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"Providing Quality, Professional Training"

Advanced Cardiac Life Support (ACLS)

Course Study Guide and Agenda

• Course Outline and General Information •

Today's course is provided by:

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Course

Advanced Cardiac Life Support (ACLS)

Topics include:

- Recognition and early management of pre-arrest conditions that may lead to cardiac arrest
- Proficiency in BLS care
- Management of cardiac arrest
- Identify and treat ischemic chest pain
- Recognize other life threatening situations such as stroke
- Demonstrate effective communication and team dynamics

Course time: Approximately 8.0 hours for renewal and 14.0 hours for initial course

Curriculum: American Heart Association (*2010 Edition*)

Source: (American Heart Association, 2008)

The following information is a guide and basic course outline. The information within this packet is limited and maybe incomplete. Students should refer to their course books and American Heart Association's Emergency Cardiovascular Care handbook for complete and accurate information.

Upon completion of the course you will receive a course completion card. Recommended renewal is every two years.

Lost Cards: If you lose your card you can obtain a duplicate by contacting us. The cost for a duplicate card is currently $30 and subject to change without notice.

Thank you for choosing Essential Medical Training, LLC

Enjoy your class!

Advanced Cardiac Life Support

The American Heart Association has updated everything again. There is new information, new books, new classes and a new test. Every 5 years the AHA updates their courses to reflect the new science.

The 2010 guidelines are evidence based and involve 356 resuscitation experts from 29 countries over 3 years of scientific review. They produce 411 scientific reviews on 277 topics in resuscitation and emergency cardiac care.

The goal of resuscitation is an outcome beyond return of spontaneous circulation (ROSC). Return to a prior quality of life and functional state of health is the ultimate goal of a resuscitation system of care. Return to quality of life is dependent upon high quality of CPR.

De-emphasis of Device, Drugs, and other Distracters

There is insufficient data to demonstrate that any drugs or mechanical CPR devices improve long term outcome after cardiac arrest.

POST RESUSCITATION

Optimizing hemodynamic, neurologic and metabolic function may improve survival to hospital discharge among patients who have ROSC. Therapeutic hypothermia is one intervention that has shown to improve occasional outcome for patients of in-hospital and out-of-hospital cardiac arrest with PEA/asystole as the presenting rhythm.

EDUCATIONAL RECOMMENDATIONS

More frequent renewal of skills is needed. Retraining should not be limited to two year intervals.

CPR OVERVIEW

There are approximately 350,000 people/year (half of them in hospital) that experience cardiac arrest and receive attempted resuscitation. This does not include those who experience cardiac arrest, but do not receive attempted resuscitation. Twenty five percent of out of hospital cardiac arrest present with a Pulseless ventricular arrhythmia. Victims who present with Ventricular Fibrillation (VF) or Pulseless Ventricular Tachycardia (VT) have a substantially better outcome compared with those who present with Asystole or PEA.

Emergency systems that can effectively implement the chain of survival can achieve witnessed VF cardiac arrest survival rates of almost 50%.

1. Immediate recognition and activation of the EMS system
2. Early CPR with emphasis on chest compressions
3. Early and Rapid Defibrillation
4. Effective Advanced Life Support
5. Integrated post cardiac arrest care

RESCUER

Application of CPR will depend on the rescuer's training, experience, and confidence. All rescuers should provide chest compressions to all victims of cardiac arrest.

- CPR should begin with chest compressions for victims of all ages
- Rescuers who are able to add ventilations to the chest compressions, should if available
- Rescuers with a higher level of training should work together to administer compressions and ventilations simultaneously without interruptions.

RECOGNITION AND ACTIVATION OF EMERGENCY RESPONSE

- Agonal gasps are common early after sudden cardiac arrest
- Can be confused with normal breathing
- Pulse detection is unreliable, even when performed by trained rescuers
- CPR should be started immediately if adult victim is unresponsive and not breathing normally
- Look, Listen and feel to aid recognition is not longer recommended

HIGH QUALITY CHEST COMPRESSIONS

- Adequate rate – at least 100/min
- Adequate depth
    - Adults: at least 2 inches
    - Infants and Children: at least 1/3 anterior-posterior diameter of the chest
- Allow complete chest recoil after each compression
- Minimizing interruptions in compressions to 10 seconds or less
- Avoiding excessive ventilation
- If multiple rescuers – rotate tasks every 2 minutes or 5 cycles

AIRWAY AND VENTILATION

- The untrained rescuer should perform Hand Only CPR (compressions only)
- Healthcare providers are typically not permitted to perform hands only compressions when practicing within their medical scope of practice.
- A patient in respirator arrest should receive ventilations at a rate of 1 breath every 5 to 6 seconds, which equals 10 to 12 breaths per minute.
- Once an advanced airway is in place the healthcare provider will deliver ventilations at a rate of one breathe every 6-8 seconds (8-10 ventilations per minute) and chest compressions can then be delivered without interruption.
- The HCP should use caution when securing the ET tube using a circumferential tie because it could obstruct venous return to the brain.

DEFIBRILLATION

- Chance of survival decreases with increased interval between arrest and defibrillation
- Defibrillation remains the cornerstone therapy for VF and VT.

- Community and hospitals should aggressively work to decrease interval between arrest and defibrillation
- One determinant of successful defibrillation is effectiveness of chest compressions prior to defibrillation.
- Improved outcome with shorter time between stopping of compressions and shock delivery
- One advantage to hands free pads is that it allows the rescuer to provide a more rapid defibrillation.

MANAGING THE AIRWAY

C~A~B (Compressions – Airway – Breathing) helps clarify that airway maneuvers should be performed quickly and efficiently so that interruptions in chest compressions are minimized and chest compressions should take priority in the resuscitation of an adult.

The trained rescuer should open the airway using the head tilt chin lift method if no signs of head or neck trauma.

Between 0.12 and 3.7% of victims with blunt trauma have a spinal injury and the risk of spinal injury is increased if the victim has craniofacial injury. Spinal immobilization devices may interfere with maintaining a patent airway but ultimately the use of such a device may be necessary to maintain spinal alignment during transport. Maintaining a patent airway and providing adequate ventilations are priorities, use the head tilt – chin lift maneuver if the jaw thrust does not adequately open the airway.

- Deliver each breath over 1 second
- Give a sufficient tidal volume to produce visible chest rise
- Use a compression to ventilation rate of 30 compressions to 2 ventilations.
- With an advanced airway – 1 breath every 6-8 seconds without a pause in compressions, this equals approximately 10 ventilations per minute.

During CPR cardiac output is 25-33% of normal, so oxygen uptake from the lungs and CO2 delivery to the lungs are also reduced. As a result, a low minute ventilation can maintain effective oxygenation and ventilation. Patients with poor lung compliance may require high pressures to be properly ventilated.

MOUTH TO MOUTH – give 1 breath over 1 second with the rescuer taking a regular breath rather than a deep breath. This prevents the rescuer from getting dizzy and over inflation of the patient's lungs.

MOUTH TO BARRIER DEVICE – the risk of disease transmission through mouth to mouth ventilation is very low and it is reasonable to initiate rescue breathing with or without a barrier device. When using a barrier, the rescuer should not delay compressions while setting up the device.

BAG VALVE MASK – provides positive pressure ventilation without an advanced airway; therefore it may produce gastric inflation and its complications. A bag valve mask should have;

- No pressure relief valve or one that can be bypassed
- Universal fittings
- Can be used with or without an oxygen source
- A non re-breathing outlet valve that cannot be obstructed with foreign material
- Transparent mask
- Not the recommended ventilation method for a lone rescuer.
- Should be used by two trained rescuers – one seals the mask and the other compresses the bag. A single rescuer can use the BVM
- AHA recommends the E-C technique

CAPNOGRAPHY AND CAPOMETRY

Detection of CO_2 is one of several methods used to confirm endotracheal tube position. The body eliminates CO_2 through ventilation. When blood passes through the lungs, CO_2 moves from the blood, across the alveolar capillary membrane into the alveoli, and then into the airways and is exhaled. The exhaled CO_2 can be detected by either of the two techniques:

1. **Qualitative** method that detects exhaled CO_2. As little as 2% concentration of exhaled carbon dioxide will cause a color change in the colorimetric device. If the color changes to yellow, CO_2 is detected (Yellow = Yes) but if the color remains purple, there is no detection of CO_2 (Purple = Problem). It is recommended that you administer a minimum of 6 breaths prior to attempting to identify the color change.
2. **Quantitative** device that uses infrared absorption detectors to measure the concentration of exhaled CO_2. Capnography devices provide a continuous recording of exhaled CO_2. This is the best method for confirming and monitoring correct placement of the endotracheal tube. A reading of 10mm/hg $\geq$ of $PETCO_2$ would be a sign of effective CPR. In addition to monitoring ET tube position, quantitative waveform capnography allows healthcare personnel to monitor CPR quality, optimize chest compressions, and detect ROSC during chest compressions or when a rhythm check reveals an organized rhythm. A good indicator for ROSC is when the $PETCO_2$ abruptly increases to a normal value of 35 to 40 mm Hg.

SUPRAGLOTTIC AIRWAY

Devices such as the LMA, esophageal tracheal Combitube and the King airway are currently within the scope of BLS practice in a number of regions. Ventilations with a bag through these devices provide an acceptable alternative to bag mask ventilation.

CRICOID PRESSURE

- Can prevent gastric inflation and reduce risk of regurgitation and aspiration but it may also impede ventilations
- Training in the maneuver is difficult for both expert and non expert providers
- Not recommended for use during cardiac arrest ventilation
- May be used in a few special circumstances such as to aid in viewing the vocal cords during intubation.

DROWNING

Rescuers should provide CPR; particularly rescue breaths, as soon as possible. The lone healthcare provider should give 5 cycles (about 2 minutes) of CPR before leaving the victim to activate EMS. There is no evidence that water acts as an obstructive foreign body. Heimlich maneuvers may cause harm (aspiration).

ELECTRICAL THERAPY

For every minute that passes between collapse and defibrillation survival decreases 7-10%.

- With CPR decrease in survival is 3-4% per minute. That means you have twice the amount of time to provided defibrillation with the possibility of success.
- Survival rates are greatest if defibrillation occurs in 4-5 minutes from collapse
- CPR prolongs VF and delays the onset of Asystole which has a poor prognosis.

Defibrillation should occur as soon as the AED is available and ready to shock. CPR should be done until the defibrillator is readied.

CPR First or SHOCK First?

When a provider witnesses an arrest or if the down time is less than 4 minutes, an AED should be used as soon as it is available. If the arrest is not witnessed or down time is greater than 4 to 5 minutes, 1 to 3 minutes of CPR is recommended prior to defibrillation. Two studies showed that when EMS call-to-arrival intervals were 4 to 5 minutes or longer, patients who received 1 ½ to 3 minutes of CPR prior to defibrillation had higher rates of resuscitation compared to those who received immediate defibrillation.

Clearing for Defibrillation- To ensure safety during defibrillation, always announce before delivering the shock. You don't have to use these exact words but you want to make sure you warn others that you are about to deliver a shock.

- **"Clear! I am going to shock on three".**
    - Check to make sure you are clear of contact with the patient, the stretcher, or other equipment.
    - Visually check to make sure no other rescuer is touching the patient or equipment.
    - Make sure oxygen is now flowing across the patient's chest.
- "**One, Two, Three…. SHOCKING**
    - When you are delivering the shock make sure you are facing the patient and not the defibrillator. This will help to ensure that no one is touching the patient when you are delivering a shock.

Post Shock Delivery- rescuers should begin CPR starting with chest compressions. This will help increase coronary perfusion. If shock is unsuccessful then (single shock) begin CPR (more perfusion) rather than more energy.

Second shocks should be at the same level or higher levels. Energy levels range from 120j to 200j for biphasic waveforms. Energy levels are device specific therefore use the manufacturers recommended dose. If not known use maximum dose.

SYNCHRONIZED CARDIOVERSION

Synchronized cardioversion is recommended for unstable SVT. The recommended initial biphasic energy dose for cardioversion of atrial fibrillation is 120j to 200j. Cardioversion of adult atrial flutter and other SVT rhythms generally require less energy of 50j to 100j. If the initial cardioversion fails then the provider should increase the dose in a stepwise fashion.

Ventricular Tachycardia- Adult stable monomorphic VT responds well to synchronize cardioversion of initial energy levels of 100j. If there is no response then increasing the dose in a stepwise fashion would be recommended. Cardioversion should not be used for VF since the device is unlikely to sense a QRS waveform, and thus, a shock may not be delivered.

IN HOSPITAL USE OF AED's

Hospitals should consider AED's as a way to facilitate early defibrillation (a goal of shock delivery < 3 min from collapse) especially in areas where staff does not have rhythm recognition skills or manual defibrillators are not used frequently. Some hospitals have implemented Rapid Response Teams (RRT) for the purpose of identifying and treating early clinical deterioration of a patient.

Pad Placement – Anterior pad placed to the right of the sternum just below the clavicle. The apex pad is placed to the left of the nipple with the center of the pad midaxillary. Patients with ICD should have the pad placed at least 1-2 inches away from the device.

DEFIBRILLATION WITH IMPLANTABLE CARDIOVERTER-DEFIBRILLATOR

If the patient has an ICD that is delivering shocks, wait 30-60 seconds to allow the ICD to complete the treatment cycle before attaching the AED. It might be reasonable to avoid placing the pads/paddles directly over the implanted device. Pacemaker spikes with unipolar pacing may confuse AED software preventing detection of VF. One study demonstrated that positioning the pads at least 3 inches away from the device did not damage device pacing, sensing, or capturing.

ACUTE STROKE

Stroke is a general term. It refers to acute neurologic impairment that follows interruption in blood supply to a specific area of the brain, either by blockage (ischemic) or bleed (hemorrhagic). Ischemic strokes account for 87% of all strokes. Hemorrhagic stroke accounts for 13% of all strokes. Each year approximately 800,000 people suffer a new or recurrent stroke, making this the second leading cause of the death in the United States. Early recognition of ischemic stroke is important because IV fibrinolytic therapy needs to be giving within 3 hours from the onset of symptoms.

Goals of stroke care include:

1. Immediate general assessment by stroke team within 10 min of arrival at hospital
2. Neurological assessment by stroke team and CT scan within 25 min of arrival

3. Interpretation of CT scan within 45 min of arrival
4. Initiation of fibrinolytic therapy within 1 hours of hospital arrival
5. Door-to-admission time 3 hours

Stroke Assessment Tools

Cincinnati Prehospital Stroke Scale is based on 3 finding:

- Facial droop
- Arm drift
- Abnormal speech

Evidence shows that patients who are transported to a stroke dedicated unit have a better survival rate. EMS should consider transporting to a stroke center when transport is within a responsible time.

MEDICATIONS

VASOPRESSORS: To date no placebo controlled trial have shown that administration of any vasopressors agent at any stage during management of VF, Pulseless VT, PEA or Asystole increases the rate of neurologically intact survival to hospital discharge. There is evidence however that the use of vasopressors is associated with an increased rate of ROSC.

Epinephrine produces alpha receptor properties which can increase coronary perfusion pressure and cerebral perfusion pressure during CPR. The value and safety of the beta effects of epinephrine are controversial because they may increase myocardial workload and reduce subendocardial perfusion. A retrospective study of patients with and without Epinephrine found improved ROSC with epinephrine but no difference in long term survival between the treatment groups. Epinephrine should be administered in 1mg doses every 3-5 minutes during resuscitation. Higher doses may be indicated to treat specific issues such as beta blocker overdose or when guided by hemodynamic monitoring such as arterial diastolic pressure or CPP.

Vasopressin is a non-adrenergic peripheral vasoconstrictor that also causes coronary and renal vasoconstriction. Trials demonstrated no difference in outcomes with vasopressin versus epinephrine as first line vasopressor in cardiac arrest. One dose of vasopressin 40 units may be given in place of the first or second dose of Epinephrine during resuscitation.

ANTIARRHYTHMICS – there is no evidence that any antiarrhythmic drug given routinely during human cardiac arrest increases survival to discharge from the hospital.

Amiodarone may be considered in the treatment of VF and Pulseless VT. HCP administration of 300mg of amiodarone improved hospital admission rates when compared with administration of placebo or 1.5mg/kg Lidocaine. Additional studies documented improvement in termination of arrhythmias when amiodarone was given to humans or animals with VF or hemodynamically unstable VT. An initial dose of 300mg can be followed by 1 dose of 150mg. There is limited experience with Amiodarone when given IO.

Lidocaine there is inadequate evidence to recommend the use of Lidocaine in patients with VT/VF. Lidocaine is an alternative of long standing and widespread familiarity with fewer immediate side effects but has no proven short or long term efficacy in cardiac arrest. It can only be considered if Amiodarone is not available. It is given at 1.5mg/kg doses with the second dose at 0.75mg/kg.

Magnesium Sulfate can facilitate termination of torsades de pointes associated with prolonged QT interval. It is not likely to be effective in patients with a normal QT interval. Dose 1-2 grams.

INTERVENTIONS NOT RECOMMENDED DURING CARDIAC ARREST

ATROPINE – no prospective controlled clinical trials have examined the use of atropine in Asystole or bradycardic PEA cardiac arrest. Available evidence suggests that routine use of atropine during PEA or Asystole is unlikely to have a therapeutic benefit and is not recommended. It has been removed from the cardiac arrest algorithm. Atropine is the drug of choice for patients with bradycardia and poor perfusion. They can receive 0.5 mg repeated to a total of 3mg. If Atropine is ineffective, you can use a chronotropic drug such as Dopamine 2 to 10 mcg/kg per minute or Epinephrine 2 to 10 mcg/min. Both Dopamine and Epinephrine drip have been shown to be very effective when TCP is not immediately available.

SODIUM BICARBONATE – Tissue acidosis and resulting acidemia during cardiac arrest and resuscitation are dynamic processes resulting from no blood flow and low flow during CPR. Rapid ROSC are the mainstays of restoring acid base balance during cardiac arrest. The majority of studies demonstrated no benefit or found a relationship with poor outcome. Bicarbonate may compromise CPP by reducing systemic vascular resistance. It can create extracellularalkalosis that will shift the oxyhemoglobin saturation curve and inhibit oxygen release. In some special situations such as preexisting metabolic acidosis, hyperkalemia or tricyclic antidepressant overdose, bicarbonate can be beneficial. Routine use of bicarbonate during arrest is not recommended.

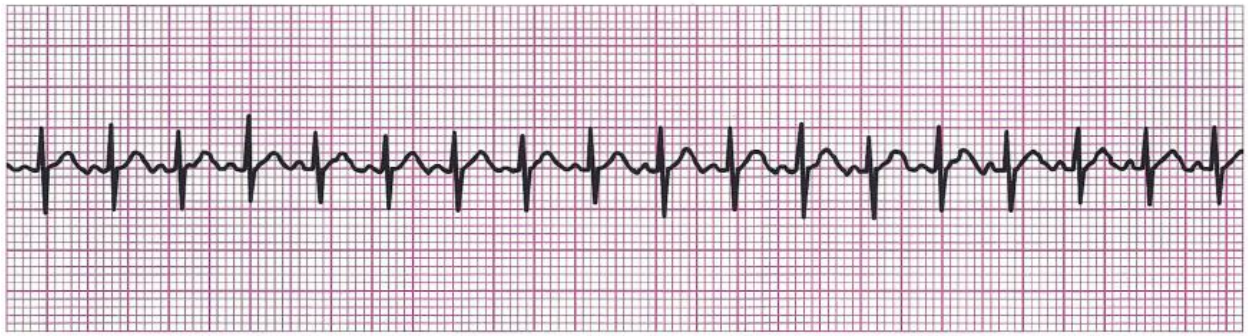
FIBRINOLYSIS – Two large clinical trials have failed to show any benefit in outcome with fibrinolytic therapy during CPR. One showed an increased risk of intracranial bleeding associated with the routine use. When pulmonary embolism is known to be the cause of arrest, fibrinolytic therapy can be considered.

ADENOSINE- Adenocard can be used as a first line drug for most stable narrow complex SVT, when vagal maneuvers are not effective. New guidelines now recommend Adenosine for regular and monomorphic wide-complex tachycardia. Initial dose is 6mg rapid IV push. A second dose of 12 mg rapid IV push can be administered after 1-2 minutes if needed.

ECG Rhythms

A

B



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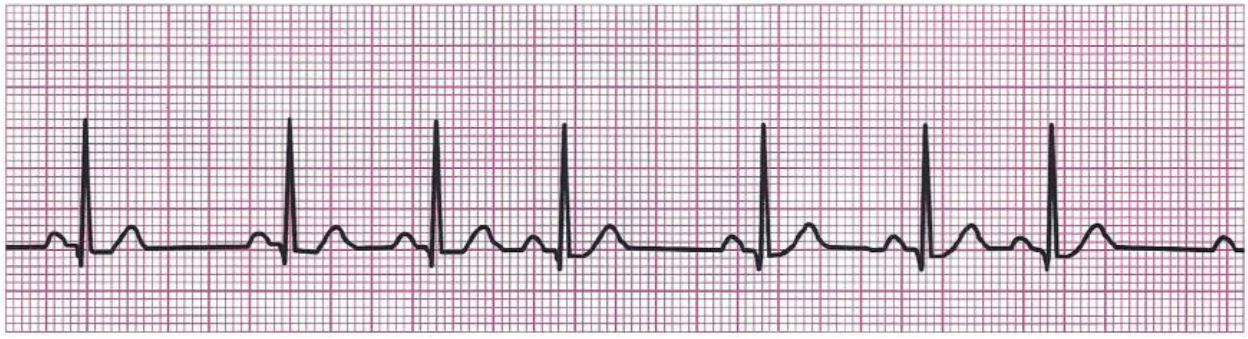

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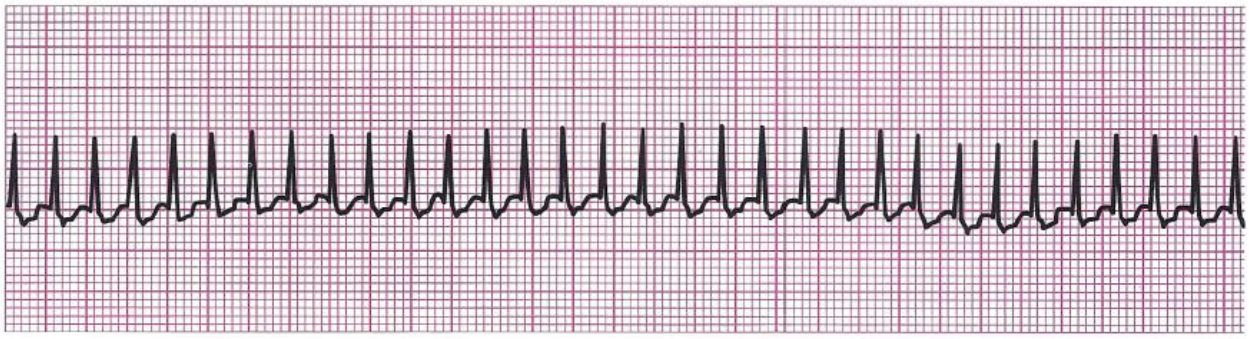

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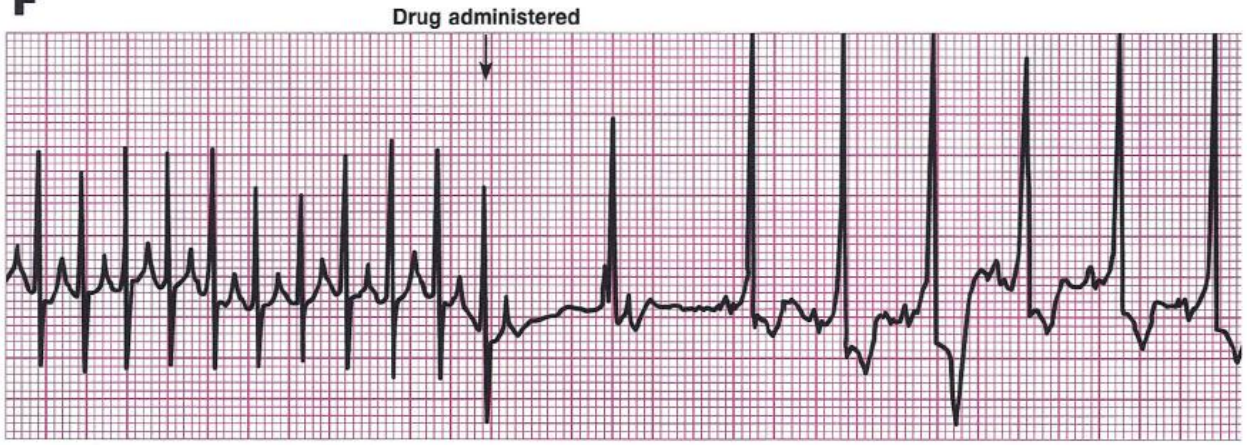

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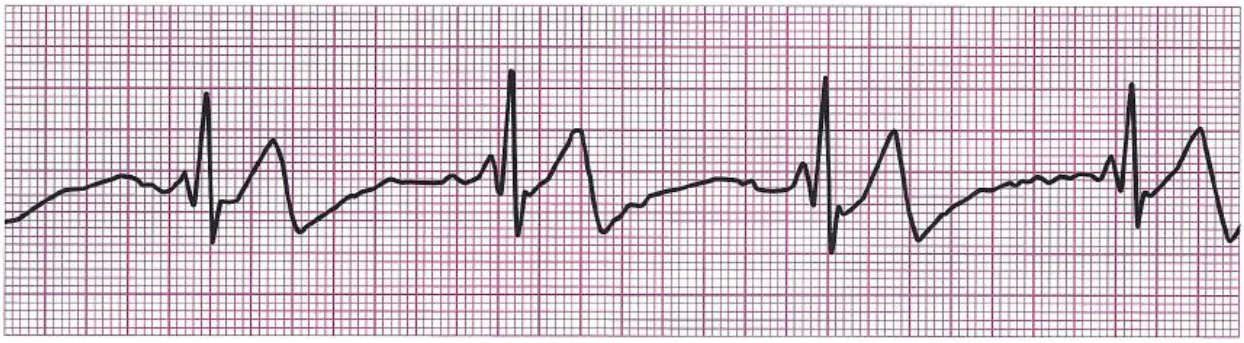

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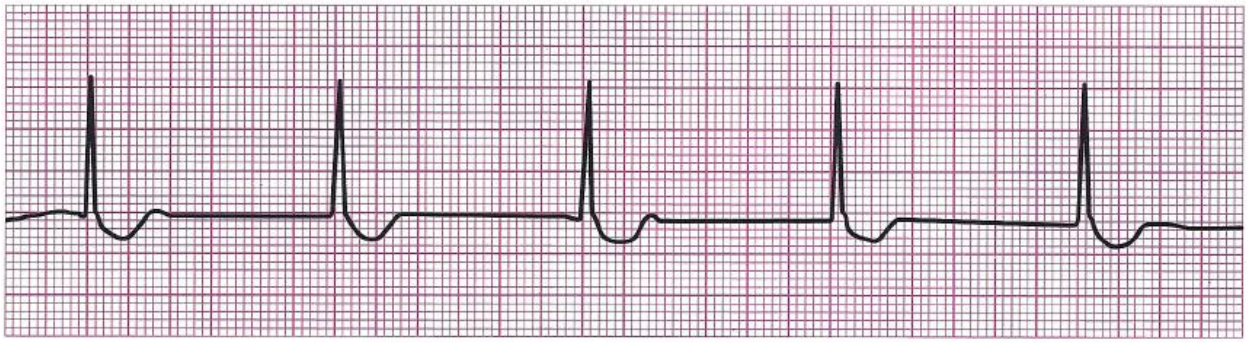

I

J

Answers to Rhythms

A. Sinus Rhythm
B. Sinus Tachycardia
C. Sinus Arrhythmia
D. Narrow-complex Tachycardia
E. Wide-complex Tachycardia
F. SVT converting to sinus rhythm with adenosine administration
G. Sinus bradycardia
H. Junctional bradycardia
I. Complete heart block with ventricular escape rhythm (3rd degree)
J. Agonal rhythm progressing to asystole

Other Courses Available:

Basic Courses:

Heartsaver First Aid- This course is designed for the community and workplace. This course teaches you how to recognize signs/symptoms and the appropriate treatment for emergency conditions. This course would be beneficial to business industry, school bus drivers, child care workers, teachers, parents, and babysitters. This course takes approximately 2 hours.

Heartsaver Bloodborne Pathogens- This course explains what bloodborne pathogens are and how to reduce the risk of exposure. This program assists in satisfying training requirements of the U.S. Department of labor, OSHA Bloodborne Pathogens Standard (29 CFR 1910.1030) This course takes 1-2 hours to complete.

Advanced Courses:

Advanced Cardiac Life Support (ACLS) - This course is designed for the healthcare provider who either directs or participates in the resuscitation of a patient either in or out of hospital setting. The goal of the ACLS Provider course is to improve the quality of care provided to the adult patient of a cardiac arrest or other cardiopulmonary emergency.

Pediatric Advanced Life Support (PALS) - This course is designed to aid the pediatric healthcare provider in developing the knowledge and skills necessary to efficiently evaluate and effectively manage seriously ill infants and children. In this course you will learn how to assess respiratory and circulatory compromise, establish treatment priorities, and intervene when necessary to stabilize the pediatric patient.

ECG and Pharmacology- This course is a comprehensive course covering basic electrophysiology, normal ECG measurements, basic arrhythmias, basic ACLS drugs, usage, and routes of administration during cardiovascular emergencies. This course can be separated into 2 parts: 1) ECG 3.5 hours and 2) basic pharmacology. This course will give the healthcare provider more confidence during cardiovascular emergencies while following the ACLS algorithms.

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