



# Chapter 14

## Cardiovascular Emergencies

# Introduction (1 of 2)

- Cardiovascular disease has been leading killer of Americans since 1900.
- Accounts for 1 of every 2.8 deaths

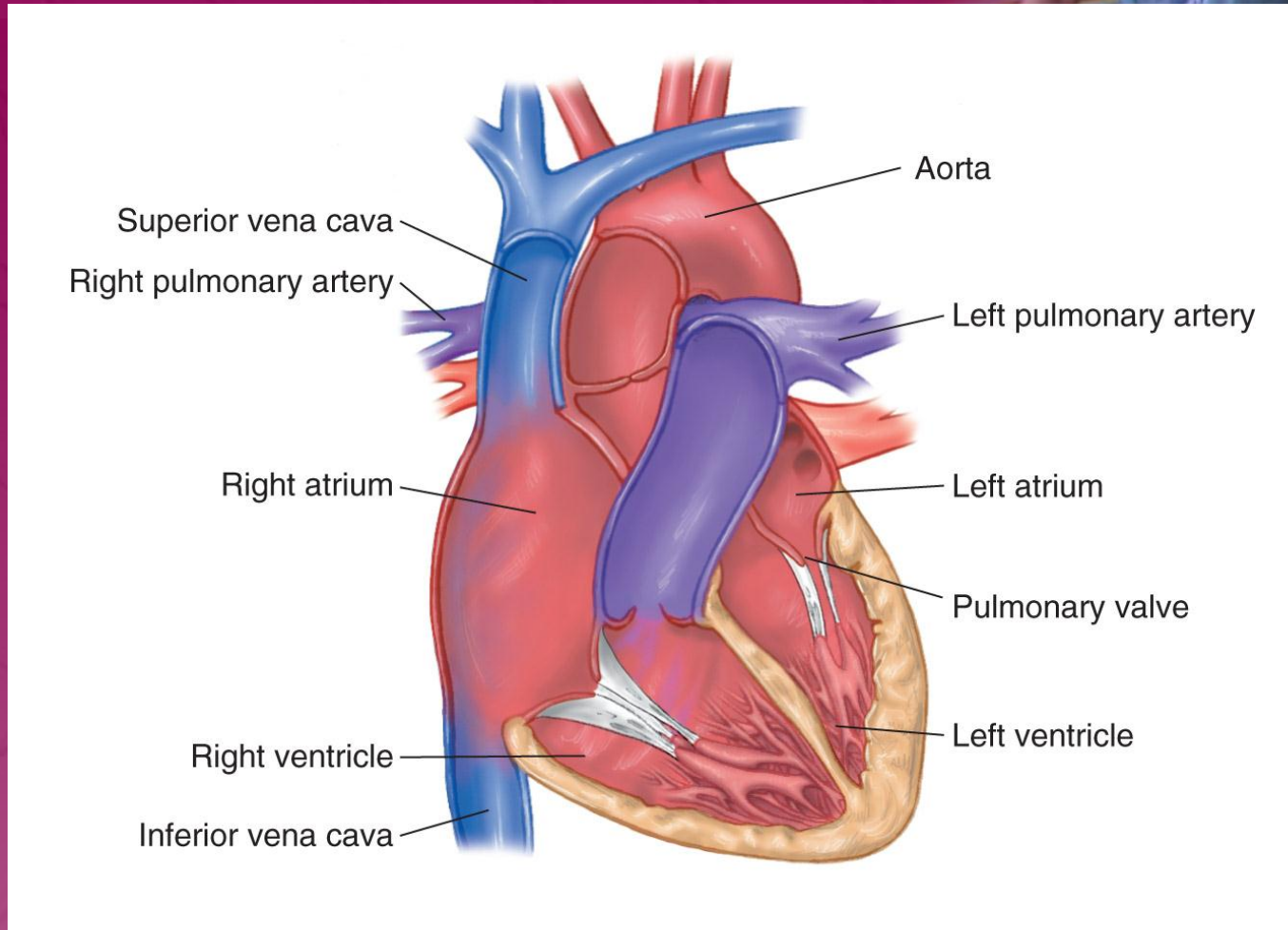
# Introduction (2 of 2)

- EMS can help reduce deaths by:
  - Encouraging healthy life-style
  - Early access
  - More CPR training of laypeople
  - Public access to defibrillation devices
  - Recognizing need for advanced life support (ALS)

# Anatomy and Physiology (1 of 21)

- Heart's job is to pump blood to supply oxygen-enriched red blood cells to tissues.
- Divided into left and right sides

# Anatomy and Physiology (2 of 21)

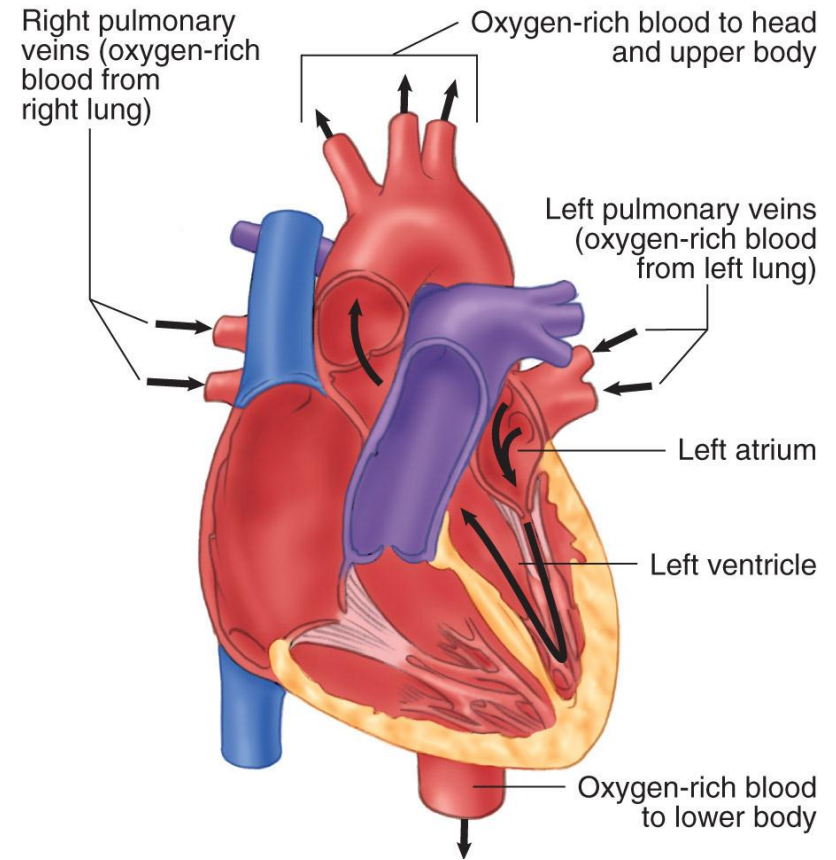
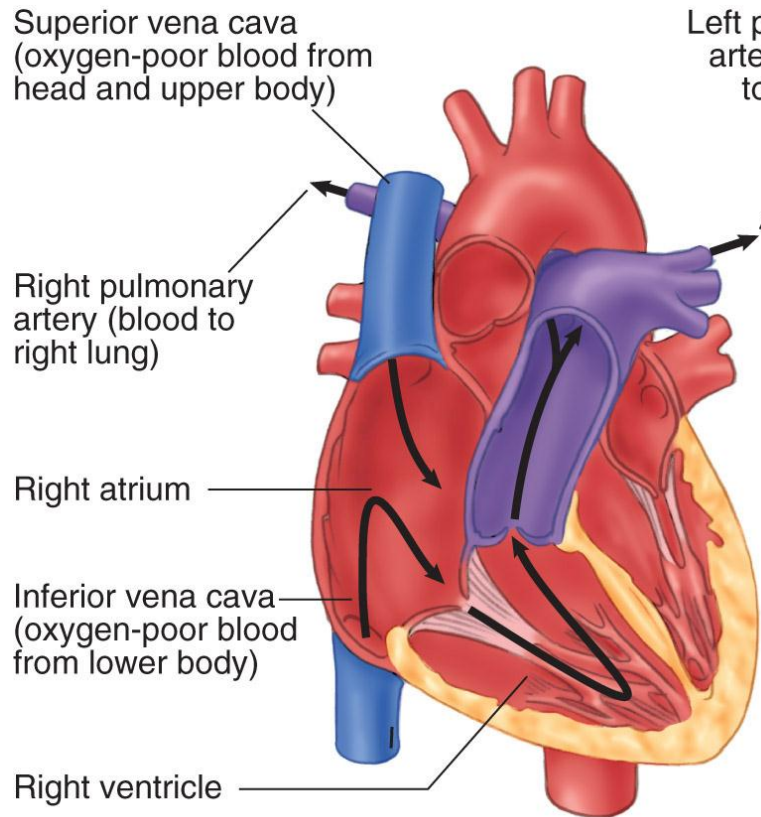


# Anatomy and Physiology (3 of 21)

- Atria receives incoming blood, and ventricles pump outgoing blood.
- One-way valves keep blood flowing in the proper direction.
- Aorta, body's main artery, receives blood ejected from left ventricle.



# Anatomy and Physiology (4 of 21)

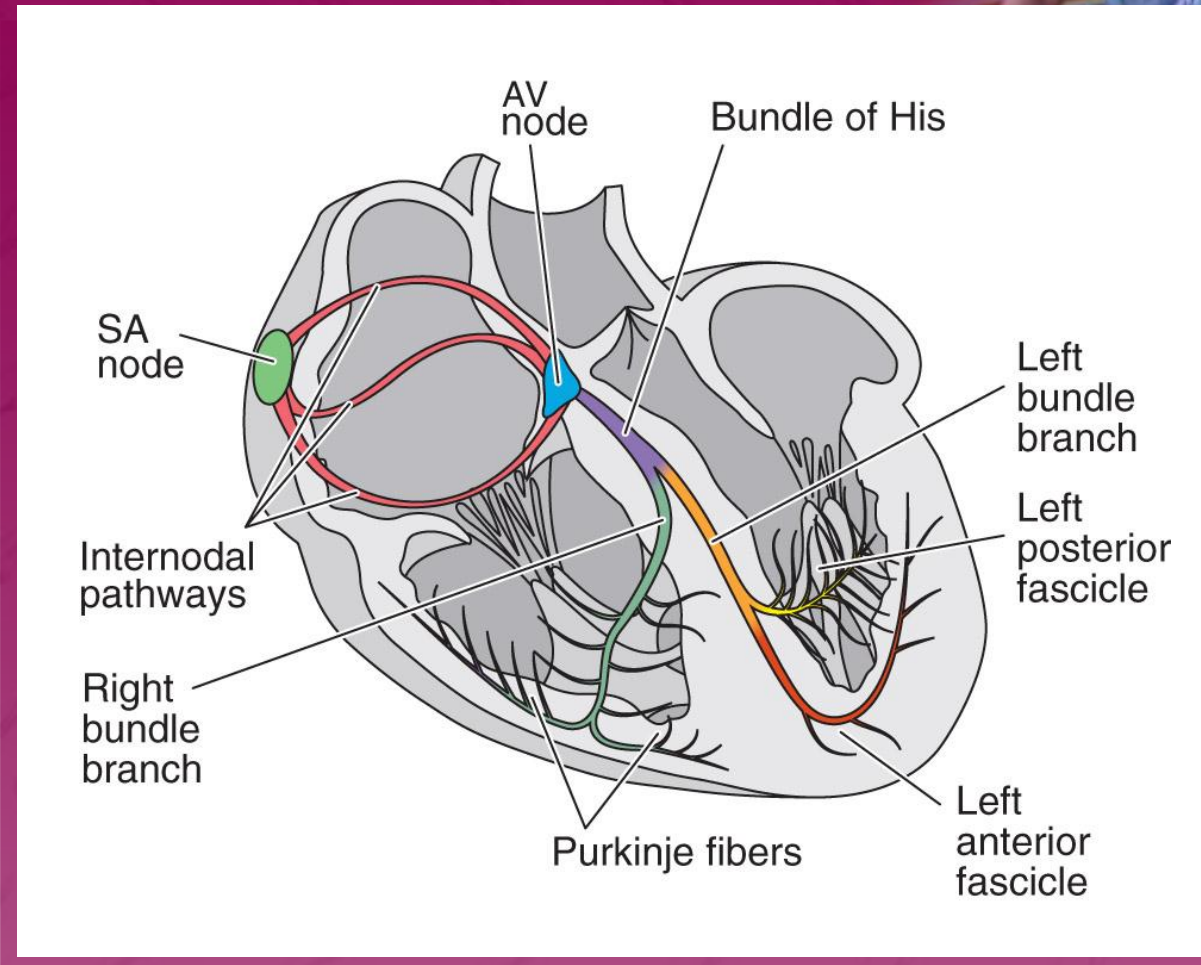


# Anatomy and Physiology (5 of 21)

- Heart's electrical system controls heart rate and coordinates atria and ventricles.
- The cardiac muscle is the myocardium.
- Automaticity allows cardiac muscles to spontaneously contract.

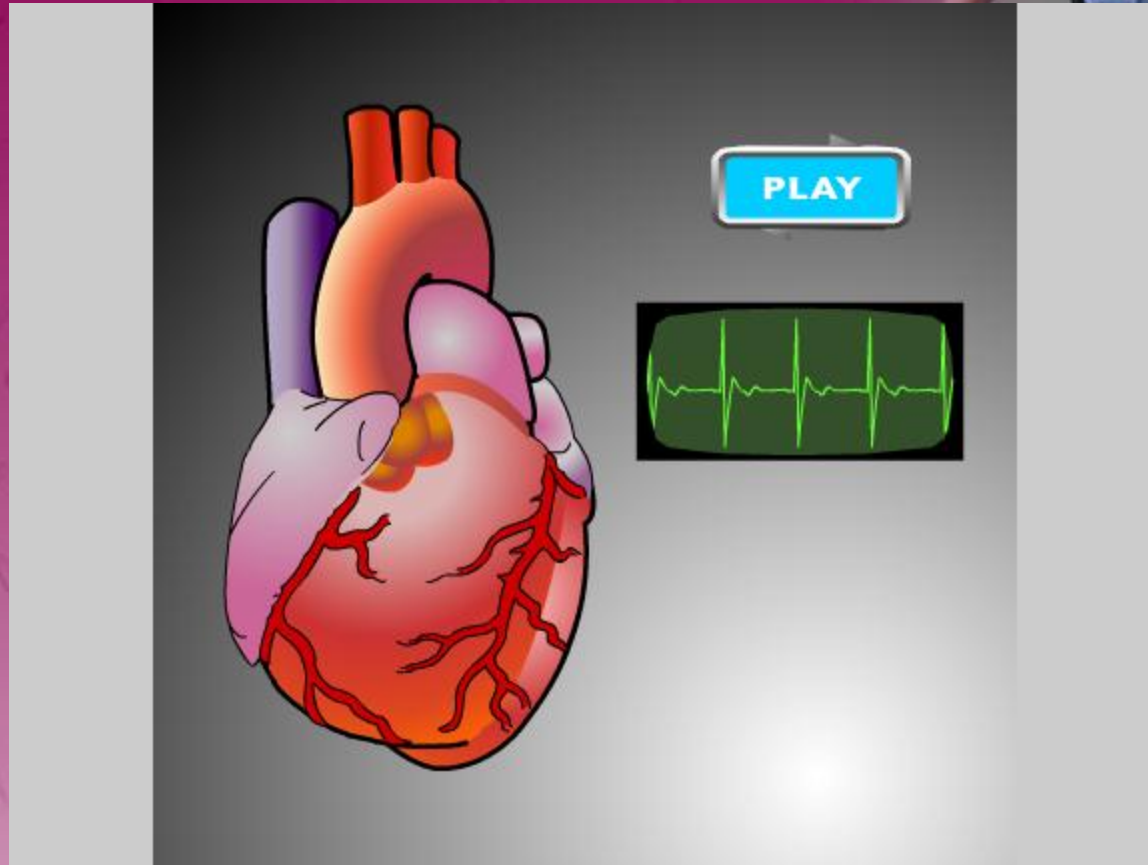


# Anatomy and Physiology (6 of 21)



Electrical conduction system of the heart

# Anatomy and Physiology (7 of 21)



# Anatomy and Physiology (8 of 21)

- Autonomic nervous system (ANS) controls involuntary activities.
- The ANS has two parts:
  - Sympathetic nervous system
    - “Fight-or-flight” system
  - Parasympathetic nervous system
    - Slows various bodily functions



# Anatomy and Physiology (9 of 21)

- The myocardium must have a continuous supply of oxygen and nutrients to pump blood.
- Increased oxygen demand by myocardium is supplied by dilation (widening) of coronary arteries.

# Anatomy and Physiology (10 of 21)

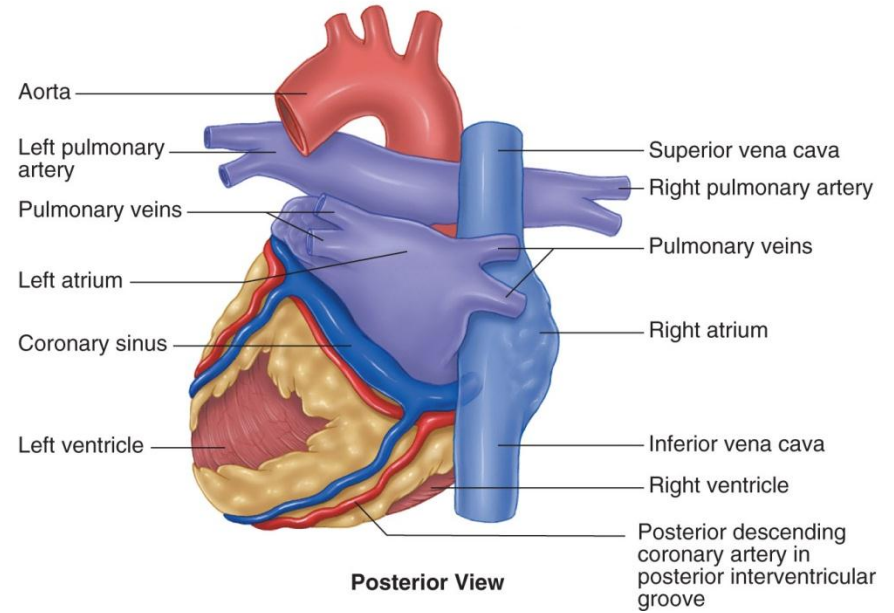
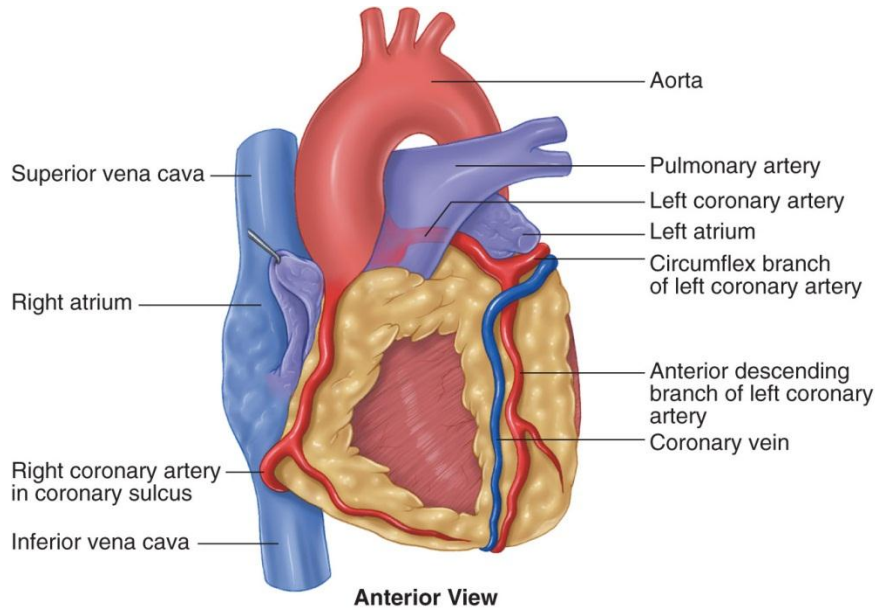
- Stroke volume is the volume of blood ejected with each ventricular contraction.
- Coronary arteries are blood vessels that supply blood to heart muscle.

# Anatomy and Physiology (11 of 21)

- Coronary arteries start at the first part of the aorta:
  - Right coronary artery
  - Left coronary artery



# Anatomy and Physiology (12 of 21)



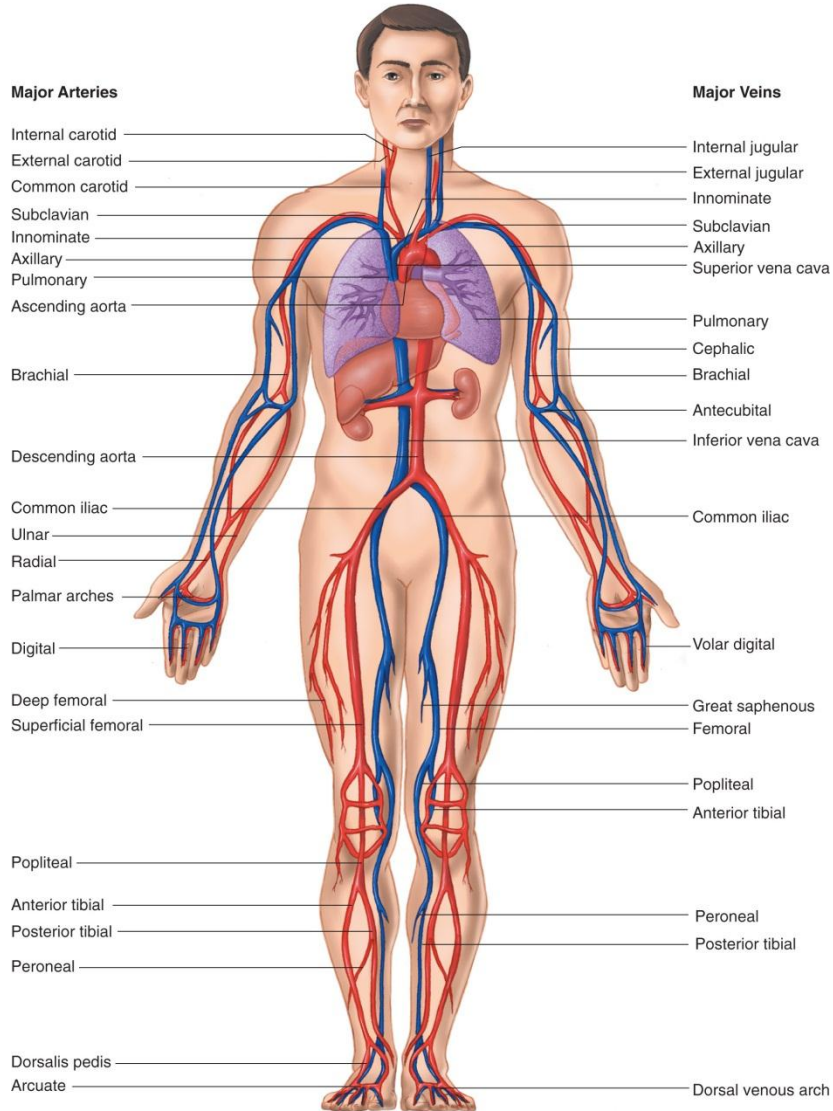
# Anatomy and Physiology (13 of 21)

- Arteries supply oxygen to different parts of the body:
  - Right and left carotid
  - Subclavian
  - Brachial
  - Radial and ulnar
  - Right and left iliac





# Anatomy and Physiology (14 of 21)

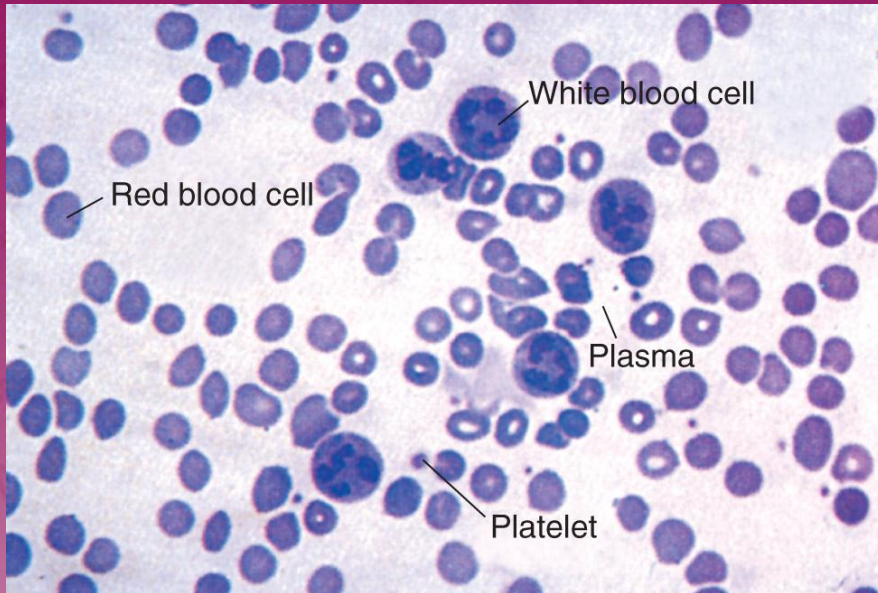


- Arteries supply oxygen to different parts of the body (cont'd):
  - Right and left femoral
  - Anterior and posterior tibial and peroneal

# Anatomy and Physiology (15 of 21)

- Arterioles and capillaries are smaller.
  - Capillaries connect arterioles to venules.
- Venules are the smallest branches of the veins.
  - Vena cavae return blood to the heart.
    - Superior vena cava: from the head and arms
    - Inferior vena cava: from the abdomen, kidneys, and legs

# Anatomy and Physiology (16 of 21)



- Blood consists of:
  - Red blood cells, which carry oxygen
  - White blood cells, which fight infection
  - Platelets, which help blood to clot
  - Plasma, which is the fluid cells float in

# Anatomy and Physiology (17 of 21)

- Blood pressure is the pressure of circulating blood against artery walls.
  - Systolic blood pressure
    - The max pressure generated by left ventricle
    - Top number in the reading
  - Diastolic blood pressure
    - The pressure while the left ventricle is at rest



# Anatomy and Physiology (18 of 21)

- A pulse is felt when blood passes through an artery during systole.
  - Peripheral pulses felt in the extremities
  - Central pulses felt near the body's trunk

# Anatomy and Physiology (19 of 21)

Carotid



Femoral



Brachial



Radial



Posterior tibial



Dorsalis pedis



# Anatomy and Physiology (20 of 21)

- Cardiac output is the volume of blood that passes through the heart in 1 min.
  - Heart rate  $\times$  volume of blood ejected with each contraction (stroke volume)
- Perfusion is the constant flow of oxygenated blood to tissues

# Anatomy and Physiology (21 of 21)

- Good perfusion requires:
  - A well-functioning heart
  - An adequate volume of blood
  - Appropriately constricted blood vessels
- If perfusion fails, cellular and eventually patient death occur.





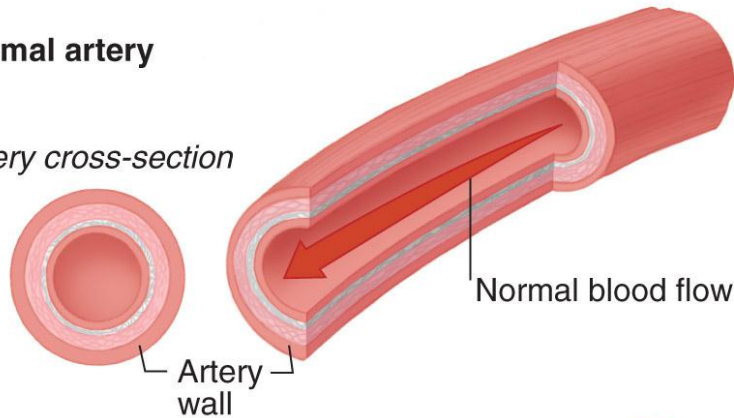
# Pathophysiology (1 of 26)

- Chest pain usually stems from ischemia, which is decreased blood flow.
  - Ischemic heart disease involves a decreased blood flow to one or more portions of the heart.
  - If blood flow is not restored, the tissue dies.

# Pathophysiology (2 of 26)

## Normal artery

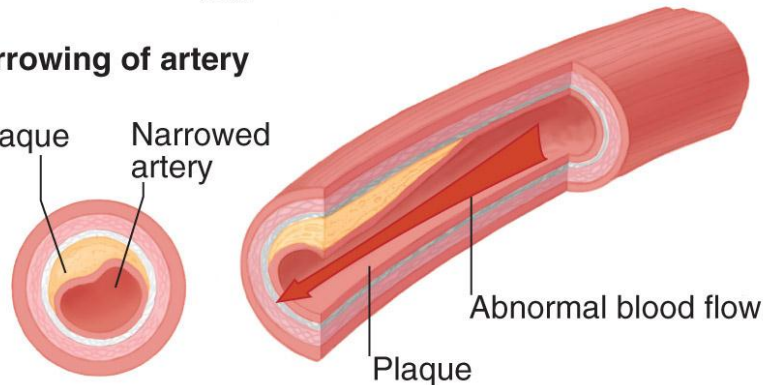
Artery cross-section



## Narrowing of artery

Plaque

Narrowed artery



- Atherosclerosis is the buildup of calcium and cholesterol in the arteries.
  - Can cause occlusion of arteries
  - Fatty material accumulates with age.

# Pathophysiology (3 of 26)



# Pathophysiology (4 of 26)

- A thrombo-embolism is a blood clot floating through blood vessels.
- If clot lodges in coronary artery, acute myocardial infarction (AMI) results.

# Pathophysiology (5 of 26)

- Coronary artery disease is the leading cause of death in the US.
- Controllable AMI risk factors:
  - Cigarette smoking, high blood pressure, high cholesterol, high blood glucose level (diabetes), lack of exercise, and stress

# Pathophysiology (6 of 26)

- Uncontrollable AMI risk factors:
  - Older age, family history, and being a male
- Acute coronary syndrome (ACS) is caused by myocardial ischemia.
  - Angina pectoris
  - Acute myocardial infarction

# Pathophysiology (7 of 26)

- Angina pectoris occurs when the heart's need for oxygen exceeds supply.
  - Crushing or squeezing pain
  - Does not usually lead to death or permanent heart damage
  - Should be taken as a serious warning sign

# Pathophysiology (8 of 26)

- Unstable angina
  - In response to fewer stimuli than normal
- Stable angina
  - Is relieved by rest or nitroglycerin
- Treat angina patients like AMI patients.



# Pathophysiology (9 of 26)

- AMI pain signals actual death of cells in heart muscle.
  - Once dead, cells cannot be revived.
  - “Clot-busting” (thrombolytic) drugs or angioplasty within 1 hour prevent damage.
  - Immediate transport is essential.

# Pathophysiology (10 of 26)

- Signs and symptoms of AMI
  - Weakness, nausea, sweating
  - Chest pain that does not change
  - Lower jaw, arm, back, abdomen, neck pain
  - Irregular heartbeat and syncope (fainting)
  - Shortness of breath (dyspnea)

# Pathophysiology (11 of 26)

- Signs and symptoms of AMI (cont'd)
  - Pink, frothy sputum
  - Sudden death
- AMI pain differs from angina pain
  - Not always due to exertion
  - Lasts 30 minutes to several hours
  - Not always relieved by rest or nitroglycerin



# Pathophysiology (12 of 26)

- AMI patients may not realize they are experiencing a heart attack.
- AMI and cardiac compromise physical findings:
  - Fear, nausea, poor circulation
  - Faster, irregular, or bradycardic pulse



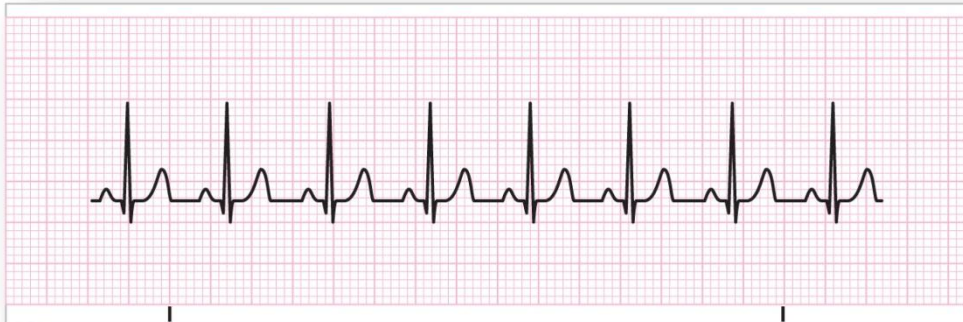
# Pathophysiology (13 of 26)

- AMI and cardiac compromise physical findings (cont'd):
  - Decreased, normal, or elevated BP
  - Normal or rapid and labored respirations
  - Patients express feelings of impending doom.

# Pathophysiology (14 of 26)

- Three serious consequences of AMI:
  - Sudden death
    - Resulting from cardiac arrest
  - Cardiogenic shock
  - CHF

# Pathophysiology (15 of 26)



Source: From *Arrhythmia Recognition: The Art of Interpretation*, courtesy of Tomas B. Garcia, MD.



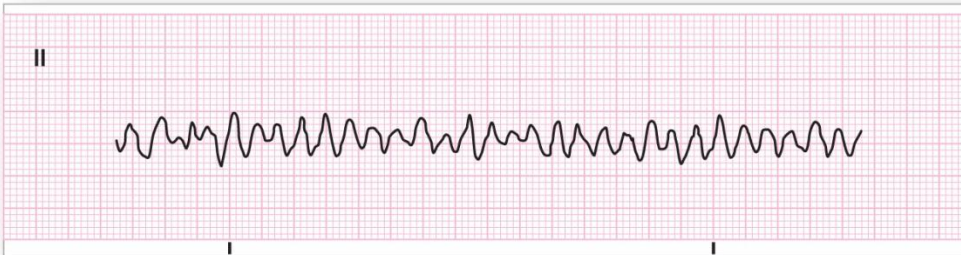
Source: From *Arrhythmia Recognition: The Art of Interpretation*, courtesy of Tomas B. Garcia, MD.

- Arrhythmias: heart rhythm abnormalities
  - Premature ventricular contractions
  - Tachycardia
  - Bradycardia

# Pathophysiology (16 of 26)



Source: From *Arrhythmia Recognition: The Art of Interpretation*, courtesy of Tomas B. Garcia, MD.



Source: From *Arrhythmia Recognition: The Art of Interpretation*, courtesy of Tomas B. Garcia, MD.

- Arrhythmias (cont'd)
  - Ventricular tachycardia
  - Ventricular fibrillation



# Pathophysiology (17 of 26)

- Defibrillation restores cardiac rhythms.
  - Can save lives
  - Initiate CPR until a defibrillator is available.
- Asystole: no heart electrical activity
  - Reflects a long period of ischemia
  - Nearly all patients will die.



Source: From *Arrhythmia Recognition: The Art of Interpretation*, courtesy of Tomas B. Garcia, MD.

# Pathophysiology (18 of 26)

- Cardiogenic shock
  - Often caused by heart attack
  - Heart lacks power to force enough blood through circulatory system
  - Inadequate oxygen to body tissues causes organs to malfunction.

# Pathophysiology (19 of 26)

- Cardiogenic shock (cont'd)
  - Often caused by a heart attack
  - Heart lacks the power to pump
  - Recognize shock in its early stages.
- Congestive heart failure
  - Often occurs a few days following heart attack

# Pathophysiology (20 of 26)

- Congestive heart failure
  - Increased heart rate and enlargement of left ventricle no longer make up for decreased heart function
  - Lungs become congested with fluid
  - May cause dependent edema

# Pathophysiology (21 of 26)

- Hypertensive emergencies
  - Systolic pressure greater than 160 mm Hg
  - Common symptoms
    - Sudden, severe headache
    - Strong, bounding pulse
    - Ringing in the ears

# Pathophysiology (22 of 26)

- Hypertensive emergencies (cont'd)
  - Common symptoms
    - Nausea and vomiting
    - Dizziness
    - Warm skin (dry or moist)
    - Nosebleed

# Pathophysiology (23 of 26)

- Hypertensive emergencies (cont'd)
  - Common symptoms include altered mental status and pulmonary edema.
  - If untreated, can lead to stroke or dissecting aortic aneurysm.
  - Transport patients quickly and safely.

# Pathophysiology (24 of 26)

- Aortic aneurysm is weakness in the wall of the aorta.
  - Susceptible to rupture
  - Dissecting aneurysm occurs when inner layers of aorta become separated (Table 14-1).
  - Primary cause: uncontrolled hypertension



# Pathophysiology (25 of 26)

**Table 14-1** AMI Versus Dissecting Aortic Aneurysm

	AMI	Dissecting Aneurysm
Onset of pain	Gradual, with additional symptoms	Abrupt, without additional symptoms
Quality of pain	Tightness or pressure	Sharp or tearing
Severity of pain	Increases with time	Maximal from the outset
Timing of pain	May wax and wane	Does not abate once it has started
Region/radiation	Substernal; back is rarely involved	Back possibly involved, between the shoulder blades
Clinical signs	Peripheral pulses equal	Blood pressure discrepancy between arms or decrease in a femoral or carotid pulse

# Pathophysiology (26 of 26)

- Aortic aneurysm (cont'd)
  - Signs and symptoms
    - Very sudden chest pain
    - Comes on full force
    - Different blood pressures
  - Transport patients quickly and safely.

# Patient Assessment

- Patient assessment steps
  - Scene size-up
  - Primary assessment
  - History taking
  - Secondary assessment
  - Reassessment

# Scene Size-up

- Scene safety
  - Ensure the scene is safe.
  - Follow standard precautions.
- Mechanism of injury (MOI)/nature of illness (NOI)
  - Clues often include report of chest pain, difficulty breathing, loss of consciousness.
  - Obtain clues from dispatch, the scene, patient, bystanders

# Primary Assessment (1 of 2)

- Form a general impression.
  - If unresponsive, pulseless, or apneic, assess for use of AED.
- Airway and breathing
  - If difficulty breathing: apply oxygen via nonrebreathing mask; if not breathing: give 100% oxygen via bag-mask device.
  - CHF patients: use CPAP.

# Primary Assessment (2 of 2)

- Circulation
  - Check skin color, temperature, condition.
- Transport decision
  - Transport in a stress-relieving manner.

# History Taking (1 of 2)

- Investigate the chief complaint (eg, chest pain, difficulty breathing).
  - Ask about recent trauma.
- Obtain a SAMPLE history from a conscious patient.
  - Use OPQRST (Table 14-2).

# History Taking (2 of 2)

**Table 14-2** OPQRST Mnemonic for Assessing Pain

Onset	When did the problem begin, and what caused it?
Provocation/palliation	Ask what makes the pain or discomfort worse. Is it positional? Does a deep breath or palpation of the chest make it worse? Did you take anything for it (including anything nonprescribed)?
Quality	Ask what type of pain it is. Let the patient use his or her own words to describe what is happening. Try to avoid supplying the patient with only one option. Do not ask, "Does it feel like an elephant is sitting on your chest?" Instead, say, "Tell me what the pain feels like." If the patient cannot answer an open-ended question, then provide a list of alternatives: "There are lots of different kinds of pain. Is your pain more like heaviness, pressure, burning, tearing, dull ache, stabbing, or needlelike?"
Region/radiation	Ask where the pain is and whether the pain travels to another part of the body.
Severity	Ask the patient to rate the pain on a simple scale. Often, a scale ranging from 0 to 10 is used; a 10 represents the worst pain imaginable. Do not use the patient's answer to determine whether the pain has a serious cause. Instead, use it to check whether the pain is getting better or worse. After a few minutes of oxygen or administration of nitroglycerin, ask the patient to rate the pain again.
Timing	Find out how long the pain lasts when it is present and whether it has been intermittent or continuous.



# Secondary Assessment

- Physical examination
  - Focus on cardiac and respiratory systems.
    - Circulation
    - Respirations
- Vital signs
  - Obtain a complete set of vital signs
  - If available, use pulse oximetry

# Reassessment (1 of 4)

- Reassess vital signs every 5 min or when patient's condition changes significantly.
- Sudden cardiac arrest is always a risk.
- Interventions
  - Give oxygen.
  - Assist unconscious patients with breathing.
  - Follow local protocol for administration of low-dose aspirin or prescribed nitroglycerin (see Skill Drill 14-1).

# Reassessment (2 of 4)



# Reassessment (3 of 4)

- Interventions (cont'd)
  - If cardiac arrest occurs, perform CPR immediately until an AED is available.
- Reassess your interventions.
- Provide rapid patient transport.

# Reassessment (4 of 4)

- Communication and documentation
  - Alert emergency department about patient condition and estimated time of arrival.
  - Report to hospital while en route.
  - Document assessment and interventions.

# Heart Surgeries and Pacemakers (1 of 6)

- Many open-heart operations have been performed in the last 20 years.
- Coronary artery bypass graft (CABG)
  - Chest or leg blood vessel is sewn from the aorta to a coronary artery beyond the point of obstruction.
- Others have implanted cardiac pacemakers.

# Heart Surgeries and Pacemakers (2 of 6)

- Percutaneous transluminal coronary angioplasty (PTCA)
  - A tiny balloon is inflated inside a narrowed coronary artery.
- Patients who have had open-heart procedures may have long chest scar.

# Heart Surgeries and Pacemakers (3 of 6)

- Cardiac pacemakers
  - Maintain regular cardiac rhythm and rate
  - Deliver electrical impulse through wires in direct contact with the myocardium
  - Implanted under a heavy muscle or fold of skin in the upper left portion of the chest



# Heart Surgeries and Pacemakers (4 of 6)



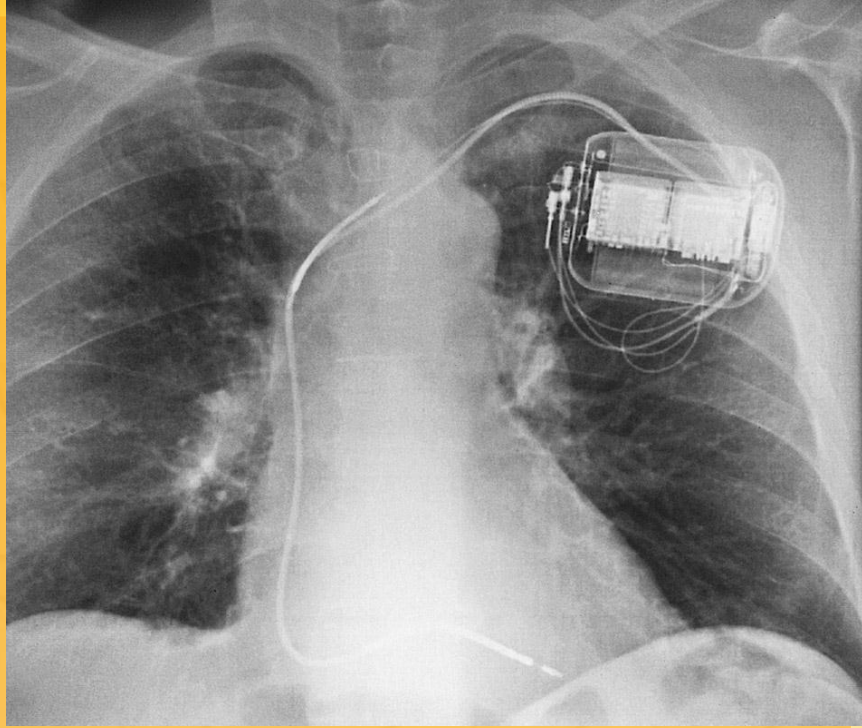
Source: © Carolina K. Smith, MD/Shutterstock, Inc.

- Cardiac pacemakers (cont'd)
  - This technology is very reliable.
  - Pacemaker malfunction can cause syncope, dizziness, or weakness due to an excessively slow heart rate.
    - Transport patients promptly and safely.

# Heart Surgeries and Pacemakers (5 of 6)

- Automatic implantable cardiac defibrillators (AICDs)
  - Used by some patients who have survived cardiac arrest due to ventricular fibrillation
  - Monitor heart rhythm and shock as needed.
  - Treat chest pain patients with AICDs like they are experiencing a heart attack.

# Heart Surgeries and Pacemakers (6 of 6)



- AICDs (cont'd)
  - Electricity is low; it will not affect responders.
  - When an AED is used, do not place patches directly over pacemaker.

# Cardiac Arrest

- The complete cessation of cardiac activity
- Absence of a carotid pulse
- Was terminal before CPR and external defibrillation were developed in the 1960s



# Automated External Defibrillation (1 of 14)



Source: The LIFEPAK® 1000 Defibrillator (AED) courtesy of Physio-Control.  
Used with Permission of Physio-Control, Inc, and according to the  
Material Release Form provided by Physio-Control.

- Analyzes electrical signals from heart
  - Identifies ventricular fibrillation
  - Administers shock to heart when needed

# Automated External Defibrillation (2 of 14)



- AEDs are relatively easy to use.
- AED models:
  - All require some operator interaction.
    - Operator must press a button to deliver shock.
  - Most have a computer voice synthesizer advising steps to take.

# Automated External Defibrillation (3 of 14)



Source: The LIFEPAK® 20e Defibrillator monitor courtesy of Physio-Control. Used with permission of Physio-Control, Inc. and according to the Material Release Form provided by Physio-Control

- AED models (cont'd):
  - Most are semiautomated
  - Monophasic vs. biphasic shocks

# Automated External Defibrillation (4 of 14)

- Potential problems:
  - Check daily and exercise the battery as recommended by manufacturer.
  - Apply to pulseless, unresponsive patients.
  - Most computers identify rhythms faster than 150 to 180 beats/min as ventricular tachycardia, which should be shocked.





# Automated External Defibrillation (5 of 14)

- Advantages of AED use:
  - Quick delivery of shock
  - Easier than performing CPR
  - ALS providers do not need to be on scene
  - Remote, adhesive pads safer than paddles
  - Larger pad area = more efficient shocks



# Automated External Defibrillation (6 of 14)

- Other considerations
  - Though all cardiac arrest patients should be analyzed, not all require shock.
  - Asystole (flatline) = no electrical activity
  - Pulseless electrical activity usually refers to a state of cardiac arrest.



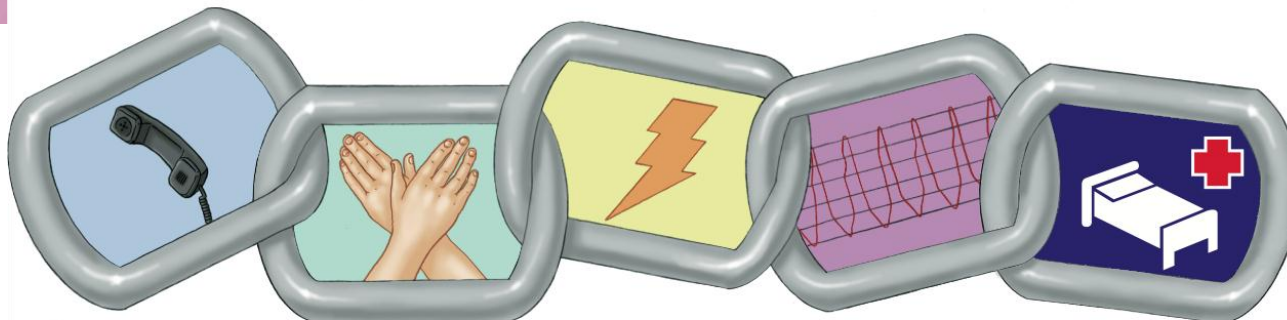
# Automated External Defibrillation (7 of 14)

- Early defibrillation
  - Few cardiac arrest patients survive outside a hospital without a rapid sequence of events.
  - Chain of survival:
    - Early recognition and activation of EMS
    - Immediate bystander CPR



# Automated External Defibrillation (8 of 14)

- Early defibrillation (cont'd)
  - Chain of survival (cont'd):
    - Early defibrillation
    - Early advanced cardiac life support
    - Integrated post-arrest care



Early access

Early CPR

Early defibrillation

Early advanced care

Post-arrest care

# Automated External Defibrillation (9 of 14)

- Early defibrillation (cont'd)
  - CPR prolongs period during which defibrillation can be effective.
  - Has resuscitated patients with cardiac arrest from ventricular fibrillation
  - Nontraditional responders are being trained in AED use.



# Automated External Defibrillation (10 of 14)

- Integrating the AED and CPR
  - Work the AED and CPR in sequence.
  - Do not touch the patient during analysis and defibrillation.
  - CPR must stop while AED performs its job.



# Automated External Defibrillation (11 of 14)

- AED maintenance
  - Maintain as manufacturer recommends.
  - Read the operator's manual.
  - Document AED failure.
  - Check equipment at beginning of shift.
  - Ask manufacturer for maintenance checklist.



# AUTOMATED EXTERNAL DEFIBRILLATOR

## Inspection Checklist

Serial # \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_

Model # \_\_\_\_\_ Inspected by \_\_\_\_\_

Item	Pass	Fail
<b>Exterior/Cables</b>		
Nothing stored on top of unit	<input type="checkbox"/>	<input type="checkbox"/>
Carry case intact and clean	<input type="checkbox"/>	<input type="checkbox"/>
Exterior/LCD screen clean and undamaged	<input type="checkbox"/>	<input type="checkbox"/>
Cables/connectors clean and undamaged	<input type="checkbox"/>	<input type="checkbox"/>
Cables securely attached to unit	<input type="checkbox"/>	<input type="checkbox"/>
<b>Batteries</b>		
Unit charger is plugged in and operational (if applicable)	<input type="checkbox"/>	<input type="checkbox"/>
Fully charged battery in unit	<input type="checkbox"/>	<input type="checkbox"/>
Fully charged spare battery	<input type="checkbox"/>	<input type="checkbox"/>
Spare battery charger plugged in and operational (if applicable)	<input type="checkbox"/>	<input type="checkbox"/>
Valid expiration date on both batteries	<input type="checkbox"/>	<input type="checkbox"/>
<b>Supplies</b>		
Two sets of electrodes	<input type="checkbox"/>	<input type="checkbox"/>
Electrodes in sealed packages with valid expiration dates	<input type="checkbox"/>	<input type="checkbox"/>
Razor	<input type="checkbox"/>	<input type="checkbox"/>
Hand towel	<input type="checkbox"/>	<input type="checkbox"/>
Alcohol wipes	<input type="checkbox"/>	<input type="checkbox"/>
Memory/voice recording device—module, card, microcassette	<input type="checkbox"/>	<input type="checkbox"/>
Manual override—module, key (if applicable)	<input type="checkbox"/>	<input type="checkbox"/>
Printer paper (if applicable)	<input type="checkbox"/>	<input type="checkbox"/>
<b>Operation</b>		
Unit self-test per manufacturer's recommendation/instructions	<input type="checkbox"/>	<input type="checkbox"/>
Display (if applicable)	<input type="checkbox"/>	<input type="checkbox"/>
Visual indicators	<input type="checkbox"/>	<input type="checkbox"/>
Verbal prompts	<input type="checkbox"/>	<input type="checkbox"/>
Printer (if applicable)	<input type="checkbox"/>	<input type="checkbox"/>
Attach AED to simulator/tester	<input type="checkbox"/>	<input type="checkbox"/>
Recognizes shockable rhythm	<input type="checkbox"/>	<input type="checkbox"/>
Charges to correct energy level within manufacturer's specifications	<input type="checkbox"/>	<input type="checkbox"/>
Delivers charge	<input type="checkbox"/>	<input type="checkbox"/>
Recognizes nonshockable rhythm	<input type="checkbox"/>	<input type="checkbox"/>
Manual override system in working order (if applicable)	<input type="checkbox"/>	<input type="checkbox"/>

Signature: \_\_\_\_\_



# Automated External Defibrillation (12 of 14)



# Automated External Defibrillation (13 of 14)

- AED maintenance (cont'd)
  - Report AED failures to manufacturer and US Food and Drug Administration (FDA).
    - Follow local protocol for notifying.
- Medical direction
  - Should help to teach AED use or approve written protocol for AED use



# Automated External Defibrillation (14 of 14)

- Medical direction (cont'd)
  - Works with quality improvement officer to review incidents where AED is used
  - Reviews focus on time from the initial call to the shock.
  - Continuing education with skill competency review is generally required every 3–6 months.



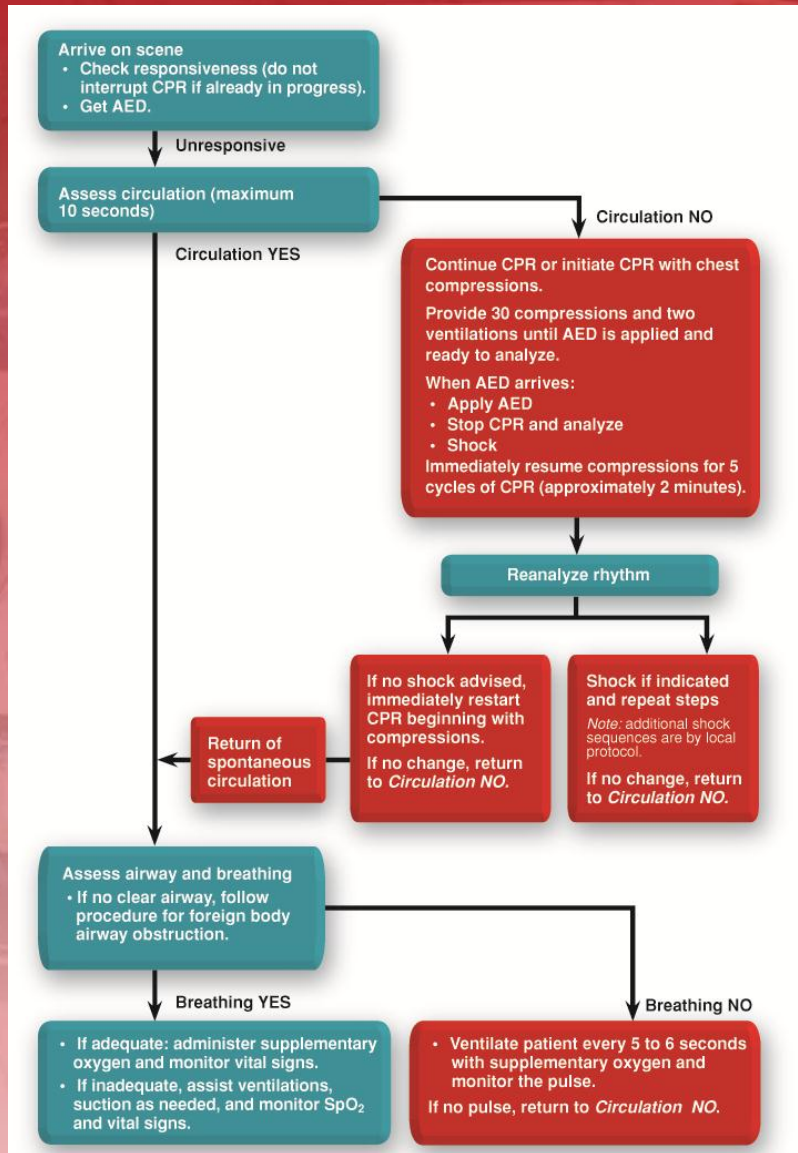
# Emergency Medical Care for Cardiac Arrest (1 of 7)

- Preparation
  - Make sure the electricity injures no one.
  - Do not defibrillate patients in pooled water.
  - Do not defibrillate patients touching metal.

# Emergency Medical Care for Cardiac Arrest (2 of 7)

- Preparation (cont'd)
  - Carefully remove nitroglycerin patch and wipe with dry towel before shocking.
  - Shave hairy chest to increase conductivity.
  - Determine the NOI and/or MOI.
    - Perform spinal stabilization.
- Performing defibrillation
  - See **Skill Drill 14-2**.

# Emergency Medical Care for Cardiac Arrest (3 of 7)



# Emergency Medical Care for Cardiac Arrest (4 of 7)

- Follow local protocol for patient care after AED shocks.
  - After AED protocol is completed, one of the following is likely:
    - Pulse regained
    - No pulse regained and no shock advised
    - No pulse regained and shock advised
- Wait for ALS, and continue shocks and CPR on scene.

# Emergency Medical Care for Cardiac Arrest (5 of 7)

- If ALS is not responding and protocols agree, begin transport when:
  - The patient regains a pulse.
  - 6 to 9 shocks are delivered.
  - AED gives 3 consecutive messages (every 2 min of CPR) advising no shock.

# Emergency Medical Care for Cardiac Arrest (6 of 7)

- Transport considerations:
  - 2 EMTs in patient compartment, 1 driving
  - Deliver additional shocks on scene or, if medical control approves, en route.
  - AEDs cannot analyze if vehicle is in motion.



# Emergency Medical Care for Cardiac Arrest (7 of 7)

- Coordination with ALS personnel
  - If AED available, do not wait for ALS.
  - Notify ALS of cardiac arrest.
  - Do not delay defibrillation.
  - Follow local protocols for coordination.

# Summary (1 of 13)

- The heart has right and left sides, each with an upper chamber (atrium) and a lower chamber (ventricle).
- The aortic valve keeps blood moving through the circulatory system in the proper direction.

# Summary (2 of 13)

- The heart's electrical system controls heart rate and coordinates the work of the atria and ventricles.
- During periods of exertion or stress, the coronary arteries dilate to increase blood flow.

# Summary (3 of 13)

- Carotid, femoral, brachial, radial, posterior tibial, and dorsalis pedis arteries provide pulses.
- Coronary artery atherosclerosis is the buildup of cholesterol plaques inside blood vessels. It can eventually lead to occlusion and cardiac compromise.

# Summary (4 of 13)

- AMI, or heart attack, occurs when heart tissue downstream of a blood clot suffers from a lack of oxygen and, within 30 minutes, begins to die.
- Angina occurs when heart tissues do not receive enough oxygen but are not yet dying.

# Summary (5 of 13)

- Signs of AMI include crushing chest pain; sudden onset of weakness, nausea, and sweating; sudden arrhythmia; pulmonary edema; and even sudden death.

# Summary (6 of 13)

- Sudden death is usually the result of cardiac arrest caused by arrhythmias (eg, tachycardia, bradycardia, ventricular tachycardia, and, most commonly, ventricular fibrillation).

# Summary (7 of 13)

- Symptoms of cardiogenic shock are restlessness; anxiety; pale, clammy skin; increased pulse rate; and decreased blood pressure.
- CHF occurs when damaged heart muscle cannot pump blood.



# Summary (8 of 13)

- Treat a patient with CHF by monitoring vital signs. Give oxygen via nonrebreathing face mask. Allow the patient to remain sitting up.

# Summary (9 of 13)

- For patients with chest pain:
  - SAMPLE history
  - OPQRST
  - Vital signs
  - Ensure patient is comfortably positioned.
  - Administer nitroglycerin and oxygen.
  - Transport.

# Summary (10 of 13)

- In an unresponsive adult or child older than 8 years and weighing at least 55 lb, perform defibrillation using AED.
- In an unresponsive child less than 8 years and weighing less than 55 lb, perform defibrillation with special pediatric pads.

# Summary (11 of 13)

- In the unresponsive infant, begin CPR.
- Maintain AED battery.
- Do not apply AED to moving a patient.
- Do not apply AED to responsive patients with rapid heart rates.

# Summary (12 of 13)

- Do not touch the patient during AED analysis or shocks.
- Effective CPR and AED use are critical to cardiac arrest patient survival.

# Summary (13 of 13)

- Chain of survival:
  - Recognition of early warning signs
  - Immediate activation of EMS
  - Immediate CPR by bystanders
  - Early defibrillation
  - Early advanced care
  - Integrated post-arrest care