

**Fast
Response**
School of Health Care Education



ACLS Study Guide



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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 fall 2005. Implementation of these guidelines by Training Centers began July 1, 2006. **This new format requires all students to be fully prepared prior to coming to class.**

The ACLS Course does not teach CPR, ECG rhythm identification, pharmacology, or ACLS algorithms. **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.

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

What we sent you:

ACLS Study Guide

ACLS Provider Manual with Student CD

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 doing the following:

1. Review this Study Guide. (You will not be taught how to interpret ECGs in the course, nor will you be taught details about ACLS pharmacology.)
2. Review and understand the information in the *ACLS Provider Manual* and the student CD; you can start with the ACLS Course Overview (Appendix B: pages 129-132). **Pay particular attention to the 10 core cases in Part 4.**

3. **Be prepared to pass the adult 1-rescuer CPR with AED skills test. You will not be taught how to do CPR or use an AED during the course, you must know this in advance.** Review and understand all BLS 2005 guidelines – you may review this using the information in Appendix A of the ACLS Provider Manual.
4. ***Please note that we do not renew your BLS card based on this CPR test, which is a requirement of the ACLS course itself.***
5. **All renewal (1-day) participants must bring their current American Heart Association-issued ACLS card to class. There are no exceptions for expired cards.**
6. Review the Competency Checklists that the instructors will use to evaluate you during the course (pages 119-127 of the *ACLS Provider Manual*). Be familiar with the ACLS algorithms so that you can apply them to scenarios. *Note: the ACLS course does not present the details of each algorithm.*
7. **Complete the Pre-course Assessment.** Use this assessment to identify areas where you need to increase your knowledge.
8. ACLS cards and Continuing Education Units (CEU's) will be issued at the end of class.

What to Bring and What to Wear

You must bring your ACLS Provider Manual to class as required by the AHA, your card will be held until you provide proof that you have the most current book. You must 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.



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 not be admitted into class and you must reschedule.

Lisa Dubnoff, R.N., EMT-P

ACLS Program Director

Christopher Ché King, EMT-P
Director Continuing Education



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 **current** (2006) provider manual available to them before, during, and after the course in order to comply with AHA guidelines. These books are available at www.emsbooks.com for a discounted rate. If you show up to your class without the required manual, there are two options:

A: You must purchase the book to attend the class. Books can be purchased at the reception desk. The current cost (as of June 2008) is \$48.50 for the Advanced Cardiac Life Support provider manual and \$55.00 for the Pediatric Advanced Life Support provider manual (including the course guide, which is not available separately).

B: If you previously purchased the book, or if you are not able to purchase it at that time, the lead instructor may allow you to attend the class with a loaner book. However, we will withhold your certification card and continuing education certificate units until you provide us with your purchase receipt for the book.

For PALS students, the course guide alone is acceptable. The ECC Handbook is not sufficient for either course.

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

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

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

ACLS Provider Manual Student CD FAQ

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 Links

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

- 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>

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

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

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



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 (CO₂ poisoning) can mask changes in blood oxygen levels, and that a high O₂ 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.). The BLS Algorithm should then be followed – Open the **Airway**, check for **Breathing**, and 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.

ACLS Algorithm Review

Always start with the ABCD survey

ACUTE CORONARY SYNDROMES

Algorithm: Acute Coronary Syndromes (p. 70)

Remember: Consider MONA for patients with suspected ACS (angina or AMI):

- **M**orphine
- **O**xygen
- **N**itroglycerine
- **A**spirin

.....but in the order of Oxygen, Aspirin, and Morphine

BRADYCARDIA

Algorithm: Bradycardia (p. 81)

Remember: **All Trained Dogs Eat:**

- **A**tropine 0.5 mg IVP for Sinus Bradycardia, 1° & 2° Type I AV Block
- **T**ranscutaneous Pacing (preferred for 2° Type II and 3° Heart Blocks); **do not delay pacing in symptomatic patients** (even those in Sinus Bradycardia or low degree Heart Blocks)
- **D**opamine 5-10 mcg/kg/min (if patient unresponsive to atropine/pacing)
- **E**pinephrine drip 2 to 10 mcg/min (if patient unresponsive to atropine/pacing)

Note: Atropine is not indicated for 2° Type II and 3° Heart Blocks – proceed directly to pacing if the patient is symptomatic, although Atropine can be considered if pacing is delayed.

TACHYCARDIA

Algorithm: Tachycardia With Pulses (p. 91 or 99)

Remember: If the patient is unstable, **go directly to synchronized cardioversion.**

Otherwise:

- **Regular Narrow Complex** Tachycardia (probable SVT)
 1. Obtain 12-lead ECG; consider expert consultation.
 2. Attempt vagal maneuvers.
 3. Adenosine 6 mg rapid IV push. If no conversion, give up to 2 more doses at 12 mg each.

- **Irregular Narrow Complex Tachycardia (probable Atrial Fibrillation)**
 1. Obtain 12-lead ECG; consider expert consultation
 2. Control rate with Diltiazem or β -blockers.
- **Regular Wide Complex Tachycardia (probable Ventricular Tachycardia)**
 1. Obtain 12-lead ECG; consider expert consultation.
 2. Covert rhythm using Amiodarone – 150 mg over 10 minutes.
 3. Elective Cardioversion.
- **Irregular Wide Complex Tachycardia**
 1. Obtain 12-lead ECG; consider expert consultation.
 2. Consider antiarrhythmics.
 3. If Torsades de Pointes, give Magnesium Sulfate – 1 to 2 g over 5 – 60 minutes

Ventricular Fibrillation/Pulseless Ventricular Tachycardia

Algorithm: Pulseless Arrest – Shockable (p. 42)

Remember: Good ACLS starts with good BLS:

- **CPR** – start immediately. Push hard and push fast.
- **Shock** – analyze rhythm, and shock if in VF/pulseless VT.
- **CPR** – resume CPR immediately after shock delivery. Continue for 5 cycles / 2 minutes.
- **Vasopressor** – Epinephrine 1 mg (1:10,000 solution) every 3-5 min IV/IO (can replace 1st or 2nd dose of Epinephrine with 40 units Vasopressin). Give as soon as possible after resuming CPR, circulate with chest compressions.
- **Shock** – analyze rhythm, and shock if in VF/pulseless VT.
- **CPR** – resume CPR immediately after shock delivery. Continue for 5 cycles / 2 minutes.
- Antiarrhythmic** – Amiodarone 300mg IV/IO or Lidocaine 1 mg/kg. Give as soon as possible after resuming CPR, circulate with chest compressions.
- **Shock** – analyze rhythm, and shock if in VF/pulseless VT.
- **CPR** – resume CPR immediately after shock delivery. Continue for 5 cycles / 2 minutes.

Note: Minimize interruptions to chest compressions – do not check a pulse or evaluate the heart rhythm after a shock. After each shock, resume CPR immediately and continue for 5 cycles prior to rhythm analysis and possible pulse check. After second dose of Epinephrine, a second Antiarrhythmic dose (Amiodarone 150 mg or Lidocaine 0.50 to 0.75 mg/kg) may be given after next rhythm check

PULSELESS ELECTRICAL ACTIVITY

Algorithm: Pulseless Arrest – Not Shockable (p.54)

Remember: PEA:

- Possible causes (consider the 6 H's and 5 T's).
- Epinephrine 1 mg IV/IO every 3-5 minutes (can replace 1st or 2nd dose of Epinephrine with 40 units Vasopressin). Give as soon as possible, after resuming CPR, circulate with chest compressions.
- **Atropine** 1 mg IV/IO to a max of 3 mg (only if electrical rate is < 60). Give as soon as possible after resuming CPR, circulate with chest compressions.

Note: In PEA, the electrical system of the heart is functioning, but there is a problem with the *pump, pipes, or volume* – a mechanical part of the system is not working. You can use the **6 H's and 5 T's** to remember the most common reversible causes of PEA:

Hypovolemia	Toxins
Hypoxia	Tamponade, cardiac
Hydrogen Ion (acidosis)	Tension Pneumothorax
Hypo-/Hyperkalemia	Thrombosis (coronary or pulmonary)
Hypoglycemia	Trauma
Hypothermia	

ASYSTOLE

Algorithm: Pulseless Arrest – Not Shockable (p. 54)

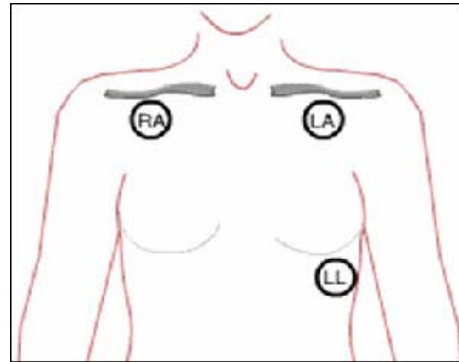
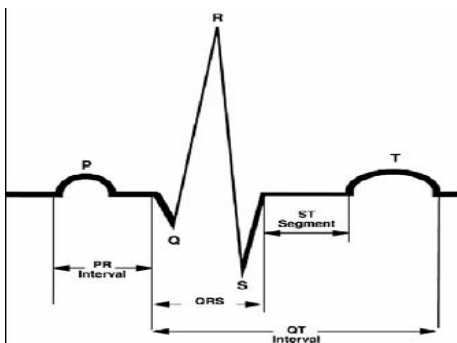
Remember: DEAD:

- Determine whether to initiate resuscitative efforts.
- Epinephrine 1 mg (1:10,000 solution) every 3-5 min IV/IO. Give as soon as possible, after resuming CPR, circulate with chest compressions.
- Aggressive oxygenation – use compression: ventilation ratio of 30:2 consider advanced airway. Avoid hyperventilation – do not ventilate too often, too quickly, or with too much volume.
- Differential Diagnosis or Discontinue resuscitation – Are they still dead? Consider the 6 H's and 5 T's (see above) – check blood glucose; check core temperature; consider Naloxone; etc.



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 (or 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 monophasic monitor, the initial dose is delivered at 100 joules. If the rhythm does not terminate, deliver additional shocks in stepwise fashion (200J, 300J, and 360J for subsequent shocks. With a biphasic monitor, dosages and steps are device dependent. If optimal doses are unknown, start with 100J and step up from there.

Transcutaneous Pacing (TCP)

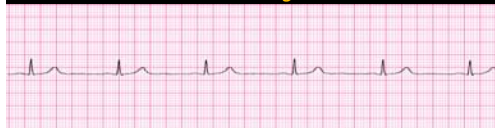
External cardiac pacing is the recommended treatment for symptomatic bradycardia. If the patient is conscious, consider sedation. However, **pacing should not be delayed while waiting for sedation**. Begin pacing at zero milliamps, slowly increasing until capture is achieved. Then set the rate at 20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

Normal Sinus Rhythm



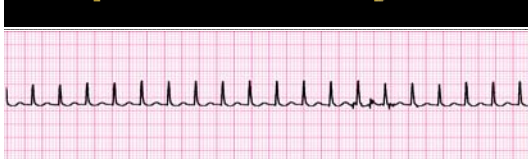
Rhythm	Regular
Rate	60 – 100
P waves	Normal configuration & direction; one P wave precedes each QRS
PRI	Normal (0.12 – 0.20 seconds)
QRS	Normal (0.12 seconds or less)

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	<u>Atrial Rate:</u> 250-400 <u>Ventricular Rate:</u> 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)



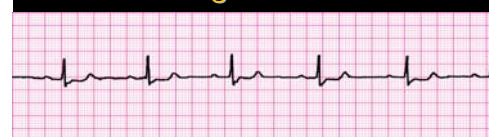
Rhythm	irregular (often grossly irregular)
Rate	<u>Atrial Rate:</u> 350 <u>Ventricular Rate:</u> Varies, however slower than atrial rate.
P waves	Irregular fibrillatory waves; sinus P waves usually not present
PRI	Not measurable
QRS	Normal (0.12 seconds or less)

Junctional Escape Rhythm



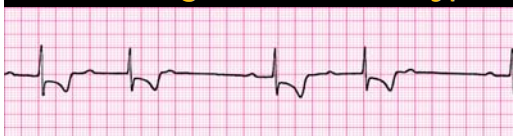
Rhythm	Regular
Rate	40 – 60
P waves	Usually inverted in Lead II; may occur before or after the QRS complex or be hidden within the QRS complex
PRI	Usually short(0.10 seconds or less); not measurable if P wave within or after QRS
QRS	Normal (0.12 seconds or less)

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	<u>Atrial</u> : Rate of underlying rhythm <u>Ventricular</u> : 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



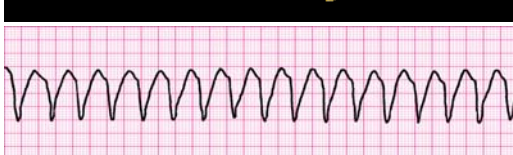
Rhythm	Irregular (atrial and ventricular rhythms are each regular, but are disassociated)
Rate	<u>Atrial</u> : varies (often 60-100) <u>Ventricular</u> : varies (often 20-40)
P waves	Usually normal in configuration & direction; P waves and QRS complexes have no relationship
PRI	N/A (because QRS complexes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

Premature Ventricular Contractions (PVC's)



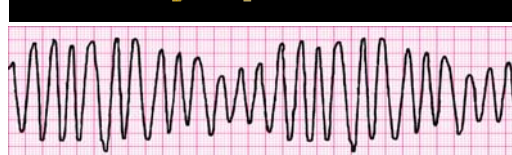
Rhythm	Underlying is usually regular. PVC's may be unifocal (same shape) or multifocal (different shape).
Rate	Dependent on the underlying rhythm. Maybe fast or slow
P waves	Normal for the underlying rhythm. PVC may not have one
PRI	Normal for the underlying rhythm. PVC N/A
QRS	Underlying rhythm normal.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

ACLS Medications Review

This information meets the standard set by the 2005 American Heart Association for Advanced Cardiac Life Support. It does not supersede local protocols or medical control; consult with your medical director for the most up-to-date guidelines on medication administration where you work.

IV/IO medication should be administered in a peripheral line during CPR as soon as possible after a rhythm check. It is recommended that you flush with 20 ml of fluid after each drug administration and elevate the extremity. Always use large bore catheters if possible.

A Note on Endotracheal Administration of Medications: This route of medication administration is being de-emphasized by the AHA as the IV or IO routes are preferred. However, the ET route can still be used if providers are unable to gain access by IV/IO. Use the mnemonic “NAVEL” to remember which drugs can be administered via this route: Narcan – Atropine – Vasopressin – Epinephrine – Lidocaine. The drug dosage is increased, typically 2-2.5 times the IV/IO bolus dosage (although there is no consensus on Epinephrine or Vasopressin dosing via this route), followed by a 10 ml normal saline flush.

ADENOSINE		
Class:	Indicated for:	IV Bolus Dosage (no IO)
Endogenous nucleoside	PSVT Regular Narrow-complex Tachycardia	6 mg rapid IV push-1 st dose 12 mg rapid IV push-2 nd dose 12 mg rapid IV push-3 rd dose

Notes: Doses followed by a saline flush. Two subsequent doses of the 12 mg each administered at 1-2 minute intervals. Use the port closest to cannulation. The AHA recommends the dosage be cut in half when administering through a central line. In the presence of Dipyridamole or Carbamazepine cut that dose in half. Larger doses may be required in the presence of caffeine or Theophylline.

Amiodarone			
Class:	Indicated for:	IV Bolus Dosage:	Infusion dose:
Antiarrhythmic	Ventricular Fibrillation Pulseless V-Tach	300 mg 1 st dose 150 mg 2 nd dose	150 mg over 10 min

Notes: cumulative doses >2.2 g per 24 hours are associated with significant hypotension. Do not administer with other drugs that prolong QT interval (e.g. Procainamide). Terminal elimination is extremely long – half life lasts up to 40 days. During arrest, IV bolus should be delivered slowly, over 1-3 minutes.

Aspirin		
Class:	Indicated for:	PO Dosage (no IV/IO)
NSAID (Non- Steroidal Anti-Inflammatory)	Chest Pain ACS	160 – 325 mg Suppository Dose: 300 mg

Notes: In suspected ACS, Aspirin can block platelet aggregation and arterial constriction. Also helps with pain control. May cause or exacerbate GI bleeding.

Atropine		
Class:	Indicated for:	IV/IO Bolus Dosage:
Parasympathetic Blocker	Bradycardia Asystole PEA < 60	0.5 mg every 3-5 min. as needed with pulses 1 mg every 3-5 min. (total dose of 3 mg) when in arrest

Notes: Used only in symptomatic bradycardia or in PEA with heart rate < 60. Not indicated in Second Degree Type II or Third Degree heart blocks. Doses < 0.4 mg may result in paradoxical Bradycardia. ET route discouraged; however, can be used if IV/IO access not available.

Dextrose/Glucose		
Class:	Indicated for:	IV/IO Bolus Dosage:
Carbohydrate	Hypoglycemia	25 g (50ml) of D ₅₀ W

Notes: Used to reverse documented hypoglycemia in patients with symptomatic bradycardia or during cardiac arrest. Should not be used routinely during cardiac arrest.

Diltiazem			
Class:		Indicated for:	IV/IO Bolus Dosage:
Calcium Blocker	Channel	Atrial Fibrillation Atrial Flutter	15-20 mg over 2 min.

Notes: May cause hypotension. Do not use in wide-QRS tachycardias of uncertain origin.

Dopamine		
Class:	Indicated for:	IV Infusion:
Catecholamine	Symptomatic Bradycardia Hypotension	5-15 mcg/kg/min - Cardiac dose 15-20 mcg/kg/min - Vasopressor dose

Notes: Titrate to patient response. Correct hypovolemia with volume replacement before initiating Dopamine. May cause tachyarrhythmias. Do not mix with Sodium Bicarbonate.

Epinephrine			
Class:	Indicated for:	IV/IO Bolus	Infusion:
Catecholamine	Pulseless Arrest Symptomatic Bradycardia	1 mg (1:10,000) every 3-5 min. Cardiac Arrest	1 mg in 500ml of Solution at 1 mcg/min titrate to effect.

Notes: First line drug in all pulseless rhythms. Increases myocardial oxygen demand, and may cause myocardial ischemia or angina. ET route is discouraged, however if used give 2-2.5 mg of a 1:1,000 solution.

Fluid Administration (i.e. Normal Saline/NS)		
Class:	Indicated for:	IV/IO Bolus Dosage:
Fluid Volume	Hypovolemia	250 – 500 cc bolus (repeat as needed)

Notes: Used to treat specific reversible causes, such as hypovolemia. Routine administration of fluids during resuscitation is not indicated, as it can reduce coronary perfusion pressure.

Heparin (Unfractionated):

Class:	Indicated for:	IV/IO Bolus Dosage:
Anticoagulant	STEMI (AMI)	Initial Dose: 60 IU/kg (max. 4000 IU) Infusion: 12 IU/kg/hr (max. 1000 IU/hr)

Notes: Do not use in patients with active bleeding or bleeding disorders; severe hypertension, or recent surgery. Monitor patients PTT and platelet count while administering.

Lidocaine:

Class:	Indicated for:	IV/IO Bolus Dosage:
Antiarrhythmic	Ventricular Fibrillation Pulseless V-Tach V-Tach with Pulses	1-1.5 mg/kg (1 st dose) Cardiac Arrest 0.5-0.75 mg/kg (2 nd dose) Cardiac Arrest Infusion: 1-4 mg/min (30-50 mcg/kg/min)

Notes: Max dose in Cardiac Arrest is 3 mg/kg. Use with caution in presence of impaired liver; discontinue if signs of toxicity develop. Prophylactic use in AMI is contraindicated. ET route discouraged however can be used if no IV/IO access available.

Magnesium:

Class:	Indicated for:	IV/IO Bolus Dosage:
Electrolyte	Torsades de Pointes Hypomagnesaemia	1-2 g in 10 ml D ₅ W over 5-20 min.

Notes: A fall in blood pressure may be noted with rapid administration. Dose is given over 5-20 minutes during cardiac arrest, 5-6 minutes in living patients. Use with caution in renal failure.

Morphine Sulfate:

Class:	Indicated for:	IV/IO Bolus Dosage:
Opiate / Analgesic	Chest pain Pulmonary Edema	2-4 mg every 5-30 min.

Notes: Administer slowly and titrate to effect; may cause hypotension. May cause respiratory depression – be prepared to support ventilations. Naloxone is the reversal agent.

Naloxone Hydrochloride (Narcan):

Class:	Indicated for:	IV/IO Bolus Dosage:
Opiate Antagonist	Narcotic overdose	0.4-2 mg (up to 10 mg in 10 min.)

Notes: Monitor for recurrence of respiratory depression. May cause opiate withdrawal. ET route discouraged however can be used if no IV/IO access available.

Nitroglycerin:

Class:	Indicated for:	IV/IO Bolus Dosage:
Vasodilator	Chest pain	12.5 -25 mcg in D ₅ W or NaCl Sublingual Dose: 0.3-0.4 mg

Notes: Most commonly given sublingually as tablet or spray – repeat up to 3 doses at 5 minute intervals. Hypotension may occur. Do not use with Viagra or other phosphodiesterase inhibitors; with severe bradycardia or tachycardia; or in presence of RV infarction or inferior MI. Do not mix with other drugs.

Oxygen:

Class:	Indicated for:	Flow Rate:
Atmospheric Gas	Any cardiopulmonary emergency Suspected stroke	Stable Patient: 2-6 lpm via NC Unstable Patient: 10-15 lpm via NRM

Notes: Pulse oximetry provides a useful method of titrating oxygen administration; however, it may be inaccurate in low cardiac output states or in patients with specific toxicities (such as Carbon Monoxide exposure).

Sodium Bicarbonate:

Class:	Indicated for:	IV Bolus Dosage:
Buffer	Acidosis Hyperkalemia	1 mEq/kg

Notes: Not recommended for routine use in cardiac arrest patients. If available, use arterial blood gas analysis to guide bicarbonate therapy.

Vasopressin:		
Class:	Indicated for:	IV/IO bolus Dosage:
Hormone	Pulseless Arrest	40 IU IV/IO

Notes: Only given one time to replace the first or second dose of Epinephrine; Epinephrine dosing can continue 3-5 minutes after Vasopressin is administered. Vasopressin should not replace antiarrhythmics (e.g. Amiodarone). May cause cardiac ischemia and angina. Not recommended for responsive patients with coronary artery disease. ET route discouraged; however, can be used IV/IO access is not available.

Verapamil:		
Class:	Indicated for:	IV/IO bolus Dosage:
Calcium Channel Blocker	Atrial Fibrillation Atrial Flutter PSVT	2.5-5 mg over 2-5 minutes

Notes: Alternative drug after Adenosine to terminate PSVT with adequate blood pressure and preserved LV function. Can cause peripheral vasodilatation and hypotension. Use with extreme caution in patients receiving oral β -blockers.