ECG STRIP INTERPRETATION

These ECG strips are meant for review. For rationale, please attend an ECG course.

SINUS RHYTHMS

VENTRICULAR RATE/RHYTHM: 60 BPM/REGULAR
ATRIAL RATE/RHYTHM: 60 BPM/REGULAR
PR INTERVAL: 0.20 SEC
QRS DURATION: 0.06 SEC
IDENTIFICATION: SINUS RHYTHM

SINUS BRADYCARDIA

VENTRICULAR RATE/RHYTHM: 58 BPM/REGULAR
ATRIAL RATE/RHYTHM: 58 BPM/REGULAR
PR INTERVAL: 0.20 SEC
QRS DURATION: 0.08 SEC
IDENTIFICATION: SINUS BRADYCARDIA
**SINUS TACHYCARDIA**

VENTRICULAR RATE/RHYTHM  130 BPM/REGULAR  
ATRIAL RATE/RHYTHM  130 BPM/REGULAR  
PR INTERVAL  0.14 – 0.16 SEC  
QRS DURATION  0.06 – 0.08 SEC  
IDENTIFICATION  SINUS TACHYCARDIA  

**SINUS ARREST**

VENTRICULAR RATE/RHYTHM  NONE  
ATRIAL RATE/RHYTHM  NONE  
PR INTERVAL  NONE  
QRS DURATION  NONE  
IDENTIFICATION  ASYSTOLE  

**ATRIAL RHYTHMS**

**SUPRAVENTRICULAR TACHYCARDIA**

VENTRICULAR RATE/RHYTHM  188 BPM/REGULAR  
ATRIAL RATE/RHYTHM  UNABLE TO DETERMINE  
PR INTERVAL  UNABLE TO DETERMINE  
QRS DURATION  0.06 SEC  
IDENTIFICATION  SUPRAVENTRICULAR TACHYCARDIA (SVT)
ATRIAL FLUTTER

VENTRICULAR RATE/RHYTHM 88 BPM/REGULAR
ATRIAL RATE/RHYTHM UNABLE TO DETERMINE
PR INTERVAL UNABLE TO DETERMINE
QRS DURATION 0.06 SEC
IDENTIFICATION ATRIAL FLUTTER

ATRIAL FIBRILLATION

VENTRICULAR RATE/RHYTHM 55-94 BPM/IRREGULAR
ATRIAL RATE/RHYTHM UNABLE TO DETERMINE
PR INTERVAL UNABLE TO DETERMINE
QRS DURATION 0.10 SEC
IDENTIFICATION ATRIAL FIBRILLATION

VENTRICULAR RHYTHMS

VENTRICULAR TACHYCARDIA

VENTRICULAR RATE/RHYTHM 214 BPM/REGULAR
ATRIAL RATE/RHYTHM UNABLE TO DETERMINE
PR INTERVAL UNABLE TO DETERMINE
QRS DURATION 0.14 SEC
IDENTIFICATION VENTRICULAR TACHYCARDIA, MONOMORPHIC
VENTRICULAR FIBRILLATION

VENTRICULAR RATE/RHYTHM: UNABLE TO DETERMINE
ATRIAL RATE/RHYTHM: UNABLE TO DETERMINE
PR INTERVAL: UNABLE TO DETERMINE
QRS DURATION: UNABLE TO DETERMINE
IDENTIFICATION: VENTRICULAR FIBRILLATION

ATRIOVENTRICULAR BLOCKS

FIRST DEGREE HEART BLOCK

VENTRICULAR RATE/RHYTHM: 68 BPM/REGULAR
ATRIAL RATE/RHYTHM: 68 BPM/REGULAR
PR INTERVAL: 0.28 SEC
QRS DURATION: 0.06 SEC
IDENTIFICATION: FIRST-DEGREE AV BLOCK

SECOND DEGREE HEART BLOCK TYPE 1

VENTRICULAR RATE/RHYTHM: 38-75 BPM/IRREGULAR
ATRIAL RATE/RHYTHM: 75 BPM/REGULAR
PR INTERVAL: LENGTHENING
QRS DURATION: 0.06 – 0.08 SEC
IDENTIFICATION: SECOND-DEGREE AV BLOCK, TYPE 1
### SECOND DEGREE HEART BLOCK TYPE 2

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<th>Parameter</th>
<th>Value</th>
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<tr>
<td>Ventricular Rate/Rhythm</td>
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<td>Atrial Rate/Rhythm</td>
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<td>QRS Duration</td>
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### THIRD DEGREE HEART BLOCK

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<th>Parameter</th>
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<td>Atrial Rate/Rhythm</td>
<td>115 BPM/REGULAR</td>
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### BASIC LIFE SUPPORT

ACLS is built heavily upon the foundation of BLS. A large percentage of this course content is structured around the concept that the ACLS student has a strong understanding of the BLS material. Many of the test questions in the ACLS exam are BLS based. Please refer to the BLS study guide or BLS course material as part of your review process. If you have not taken a BLS class with the 2010 science updates, it is highly recommended that you do so prior to taking the 2010 ACLS course.

### THE SYSTEMATIC APPROACH: THE BLS AND ACLS SURVEYS

- If the patient appears unconscious
  - Use the BLS survey for the initial assessment
  - After initiating all of the initial steps of BLS conduct the ACLS survey
- If the patient appears conscious
  - Use the ACLS survey for the initial assessment
**EFFECTIVE RESUSCITATION TEAM DYNAMICS**

CLOSED-LOOP COMMUNICATION

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

**SYSTEMS OF CARE**

CARDIOPULMONARY RESUSCITATION

Medical Emergency Teams (METs) and Rapid Response Teams (RRTs) are teams designed to improve patient outcome by identifying and treating early clinical deterioration.

POST-CARDIAC ARREST CARE

Titrate inspired oxygen during post-cardiac arrest care, titrating oxygen saturation to ≥ 94%. This will avoid oxygen toxicity.

**ACLS CASE: RESPIRATORY ARREST**

BLS SURVEY-review

1. The BLS survey includes early defibrillation. It does not include advanced airway, meds, or post resuscitation treatments.
2. In the BLS survey, if an advanced airway is present, give 1 breath every 6-8 seconds with compressions being delivered continuously without pause at a rate of 100.

ACLS SURVEY-review: MONITORING CPR QUALITY

1. If PETCO₂ <10 mmHg → attempt to improve quality of chest compressions
2. If Arterial line diastolic pressure is <20 mmHg → attempt to improve quality of chest compressions

OPENING THE AIRWAY

If a patient is unresponsive, the airway can become obstructed by the tongue secondary to the relaxation of the upper airway muscles. A common and effective method of opening the airway is to use the “head tilt-chin lift” technique.
TECHNIQUES OF OPA INSERTION

To select the appropriately sized OPA, place it against the side of the face. When the tip of the OPA is at the corner of the mouth, the flange is at the angle of the mandible. A properly sized and inserted OPA results in proper alignment with the glottic opening.

ENDOTRACHEAL TUBE SUCTIONING PROCEDURE

1. Precede suctioning with a short administration time of 100% oxygen.
2. Suctioning attempts should not exceed 10 seconds.
3. **DO NOT HYPER-VENTILATE**

VENTILATION RATES DURING RESPIRATORY ARREST

*Respiratory Arrest* is the description given to a patient who is not breathing but has a pulse. When ventilating (with either a bag mask or through the use of an advanced airway) for this adult victim, the rescuer should give one breath every 5-6 seconds (or 10-12 breaths per minute).

The routine use of cricoid pressure in cardiac arrest in not recommended.

ACLS CASE: VF TREATED WITH CPR AND AED

BLS SURVEY-review

1. Early defibrillation is critical for patients with sudden cardiac arrest.
2. When VF is present, CPR can provide a small amount of blood flow to the heart and brain but cannot directly restore an organized rhythm.
3. If the AED does not promptly analyze the rhythm **resume high-quality chest compressions** and ventilations and **check all connections** between the AED and the patient to make sure that they are intact.
4. The AHA strongly recommends performing CPR while a defibrillator or AED is readied for use and while charging for all patients in cardiac arrest.

AED USE IN SPECIAL SITUATIONS

If the patient is lying on snow or ice or is in a small puddle, use the AED.

ACLS CASE: VF/PULSELESS VT

MANAGING VF/PULSELESS VT: THE CARDIAC ARREST ALGORITHM

Once you recognize VF/Pulseless VT, shock immediately. Followed immediately by 2 minutes of CPR during which you establish IV/IO access. After those two minutes, shock again. Review the VF/Pulseless VT algorithm.
APPLICATION OF THE CARDIAC ARREST ALGORITHM: VF/VT PATHWAY

1. Minimize interruptions in chest compressions.
2. Chest compressions should ideally be interrupted only for ventilations unless an advanced airway is in place.
3. While charging the defibrillator, continue with compressions.
4. When delivering a shock, be sure that oxygen is not flowing across the patient’s chest.
5. Perform a pulse check only if an organized non-shockable rhythm is present during a rhythm analysis. Rhythm analysis will take place every 2 minutes.
6. Self-adhesive pads reduce the risk of arcing, allow monitoring of patients underlying rhythm, and permit for rapid delivery of a shock if necessary.
7. The term refractory, such as refractory VF, means not responding to treatment.
8. When considering or giving Amiodarone please note that the first dose is 300 mg and the subsequent dose is 150 mg.

PHYSIOLOGIC MONITORING DURING CPR

1. Using quantitative waveform capnography in intubated patients allows the provider to monitor CPR quality
2. The PETCO\textsubscript{2} values should exceed 10 mmHg
3. If PETCO\textsubscript{2} is less than 10 mmHg, ROSC is unlikely.
4. Normal PETCO\textsubscript{2} should range 35-40 mmHg

ROUTES OF ACCESS FOR DRUGS

1. Routes in order of preference: IV, IO, then ETT
2. A peripheral IV is preferred for drug and fluid administration
3. Preferred site for 1\textsuperscript{st} IV attempt is antecubital.
4. Give drug by bolus injection (rapidly) unless otherwise specified

VASOPRESSORS USED DURING CARDIAC ARREST

If IV/IO access cannot be established or is delayed, give epinephrine 2 to 2.5 mg diluted in 5 to 10 mL of sterile water or normal saline and injected directly into the ET tube. Remember, the ETT route of drug administration results in variable and unpredictable drug absorption and blood levels.
APPLICATION OF THE IMMEDIATE POST-CARDIAC ARREST CARE ALGORITHM

1. Immediately after ROSC, ensure an adequate airway and support breathing
2. Titrate (adjust) FiO₂ to maintain O₂ saturation greater than 94%. Maintaining FiO₂ greater than 100% for any significant period of time leads to O₂ toxicity.
3. When securing an advanced airway, avoid using ties that pass circumferentially around the patient’s neck, thereby obstructing venous return from the brain
4. Excessive ventilation (hyperventilating) may potentially lead to adverse hemodynamic effects when intrathoracic pressures are increased and because of potential decreases in cerebral blood flow when Paco₂ decreases.
5. With ROSC if the patient is hypotensive (SBP less than 90 mmHg) treat as follows:
   a. 1-2 L NS or LR
   b. Epinephrine 0.1-0.5 mcg/kg/min. Titrate to keep SBP >90 mmHg with a MBP >65 mmHg
6. If the patient fails to follow commands, consider therapeutic hypothermia
7. Therapeutic hypothermia: target temp 32°C -34°C for 12-24 hours.

ACLS CASE: PULSELESS ELECTRICAL ACTIVITY

DESCRIPTION OF PEA
Any organized rhythm without a pulse is defined as PEA.

THE CARDIAC ARREST ALGORITHM
If PEA, begin with chest compressions. The only medication that can be given at this point is Epinephrine 1mg every 3-5 minutes with Vasopressin 40 units as a replacement option for the 1st or 2nd dose only.

THE PEA PATHWAY OF THE CARDIAC ARREST ALGORITHM
IV/IO access is a priority over advanced airway management unless bag-mask ventilation is ineffective or the arrest is caused by hypoxia.

ADMINISTER VASOPRESSORS
Give a vasopressor as soon as IV/IO access becomes available (Epinephrine 1mg, Vasopressor 40 units)
ACLS CASE: ASYSTOLE  PG 86-90

PATIENTS WITH DNAR ORDERS

Reasons to stop or withhold resuscitative efforts: Rigor mortis, threat to safety of providers.

ADMINISTER VASOPRESSORS

If asystole, begin with chest compressions. The only medication that can be given at this point is Epinephrine 1mg every 3-5 minutes with Vasopressin 40 units as a replacement option for the 1st or 2nd dose only.

NON-SHOCKABLE RHYTHM

- No electrical activity is present (asystole)
- Electrical activity is present (but not VF/VT) try to palpate a pulse. If no pulse is present no shock is advised.
- Also, a pulseless patient cannot be paced

TERMINATING OUT-OF-HOSPITAL RESUSCITATIVE EFFORTS

- The healthcare provider is unable to continue because of exhaustion

DURATION OF RESUSCITATIVE EFFORTS

While in asystole, prolonged resuscitative efforts are unlikely to be successful. Twenty-five minutes may be too long.

ASYSTOLE: AN AGONAL RHYTHM CONFIRMING DEATH

Asystole is terminal rhythm in a resuscitation attempt that started with another rhythm. Asystole most often represents an agonal rhythm confirming death rather than a rhythm to be treated or a patient who can be resuscitated if the attempt persists long enough.

ACLS CASE: ACUTE CORONARY SYNDROMES  PG 91-103

THE ACUTE CORONARY SYNDROMES ALGORITHM

Immediate ED general treatment

- O₂: Titrate oxygen saturations to equal or greater than 94%. The idea is to use as little oxygen as necessary
- Aspirin: give 160-325 to chew
- Nitroglycerin: used cautiously or not at all with a patient with inferior wall MI and right ventricular infarction
- Morphine: indicated in STEMI when chest discomfort is unresponsive to nitrates.
- ECG interpretation: If a patient is otherwise stable an ECG is always the right answer.
ACLS CASE: BRADYCARDIA PG 104-113

BLS AND ACLS SURVEYS
If patient is in respiratory arrest but has bradycardia with a pulse use the ACLS survey as follows

- A: Maintain patent airway
- B: Assist breathing, give oxygen for hypoxemia, monitor oxygen sats
- C: as appropriate
- D: Search for and treat reversible causes

TREATMENT SEQUENCE SUMMARY

- Give atropine as first line treatment for symptomatic bradycardia. Dose to 0.5 mg. May repeat dosing until total of all doses equal 3 mg.
- If Atropine is ineffective and transcutaneous pacing is not used or is ineffective as well, give dopamine 2-10 micrograms/kg/min. An epinephrine drip may also be administered.
- Note: Atropine should not be given for a second degree type II heart block or third degree heart block.

ACLS CASE: UNSTABLE TACHYCARDIA PG 114-123

SYMPTOMS AND SIGNS
Unstable tachycardia leads to serious signs and symptoms.

- Hypotension
- Altered mental status
- Shock
- Ischemic chest discomfort
- Acute heart failure

RAPID RECOGNITION IS THE KEY TO MANAGEMENT

A heart rate greater than 150/min is an inappropriate response to physiologic stress.

MANAGING UNSTABLE TACHYCARDIA: THE TACHYCARDIA ALGORITHM

- Initial priority for the management of any patient with tachycardia is to determine if there is a pulse or not.
- If s/s persist or are rapidly deteriorating because of tachycardia then this would be considered unstable and requires immediate synchronized cardioversion.

CRITICAL CONCEPTS: UNSTABLE PATIENTS

- If stable: Healthcare providers should obtain a 12-lead ECG early in the assessment to better define the rhythm
- If unstable: Do not delay immediate synchronized cardioversion for a 12-lead ECG.
RECOMMENDATIONS

1. When to use synchronized shocks
   a. Unstable SVT
   b. Unstable A-fib: biphasic 120-200 J synchronized
   c. Unstable A-flutter
   d. Unstable Regular Monomorphic tachycardia with a pulse

2. When to use unsynchronized shocks
   a. Patient with no pulse
   b. Polymorphic VT with a pulse which is quickly deteriorating towards a pulseless algorithm.
   c. When unsure as to whether or not it is monomorphic or polymorphic VT with a pulse.

ACLS CASE: STABLE TACHYCARDIA  PG 124-129

DECISION POINT: NARROW OR WIDE

If a monomorphic wide-complex rhythm is present and the patient is stable, expert consultation is advised.

NARROW QRS, REGULAR RHYTHM

1. Attempt vagal maneuvers
2. Give adenosine
   a. 1st dose: 6mg as rapid IV push followed immediately with rapid NS flush
   b. 2nd dose: 12mg, same procedure.

ACLS CASE: ACUTE STROKE  PG 130-147

ACTIVATE EMS SYSTEM IMMEDIATELY

Emergency medical dispatchers play a critical role in timely treatment of potential stroke victims by instructing bystanders in lifesaving CPR skills or other supportive care if needed.

STROKE ASSESSMENT TOOLS

Cincinnati Pre-hospital Stroke Scale (if no immediate lifesaving interventions are needed)

There you go! All the highlights necessary to do well on the ACLS 50 question test have been covered in the above outlined material. Please refer to your ACLS course book for more detailed information. Good luck and see you in class.

Information compiled by David Jason Balogh, ACLS instructor, RN