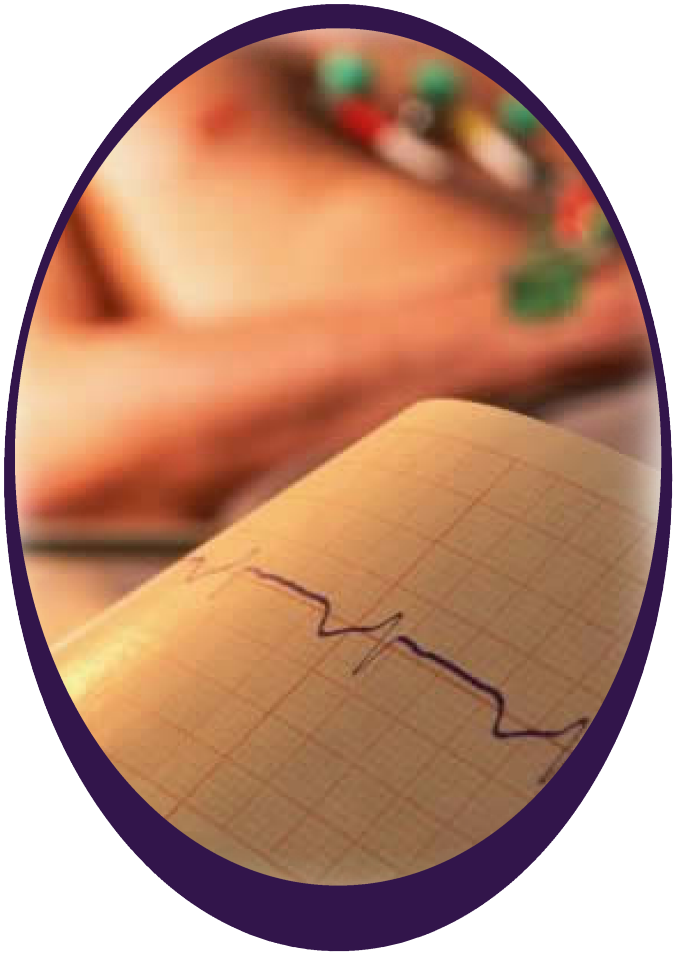
Fast Response

School of Health Care Education

ACLS Study Guide



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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. Your class is scheduled to begin promptly at 9:00 am. If you are late, you will be turned away and asked to reschedule. Please plan your trip accordingly. Parking in downtown Berkeley is limited to metered street parking and garage parking. We are conveniently located ½ block away from the Downtown Berkeley BART station. Discounted parking may be available for students arriving by 8:30 am; visit our website for additional information on parking and public transportation options. Students are expected to attend and participate in the entire course. ACLS cards and Continuing Education Units (CEU's) will be issued at the end of class.

As you are probably aware, changes were made in the American Heart Association'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, and if you do not understand the ECG and pharmacology information in the Precourse Assessment, it is unlikely you can successfully complete the course. Fast Response offers the American Heart Association's "ECG & Pharmacology" course as a preparatory class for ACLS; please call us for more information.

What we sent you

Enclosed are the ACLS Study Guide and an *ACLS Provider Manual* with Student CD.

***** Note** – The *ACLS Provider Manual* Student CD includes a Pre-course Assessment. If you experience difficulty, directions to access this Precourse Assessment are included on page 7 of this study guide. **Please complete this Precourse Assessment and bring the results with you to class**. If you are unable to access the Precourse Assessment on the Student CD, complete the included Written Precourse Self-assessment (which is similar to the one on the CD) and bring it with you to class.

Precourse 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. Review the Competency Checklists that will be used to evaluate you during the course (pages 119-127 of the *ACLS Provider Manual*).
4. **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. (Please note that we are not able to renew your BLS card based on this CPR test, which is a requirement of the ACLS course itself.)
5. 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.
6. **Complete the Precourse Assessment**. Use this assessment to identify areas where you need to increase your knowledge.

What to Bring and What to Wear

You must bring your ACLS Provider Manual to class, or you will not be allowed to attend. You must bring your completed Precourse 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 that according to Fast Response policy:

- There are no refunds for class fees. If you do not attend, you forfeit your entire class fee.
- You may reschedule your course **once** by calling us at least 5 business days before your scheduled class date. You will be charged a rescheduling fee of $25.
- If you reschedule with less than 5 business days' notice, the rescheduling fee will be 50% of your total class fee.
- We may not accept reschedule requests on weekends or holidays.
- You must attend **both days** of the ACLS Provider (2-day) course. If you miss a significant portion of either day, you must retake the entire course.
- Renewal (1-day) participants **must** bring a current **American Heart Association** ACLS card to class. There is no grace period for expired cards.

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

Lisa Dubnoff, MICP
ACLS Program Director

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Dear Student,

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

1. Each student must have the **current** (2006) provider manual available to them before, during, and after the course to fall within American Heart Association 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 only two options. (For PALS students, the course guide alone is acceptable. The ECC Handbook is not sufficient for either course.)

   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 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 CEU certificate until you provide us with your purchase receipt for the book.

2. If you are attending this class from a contracted hospital provider, you were 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 American Heart Association are very specific in how the class literature must be handled.

Thank you,

Fast Response Management

ACLS – Provider
Course Agenda

Day 1

935-935 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 Arrest (Group 1) and CPR/AED (Group 2) Practice and Testing

1120-1200 Respiratory Arrest (Group 2) and CPR/AED (Group 1) Practice and Testing

1200-1300 Lunch

1300-1335 Stroke; Video and Discussion

1335-1410 Resuscitation Team Concept; Video and Discussion

1410-1415 Break

1415-1515 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 Testing; Megacode

1345-1400 ACLS Review; Jeopardy

1400-1500 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 Arrest (Group 1) and CPR/AED (Group 2)
	Practice and Testing
1100-1140	Respiratory Arrest (Group 2) and CPR/AED (Group1)
	Practice and Testing
1140-1200	Stroke Video
1200-1300	Lunch
1300-1330	Resuscitation Team Concept; Video and Discussion
1330-1430	Learning Station; Megacode practice
1430-1440	Break
1440-1540	Testing; Megacode
1540-1550	ACLS Review; Jeopardy
1550-1640	Testing; Written

ACLS PROVIDER MANUAL STUDENT CD FAQ

1. **I cannot access the ACLS Precourse Self-Assessment Test.**
   - 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" and "Adobe Reader" 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 "ACLS Core Drugs" or any other PDF files on the CD**
   - 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. Adjust Volume if needed and make sure Mute is not checked.
     - 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

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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**, or **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, including *General Appearance*, *Level of Consciousness*, and *Vital Signs* (especially systolic Blood Pressure).

> *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, but should not be relied upon exclusively. Pulse Oximetry can be useful, especially if it rises or falls, but providers should remember that various conditions (such as CO_2 poisoning) can mask changes in blood oxygen levels, and that a high O2 saturation may be present in unstable patients (such as 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*, while 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 that they may be unconscious, you should check for responsiveness. If the patient is **Unresponsive**, get help (send someone to call 911 and bring back an AED, call a code, etc.). The BLS Algorithm should then be followed – 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 (for V-Fib and Pulseless V-Tach). Regardless of the heart rhythm, medications should be given as soon as possible after CPR is resumed (the specific medication determined by the patient's exact status and heart rhythm).

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ACLS Algorithm Review

Always start with the ABCD survey!

ACUTE CORONARY SYNDROMES

Algorithm: Acute Coronary Syndromes (page 70)

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

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

…but in the order Oxygen, Aspirin, Nitro, Morphine.

BRADYCARDIA

Algorithm: Bradycardia (page 81)

Remember: **A**ll **T**rained **D**ogs **E**at:

- **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° HB); **do not delay pacing in symptomatic patients** (even those in Sinus Brady 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 & 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 (page 91 or 99)

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

- For **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 two more doses at 12 mg each.

- For **Irregular Narrow Complex** Tachycardia (probable *A-Fib*)

1. Obtain 12-lead ECG; consider expert consultation.
2. Control rate with Diltiazem or β-blockers.

- For **Regular Wide Complex** Tachycardia (probable *V-Tach*)

1. Obtain 12-lead ECG; consider expert consultation.
2. Convert rhythm using Amiodarone – 150 mg over 10 minutes.
3. Elective cardioversion.

- For **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** (page 42)

Remember: Good ACLS starts with good BLS:

- **C**PR – start immediately. Push hard and push fast.
- **S**hock – analyze rhythm, and shock if in VF/pulseless VT.
- **C**PR – resume CPR immediately after shock delivery. Continue for 5 cycles / 2 minutes.
- **V**asopressor – Epi 1 mg q 3-5 min (can *replace* 1st or 2nd dose of Epi with 40 units Vasopressin).
  Give as soon as possible after resuming CPR, circulate with chest compressions.
- **S**hock – analyze rhythm, and shock if in VF/pulseless VT.
- **C**PR – resume CPR immediately after shock delivery. Continue for 5 cycles / 2 minutes.
- **A**ntiarrhythmic – Amiodarone 300 mg IV/IO or Lidocaine 1-1.5 mg/kg up to 3 mg/kg.
  Give as soon as possible after resuming CPR, circulate with chest compressions.
- **S**hock – analyze rhythm, and shock if in VF/pulseless VT.
- **C**PR – 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 a second dose of Epinephrine, a second antiarrhythmic dose (Amiodarone 150 mg or Lidocaine 0.5 – 0.75 mg/kg) may given after the next rhythm check.

PULSELESS ELECTRICAL ACTIVITY

Algorithm: Pulseless Arrest – **Not Shockable** (page 54)

Remember: **PEA**:

- **P**ossible causes (consider the 6 H's and 5 T's).
- **E**pinephrine 1 mg q 3-5 min (can *replace* 1st or 2nd dose of Epi with 40 units Vasopressin).
  Give as soon as possible after resuming CPR, circulate with chest compressions.
- **A**tropine, 1mg IV/IO q 3-5 min to max 3mg (*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	Hypoxia	Tamponade, cardiac	Toxins
Hypo-/Hyperkalemia	Hypoglycemia	Tension Pneumothorax	Trauma
Hydrogen Ion (acidosis)	Hypothermia	Thrombosis (coronary or pulmonary)	

ASYSTOLE

Algorithm: Pulseless Arrest – **Not Shockable** (page 54)

Remember: **DEAD**:

- **D**etermine whether to initiate resuscitation.
- **E**pinephrine 1 mg q 3-5 min (can *replace* 1st or 2nd dose of Epi with 40 units Vasopressin).
  Give as soon as possible after resuming CPR, circulate with chest compressions.
- **A**tropine, 1mg IV/IO q 3-5 min to max 3mg
  Give as soon as possible after resuming CPR, circulate with chest compressions.
- **D**ifferential Diagnosis or **D**iscontinue 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.

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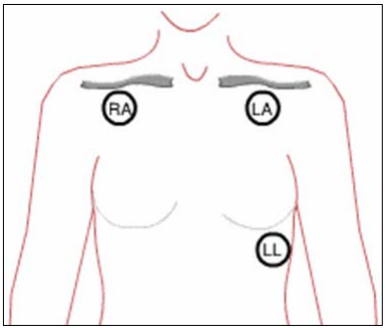
EKG and Electrical Therapy Review

The EKG tracing represents electrical activity through the heart. The **P wave** represents depolarization of the atria; the **QRS complex** represents depolarization of the ventricles; and the **T wave** represents the latter stage of repolarization of the ventricles. The interval from the first deflection of the P wave to the beginning of the QRS complex is the P-R Interval (PRI), and should be between 0.12 and 0.20 seconds. A normal QRS complex has a 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 strip measures time. Each large box represents 0.20 seconds; each small box represents 0.04 seconds.



To obtain a 3-lead EKG tracing, place the white (RA) electrode on the right chest just below the clavicle; the black electrode (LA) on the left chest just below the clavicle; and the Red electrode (LL) laterally on the lower left abdomen. Pacer pads go in the anterior/posterior positions. Defibrillation pads go on the upper right chest and lower left abdomen, although on children and other small patients the pads may need to be placed in the middle of the anterior and posterior chests.

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 or PEA. Common causes include sympathetic stimulation, stress, hypoxia, ischemia, drugs/toxins, and electrolyte disturbances. Although lab draws can be useful, a history of the patient and the current event obtained from a family member or caregiver is often more useful.

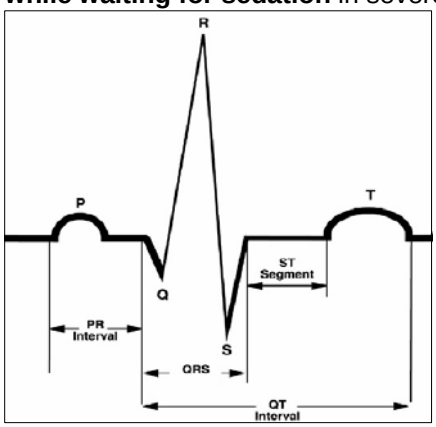
Defibrillation (Unsynchronized Shock)

Fibrillation is a disorganized rhythm that, if present in the ventricles, is life-threatening. Immediate CPR combined with early defibrillation is critical to survival from sudden cardiac arrest. Defibrillation terminates all electrical activity in the pulseless heart in the hopes that it will resume beating in a coordinated fashion. A shock should be delivered about once every 2 minutes if the patient remains in Ventricular Fibrillation.

With a monophasic monitor, the recommendation is to deliver a single shock at 360 Joules. If a biphasic monitor is used, the recommended dosage is machine-dependent, and should appear on the front of the monitor. If optimal shock dosage is not known, the consensus is to defibrillate at 200 J.

Synchronized Cardioversion

Synchronized cardioversion is the preferred treatment for unstable patients with a tachycardia such as Atrial Fibrillation, V-Tach with a pulse, or Supraventricular Tachycardia (SVT). 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 shock is delivered at 100 J; if the rhythm does not terminate, deliver additional shocks in stepwise fashion (200J, 300J, and 360J for subsequent shocks). With a biphasic monitor, dosage and steps are device-dependent; if optimal doses are unknown, begin at 100 J and step up from there.

Transcutaneous Pacing (TCP)

External cardiac pacing is the recommended treatment for symptomatic bradycardias. 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 above the monitored heart rate, with a minimum rate of 50 bpm.

Normal Sinus Rhythm (NSR)

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

Sinus Tachycardia

("Jim never has a second cup at home…")

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

Supraventricular Tachycardia (SVT)

Rhythm	Regular; runs of SVT may be regular or irregular.
Rate	SVT rate 150-250.
P waves	P waves in the runs of SVT usually abnormal (often pointed); usually hidden in preceding T wave.
PRI	Not measurable in the runs of SVT.
QRS	Normal (0.12 seconds or less).

Wandering Atrial Pacemaker (WAP, MAT)

Rhythm	Regular or irregular
Rate	Usually normal (60-100) or slow (less than 60); called *Multifocal Atrial Tachycardia* if fast (>100).
P waves	Vary in shape, orientation, size, and duration across rhythm strip
PRI	May vary depending on origin site; usually normal
QRS	Normal (0.12 seconds or less)

Atrial Fibrillation (A-Fib, AF)

Rhythm	Irregular (often grossly irregular)
Rate	*Atrial Rate*: 350 or more *Ventricular Rate*: Varies, but slower than the atrial rate.
P waves	Irregular *fibrillatory waves*; sinus P waves usually not present.
PRI	Not measurable
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, but slower than the atrial rate.
P waves	V-shaped flutter waves (F waves) with a "sawtooth" appearance
PRI	Not measurable
QRS	Normal (0.12 seconds or less)

Sinus Bradycardia

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

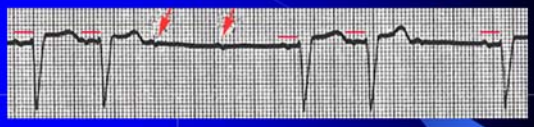
First-Degree AV Block

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 Contraction (PVC)

Rhythm	Underlying is usually regular. The PVCs may all be unifocal (same shape) or multifocal (different shapes)
Rate	Underlying rhythm may be slow (< 60), normal (60-100), or fast (> 100). More than 6 PVCs in one minute are significant.
P Waves	As normal for the underlying rhythm. The PVCs will not have P wave.
PRI	As normal for the underlying rhythm; N/A in the PVCs.
QRS	Usually normal (< 0.12) in the underlying rhythm. Usually wide (>0,12) in the PVCs, which are usually bizarre in appearance (compared to the underlying complexes).

Idioventricular Rhythm
(Ventricular Escape Rhythm)

Rhythm	Usually regular
Rate	20-40
P waves	Absent
PRI	N/A
QRS	Wide (0.12 seconds or greater) and/or bizarre in morphology

Asystole
(Hint: This is not a good sign)

Rhythm	Regular (or "None")
Rate	0 (or "None")
P Waves	Usually absent, but may be present.
PRI	N/A
QRS	Absent

Ventricular Fibrillation

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

Ventricular Tachycardia

Rhythm	Usually regular
Rate	> 100 (usually 140 to 250)
P waves	SA node often still beats; however, the P wave is usually hidden in the QRS
PRI	Not measurable
QRS	Wide (0.12 seconds or greater) and/or bizarre in morphology

Torsades de Pointes

Rhythm	Regularly irregular
Rate	> 100 (usually 140 to 250)
P waves	SA node often still beats; however, the P wave is usually hidden in the QRS
PRI	Not measurable
QRS	Wide (0.12 seconds or greater) and/or bizarre, with two distinct morphologies

Fast Response
School of Health Care Education

ACLS Medications Review

This information on medications 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 medications 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 – **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. If using the ET route, the drug dosage must be 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 – 1st dose; 12 mg rapid IV push – 2nd dose 12 mg rapid IV push – 3rd dose

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

AMIODARONE

Class:	**Indicated for:**	**IV/IO Bolus Dosage:**
Antiarrhythmic	V-Fib / Pulseless V-Tach	300 mg – 1st dose; 150 mg – 2nd dose
	Arrhythmias	360 mg over 6 hours (slow) 150 mg over 10 minutes (rapid)
	Infusion dose	540 mg IV/IO over 18 hours (.5 mg/min)

Notes: Cumulative doses >2.2 g/24 hours are associated with significant hypotension. Do not administer with other drugs that prolong QT interval (i.e., Procainimide). 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 Drug)	Chest pain / ACS	160 mg – 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	0.5 mg every 3-5 minutes as needed
	Asystole, slow PEA	1 mg every 3-5 minutes (up to 3 mg)

Notes: Used only in symptomatic bradycardia or in PEA with heart rate < 60. (Not indicated in Second Degree Type II or Third Degree heart block.) Doses < 0.5 mg may result in paradoxical slowing of the heart. ET route discouraged, but can be used if IV/IO access not available.

DEXTROSE/GLUCOSE

Class:	**Indicated for:**	**IV/IO Bolus Dosage:**
Carbohydrate	Hypoglycemia	25 g (50 ml) 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 Dosage:***
Calcium Channel Blocker	A-Fib / A-Flutter	15-20 mg over 2 minutes

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

DOPAMINE

Class:	**Indicated for:**	***IV Infusion:***
Catecholamine	Symptomatic Bradycardia	2-10 µg/kg/min – cardiac dose
	Hypotension	10-20 µg/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 Dosage:**
Catecholamine	Pulseless Arrest	1 mg (1:10,000) every 3-5 minutes
	Symptomatic Bradycardia	*Infusion*: 1 mg in 500ml of D_5W or NaCl at 1 µg/min titrated 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, but if used give 2-2.5 mg of a 1:1000 solution diluted in 10 ml normal saline.

FLUID ADMINISTRATION (e.g., Normal Saline / NaCl)

Class:	Indicated for:	IV/IO Bolus Dosage:
Fluid Volume	Hypovolemia	250 – 500 cc bolus (repeat as needed)

Notes: Use to treat specific reversible causes, such as hypovolemia. Routine administration of fluids during a 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 aPTT and platelet count while administering.

LIDOCAINE

Class:	Indicated for:	IV/IO Bolus Dosage:
Antiarrhythmic	V-Fib/Pulseless V-Tach	1-1.5 mg/kg (1st dose)
	Stable V-Tach	*Infusion*: 1-4 mg/min (30-50 µg/kg/min)

Notes: May repeat at 0.5-0.75 mg/kg every 5-10 minutes to a max. dose of 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, but can be used if IV/IO access not available.

MAGNESIUM SULFATE

Class:	Indicated for:	IV/IO Bolus Dosage:
Electrolyte	Torsades de pointes or Hypomagnesemia	1-2 g in 10 ml D_5W over 5-20 minutes

Notes: A fall in blood pressure may be noted with rapid administration. Dose is given over 5-20 minutes during cardiac arrest, 5-60 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 minutes

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	0.4-2.0 mg (up to 10 mg in 10 min.)

Notes: Monitor for recurrence of respiratory depression. May cause opiate withdrawal. ET route discouraged, but can be used if IV/IO access not available.

NITROGLYCERIN

Class:	**Indicated for:**	***IV Bolus Dosage:***
Vasodilator	Chest pain/ACS	12.5-25 µg in D_5W 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 phosphodiasterase 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 NRB

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 U IV/IO

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

VERAPAMIL

Class:	**Indicated for:**	***IV Bolus Dosage:***
Calcium Channel Blocker	A-Fib/A-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 vasodilation and hypotension. Use with extreme caution in patients receiving oral β-blockers.