Module 4
Cardiac Arrest & CPR

Lesson 1:
Circulation

OBJECTIVES

At the completion of this lesson, the student will be able to:

Cognitive Objectives

4-1 Describe the structure of the heart.
4-2 Describe the function of the heart.
4-3 Define coronary heart disease.
4-4 Define clinical manifestations of CHD
4-5 Identify the risk factors associated with cardiovascular disease.
4-6 Discuss prudent heart living.
4-7 Describe the early warning signs of heart attack and stroke.
4-8 List and discuss causes of sudden death.
4-9 Define cardiopulmonary arrest.
4-10 Describe cardiopulmonary anatomy and physiology.
4-11 Describe the rationale for each of the steps in CPR.
4-12 List the reasons for the heart to stop beating (C-1)
4-13 Define the components of cardiopulmonary resuscitation (C-1)
4-14 Describe each link in the chain of survival and how it relates to the EMS system.
4-15 List the steps of one-rescuer adult CPR (C-1)
4-16 Describe the technique of external chest compressions on an adult patient. (C-1)
4-17 Describe the technique of external chest compressions on a child. (C-1)
4-18 Describe the technique of external chest compressions on an infant. (C-1)
4-19 Explain when the CFR is able to stop CPR. (C-2)
4-20 List the steps of two-rescuer adult CPR (C-1)
4-21 List the steps of child CPR (C-1)
4-22 List the steps of infant CPR (C-1)

Affective Objectives

4-23 Respond to the feelings that the family of a patient may be having during a cardiac event. (A-3)
4-24 Demonstrate a caring attitude towards patients with cardiac events who request emergency medical services. (A-3)
4-25 Place the interests of the patient with a cardiac event as the foremost consideration when making any and all patient care decisions. (A-3)
4-26 Communicate with empathy with family members and friends of the patient with a cardiac event. (A-3)

Psychomotor Objectives

4-27 Demonstrate the proper technique of chest compressions on an adult.
4-28 Demonstrate the proper technique of chest compressions on a child.
4-29 Demonstrate the proper technique of chest compressions on an infant.
4-30 Demonstrate the steps of adult one rescuer CPR. (P-1,2)
4-31 Demonstrate the steps of adult two rescuer CPR. (P-1,2)
4-32 Demonstrate child CPR. (P-1,2)
4-33 Demonstrate infant CPR. (P-1,2)

PREPARATION

Motivation: Over 600,000 patients die each year from cardiovascular diseases; half of these deaths occur outside the hospital, with sudden death (collapse) being the first sign of cardiac disease in 50% of the cases. Cardiopulmonary Resuscitation (CPR), which will be covered in this module, is the major determinant of survival in cardiac arrest.

Prerequisites: Preparatory, Airway, Patient Assessment Modules

Materials

AV Equipment: Utilize various audio-visual materials relating to emergency medical care. The continuous development of new audio-visual materials relating to EMS requires careful review to determine which best meet the needs of the program. Materials should be edited to ensure that the objectives of the curriculum are met.

EMS Equipment: CPR manikins, artificial ventilation manikins, suction equipment, airway management equipment, eye protection, exam gloves.

Personnel

Primary Instructor: One instructor certified in AHA/ARC/NSC basic life support.

Assistant Instructor: The instructor to Student ratio of 6:1 for psychomotor skills practice. Individuals used as assistants should be knowledgeable in basic life support skills.

Recommended Minimum Time to Complete Module: Six hours

PRESENTATION

Declarative (What)

I. Review of the Circulatory System
- A. Function
  1. Deliver oxygen and nutrients to the tissues
  2. Remove waste products from the tissues

- B. Components/Anatomy
  1. Heart
     - a. Atrium
       - (1) Right - receives blood from the veins of the body
       - (2) Left - receives blood from the lungs
     - b. Ventricle
       - (1) Right - pumps blood to the lungs.
       - (2) Left - pumps blood to the body.
     - c. Valves prevent back flow of blood.
  2. Arteries
     - a. Carry blood away from the heart.
     - b. Major arteries
       - (1) Carotid
         - (a) Major artery of the neck.
         - (b) Pulsations can be palpated on either side of the neck.
       - (2) Femoral
         - (a) The major artery of the thigh.
         - (b) Pulsations can be palpated in the groin area (the crease between the abdomen and thigh).
       - (3) Radial
         - (a) Major artery of the lower arm.
         - (b) Pulsations can be palpated at palm side of the wrist thumb-side.
       - (4) Brachial
         - (a) An artery of the upper arm.
         - (b) Pulsations can be palpated on the inside of the arm between the elbow and the shoulder.
  3. Capillaries
     - a. Tiny blood vessels that connect arteries to veins
     - b. Found in all parts of the body
     - c. Allow for the exchange of oxygen and carbon dioxide
  4. Veins - vessels that carry blood back to the heart
  5. Blood
     - a. Fluid of the circulatory system
     - b. Carries oxygen and carbon dioxide

C. Physiology
1. Left ventricle contracts, sending a wave of blood through the arteries to the body.
2. A pulse is generated when the left ventricle contracts and sends a wave of blood through the arteries.
3. A pulse can be felt in the major arteries.
4. Pulse can be felt anywhere an artery passes near the skin surface and over a bone.
   a. Carotid
   b. Femoral
   c. Radial
   d. Brachial
5. If the heart stops contracting, no blood will flow.
6. The body cannot survive when the heart stops.
   a. When the patient is in cardiac arrest they will have no pulse.
   b. Organ damage begins quickly after circulation stops.
   c. Brain damage begins 4-6 minutes after the patient suffers cardiac arrest.
   d. Brain damage becomes irreversible in 8-10 minutes.
   e. External chest compressions are used to circulate blood any time that the heart is not beating.
   f. External chest compressions are combined with artificial ventilation to oxygenate and circulate the blood.
   g. The combination of artificial ventilation and external chest compressions is called cardiopulmonary-pulmonary resuscitation (CPR)
7. General reasons for the heart to stop beating
   a. Sudden death and heart disease
   b. Respiratory arrest, especially in infants and children
   c. Medical emergencies (stroke, epilepsy, diabetes, allergic reactions, electrical shock, poisoning, etc.)
   d. Drowning, suffocation, congenital abnormalities
   e. Trauma and bleeding
   f. Regardless of the reason, the EMT -B's emergency medical care of cardiac arrest is CPR.
8. Signs of Cardiac Arrest
   a. The patient is not breathing.
   b. The patient has no carotid pulse.

II. Coronary Heart Disease
A. Terms associated with CHD
1. Arteriosclerosis,
   a. “hardening of the arteries”
   b. artery walls thicken and lose elasticity.
2. Atherosclerosis

a. a form of arteriosclerosis
b. inner layers of the artery become thick and irregular from deposits of a fatty substance
c. blood flow is reduced.

B. Clinical manifestations of Coronary Heart Disease
1. Angina pectoris
2. Heart attack
3. Sudden death

C. Risk factors associated with cardiovascular disease
1. Risk factors that cannot be changed.
a. Heredity
b. Gender
c. Age
2. Risk factors that can be changed.
a. Cigarette smoke
b. High blood pressure
c. High blood cholesterol levels
d. Physical inactivity
3. Contributing factors
a. Diabetes
b. Obesity
c. Stress

D. Prudent heart living
1. Reduce risk factors

E. Heart attack - early warning signs
1. Chest discomfort
2. Pain in shoulder, arm, jaw, neck, back or upper abdomen.
3. Sweating
4. Nausea
5. Shortness of breath
6. Weakness
7. Patient may experience some or all of the signs and symptoms.
8. Any age, any time, any place

III. Cardiopulmonary Resuscitation
A. A combination of artificial ventilation and external chest compressions to oxygenate and circulate blood when the patient is in cardiac arrest.

B. External chest compressions
1. Depressing the sternum causes enough blood to flow to sustain life for a short period of time.

C. CPR is only effective for a short period of time
   1. Cannot sustain life indefinitely
   2. Must be started as early as possible
   3. Effectiveness decreases the longer you are doing CPR
   4. In many cases the patient needs to be defibrillated to survive
   5. CPR increases the amount of time that defibrillation will be effective

D. The chain of survival and the EMS system
   1. Weak links in the chain lower survival rates
   2. Early access
      a. Public education and awareness
         (1) Rapid recognition of a cardiac emergency
         (2) Rapid notification before CPR is started - "phone first"
      b. 911-pre-arrival instructions and dispatcher directed CPR
   3. Early CPR
      a. Lay public
         (1) Family
         (2) Bystanders
      b. First Responders
   4. Early defibrillation
      a. Is an EMT-basic skill.
      b. The can be taught and authorized to use AED.
   5. Early advanced cardiac life support (ACLS)

E. Technique of Cardiopulmonary Resuscitation
   1. General procedure
      a. Place patient on a firm surface.
      b. Provide artificial ventilation.
      c. Place hands on the lower half of the sternum.
         (1) Place heel of one hand on top of the other - with fingers raised.
      d. Position your body next to the patient, lean over with elbows straight
      e. Compressions - 50% Compression/50% Relaxation
         (1) Depth - **Refer to current AHA/ARC/NSC Guidelines for CPR**
            (a) Adult -
            (b) Child -
            (c) Infant -
         (2) Rate - **Refer to current AHA/ARC/NSC Guidelines for CPR**
            (a) Adult -
            (b) Child -

(c) Infant -

2. Skill performance steps for One Rescuer Adult CPR - **Refer to current AHA/ARC/NSC Guidelines for CPR**
3. Skill performance steps for Two Rescuer Adult CPR - **Refer to current AHA/ARC/NSC Guidelines for CPR**
4. Skill performance steps for Child One-Rescuer CPR - **Refer to current AHA/ARC/NSC Guidelines for CPR**
5. Skill performance steps for Infant One-Rescuer CPR - **Refer to current AHA/ARC/NSC Guidelines for CPR**

F. Signs of Effective CPR

1. A carotid pulse can be felt by the rescuer providing ventilations.
2. Pupils constrict when exposed to light.
3. Skin color improves.
4. There may be gasping respirations.
5. There may be spontaneous movement of the patient's arms or legs.
6. The heart may resume normal beating.

Note: CPR produces a pumping activity that is only 25% to 33% as effective as the action of a normal heart. Thus 90-100% oxygen should be delivered to all patients who have sustained a cardiac arrest, as soon as possible.

G. CPR Interruption

1. CPR should not be interrupted for more than 5 seconds unless it is necessary to move a patient up or down a stairway. Such interruptions should not exceed 15 seconds.

H. Complications

1. Review of the structure of the chest cavity and location of organs proximal to the heart.
2. Emphasize the importance of correct performance of the technique and dangers to the patient whether performed correctly or not. The following complications may result if it is not performed correctly, that is:
   a. Fractured ribs.
   b. Fractured sternum.
   c. Lacerations of the liver, spleen, lungs, or heart.
   d. Damage to the pleura resulting from broken ribs.

I. Beginning and Terminating CPR

1. CPR is not indicated for a patient known to be in the terminal stages of an incurable condition, if signed DNR orders are present.

2. Once started, CPR should be terminated only when one of the following occurs:
    a. The patient's heart resumes normal beating.
    b. A physician or other properly trained person responsible for emergency medical services assumes responsibility for the patient.
    c. The rescuer is exhausted and unable to continue.
    d. The patient is pronounced dead by a physician, coroner, or other individual with the legal authority to do so.

SUGGESTED APPLICATION

Procedural (How)

1. Demonstrate assessment, airway management, and emergency medical care of a manikin in a simulated cardiac arrest situation.

Contextual (When, Where, Why)

The Emergency Medical Technician - Basic student must prepare to assess and manage patients with cardiac emergencies. The training laboratory must provide simulated cardiac arrest situations for the student to practice demonstrated skills. The student must be able to integrate many single skills into one simulated cardiac arrest scenario in order to perform effective practice after course completion.

Student Activities

Auditory (Hearing)

1. The student should hear of actual cases where cardiac arrest resuscitation efforts were successful and unsuccessful and the reasons for the outcomes.

Visual (Seeing)

1. The student should see an instructor team appropriately resuscitate a simulated cardiac arrest patient.
2. The student should see re - enactments of cardiac arrest resuscitation efforts by EMT-Bs.

Kinesthetic (Doing)

1. The student should practice the assessment and emergency medical care of a patient in cardiac arrest.
2. The student should practice assessment, airway management, and emergency medical care and transportation of a manikin in a simulated cardiac arrest situation outside the training laboratory.

Instructor Activities

Facilitate discussion and supervise practice.
Reinforce student progress in cognitive, affective, and psychomotor domains.
Redirect students having difficulty with content. (Complete remediation form.)

EVALUATION

Written: Develop evaluation instruments, e.g., case studies, examinations, oral reviews, and handouts, to determine if the students have met the cognitive and affective objectives of this lesson.

Practical: Evaluate the actions of the Emergency Medical Technician - Basic students during role play, practice, or other skill stations to determine their compliance with the cognitive and affective objectives and their mastery of the psychomotor objectives of this lesson.

REMEDIATION

Identify students or groups of students who are having difficulty with this subject content. Complete remediation sheet from the instructor's course guide.

SUGGESTED ENRICHMENT

What is unique in the local area concerning this topic? Complete enrichment sheets from instructor's course guide and attach with lesson plan.

Module 4
Cardiac Arrest & CPR

Lesson 2:
Practical Lab:

OBJECTIVES

Cognitive Objectives

- Demonstrate the cognitive objectives of Module 4- Lesson 1.

Affective Objectives

- Demonstrate the affective objectives of Module 4- Lesson 1.

Psychomotor Objectives

- Demonstrate the proper technique of chest compressions on an adult. (P-1,2)
- Demonstrate the proper technique of chest compressions on a child. (P-1,2)
- Demonstrate the proper technique of chest compressions on an infant. (P-1,2)
- Demonstrate the steps of adult one rescuer CPR. (P-1,2)
- Demonstrate the steps of adult two rescuer CPR. (P-1,2)
- Demonstrate child CPR. (P-1,2)
- Demonstrate infant CPR. (P-1,2)

PREPARATION

Motivation: The practical lesson is designed to allow the students additional time to perfect skills. It is of utmost importance that the students demonstrate proficiency of the skill, cognitive knowledge of the steps to perform a skill, and a healthy attitude towards performing that skill on a patient.

This is an opportunity for the instructor and assistant instructors to praise progress and redirect the students toward appropriate psychomotor skills. The material from all preceding lessons and basic life support should be incorporated into these practical skill sessions.

Prerequisites: Completion of Module 2 and Module 3

Materials

AV Equipment: Utilize various audio-visual materials relating to emergency medical care. The continuous development of new audio-visual materials relating to EMS requires careful review to determine which best meet the needs of the program. Materials should be edited to ensure that the objectives of the curriculum are met.

EMS Equipment: CPR manikins, artificial ventilation manikins, suction equipment, airway management equipment, eye protection, exam gloves.

Personnel

Primary Instructor: One instructor certified in AHA/ARC/NSC basic life support and airway management.

Assistant Instructor: The instructor-to-student ratio should be 1:6 for psychomotor skill practice. Individuals used as assistant instructors should be knowledgeable in basic life support and airway management techniques.

Recommended Minimum Time to Complete Module: Six hours

PRESENTATION

Declarative (What) None identified for this lesson.

SUGGESTED APPLICATION

Procedural (How)

Instructor should demonstrate the procedural activities from CPR Lesson 1.

Contextual (When, Where, Why)

Instructor should review contextual information from CPR Lesson 1.

Student Activities

Auditory (Hearing)

1. The student should hear of actual cases where cardiac arrest resuscitation efforts were successful and unsuccessful and the reasons for the outcomes.

Visual (Seeing)

1. The student should see an instructor team appropriately resuscitate a simulated cardiac arrest patient.
2. The student should see re-enactments of cardiac arrest resuscitation efforts by EMT-Bs.

Kinesthetic (Doing)

1. The student should practice the assessment and emergency medical care of a patient in cardiac arrest.
2. The student should practice assessment, airway management, and emergency medical care and transportation out of the training laboratory of a manikin in a simulated cardiac arrest situation.

Instructor Activities

Supervise student practice.
Reinforce student progress in cognitive, affective, and psychomotor domains.
Redirect students having difficulty with content (complete remediation forms).

EVALUATION

Practical: Evaluate the actions of the Emergency Medical Technician - Basic students during role play, practice or other skills stations to determine their compliance with the cognitive and affective objectives and their mastery of the psychomotor objectives of this lesson.

REMEDIATION

Identify students or groups of students who are having difficulty with this subject content. Complete remediation sheet from the instructor's course guide.

SUGGESTED ENRICHMENT

What is unique in the local area concerning this topic? Complete enrichment sheets from the instructor's course guide and attach with lesson plan.

Module 4
Cardiac Arrest & CPR

Lesson 3:
Evaluation

OBJECTIVES

Cognitive Objectives

- Demonstrate competence in the cognitive objectives of Module 4- Lesson 1.
- Demonstrate competence in the cognitive objectives of Module 4- Lesson 1.

Affective Objectives

- Demonstrate competence in the affective objectives of Module 4 - Lesson 1.
- Demonstrate competence in the affective objectives of Module 4 - Lesson 1.

Psychomotor Objectives

- Demonstrate competence in the psychomotor objectives of Module 4 - Lesson 1.
- Demonstrate competence in the psychomotor objectives of Module 4 - Lesson 1.

PREPARATION

Motivation: Evaluation of the student's attainment of the cognitive and affective knowledge and psychomotor skills is an essential component of the Emergency Medical Technician's educational process. The modules are presented in a "building block" format. Once the students have demonstrated their knowledge and proficiency, the next lesson should be built upon that knowledge. This evaluation will help to identify students or groups of students having difficulty with a particular area. This is an opportunity for the instructor to evaluate their performance and make appropriate modifications to the delivery of material.

Prerequisites: Completion of Module 2 and Module 3.

Material

AV Equipment: Typically none required.

EMS Equipment: The EMS equipment used in the CPR Module.

Personnel

Primary Instructor: One proctor for the written evaluation.

Assistant Instructor: One practical skills examiner for each 6 students.

Recommended Minimum Time to Complete Module: Six hours

PRESENTATION

Declarative (What)

I. Purpose of the evaluation

II. Items to be evaluated

III. Feedback from evaluation

SUGGESTED APPLICATION

Procedural (How)

1. Written evaluation based on the cognitive and affective objectives of CPR Lesson 1.

2. Practical evaluation stations based on the psychomotor objectives of CPR Lesson 1.

Contextual (When, Where and Why)

The evaluation is the final lesson in this module and is designed to bring closure to the module and to assure that students are prepared to proceed to the next module.

This modular evaluation is done to determine the effectiveness of the presentation of materials and how well students have retained the material. This is an opportunity for the students to make necessary adjustments in study habits or for the instructor to adjust the manner in which material is presented.

Instructor Activities

Supervise student evaluation.
Reinforce student progress in cognitive, affective, and psychomotor domains.
Redirect students having difficulty with content. (Complete remediation forms.)

REMEDIATION

Identify students and/or groups of students who are having difficulty with this subject content. Complete a remediation sheet from the instructor's course guide. If students continue to have difficulty demonstrating knowledge of the cognitive and affective objectives or demonstrating proficiency in psychomotor skills, the students should be counseled, remediated, and re-evaluated. If improvements in cognitive, affective, or psychomotor skills are not achieved, consideration regarding the ability of the student to progress in the program should be taken into account.