Chapter 14
Cardiac Emergencies

Objectives
• Describe the proper mode of administration for sublingual tablet and sublingual spray nitroglycerin, and list the potential side effects and contraindications
• Identify six risk factors for cardiac disease
• List and differentiate between the symptoms of angina and myocardial infarction (heart attack)
• List three complications of myocardial infarction

Objectives
• Describe common features of cardiogenic shock
• List five symptoms and signs of congestive heart failure
• Compare the signs and symptoms of right-sided and left-sided congestive heart failure
• Describe the signs and symptoms of dissecting thoracic aortic aneurysm, leaking abdominal aortic aneurysm, and ruptured abdominal aortic aneurysm
Objectives

- Outline three risk factors for acute pulmonary embolism and describe the most common clinical signs and symptoms
- List five causes of hypertensive crisis
- Identify six symptoms of hypertensive crisis
- List five causes of syncope

Objectives

- Discuss four main items to assess in patients who suffer syncope
- Describe the cardiac conduction system

Objectives

- Identify the following components on a normal electrocardiogram tracing and describe the events of the cardiac cycle that they represent: P wave, PR segment, QRS complex, ST segment, and T wave
Objectives

- Identify each of the following cardiac rhythms on an oscilloscope monitor: normal sinus rhythm, sinus bradycardia, sinus tachycardia, premature ventricular contractions, ventricular tachycardia, ventricular fibrillation, and asystole

Objectives

- List the rationale for early defibrillation and describe the most common electrical disturbance resulting in cardiac arrest
- List the indications for automated external defibrillation
- Describe the proper steps for patient evaluation, placement, and use of an automated external defibrillator

Objectives

- List the contraindications for automated external defibrillation
- Describe the proper steps for patient evaluation and administration of manual defibrillation
General Approach to a Cardiac Patient

- Cardiac signs and symptoms
  - Chest pain
  - Sweating
  - Breathing difficulty
  - Anxiety and irritability
  - Feeling of impending doom
  - Abnormal pulse rate
  - Abnormal blood pressure
  - Atypical cardiac pain
  - Nausea and vomiting

General Approach to a Cardiac Patient

- Initial assessment
  - OPQRST
    - O = Onset
    - P = Provocation
    - Q = Quality
    - R = Radiation/relief
    - S = Severity
    - T = Time

General Approach to a Cardiac Patient

- Nitroglycerin
  - Tablet or spray
  - Dilates blood vessels
  - Criteria
    - Chest pain
    - Specific authorization
    - Follow local protocols
  - Contraindications
    - Systolic BP < 100 mm Hg
    - Head injury
    - Infants and children
    - Patient has already taken three doses
General Approach to a Cardiac Patient

- Administration of NTG
  - Contact medical direction
  - Place tablet under patient’s tongue

Angina

- Pain associated with decreased blood flow to heart
- Ischemia
  - Lack of oxygen to myocardium
- Unstable angina
  - Change in pattern of stable angina
Angina

- Assessment
  - Chest pain
    - Substernal
    - May radiate
    - Epigastric region
    - Indigestion
    - Lasts <10-15 min

Angina

- Emergency care
  - Request paramedic response
  - Monitor cardiac rhythm
  - Maintain airway and administer high-concentration oxygen
  - IV line
  - Vital signs every 5 min
  - Minimize patient activity
  - Loosen restrictive clothing
  - Help patient take own NTG
  - Transport
  - Watch for cardiac arrest

Heart Attack (Myocardial Infarction)

- Death of heart muscle caused by lack of oxygen
- Leading cause of death in U.S.
- Many die before reaching hospital
Heart Attack (Myocardial Infarction)

- MI occurs when an artery to the heart is blocked
- Rarely, spasms cause blockage of the artery

Heart Attack (Myocardial Infarction)

- Risk factors
  - Cigarette smoking
  - Family history
  - Male sex
  - Diabetes mellitus
  - Hypertension
  - Elevated BP
  - Obesity
  - Sedentary life-style
  - Stress

Heart Attack (Myocardial Infarction)

- Assessment
  - Difficult to differentiate pain between angina and MI
  - Pain lasts >15 min
  - Respiratory distress more severe
  - Skin cold and clammy
  - Pulse rapid, slow, and/or irregular
  - Hypotension/shock
  - Patient may deny symptoms
  - Cardiac arrest may occur
Heart Attack
(Myocardial Infarction)

- Complications
  - Cardiac arrest
  - Congestive heart failure
  - Cardiogenic shock

Heart Attack
(Myocardial Infarction)

- Emergency care
  - Request paramedic assistance
  - Maintain airway and give oxygen
  - IV line
  - Monitor vital signs and apply pulse oximetry
  - Monitor cardiac rhythm
  - Minimize patient motion
  - Loosen restrictive clothing
  - Help patient take NTG
  - Administer chewable aspirin
  - Transport in comfortable position

Heart Attack
(Myocardial Infarction)

- Newer medical treatments
  - Thrombolysis
  - Balloon angioplasty
  - Coronary arterectomy
  - Laser angioplasty
  - Coronary artery stents
  - Coronary bypass surgery
Cardiogenic Shock

- Cardiac failure whereby the heart cannot sufficiently pump blood to the rest of the circulatory system

Cardiogenic Shock

- Caused by several factors
  - Severe MI
  - Severe heart failure
  - Cardiac valve muscle rupture
  - Trauma

Cardiogenic Shock

- Assessment
  - Severe respiratory distress
  - Chest pain
  - Abnormal mental status
  - Collapse of peripheral veins
  - Cold, clammy skin
  - Rapid, shallow respirations
  - Rapid, thready pulse
  - Decreased oxygen saturation on pulse oximetry
Cardiogenic Shock

- Emergency care
  - Call for paramedic assistance
  - Secure and maintain airway
  - High-concentration oxygen
  - IV line
  - Monitor vital signs
  - Monitor cardiac rhythm
  - Transport

Congestive Heart Failure and Pulmonary Edema

- Congestive heart failure
  - Inability of the heart to pump blood; caused by heart muscle damage

- Pulmonary edema
  - Excessive backup of fluids in the lungs

Causes of congestive heart failure

- Cardiomyopathy
- Drugs
- Hypertension
- Thyroid disease
- Heart valve disease
**Congestive Heart Failure and Pulmonary Edema**

- **Left-sided CHF**
  - Pumping capability of left ventricle decreased
  - Can result in pulmonary edema

- **Right-sided CHF**
  - Pumping capacity of right ventricle impaired
  - Results from increased resistance to flow through lungs

**Assessment**
- Respiratory distress
- Diaphoresis
- Restlessness, anxiety
- Shortness of breath
- Distended neck veins
- Swollen, edematous legs
- Weakness, fatigue
- Tachycardia
- Chest pain
- Cyanosis
- ↑ systolic blood pressure

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Congestive Heart Failure and Pulmonary Edema

- Emergency care
  - Sitting position
  - Maintain airway
  - Oxygen
  - Assist ventilation
  - IV line
  - Monitor cardiac rhythm
  - Monitor vital signs
  - Assist with NTG

Drug treatment for acute pulmonary edema
- Nitroglycerin
- Furosemide
- Morphine sulfate

Aortic Aneurysm
- Dilation of a portion of blood vessel that may cause a weakness or tear of the vessel wall
  - Dissecting thoracic aortic aneurysm
  - Ruptured or leaking abdominal aortic aneurysm
**Aortic Aneurysm**

- Dissecting thoracic aortic aneurysm
  - Excruciating pain
    - Anterior chest
    - Tearing sensation
    - Pain between shoulder blades
  - Physical findings vary greatly
    - Asymmetry of pulses
    - Neurologic symptoms
    - Femoral pulse decreased or absent on one side

**Aortic Aneurysm**

- Dissecting thoracic aortic aneurysm
  - Treatment
    - Priority patient
    - Paramedic backup
    - Do not prolong transport
    - Airway
    - Oxygen
    - PASG
    - IV
    - Monitor cardiac rhythm
    - Monitor vital signs

**Aortic Aneurysm**

- Ruptured or leaking abdominal aortic aneurysm
  - Symptoms with rupture
**Aortic Aneurysm**

- Ruptured or leaking abdominal aortic aneurysm
  - Symptoms with rupture
    - Back pain
    - Abdominal pain
    - Nausea, vomiting
    - Shock
    - Rapid onset of pain radiating to back and scrotum
    - Diaphoresis
    - Pulsating abdominal mass
    - Distended, tender abdomen
    - Decreased femoral pulses
    - Blue scrotum sign

**Aortic Aneurysm**

- Ruptured or leaking abdominal aortic aneurysm
  - Treatment
    - Paramedic backup
    - Gentle rapid transport
    - Airway
    - Oxygen
    - PALS
    - IV
    - Monitor cardiac rhythm
    - Monitor vital signs

**Pulmonary Embolism**

- Risk factors
  - Sedentary life-style
  - Obesity
  - Oral contraceptives
  - Long bone fracture
  - Pregnancy
  - Surgery
  - Blood disease
**Pulmonary Embolism**

- Signs and symptoms
  - Sudden chest pain that increases in intensity
  - Respiratory distress
  - Wheezing or coughing up blood
  - Anxiety
  - Shock
  - Hypotension

- Emergency care
  - Airway
  - Oxygen
  - Place in comfortable position
  - Monitor vital signs
  - IV
  - Transport

**Hypertensive Crisis**

- Causes
  - Drugs
  - Amphetamines
  - Acute heart failure
  - Pregnancy-associated hypertension
  - Acute kidney infection or abnormal function
  - Dissecting thoracic aortic aneurysm
  - Intracranial event
Hypertensive Crisis

- Signs and symptoms
  - Severe headache or dizziness
  - Decreased level of responsiveness
  - Visual disturbances
  - Nausea or vomiting
  - Chest pain
  - Shortness of breath
  - Nosebleed

Hypertensive Crisis

- Emergency care
  - Airway
  - IV line
  - Monitor cardiac rhythm
  - Monitor vital signs

Palpitations and Syncope

- Causes
  - Cardiac dyserythmias
  - Nervous system disorders
  - Anxiety
  - Thyroid disease
  - Variety of drugs
  - Simple fainting spell
Palpitations and Syncope

- Assessment
  - How long was patient unresponsive?
  - What position was patient in when episode occurred?
  - Does patient feel light-headed when going from lying down to sitting position?
  - Is patient pregnant?
  - Did patient appear to have seizure?
  - Are vital signs normal?

Palpitations and Syncope

- Emergency care
  - Oxygen
  - Monitor cardiac rhythm
  - IV line
  - Monitor vital signs

Basic ECG Interpretation

- Cardiac conduction system
  - Myocardium has ability to generate and conduct electrical impulses
Basic ECG Interpretation

- Components of the normal adult electrocardiogram
  - ECG paper
  - Standard line distances
  - Markings

Basic ECG Interpretation

- Components of the normal adult electrocardiogram
  - ECG composed of:
    - P waves
    - QRS complexes
    - T waves

Basic ECG Interpretation

- P waves occur at regular intervals
- PR segment of normal duration followed by normal QRS
- ST segment – flat followed by normal T wave
Basic ECG Interpretation

- Step 1 - Evaluate the rate
- Step 2 - Evaluate the rhythm
- Step 3 - Evaluate the P waves
- Step 4 - Evaluate the PR interval
- Step 5 - Evaluate the QRS complex
Basic ECG Interpretation
Evaluate the rate: Method 2

Muscle tremor

AC interference

Loose electrodes

Biotelemetry interference
Basic ECG Interpretation

- Normal sinus rhythm
  - Rate 60-100 BPM
  - P wave
  - Normal QRS complex
  - Normal T wave

Basic ECG Interpretation

- Sinus bradycardia
  - Rate <60 BPM
  - P wave
  - Normal QRS complex
  - Normal T wave

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Basic ECG Interpretation

- Sinus tachycardia
  - Rate >100 BPM
  - P wave
  - Normal QRS complex
  - Normal T wave
**Basic ECG Interpretation**

- Premature ventricular complex
  - No P waves
  - Wide QRS complexes followed by a pause

**Basic ECG Interpretation**

- Multiform PVCs
  - Appear different
  - Arise from several areas
Basic ECG Interpretation

- Ventricular tachycardia
  - Rate 150-220 BPM
  - Three or more PVCs in a row
  - P wave not discernible
  - Wide and bizarre QRS complexes
  - T waves may or may not be present

Basic ECG Interpretation

- Ventricular fibrillation
  - Erratic firing of multiple sites in ventricles
Basic ECG Interpretation

- Pulseless electrical activity (PEA)
  - Rhythm on monitor
  - Patient pulseless and apneic

General Principles of Defibrillation

- Defibrillation
  - Electrical shock delivered to the heart in order to restore an effective rhythm
  - Ventricular fibrillation
  - Pulseless ventricular tachycardia
General Principles of Defibrillation

- Defibrillation
  - Successful defibrillation depends on:
    - Duration of time from onset of fibrillation
    - Transthoracic resistance
    - Energy output
    - Paddle placement

Automated External Defibrillation

- No need to interpret cardiac rhythms
- Fully automatic defibrillators
- Semiautomatic defibrillators

Automated External Defibrillation

- Proper steps
  - Assess for pulse
  - Give 30 compressions and 2 breaths
  - Place AED next to left ear
  - Activate device
Automated External Defibrillation

Proper steps
- Attach electrodes and pads to patient
  - Below clavicle
  - Right of sternal
- Stop CPR after pads attached
- Push "analyze" button
- If AED advises to shock:
  - Announce "clear"
  - Push "shock" button

If no shock indicated:
- Patient does not have treatable rhythm
- Continue quality CPR during preparation for defibrillation

Standard Defibrillation

Standard paddle placement
Video for Defibrillation

Manual Defibrillation

- Proper steps
  - Place pads on patient's chest or apply gel to paddles
  - Select appropriate energy level
  - Charge defibrillator
  - Continue quality CPR while defibrillator is charging

Manual Defibrillation

- Proper steps
  - Apply paddles to chest
  - Use firm arm pressure
  - State "stand clear"
  - Verify that no one is touching patient
  - Depress buttons simultaneously to deliver shock
Cardiac Drugs

- Epinephrine
  - Most common drug used for cardiac arrest
  - Ventricular fibrillation
  - Pulseless ventricular tachycardia
  - Asystole
  - Pulseless electrical activity (PEA)

Cardiac Drugs

- Amiodarone and Lidocaine
  - Antiarrhythmic drugs
  - Used to treat ventricular dysrhythmias
    - VT, VF
  - Only used when:
    - Electrical shock fails
    - Following successful defibrillation to prevent recurrence

First-Line Cardiac Drugs

- Atropine
  - Increases heart rate
  - Indications include:
    - Symptomatic bradycardias
    - Asystole
Summary

- Cardiovascular disease is a common cause of medical problems.
- Most common symptom of cardiac disease is chest pain.
- Take an appropriate history in a responsive patient.
- Assist with the patient's prescribed nitroglycerin if indicated:
  - Follow local protocols and obtain permission from medical direction prior to giving any drug.

Summary

- Angina is chest pain and related symptoms due to lack of oxygen in heart muscle:
  - May be brought on by:
    - Exercise
    - Cold
    - Emotion
- Underlying lesion is atherosclerotic plaque that narrows the lumen of the coronary artery.

Summary

- Patients with angina complain of substernal chest pain, which may radiate to:
  - Epigastrium
  - Arms
  - Jaw
  - Teeth
  - Neck
- Other symptoms of angina include diaphoresis, shortness of breath, and nausea.
Summary

- Anginal pain subsides with rest or nitroglycerin
- Heart attack (acute MI) occurs when blood flow through coronary artery is completely blocked
- Thrombus occludes artery whose lumen has been narrowed by atherosclerotic plaque
- Cigarette smoking is major risk factor for MI

Summary

- MI pain typically lasts >15 min
  - Patients often look pale and ill
  - Denial of severity of illness common
- Elderly patients with MI may have weakness or shortness of breath
- Complications of MI include:
  - Cardiac arrest
  - CHF
  - Cardiogenic shock

Summary

- Cardiogenic shock occurs when >40% of myocardium is unable to effectively pump blood
- Most common cause is acute MI
- Blood pressure may be high, low, or normal
Summary

- Care for MI includes:
  - High-concentration oxygen
  - IV placement
  - ECG monitoring
  - Calm and quiet transport

- Cardiogenic shock
  - Administer IV bolus if mandated by local protocol

- CHF is circulatory congestion due to inadequate flow of blood

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Summary

- CHF is caused by heart muscle damage
  - Pulmonary edema is most severe form

- Most common cause of CHF is coronary artery disease

- Both right- and left-sided CHF may occur

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Summary

- Hypotension with acute pulmonary edema is serious sign

- Aneurysm of aorta commonly occurs
  - In abdomen (abdominal aortic aneurysm)
  - In thoracic aorta (dissecting thoracic aortic aneurysm)

- Both types result in pain and may cause decreased peripheral pulses and shock
Summary

- **Pulmonary embolism**
  - Blockage of pulmonary artery by foreign matter
  - Usually blood clot from veins of pelvis and legs
  - Potentially lethal
  - Relatively common
  - Often underdiagnosed
  - Patients may present with:
    - Sudden cardiovascular collapse
    - Pleuritic chest pain
    - Anxiety
    - Shortness of breath

Summary

- **Hypertensive crisis**
  - Sudden increase in blood pressure
  - Results in functional disturbances in:
    - Central nervous system
    - Heart
    - Kidneys
  - Without treatment life-threatening complications can occur
  - Patients have markedly elevated blood pressure; dizziness and headache may be present

Summary

- **Palpitation**—pounding or racing of heart
- **Syncope**—transient state of unresponsiveness
- Both may be caused by:
  - Heart disease
  - Metabolic problems
  - Drugs
Summary

- Electrocardiogram (ECG)
  - Graphic representation of heart's electrical activity
    - P wave
    - PR segment
    - QRS complex
    - ST segment
    - T wave
  - Lead II is used most commonly for monitoring

Summary

- Cardiac dysrhythmias including VF, VT, and PEA commonly occur during cardiac arrest
- VF and pulseless VT are treated with electrical shock defibrillation

Summary

- EMT-I may administer or assist in administration of cardiac drugs

  - Epinephrine
    - Most common drug during cardiac arrest
    - Improves coronary artery perfusion
Summary

- Amiodarone and Lidocaine
  - Ventricular dysrhythmias as result of acute MI or myocardial ischemia

- Atropine
  - Reverses excess parasympathetic nervous system tone that may perpetuate bradycardia or asystole

Questions?