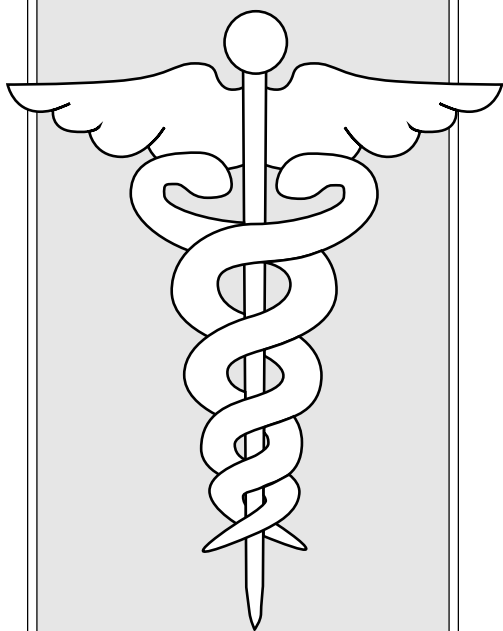


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# **Essentials of Advanced Cardiac Life Support**

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**HSTN**®  
*Health & Sciences Television Network*

*presenter:*

**Kendra Ellis, RN, MS, CCRN**

*Education Consultant*

*Med Ed*

*Charlotte, North Carolina*

*Staff Nurse*

*Surgical Intensive Care Unit*

*Parkland Memorial Hospital*

*Dallas, Texas*

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## INTRODUCTION

Sudden death due to myocardial infarction (MI) is a common occurrence, both in the hospital setting and in the community. Rapid resuscitative efforts to restore the spontaneous beating heart is the best chance of an individual's survival. Restoration of the heartbeat needs to happen before permanent injuries affect the brain. This course introduces the concepts of Advanced Cardiac Life Support (ACLS) and assists in teaching about myocardial infarctions and the roles of a resuscitative team.

## LEARNING OBJECTIVES

After participating in this activity, a learner should be able to:

1. state the objectives of an ACLS course.
2. identify the skills required to pass an ACLS course.
3. explain the ABCDs of both primary and secondary surveys.
4. list two presenting symptoms of a myocardial infarction.

**CNE Credit:** 1.0 Contact hour—ANCC

7/99



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*(Upon the completion of an Answer Sheet/Evaluation Form, participants will receive a Certificate of CNE Credit)*

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**Director of Education  
PRIMEDIA Healthcare  
4101 International Parkway  
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# ESSENTIALS OF ADVANCED CARDIAC LIFE SUPPORT

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## CARDIOVASCULAR DISEASE AND SUDDEN DEATH

Cardiovascular disease accounts for more than 930,000 deaths in the United States annually (AHA, 1997). The majority of deaths due to coronary disease occur suddenly. Coronary heart disease is the major cause of death in women in their 50s. However, death rates for men and women are declining. This can be attributed to improved medical therapy, increased awareness and knowledge in the lay population, and improvement in lifestyles.

## ACLS COURSE

The Advanced Cardiac Life Support (ACLS) course is designed to provide knowledge and skills to healthcare professionals when managing life-threatening arrhythmias, especially those due to cardiovascular disease.

After successful completion of the course, the knowledge and skills obtained assist a healthcare professional in becoming a part of a resuscitative team. During testing, a participant must demonstrate the following knowledge in regards to resuscitative devices and procedures, including airway management, defibrillation, and IV therapy:

- ❖ indications for the devices or procedures.
- ❖ precautions for the devices or procedures.
- ❖ proper use of the equipment (hands-on testing).
- ❖ safety precautions.

Participants are also tested on knowledge of pharmacological agents used in ACLS. The participant is expected to know:

- ❖ why an agent is used.
- ❖ when the agent is used.
- ❖ how the agent is used.

- ❖ side effects.
- ❖ precautions.

Participants are expected to be able to recognize lethal arrhythmias and follow the appropriate algorithm for each arrhythmia.

The course testing includes a *Megacode scenario* in which a participant uses his or her knowledge to manage a code according to ACLS algorithms. The megacode scenario includes:

- ❖ universal algorithms (including a pulseless patient).
- ❖ basic CPR.
- ❖ primary survey.
- ❖ secondary survey.
- ❖ airway management.
- ❖ IV techniques.
- ❖ defibrillation (both automated external (AEDs) and conventional defibrillators).
- ❖ use of ACLS pharmacologic agents.

## CORE CONCEPTS

During resuscitation, a healthcare provider must never lose sight of the overall condition of the patient. Code situations require quick assessments and decision making. These decisions are made under pressure and require that a leader remain calm. Do not get too focused on the specific interventions being performed but continue to troubleshoot the situation. Ask the following questions frequently:

- ❖ Is there a patent IV?
- ❖ Is there an adequate airway?
- ❖ Are ventilations effective?
- ❖ Are chest compressions being performed?
- ❖ What rhythm is the patient currently demonstrating?
- ❖ Is there a pulse without chest compressions?

- ❖ What algorithm is required at this point?
- ❖ What could have caused the arrest?
- ❖ What assessments need to be done?
- ❖ What labs need to be sent?
- ❖ What have I missed?
- ❖ Is the right medication being given?
- ❖ What else can be done?

Determine the cause of an arrest rapidly to help guide the care provided. Medical personnel must also be able to identify conditions which can lead to an arrest and be knowledgeable in interventions to prevent the cardiac arrest. Once resuscitation is successful, care must be continued to maintain restoration of the circulation.

The end goal of ACLS is to reestablish a heart beat and circulation before neurologic injury occurs. The longer it takes to establish a spontaneous heart beat, the lower the chance of survival. Basic CPR can extend this time.

### **PRIMARY SURVEY**

A systemic approach to care of a patient in a cardiac arrest helps alleviate the anxiety of the code team and code leader. A simple approach is the use of a primary, followed by secondary, survey. The primary survey involves the ABCD assessment. This includes:

- A** = Airway (open airway)
- B** = Breathing (provide positive pressure ventilation)
- C** = Circulation (give chest compressions)
- D** = Defibrillation (shock ventricular fibrillation (VF)/pulseless ventricular tachycardia (VT))

These are also the steps in the ABCs of basic CPR. All healthcare personnel should be able to perform these steps, which include:

1. assessing for respirations and opening the airway.
2. providing positive pressure ventilation.
3. improving circulation with chest compressions.
4. defibrillating to arrest the rhythm of ventricular fibrillation or pulseless ventricular tachycardia.

In the hospital, this happens when the crash cart arrives at the patient's bedside and a monitor is connected to assess the previous arrhythmias.

### **SECONDARY SURVEY**

The secondary survey also uses the letters ABCD to guide the more in-depth assessments and interventions. The *second ABCD* includes:

- A** = Airway (establish advanced airway control; perform intubation).
- B** = Breathing (assess adequacy of ventilation via endotracheal tube).
- C** = Circulation (obtain IV access for fluids and medications, continue CPR, administer pharmacologic support according to algorithms).
- D** = Differential Diagnosis (identify possible reasons for the arrest).

Endotracheal intubation is a priority if noninvasive methods are ineffective. This should occur before taking the time to establish an IV. Airway control is more important than medications. The optimal situation is an arrest team capable of establishing an airway, ventilation, and IV, simultaneously.

A differential diagnosis assists with understanding the reason for the arrest and identifying reversible causes that have a specific therapy. This mental review is helpful in prolonged arrests or unstable postresuscitation periods. A team leader needs to think "what caused or precipitated this arrest?" and "why has the patient not responded to therapy?" Some of the algorithms (PEA, asystole) provide examples of causes and cause-specific interventions.

## **MYOCARDIAL INFARCTION**

Myocardial infarction (MI) is one of the major causes of a cardiac arrest. A myocardial infarction refers to necrosis of the heart muscle caused by an inadequate blood supply or *ischemia*. In most cases, ischemia is caused by the buildup of atherosclerotic plaque in the coronary arteries. This plaque ruptures, causing platelets to adhere and clump, further occluding the vessel with a thrombus. Early recognition of the symptoms and prompt care can limit

the infarct size and prevent electrical instability and sudden death.

### ***PRECIPITATING EVENTS AND SYMPTOMS***

Precipitating events can include mild-to-moderate exercise and emotional stress and life events. The onset also can occur at rest, during sleep, or during usual exercise. Symptoms of a MI include:

- ❖ chest pain commonly described as “crushing,” “pressing,” “heavy.”
- ❖ pain may radiate to one or both shoulders and arms, to the back, neck or lower jaw.
- ❖ high epigastric pain.

When should an individual seek care with these symptoms? A person with no history of cardiac disease who experiences these symptoms for longer than a few minutes should seek medical care. A person with a history of angina should seek emergency assistance if the pain is unrelieved by three nitroglycerin tablets over 10 minutes.

Ventricular fibrillation, a lethal arrhythmia, occurs more frequently in the first hour of a MI than during the following 12 hours. The average delay between onset of symptoms and medical assistance is 2-4 hours. Most people either do not recognize the symptoms or deny their significance. This delay increases the risk of sudden death as well as interfering with initial treatment and effectiveness.

### ***GENERAL MANAGEMENT***

General management of a MI includes:

- ❖ ECG monitoring.
- ❖ establishing intravenous access.
- ❖ providing oxygen therapy.
- ❖ providing pain relief with nitroglycerin and morphine.

ECG monitoring should be continuous to identify the onset of arrhythmias. Hypoxemia may be present in even uncomplicated MI patients and should be applied to all patients. Elevation of PaO<sub>2</sub> may limit the infarction size. Oxygen should be administered by nasal cannula or mask at a flow rate of 4 to 6 liters or 40% FiO<sub>2</sub>. Pain relief is important and may be attempted with sublingual or IV nitro-

glycerin. Nitroglycerin can reduce myocardial oxygen demand, increase collateral flow to myocardial muscle, and reduce coronary artery spasm. Morphine is another drug of choice for pain related to a MI because of its pain-relief properties, its increase in venous pooling, and reduction in systemic vascular resistance. Monitor blood pressure closely after administration.

## **PHARMACOLOGIC INTERVENTIONS**

### ***THROMBOLYTICS***

Thrombolytic therapy has been shown to reduce mortality significantly and improve left ventricular function in acute transmural infarctions. There have been multiple studies performed in an attempt to determine which thrombolytic agent is better at decreasing mortality and infarction size. (AHA, 1997). One thrombolytic agent has not been found to be better than others. Time between onset of symptoms and the initiation of treatment is more important than the issue of which thrombolytic agent performs better.

A study performed to compare mortality between patients receiving thrombolytic agents prehospital and in the emergency room found there was no significant difference between the two groups as long as therapy was started within 70 minutes (AHA, 1997). The maximal reduction in mortality occurs when a patient seeks medical assistance within 3 hours of the onset of chest pain. The major complication of thrombolytic therapy is bleeding.

### ***ANTICOAGULANTS***

Anticoagulants include heparin and platelet inhibitory agents such as aspirin. These agents have been found effective in reducing the reocclusion after successful reperfusion and decreasing infarct expansion. Heparin has been found to prevent reocclusion by inactivated free thrombin formed by a lysing clot. Aspirin inhibits the synthesis of thromboxane A<sub>2</sub>, a prostaglandin.

Thromboxane A<sub>2</sub> is a powerful platelet activator, increasing clot formation. One study found a 14%

reduction in mortality when aspirin was added to thrombolytic therapy (AHA, 1997).

### **BETA BLOCKERS**

Beta blockers continue to be studied in the treatment of myocardial infarctions. They act to decrease myocardial oxygen demand, thus, limiting myocardial damage. Beta blockers have been found to decrease the risk of mortality by 14%. Studies find they are only used in 25-30% of the cases even though significant reduction in reinfarction rates have been found. Atenolol was found to decrease mortality by 29% (AHA, 1997).

### **CALCIUM CHANNEL BLOCKERS**

Calcium channel blockers cause vasodilation of coronary and peripheral vessels, decreased peripheral vascular resistance, decreased afterload, decreased inotropic effects and decreased heart rate. Diltiazem has been found effective in preventing early reinfarction in patients with non-Q-wave MI. It has also been recommended to give patients with non-Q-wave after angioplasty to prevent spasm and for postinfarction angina without heart failure (AHA, 1997). Another recommendation is to add a beta blocker when using nifedipine because of the risk of hypotension and reflex tachycardia when using nifedipine alone (AHA, 1997).

### **ACE-INHIBITORS**

Recently, ACE-inhibitors have been found to decrease mortality rates in anterior wall infarctions. Another large study found captopril to reduce mortality by 21%, a 37% decrease in heart failure, and a 25% reduction in reoccurrence of an acute MI (AHA, 1997).

### **MAGNESIUM**

Hypomagnesium can result in AV conduction abnormalities and thrombogenesis. Results of the studies are controversial as to whether the administration of IV magnesium actually improves survival (AHA, 1997).

### **COMMUNITY APPROACH**

Sudden death related to coronary artery disease can be prevented by a more rapid entry into the medical emergency system, immediate CPR, and early defibrillation. The majority of the sudden deaths occur outside the hospital. The “commu-

nity” becomes the primary caregiver until the EMS system arrives on the scene. Community education is important in primary prevention, early recognition of symptoms, accessing EMS, and initiating CPR. The goals of teaching a community program includes:

- ❖ recognition of the symptoms of MI.
- ❖ how to initiate the EMS system by using 911.
- ❖ teaching skills in CPR.
- ❖ recognition and reduction of reversible risk factors.

The American Heart Association uses the term *chain of survival* to assist with teaching the necessary sequence of events in saving a life. The chain has four links and all links must be present without delay for successful emergency cardiac care (ECC).

**First Link** —Early access to the EMS system.

This includes recognition of signs of MI and emergency care access before a situation deteriorates into a cardiac arrest.

**Second Link** —Early CPR. CPR is most effective when started immediately after a patient collapses.

**Third Link** —Early Defibrillation. This link is most likely to improve survival. It includes the use of automated external defibrillators.

**Fourth Link** - Early ACLS. ACLS provided by paramedics at the scene.

If there is a weak link in the chain, survival rates decrease. The community lay person at the scene and the EMS system are integral parts of ECC.

## **SUMMARY**

The ACLS course is designed to provide healthcare workers with the knowledge and skills to perform the primary and secondary surveys, recognize arrest situations, intervene according to algorithms, and resuscitate a patient with defibrillation and pharmacological therapy. Practice stations and testing allow hands-on practice and provide excellent opportunities to function as the team leader of a cardiac arrest resuscitation.

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## **DISCUSSION QUESTIONS**

1. List the components of a megacode in the ACLS course.
2. What are the ABCDs of the primary survey?
3. What are the ABCDs of the secondary survey?
4. Describe the common symptoms of chest pain related to a MI.
5. What are the four “links” identified in the chain of survival in the community?