National EMS Education
Standard Competencies

Pathophysiology
Applies fundamental knowledge of the pathophysiology of respiration and perfusion to patient assessment and management.

Medicine
Applies fundamental knowledge to provide basic emergency care and transportation based on assessment findings for an acutely ill patient.

Cardiovascular
Anatomy, signs, symptoms, and management of
› Chest pain (pp 629–665)
› Cardiac arrest (pp 629–639, 654–665)
Anatomy, physiology, pathophysiology, assessment, and management of
› Acute coronary syndrome (pp 629–639, 642–652)
  • Angina pectoris (pp 629–638, 642–652)
  • Myocardial infarction (pp 629–639, 654–665)
› Aortic aneurysm/dissection (pp 629–636, 642–652)
› Thromboembolism (pp 629–637, 642–652)
› Heart failure (pp 629–636, 640–652)
› Hypertensive emergencies (pp 629–636, 642–652)

Knowledge Objectives
1. Discuss the basic anatomy and physiology of the cardiovascular system. (pp 629–636)
2. Discuss the pathophysiology of the cardiovascular system. (pp 636–642)
3. Describe the anatomy, physiology, pathophysiology, assessment, and management of thromboembolism. (pp 636–639)
4. Describe the anatomy, physiology, pathophysiology, assessment, and management of angina pectoris. (pp 637–638)
5. Describe the anatomy, physiology, pathophysiology, assessment, and management of myocardial infarction. (pp 638–639)
6. Describe the anatomy, signs and symptoms, and management of hypertensive emergencies. (p 642)
7. Describe the anatomy, physiology, pathophysiology, assessment, and management of aortic aneurysm/dissection. (p 642)
8. Explain the assessment for patients with cardiovascular problems. (pp 642–647)
9. Explain the relationship between airway management and the patient with cardiac compromise. (pp 643–644)
10. Give the indications and contraindications for the use of aspirin and nitroglycerin. (p 648)
11. Recognize that many patients will have had cardiac surgery and may have implanted pacemakers or defibrillators. (pp 653–654)
12. Define cardiac arrest. (p 654)
13. Compare the difference between the fully automated and the semiautomated defibrillator. (pp 654–655)
14. Describe the different types of AEDs. (p 655)
15. Explain the use of remote adhesive defibrillator pads. (p 656)
16. Recognize that not all patients in cardiac arrest require an electric shock. (p 656)
17. List the indications and contraindications for use of an automated external defibrillator (AED). (pp 656–657)
18. Discuss the reasons for early defibrillation. (pp 656–657)
19. Explain the circumstances that may result in inappropriate shocks from an AED. (p 657)
20. Explain the reason not to touch the patient, such as by delivering CPR, while the AED is analyzing the heart rhythm and delivering shocks. (p 657)
21. Describe AED maintenance procedures. (pp 657–659)
22. Explain the relationship of age to energy delivery. (p 659)
23. Explain the role of medical direction in the use of AEDs. (p 659)
24. Discuss the importance of practice and continuing education with the AED. (p 659)
25. Explain the need for a case review of each incident in which an AED is used. (p 659)
26. List quality improvement goals relating to AEDs. (p 659)
27. Discuss the procedures to follow for standard operation of the various types of AEDs. (pp 659–661)
28. Describe the emergency medical care for the patient with cardiac arrest. (pp 659–661)
29. Describe the components of patient care following AED shocks. (pp 661–663, 665)
30. Explain criteria for transport of the patient for advanced life support (ALS) following CPR and defibrillation. (pp 663–664)
31. Discuss the importance of coordinating with ALS personnel. (pp 664–665)

**Skills Objectives**

1. Describe the steps to take in the assessment of a patient with chest pain or discomfort. (pp 642–647)
2. Demonstrate how to provide emergency medical care for a patient with chest pain or discomfort. (pp 647–649)
3. Demonstrate the administration of nitroglycerin. (pp 648–649, Skill Drill 16-1)
4. Demonstrate how to attach a cardiac monitor to obtain an ECG. (pp 651–652, Skill Drill 16-2)
5. Demonstrate how to perform maintenance of an AED. (pp 657–659)
6. Demonstrate how to perform CPR. (pp 660–663, Skill Drill 16-3)
7. Demonstrate the use of an AED. (pp 660–663, Skill Drill 16-3)

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**Introduction**

The American Heart Association reports that cardiovascular disease claimed 786,641 lives in the United States in 2011. This is 31.3% of all deaths, or approximately 1 of every 3 deaths. Although this is a decline from previous years, heart disease has been the leading killer of Americans since 1900.

It is important for EMS providers to understand that many deaths caused by cardiovascular disease occur because of problems that may have been avoided by people living more healthful lifestyles and by access to improved medical technology. We can help to reduce the number of deaths with better public awareness, early access to medical care, increased numbers of laypeople trained in cardiopulmonary resuscitation (CPR), increased use of evolving technology in dispatch and cardiac arrest response, public access to defibrillation devices, the recognition of the need for advanced life support (ALS) services and use of cardiac specialty centers when they are available.

This chapter begins with a brief description of the heart and how it works. It then discusses the relationship between chest pain or discomfort and ischemic heart disease. It explains how to recognize and treat acute myocardial infarction (classic heart attack) and its complications—sudden death, cardiogenic shock, and congestive heart failure (CHF). The use of nitroglycerin and aspirin are described. The last part of the chapter is devoted to the use and maintenance of the automated external defibrillator (AED).

**Anatomy and Physiology**

The heart is a relatively simple organ with a simple job. It has to pump blood to supply oxygen-enriched red blood cells to the tissues of the body. The heart is divided down the middle into two sides (left and right) by a wall called the septum. Each side of the heart has an atrium, or upper chamber, to receive incoming blood, and a ventricle, or lower chamber, to pump outgoing blood. Blood leaves each of the four chambers of the heart through a one-way valve. These valves keep the blood moving through the circulatory system in the proper direction. The aorta, the body’s main artery, receives the blood ejected from the left ventricle and delivers it to all the other arteries so they can carry blood to the tissues of the body.

The right side of the heart receives oxygen-poor (deoxygenated) blood from the veins of the body...