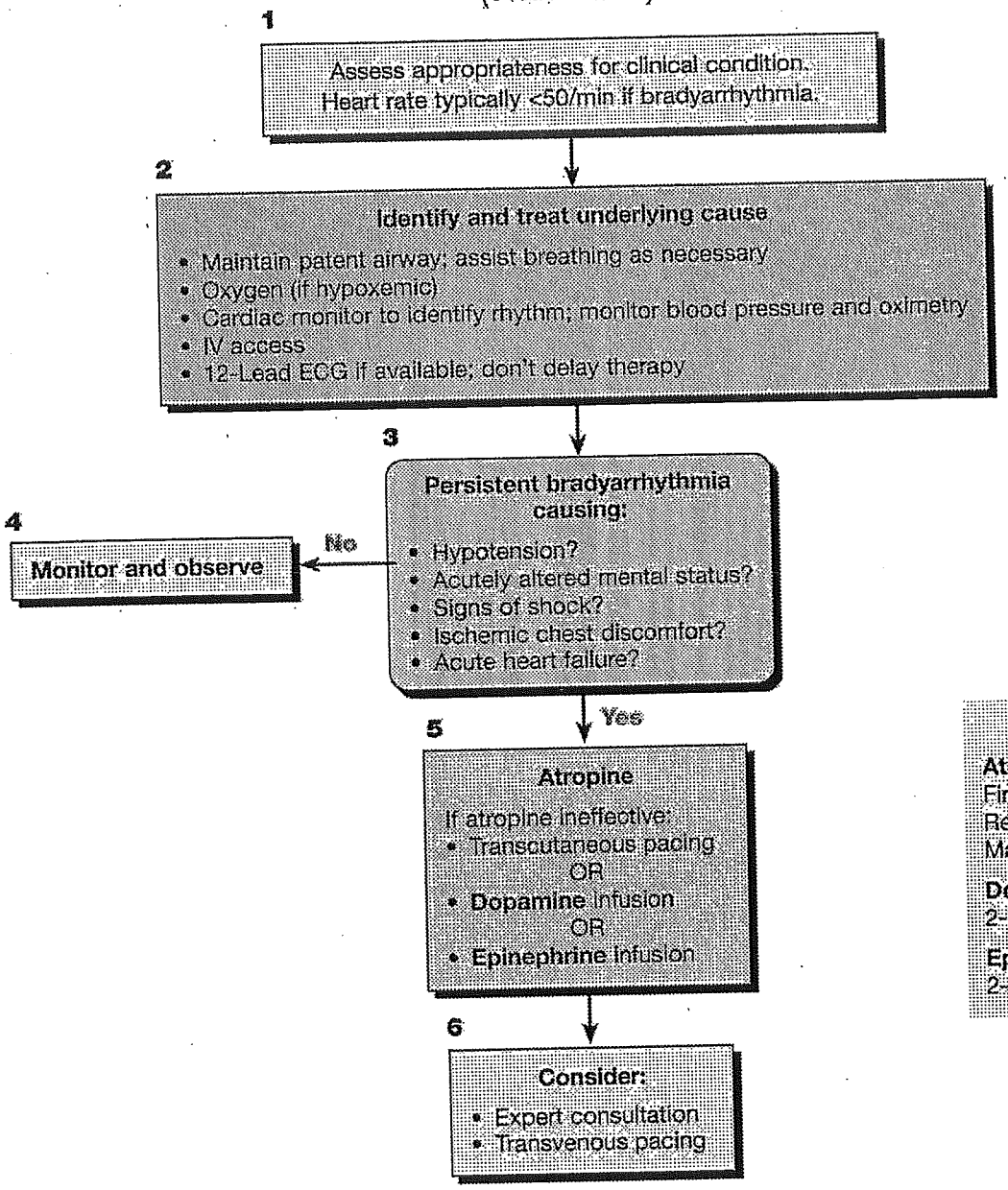
Drug Therapy
- **Epinephrine IV/IO Dose:** 1 mg every 3-5 minutes
- **Vasopressin IV/IO Dose:** 40 units can replace first or second dose of epinephrine
- **Amiodarone IV/IO Dose:** First dose: 300 mg bolus. Second dose: 150 mg.

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

Figure 1. ACLS Cardiac Arrest Algorithm.

Adult Bradycardia
(With Pulse)



Doses/Details

Atropine IV Dose:
First dose: 0.5 mg bolus
Repeat every 3-5 minutes
Maximum: 3 mg

Dopamine IV Infusion:
2-10 mcg/kg per minute

Epinephrine IV Infusion:
2-10 mcg per minute

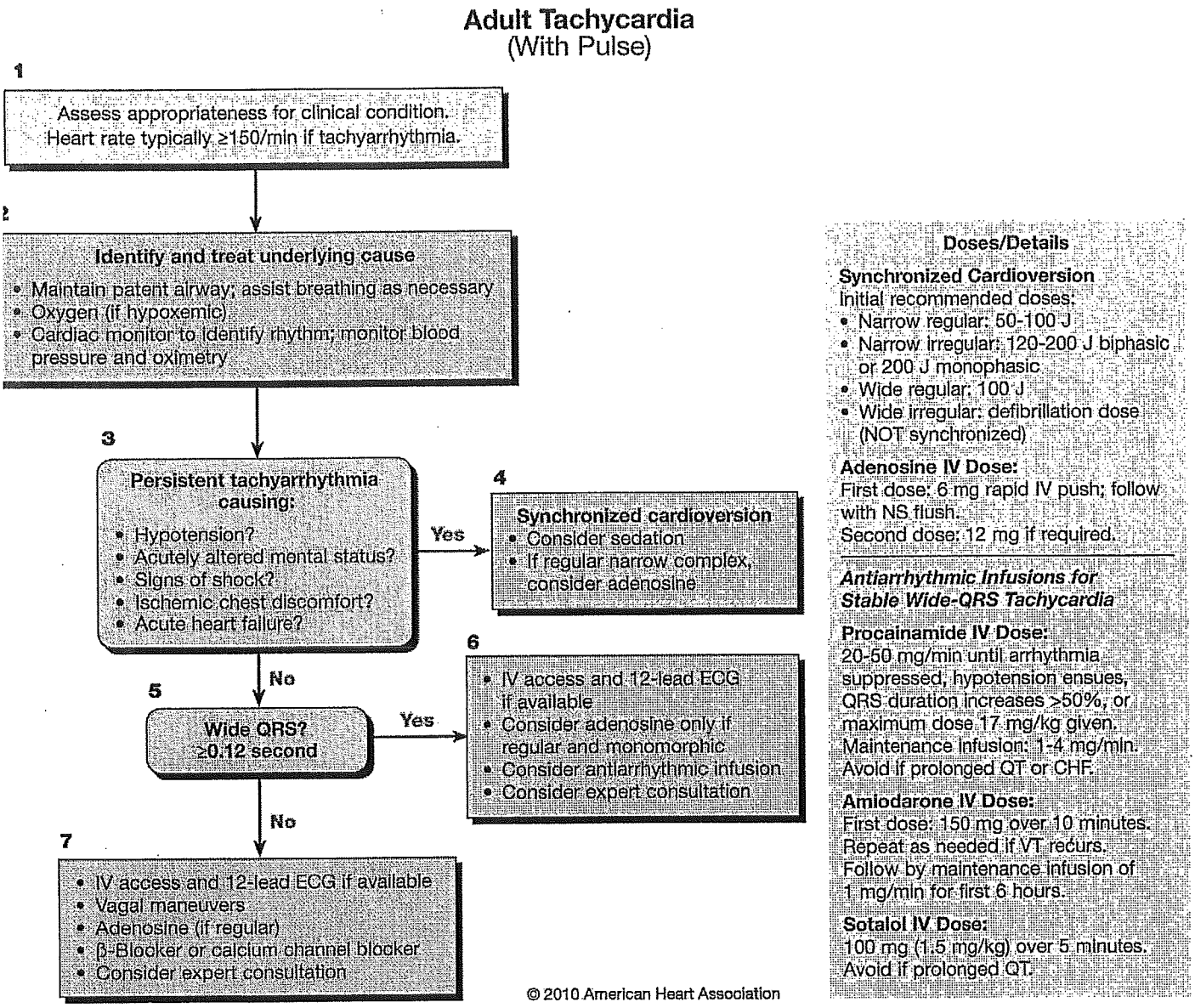
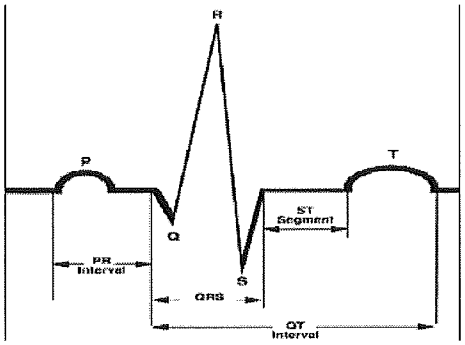
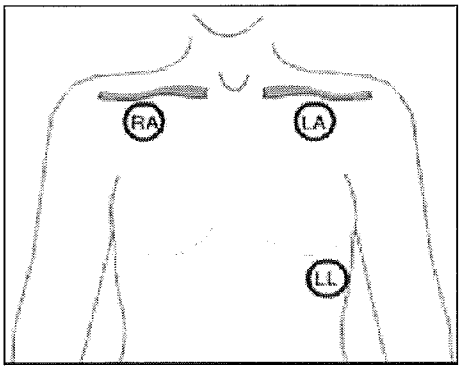


Figure 4. Tachycardia Algorithm.

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 patient's QRS complex has duration of 0.12 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 strips 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. 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 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 a monophasic defibrillator, the recommendation is to deliver the first shock at 360 joules. If a biphasic defibrillator is used, the recommended dosage is machine dependent and should appear on the front of the machine. If optimal shock dosage is not known, the consensus is to defibrillate at 200 joules.

Synchronized Cardioversion

In 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.

With a biphasic monitor, the initial dose is delivered at 120 to 200 joules for atrial fibrillation. Cardioversion of atrial flutter and other SVT's generally require less energy; an initial energy of 50 joules to 100 joules is often sufficient. Deliver additional shocks in stepwise fashion. Monomorphic V-Tach with a pulse responds well to initial energies of 100 joules. Polymorphic V-Tach should be treated like V-Fib. That is, deliver a high energy unsynchronized shock.

Transcutaneous Pacing (TCP)

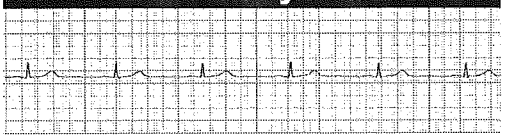
External cardiac pacing is the recommended treatment for symptomatic bradycardia. If the patient is conscious, consider sedation. However, **pacing should not be delayed while waiting for sedation.** Begin pacing at zero milliamps, slowly increasing until capture is achieved. Then set the rate at 20 beats per minute (bpm) above the monitored heart rate, with a minimum rate of 50 bpm.

Fast Response
School of Health Care Education

Normal Sinus Rhythm

Rhythm	Regular
Rate	60 – 100
P waves	Normal configuration & direction; one P wave precedes each QRS
PRI	Normal (0.12 – 0.20 seconds)
QRS	Normal (0.12 seconds or less)

Sinus Bradycardia



Rhythm	Regular
Rate	40 - 60
P waves	Normal configuration & direction; one P wave precedes each QRS
PRI	Normal (0.12 – 0.20 seconds)
QRS	Normal (0.12 seconds or less)

Supraventricular Tachycardia

Rhythm	Regular
Rate	150 – 250 +
P waves	Unable to discern (usually hidden in preceding T wave).
PRI	Not measurable
QRS	Normal (0.12 seconds or less)

Sinus Tachycardia

Rhythm	Regular
Rate	100 - 160
P waves	Normal configuration & direction; one P wave precedes each QRS
PRI	Normal (0.12 – 0.20 seconds)
QRS	Normal (0.12 seconds or less)

Atrial Flutter

Rhythm	Regular or irregular (depends on AV conduction ratio)
Rate	*Atrial Rate*: 250-400 *Ventricular Rate*: Varies, however slower than atrial rate.
P waves	V-shaped flutter waves (F waves) with a "sawtooth" appearance
PRI	Not measurable
QRS	Normal (0.12 seconds or less)

Atrial Fibrillation (A-Fib)

Rhythm	irregular (often grossly irregular)
Rate	*Atrial Rate*: 350 *Ventricular Rate*: Varies, however slower than atrial rate.
P waves	Irregular fibrillatory waves; sinus P waves usually not present
PRI	Not measurable
QRS	Normal (0.12 seconds or less)

Junctional Escape Rhythm

Rhythm	Regular
Rate	40 – 60
P waves	Usually inverted in Lead II; may occur before or after the QRS complex or be hidden within the QRS complex
PRI	Usually short(0.10 seconds or less); not measurable if P wave within or after QRS
QRS	Normal (0.12 seconds or less)

First-Degree AV Block

Rhythm	Regular
Rate	Heart rate is that of the underlying rhythm (usually sinus); both Atrial and ventricular rates will be the same
P waves	Normal in configuration & direction; one P wave precedes each QRS
PRI	Prolonged (> 0.20 seconds); remains constant
QRS	Normal (0.12 seconds or less)

Second-Degree AV Block Type I

Rhythm	Irregular (may be Regularly Irregular)
Rate	Depends on the underlying rhythm; Ventricular rate is less than atrial rate
P waves	Normal in configuration & direction; one P wave precedes each QRS until a P wave occurs with no following QRS complex
PRI	Progressively lengthens until a QRS is dropped, then the cycle begins again
QRS	Normal (0.12 seconds or less)

Second-Degree AV Block Type II

Rhythm	Irregular (may be Regularly Irregular, depending on the location and severity of the block)
Rate	*Atrial*: Rate of underlying rhythm *Ventricular*: Rate depends on conduction through AV node; less than the atrial rate
P waves	Normal in configuration & direction; some P waves not followed by QRS complexes
PRI	May be normal or prolonged; remains constant
QRS	Can be Normal or Wide (depending on location of block)

Third-Degree AV Block

Rhythm	Irregular (atrial and ventricular rhythms are each regular, but are disassociated)
Rate	*Atrial*: varies (often 60-100) *Ventricular*: varies (often 20-40)
P waves	Usually normal in configuration & direction; P waves and QRS complexes have no relationship
PRI	N/A (because QRS complexes and P waves are completely disassociated)
QRS	Can be normal but are often wide (>0.12 seconds)

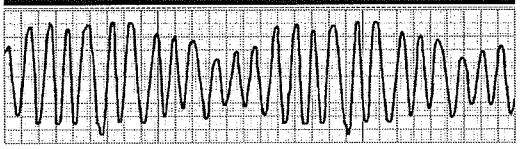
Premature Ventricular Contractions (PVC's)

Rhythm	Underlying is usually regular. PVC's may be unifocal (same shape) or multifocal (different shape).
Rate	Dependent on the underlying rhythm. Maybe fast or slow
P waves	Normal for the underlying rhythm. PVC may not have one
PRI	Normal for the underlying rhythm. PVC N/A
QRS	Underlying rhythm normal. Wide in PVC (>0.12 seconds)

Ventricular Tachycardia

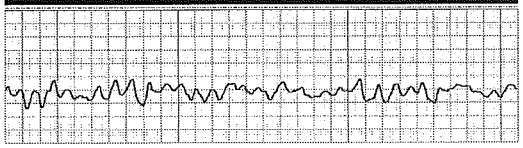
Rhythm	Usually regular
Rate	>100n(usually 140 to 250)
P waves	SA node often still beats; however, the P wave is usually hidden in the QRS
PRI	N/A
QRS	Wide (0.12 seconds or greater)

Polymorphic V-Tach



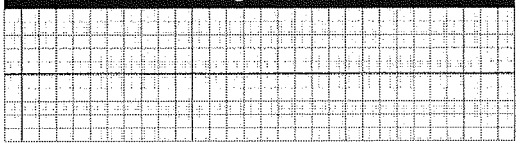
Rhythm	Usually regular
Rate	>100n(usually 140 to 250)
P waves	SA node often still beats; however, the P wave is usually hidden in the QRS
PRI	N/A
QRS	Wide (0.12 seconds or greater)

Ventricular Fibrillation



Rhythm	Irregular; the baseline is totally chaotic.
Rate	Cannot be determined (no discernible waves or complexes).
P waves	There are no discernible waves.
PRI	N/A
QRS	There are no discernible complexes

Asystole



Rhythm	Regular
Rate	None
P waves	Usually absent, but may be present
PRI	N/A
QRS	Absent