OBJECTIVES

20.1 Define key terms introduced in this chapter. Slides 14, 20, 23, 34–35, 37–38, 40–42, 50–51

20.2 Describe the anatomy and physiology of the cardiovascular system. Slides 14–17

20.3 Define acute coronary syndrome and discuss its most common signs and symptoms. Slides 20–24

continued
OBJECTIVES

20.4 Discuss the management of a patient with acute coronary syndrome. Slides 25–27

20.5 Discuss the indications, contraindications, dosage, and administration of nitroglycerin to a patient with chest pain. Slides 25–26

continued
OBJECTIVES

20.6 Discuss the indications (including conditions that must be met), contraindications, and administration of aspirin to a patient with chest pain. Slides 27–28
20.7 Discuss the following conditions and how each may lead to a cardiac emergency: coronary artery disease (CAD), aneurysm, electrical malfunctions of the heart, mechanical malfunctions of the heart, angina pectoris, acute myocardial infarction (AMI), and congestive heart failure (CHF). Slides 33–46
20.8 Discuss the following factors in the chain of survival and how each may contribute to patient survival of cardiac arrest: immediate recognition and activation, early cardiopulmonary resuscitation (CPR), rapid defibrillation, effective advanced life support, and integrated post-cardiac arrest care. Slides 48–54

continued
OBJECTIVES

20.9 List the skills necessary for the EMT to manage a patient in cardiac arrest. Slides 55–57

20.10 Discuss types of automated external defibrillators (AEDs) and how AEDs work. Slides 58–66

20.11 Discuss the effective coordination of CPR and AED for a patient in cardiac arrest. Slides 67–74

continued
20.12 Discuss special considerations for AED use, including general principles, coordination with others, and post-resuscitation care. Slides 75–76

20.13 Discuss the purpose and use of mechanical CPR devices. Slide 77
MULTIMEDIA

- Slide 78 Using an AED Video
- Slide 79 Cardiac Arrest Video
- Slide 80 AEDs Video
- Slide 81 Understanding Myocardial Infarctions Video
CORE CONCEPTS

- Aspects of acute coronary syndrome (ACS)
- Conditions that may lead to a cardiac emergency
- Cardiac arrest and the chain of survival
- Management of a cardiac arrest patient
- Use of an automated external defibrillator (AED)

continued
CORE CONCEPTS

- Special considerations in AED use
- Use of mechanical cardiopulmonary resuscitation (CPR) devices
Topics

- Cardiac Anatomy and Physiology
- Acute Coronary Syndrome
- Causes of Cardiac Conditions
- Cardiac Arrest
Cardiac Anatomy and Physiology
### Four Chambers of the Heart

<table>
<thead>
<tr>
<th>Chamber</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Right Atrium</strong></td>
<td>Receives blood from veins; pumps to right ventricle.</td>
</tr>
<tr>
<td><strong>Right Ventricle</strong></td>
<td>Pumps blood to the lungs.</td>
</tr>
<tr>
<td><strong>Left Atrium</strong></td>
<td>Receives blood from lungs; pumps to left ventricle.</td>
</tr>
<tr>
<td><strong>Left Ventricle</strong></td>
<td>Pumps blood through the aorta to the body.</td>
</tr>
</tbody>
</table>
Blood Vessels

- Vein
- Artery
- Valve
- Venules
- Arterioles
- Capillary bed
Think About It

• How does the normal function of the heart and blood vessels relate to blood pressure and distal pulses?

• How is shock related to the function of the heart and blood vessels?
Acute Coronary Syndrome
Acute Coronary Syndrome (ACS)

• Sometimes called cardiac compromise
• Refers to any time the heart may not be getting enough oxygen
• Many different kinds of problems under the ACS heading

continued
Acute Coronary Syndrome (ACS)

• Symptoms often mimic non-cardiac conditions

• Treat all patients with ACS-like signs and symptoms as though they are having a heart problem
Symptoms

• Chest pain is best-known symptom
• Can be described as “crushing, dull, heavy, or squeezing”
• Sometimes described only as pressure or discomfort
• Radiates to arms, upper abdomen, jaw
Symptoms

- Dyspnea also found in ACS
- May be the only finding in some patients
Other Signs and Symptoms

- Anxiety, feeling of impending doom
- Nausea and pain or discomfort in upper abdomen (epigastric pain)
- Sweating
- Abnormal pulse (tachycardia/bradycardia)
- Abnormal blood pressure
Assessment

- Perform primary assessment
- Obtain history and physical exam
- Use OPQRST to get history of present illness
- Obtain SAMPLE history
- Take baseline vital signs
Treatment

- Place patient in position of comfort (typically sitting up)
- Apply high-concentration oxygen
- Transport
Treatment

• If trained, equipped, and authorized to do so, obtain a 12-lead electrocardiogram (ECG)

• Follow local protocol as to whether to transmit it to hospital for interpretation

continued
Treatment

- Indications for administering nitroglycerin
  - Chest pain
  - History of cardiac problems and prescribed nitroglycerin
  - Patient has nitroglycerin
  - Medical direction authorizes administration

continued
Treatment

• Contraindications for administering nitroglycerin
  – Systolic blood pressure less than 90–100 (consult local protocol)
  – Patient has taken Viagra or similar drug for erectile dysfunction within 48–72 hours
Treatment

• Indications for administering aspirin
  – Chest pain
  – Ability to safely swallow
  – Medical control authorization
Treatment

- Contraindications for administering aspirin
  - Inability to swallow
  - Allergy to aspirin
  - History of asthma
  - Patient already taking other anti-clotting medications
Causes of Cardiac Conditions
Causes of Cardiac Conditions

• Heart problems caused by a number of disorders affecting condition and function of blood vessels and heart
Coronary Artery Disease

- Conditions that narrow or block arteries of heart
- Often result from fatty deposit build-up on inner walls of arteries
- Build-up narrows inner vessel diameter, restricts flow of blood
Coronary Artery Disease

- Thrombus—occlusion of blood flow caused by formation of a clot on rough inner surface of diseased artery
- Thrombus can break loose and form an embolism
- Emboli can move to occlude flow of blood downstream in a smaller artery
Coronary Artery Disease

- Reduced blood supply to myocardium causes emergency in majority of cardiac-related medical emergencies
- Chest pain is most common symptom of reduced blood supply
Aneurysm

- Weakened sections of blood vessels begin to dilate (balloon)
- Bursting can cause rapid, life-threatening internal bleeding
Electrical Malfunction of the Heart

- Malfunction of heart’s electrical system generally results in dysrhythmia
- Dysrhythmias include bradycardia, tachycardia, and rhythms that may be present when there is no pulse
Mechanical Malfunctions of the Heart

- Angina pectoris
- Acute myocardial infarction (AMI)
- Congestive Heart Failure (CHF)
Angina Pectoris

- Chest pain caused by insufficient blood flow to the myocardium
- Typically due to narrowed arteries secondary to coronary artery disease
- Pain usually during times of increased myocardial oxygen demand, such as exertion or stress
Acute Myocardial Infarction (AMI)

- Death of a portion of the myocardium due to lack of oxygen
- Coronary artery disease is usually the underlying reason
Congestive Heart Failure (CHF)

- Inadequate pumping of the heart
- Often leads to excessive fluid build-up in lungs and/or body
- May be brought on by diseased heart valves, hypertension, obstructive pulmonary disease
- Often a complication of AMI
Progression of CHF

- Patient sustains AMI
- Myocardium of left ventricle dies
- Because of damage to left ventricle, blood backs up into pulmonary circulation and lungs
- If untreated, left heart failure commonly causes right heart failure
Signs and Symptoms of CHF

- Tachycardia
- Dyspnea and cyanosis
- Normal or elevated blood pressure
- Diaphoresis
- Pulmonary edema

continued
Signs and Symptoms of CHF

- Anxiety or confusion due to hypoxia
- Pedal edema
- Engorged, pulsating neck veins (late sign)
- Enlarged liver and spleen
Signs and Symptoms of CHF

SIGNS AND SYMPTOMS OF CONGESTIVE HEART FAILURE

- Mild to severe confusion.
- Anxiety.
- Cyanosis.
- Distended neck veins. (Late)
- Tachypnea.
- Crackles.
- May cough up pink sputnum.
- Shortness of breath (dyspnea).
- Low, normal, or high blood pressure.
- Pale, cool, clammy skin.
- Rapid heart rate.
- Abdominal distention.
- A desire to sit upright.
- Pedal and lower extremity edema.
Cardiac Arrest
The Chain of Survival

• Five elements
   1. Immediate recognition and activation
   2. Early CPR
   3. Rapid defibrillation
   4. Effective advanced life support
   5. Integrated post-cardiac arrest care

• Teamwork
• Coordination
Immediate Recognition and Activation

- Requires prompt notification of EMS system
- Most likely a bystander responsibility
Early CPR

- Increases survival chances significantly
- Three ways CPR can be delivered earlier
  - Get CPR-trained professionals to patient faster
  - Train laypeople in CPR
  - Train dispatchers to instruct callers how to perform CPR
Rapid Defibrillation

- Sooner defibrillator arrives, more likely patient will survive cardiac arrest
Effective Advanced Life Support

- Generally EMT-paramedics who respond to scene or rendezvous with BLS unit en route to hospital
- Rapid transport to hospital may be the most time-efficient means of obtaining ALS
Integrated Post-Cardiac Arrest Care

• Coordinating numerous means of assessment and interventions that together maximize the chance of neurologically intact survival

continued
Integrated Post-Cardiac Arrest Care

• Maintaining adequate oxygenation
• Avoiding hyperventilation
• Performing 12-lead ECG
• Managing treatable causes of arrest
• Appropriate destination for patient
• Possibly inducing hypothermia
Management of Cardiac Arrest

- EMT provides two links in chain of survival
  - Early CPR
  - Rapid defibrillation
Treatment of Cardiac Arrest

- Standard Precautions
- ALS (when available)
- One- and two-rescuer CPR
- Using an automated external defibrillator

continued
Treatment of Cardiac Arrest

- Artificial ventilations and airway management
- Interviewing bystanders and family members
- Lifting and moving patients
Automated External Defibrillator (AED)

- Semiautomatic
  - Advises EMT to press button that causes machine to deliver shock through pads
- Fully automatic
  - Does not advise EMT to take any action; delivers shock automatically

continued
Automated External Defibrillator (AED)

- Classified by type of shock delivered
  - Monophasic: sends single shock from negative pad to positive pad
  - Biphasic: sends shock in one direction and then the other

continued
Automated External Defibrillator (AED)

- Analyzes cardiac rhythm to determine whether shock is indicated
Automated External Defibrillator (AED)

- Most common conditions resulting in cardiac arrest are shockable rhythms
  - Ventricular fibrillation
  - Ventricular tachycardia
AED Safety

• Do not defibrillate soaking-wet patient
• Do not defibrillate if patient is touching anything metallic that other people are touching
• Remove nitroglycerin patches before defibrillating

continued
AED Safety

- Verbally and visually “CLEAR” patient before defibrillating
AED Safety

- Defibrillation can be performed on patient with an implanted device
- Position defibrillation pads on patient’s chest to avoid contact with the device
AED Maintenance

- Use checklist at beginning of every shift to ensure you have all supplies and AED is functioning properly
- Make sure battery is charged and you have a spare with defibrillator
AED Quality Improvement

- Involves multiple functions
  - Medical direction
  - Initial training
  - Maintenance of skills
  - Case review
  - Trend analysis
  - Strengthening links in chain of survival
Coordinating CPR and AED

- Interrupt CPR only when absolutely necessary and for as short a period as possible
- CPR must be paused for rhythm analysis and defibrillation
Patient Assessment

- Perform primary assessment
  - If bystanders are doing CPR when you arrive, have them stop
  - Verify pulselessness, apnea, absence of other signs of life no longer than 10 seconds
• Apply AED
  – Bare patient’s chest; quickly shave area where pads will be placed if necessary
  – If available, use pediatric AED pads
  – If using adult pads, do not overlap

Patient Care Continued
Patient Care

- Use AED
  - Turn on AED
  - Attach pads to cables and then to patient
  - Stop CPR and analyze
  - Clear patient and shock if indicated

continued
Patient Care

- Immediately begin CPR after delivering a shock
- Reassess patient after providing 2 minutes or 5 cycles of CPR

continued
Patient Care

• If AED finds no shockable ECG rhythm, will advise that no shock is indicated
  – Pulseless electrical activity
  – Asystole
• Resume CPR immediately
Patient Care

• When providing CPR
  – Compressions must not be interrupted for any longer than 10 seconds
  – Compressions at least 2 inches deep for adult and at least one-third depth of chest for infants and children with full chest recoil
  – Rate should be at least 100 per minute
  – Rotate personnel through compressor position to prevent fatigue

continued
Patient Care

- If patient wakes or begins to move
  - Obtain baseline vital signs
  - Administer high-concentration oxygen
  - Transport
Post-Resuscitation Care

- Patient has a pulse
  - Manage airway; avoid hyperventilation
  - Keep defibrillator on patient during transport in case patient goes back into arrest
  - Reassess frequently (every 5 minutes)
  - Consider hypothermia protocols

continued
Post-Resuscitation Care

• Patient goes back into cardiac arrest
  – Stop vehicle, resume CPR
  – Analyze rhythm as soon as possible
  – Deliver shock if indicated
  – Continue with 2 shocks separated by 2 minutes (5 cycles)
Mechanical CPR Devices

- Mechanical devices assist EMTs to provide high-quality compressions
  - Thumper®
  - Auto-Pulse™
Using an AED Video

Click [here](#) to view a video on the subject of how to use an AED.
Cardiac Arrest Video

Click here to view a video on the subject of cardiac arrest.
AEDs Video

Click [here](#) to view a video on the subject of AEDs.
Click [here](#) to view a video on the subject of myocardial infarctions.
Chapter Review
Chapter Review

• Patients with cardiac compromise or ACS can have many different presentations.
• Some complain of pressure or pain in the chest with difficulty breathing. Others may have just mild discomfort that they ignore or that goes away and returns.

continued
• Between 10%–20% of heart attack patients have no chest discomfort.
• Because of these possibilities and the severe complications of heart problems, have a high suspicion and treat patients with these symptoms for cardiac compromise.
Chapter Review

• ACS patients need high-concentration oxygen and prompt, safe transportation to definitive care.
• You may be able to assist patients who have their own nitroglycerin.
Chapter Review

• To provide maximum chance of survival for patients in cardiac arrest, EMS agencies must strengthen their performance of the chain of survival: immediate recognition and activation, early CPR, rapid defibrillation, effective ALS, and integrated post-cardiac arrest care.
Remember

• The heart is a simple pump that moves deoxygenated blood to the lungs and oxygenated blood to the body. Pressure within the cardiovascular system is critical to the moving of blood.
Remember

• Acute coronary syndrome (ACS) is a blanket term that refers to a number of situations in which perfusion of the heart is inadequate.

• Although there are common symptoms of ACS, EMTs must recognize atypical findings and err on the side of caution.
Remember

- Oxygen, nitroglycerine, and aspirin are key medications indicated to treat ACS. However, the definitive treatment is transportation of the patient to a facility that can open the blocked artery.
Remember

• Most cardiac conditions are caused by arterial problems. Angina pectoris and acute myocardial infarction are caused by inadequate perfusion of the heart.

• Heart failure can be caused by either electrical or mechanical problems.
Remember

- The most important element of cardiac arrest care is the administration of high-quality chest compressions.
- The American Heart Association’s chain of survival describes the key elements necessary to maximize the cardiac arrest patient’s chance of survival.
Remember

• AED provides early defibrillation in cardiac arrest patients with ventricular tachycardia and ventricular fibrillation.
• Post-cardiac arrest care is an essential element of cardiac arrest care.
• Mechanical CPR devices provide automated chest compressions in cardiac arrest settings.
Questions to Consider

• What position is best for a patient with:
  – Difficulty breathing and a blood pressure of 100/70?
  – Chest pain and a blood pressure of 180/90?

• Describe how to “clear” a patient before administering a shock.
Questions to Consider

• List three safety measures to keep in mind when using an AED.
• List the steps in the application of an AED.
Critical Thinking

• A 78-year-old male has been complaining of severe shortness of breath for 20 minutes prior to your arrival. When you arrive, you find the patient unconscious and not moving. What are your immediate priorities?
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