
CHAPTER 52

Cardiovascular Problems

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Priority Concepts

Health Promotion; Perfusion

I. Anatomy and Physiology

A. Heart and heart wall layers

1. The heart is located in the left side of the mediastinum.
2. The heart consists of 3 layers.
 - a. The epicardium is the outermost layer of the heart.
 - b. The myocardium is the middle layer and is the actual contracting muscle of the heart.
 - c. The endocardium is the innermost layer and lines the inner chambers and heart valves.

B. Pericardial sac

1. Encases and protects the heart from trauma and infection
2. Has 2 layers
 - a. The parietal pericardium is the tough, fibrous outer membrane that attaches anteriorly to the lower half of the sternum, posteriorly to the thoracic vertebrae, and inferiorly to the diaphragm.
 - b. The visceral pericardium is the thin, inner layer that closely adheres to the heart.
3. The pericardial space is between the parietal and visceral layers; it holds 5 to 20 mL of pericardial fluid, lubricates the pericardial surfaces, and cushions the heart.

C. There are 4 heart chambers.

1. The right atrium receives deoxygenated blood from the body via the superior and inferior vena cava.
2. The right ventricle receives blood from the right atrium and pumps it to the lungs via the pulmonary

artery.

3. The left atrium receives oxygenated blood from the lungs via 4 pulmonary veins.
4. The left ventricle is the largest and most muscular chamber; it receives oxygenated blood from the lungs via the left atrium and pumps blood into the systemic circulation via the aorta.

D. There are 4 valves in the heart.

1. There are 2 atrioventricular valves, the tricuspid and the mitral, which lie between the atria and ventricles.
 - a. The tricuspid valve is located on the right side of the heart.
 - b. The bicuspid (mitral) valve is located on the left side of the heart.
 - c. The atrioventricular valves close at the beginning of ventricular contraction and prevent blood from flowing back into the atria from the ventricles; these valves open when the ventricles relax.
2. There are 2 semilunar valves, the pulmonic and the aortic.
 - a. The pulmonic semilunar valve lies between the right ventricle and the pulmonary artery.
 - b. The aortic semilunar valve lies between the left ventricle and the aorta.
 - c. The semilunar valves prevent blood from flowing back into the ventricles during relaxation; they open during ventricular contraction and close when the ventricles begin to relax.

E. Sinoatrial (SA) node

1. The main pacemaker that initiates each heartbeat
2. It is located at the junction of the superior vena cava and the right atrium.
3. The SA node generates electrical impulses at 60 to 100 times per minute and is controlled by the sympathetic and parasympathetic nervous systems.

F. Atrioventricular (AV) node

1. Located in the lower aspect of the atrial septum
2. Receives electrical impulses from the SA node
3. If the SA node fails, the AV node can initiate and sustain a heart rate of 40 to 60 beats per minute.

G. The bundle of His

1. A continuation of the AV node; located at the interventricular septum
2. It branches into the right bundle branch, which extends down the right side of the interventricular

- septum; and the left bundle branch, which extends into the left ventricle.
3. The right and left bundle branches terminate in the Purkinje fibers.

H. Purkinje fibers

1. Purkinje fibers are a diffuse network of conducting strands located beneath the ventricular endocardium.
2. These fibers spread the wave of depolarization through the ventricles.
3. Purkinje fibers can act as the pacemaker with a rate between 20 and 40 beats per minute when higher pacemakers (such as the SA and AV nodes) fail.



I. Coronary arteries (Fig. 52-1)

1. The right main coronary artery supplies the right atrium and ventricle, the inferior portion of the left ventricle, the posterior septal wall, and the SA and AV nodes.
2. The left main coronary artery consists of 2 major branches, the left anterior descending (LAD) and the circumflex arteries.
3. The LAD artery supplies blood to the anterior wall of the left ventricle, the anterior ventricular septum, and the apex of the left ventricle.
4. The circumflex artery supplies blood to the left atrium and the lateral and posterior surfaces of the left ventricle.



The coronary arteries supply the capillaries of the myocardium with blood. If blockage occurs in these arteries, the client is at risk for myocardial infarction (MI).

J. Heart sounds

1. The first heart sound (S_1) is heard as the atrioventricular valves close and is heard loudest at the apex of the heart.
2. The second heart sound (S_2) is heard when the semilunar valves close and is heard loudest at the base of the heart.
3. A third heart sound (S_3) may be heard if ventricular wall compliance is decreased and structures in the ventricular wall vibrate; this can occur in conditions such as heart failure or valvular regurgitation. However, a third heart sound may be normal in individuals younger than 30 years.
4. A fourth heart sound (S_4) may be heard on atrial **systole** if resistance to ventricular filling is present;

this is an abnormal finding, and the causes include cardiac hypertrophy, disease, or injury to the ventricular wall.



K. Heart rate

1. The faster the heart rate, the less time the heart has for filling. At very fast rates the **cardiac output** decreases.
2. The normal sinus heart rate is 60 to 100 beats per minute.
3. Sinus tachycardia is a rate more than 100 beats per minute.
4. Sinus bradycardia is a rate less than 60 beats per minute.

L. Autonomic nervous system

1. Stimulation of sympathetic nerve fibers releases the neurotransmitter norepinephrine, producing an increased heart rate, increased conduction speed through the AV node, increased atrial and ventricular **contractility**, and peripheral vasoconstriction. Stimulation occurs when a decrease in pressure is detected.
2. Stimulation of the parasympathetic nerve fibers releases the neurotransmitter acetylcholine, which decreases the heart rate and lessens atrial and ventricular contractility and **conductivity**. Stimulation occurs when an increase in pressure is detected.

M. Blood pressure (BP) control

1. **Baroreceptors** (specialized nerve endings affected by changes in the arterial BP), also called *pressoreceptors*, are located in the walls of the aortic arch and carotid sinuses.
2. Increases in **arterial pressure** stimulate baroreceptors, and the heart rate and arterial pressure decrease.
3. Decreases in arterial pressure reduce stimulation of the baroreceptors and vasoconstriction occurs, as does an increase in heart rate.
4. **Stretch receptors**, located in the vena cava and the right atrium, respond to pressure changes that affect circulatory blood volume.
5. When the BP decreases as a result of hypovolemia, a sympathetic response occurs, causing an increased heart rate and blood vessel constriction; when the BP increases as a result of hypervolemia, an opposite effect occurs.
6. Antidiuretic hormone (vasopressin) influences BP indirectly by regulating vascular volume.
7. Increases in blood volume result in decreased antidiuretic hormone release, increasing diuresis,

- decreasing blood volume, and thus decreasing BP.
8. Decreases in blood volume result in increased antidiuretic hormone release; this promotes an increase in blood volume and therefore BP.
 9. Renin, a potent vasoconstrictor, causes the BP to increase.
 10. Renin converts angiotensinogen to angiotensin I; angiotensin I is then converted to angiotensin II in the lungs.
 11. Angiotensin II stimulates the release of aldosterone, which promotes water and sodium retention by the kidneys; this action increases blood volume and BP.



N. The vascular system

1. Arteries are vessels through which the blood passes away from the heart to various parts of the body; they convey highly oxygenated blood from the left side of heart to the tissues.
2. Arterioles control the blood flow into the capillaries.
3. Capillaries allow the exchange of fluid and nutrients between the blood and the interstitial spaces.
4. Venules receive blood from the capillary bed and move blood into the veins.
5. Veins transport deoxygenated blood from the tissues back to the right heart and then to the lungs for oxygenation.
6. Valves help return blood to the heart against the force of gravity.
7. The lymphatics drain the tissues and return the tissue fluid to the blood.

II. Diagnostic Tests and Procedures (refer to [Chapter 10](#) for further information on laboratory reference levels)



A. Cardiac markers

1. Troponin

- a. Troponin is composed of 3 proteins—troponin C, cardiac troponin I, and cardiac troponin T.
- b. Troponin I especially has a high affinity for myocardial injury; it rises within 3 hours and persists for up to 7 to 10 days.
- c. Normal values are low, with troponin I being less than 0.35 ng/mL (less than 0.35 mcg/L) and troponin T being less than 0.1 ng/mL (less than 0.1 mcg/L); thus, any rise can indicate myocardial

cell damage.

2. CK-MB (creatinase kinase, myocardial muscle)
 - a. An elevation in value indicates myocardial damage.
 - b. An elevation occurs within hours and peaks at 18 hours following an acute ischemic attack.
 - c. Normal value for CK-MB (CK-2) is 2 to 6 ng/mL (2 to 6 mcg/L) for males and 2 to 5 ng/mL (2 to 5 mcg/L) for females.
3. Myoglobin
 - a. Myoglobin is an oxygen-binding protein found in cardiac and skeletal muscle.
 - b. The level rises within 2 hours after cell death, with a rapid decline in the level after 7 hours; however, it is not cardiac specific.

B. Complete blood count

1. The red blood cell count decreases in rheumatic heart disease and infective endocarditis and increases in conditions characterized by inadequate tissue oxygenation.



2. The white blood cell count increases in infectious and inflammatory diseases of the heart and after MI, because large numbers of white blood cells are needed to dispose of the necrotic tissue resulting from the infarction.

3. An elevated hematocrit level can result from vascular volume depletion.
4. Decreases in hemoglobin and hematocrit levels can indicate anemia.



C. Blood coagulation factors: An increase in coagulation

factors can occur during and after MI, which places the client at greater risk for thrombophlebitis and formation of clots in the coronary arteries.

D. Serum lipids (refer to [Chapter 10](#))

1. The lipid profile measures serum cholesterol, triglyceride, and lipoprotein levels.
2. The lipid profile is used to assess the risk of developing coronary artery disease.
3. Lipoprotein-*a* or *Lp(a)*, a modified form of low-density lipoprotein (LDL), increases atherosclerotic plaques and increases clots; value should be less than 30 mg/dL (300 mg/L).

- E. Homocysteine: Elevated levels may increase the risk of cardiovascular disease; normal value is 4.5 to 11.9 $\mu\text{mol/L}$ (4.5 to 11.9 $\mu\text{mol/L}$), age and gender dependent.
- F. Highly sensitive C-reactive protein (hsCRP): Detects an inflammatory process such as that associated with the development of atherothrombosis; a level less than 1 mg/L is considered low risk, and a level greater than 3 mg/L places the client at high risk for heart disease.
- G. Microalbuminuria: A small amount of protein in the urine has been a marker for endothelial dysfunction in cardiovascular disease.
- H. Electrolytes (refer to [Chapters 8 and 10](#))



1. Potassium

- a. Hypokalemia causes increased cardiac electrical instability, ventricular dysrhythmias, and increased risk of digoxin toxicity.
- b. In hypokalemia, the electrocardiogram (ECG) shows flattening and inversion of the T wave, the appearance of a U wave, and ST depression.
- c. Hyperkalemia causes asystole and ventricular dysrhythmias.
- d. In hyperkalemia, the ECG may show tall, peaked T waves, widened QRS complexes, prolonged PR intervals, or flat P waves.

2. Sodium

- a. The serum sodium level decreases with the use of diuretics.
- b. The serum sodium level decreases in heart failure, indicating water excess.

I. Calcium

- 1. Hypocalcemia can cause ventricular dysrhythmias, prolonged ST and QT intervals, and cardiac arrest.
- 2. Hypercalcemia can cause a shortened ST segment and widened T wave, atrioventricular block, tachycardia or bradycardia, digitalis hypersensitivity, and cardiac arrest.

J. Phosphorus level: Phosphorus levels should be interpreted with calcium levels, because the kidneys retain or excrete one electrolyte in an inverse relationship to the other.

K. Magnesium

- 1. A low magnesium level can cause ventricular tachycardia and fibrillation.
- 2. Electrocardiographic changes that may be observed with hypomagnesemia include tall T waves and

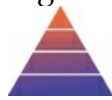
- depressed ST segments.
3. A high magnesium level can cause muscle weakness, hypotension, and bradycardia.
 4. Electrocardiographic changes that may be observed with hypermagnesemia include a prolonged PR interval and widened QRS complex.



Electrolyte and mineral imbalances can cause cardiac

electrical instability that can result in life-threatening dysrhythmias.

- L. Blood urea nitrogen: The blood urea nitrogen level is elevated in heart disorders such as heart failure and cardiogenic shock that reduce renal circulation.
- M. Blood glucose: An acute cardiac episode can elevate the blood glucose level.



N. B-type natriuretic peptide (BNP)

1. BNP is released in response to atrial and ventricular stretch; it serves as a marker for heart failure.
2. BNP levels should be less than 100 ng/mL (less than 100 mcg/L); the higher the level, the more severe the heart failure.

O. Chest x-ray

1. Description: Radiography of the chest is done to determine anatomical changes such as the size, silhouette, and position of the heart.
2. Interventions
 - a. Prepare the client, explaining the purpose and procedure.
 - b. Remove jewelry.
 - c. Ensure that the client is not pregnant.

P. Electrocardiography (Box 52-1)

1. Description: This common noninvasive diagnostic test records the electrical activity of the heart and is useful for detecting cardiac dysrhythmias, location and extent of MI, and cardiac hypertrophy, and for evaluation of the effectiveness of cardiac medications.
2. Interventions
 - a. Determine the client's ability to lie still; advise the client to lie still, breathe normally, and refrain from talking during the test.
 - b. Reassure the client that an electrical shock will not occur.
 - c. Document any cardiac medications the client is taking.

Q. Holter monitoring

1. Description
 - a. A noninvasive test; the client wears a

monitor and an electrocardiographic tracing is recorded continuously over a period of 24 hours or more while the client performs her or his activities of daily living.

- b. The monitor identifies dysrhythmias if they occur and evaluates the effectiveness of antidysrhythmics or pacemaker therapy.

2. Interventions



- a. Instruct the client to resume

normal daily activities and to maintain a diary documenting activities and any symptoms that may develop for correlation with the electrocardiographic tracing.

- b. Instruct the client using a wired monitor to avoid tub baths, showers, or swimming, because they will interfere with the electrocardiographic recorder device.

R. Echocardiography

1. Description

- a. This noninvasive procedure is based on the principles of ultrasound and evaluates structural and functional changes in the heart.
- b. Used to detect valvular abnormalities, congenital heart defects, wall motion, ejection fraction, and cardiac function.
- c. Transesophageal echocardiography may be performed, in which the echocardiogram is done through the esophagus to view the posterior structures of the heart; this is an invasive exam and requires preparation and care similar to endoscopy procedures.

2. Interventions: Advise the client to lie still, breathe normally, and refrain from talking during the test.

S. Exercise electrocardiography testing (stress test)

1. Description

- a. This noninvasive test studies the heart during activity and detects and evaluates coronary artery disease.
- b. Treadmill testing is the most commonly used mode of stress testing.

- c. If the client is unable to tolerate exercise, an intravenous (IV) infusion of dipyridamole or dobutamine hydrochloride is given to dilate the coronary arteries and simulate the effect of exercise; the client may need to be NPO (nothing by mouth) for 3 to 6 hours preprocedure.

2. Preprocedure interventions

- a. Ensure that an informed consent is obtained if required.
- b. Encourage adequate rest the night before the procedure.
- c. Instruct the client having a noninvasive test to eat a light meal 1 to 2 hours before the procedure.
- d. Instruct the client to avoid smoking, alcohol, and caffeine before the procedure.
- e. Instruct the client to ask the primary health care provider (PHCP) or cardiologist about taking prescribed medication on the day of the procedure; theophylline products are usually withheld 12 hours before the test, and calcium channel blockers and beta blockers are usually withheld on the day of the test to allow the heart rate to increase during the stress portion of the test.



- f. Instruct the client to wear nonconstrictive, comfortable clothing and supportive rubber-soled shoes for the exercise stress test.
- g. Instruct the client to notify the PHCP if any chest pain, dizziness, or shortness of breath occurs during the procedure.

3. Postprocedure interventions: Instruct the client to avoid taking a hot bath or shower for at least 1 to 2 hours.

T. Myocardial nuclear perfusion imaging (MNPI)

1. Description

- a. Nuclear cardiology involves the use of radionuclide techniques and scanning for cardiovascular assessment.
- b. The most common tests include technetium pyrophosphate scanning,

thallium imaging, and multigated cardiac blood pool imaging; these tests can evaluate cardiac motion and calculate the ejection fraction.

2. Preprocedure interventions

a. Ensure that an informed consent is obtained.



b. Inform the client that a small

amount of radioisotope will be injected and that the radiation exposure and risks are minimal.

3. Postprocedure interventions

a. Assess vital signs.

b. Assess injection site for bleeding or discomfort.

c. Inform the client that fatigue is possible.

U. Magnetic resonance imaging (MRI)

1. Description

a. This is a noninvasive diagnostic test that produces an image of the heart or great vessels through the interaction of magnetic fields, radiowaves, and atomic nuclei.

b. It provides information on chamber size and thickness, valve and ventricular function, and blood flow through the great vessels and coronary arteries.

2. Preprocedure interventions

a. Evaluate the client for the presence of a pacemaker or other implanted items that present a contraindication to the test.

b. Ensure that the client has removed all metallic objects such as a watch, jewelry, clothing with metal fasteners, and metal hair fasteners.

c. Inform the client that she or he may experience claustrophobia while in the scanner.

V. Electrophysiological studies: An invasive procedure in which a programmed electrical stimulation of the heart is induced to cause dysrhythmias and conduction defects; assists in finding an accurate diagnosis and aids in determining treatment.

W. Electron-beam computed tomography (EBCT) scan: Determines whether calcifications are present in the arteries; a coronary artery calcium (CAC) score is provided (a score higher than 300 indicates high risk of myocardial infarction and requires intensive

preventive treatment).

X. Cardiac catheterization (Fig. 52-2)

1. Description

- a. An invasive test involving insertion of a catheter into the heart and surrounding vessels
- b. Obtains information about the structure and performance of the heart chambers and valves and the coronary circulation



2. Preprocedure interventions

- a. Ensure that informed consent has been obtained.
- b. Assess for allergies to seafood, iodine, or radiopaque dyes; if allergic, the client may be premedicated with antihistamines and corticosteroids to prevent a reaction.
- c. Withhold solid food for 6 to 8 hours and liquids for 4 hours as prescribed to prevent vomiting and aspiration during the procedure.
- d. Document the client's height and weight, because these data will be needed to determine the amount of dye to be administered.
- e. Document baseline vital signs and note the quality and presence of peripheral pulses for postprocedure comparison.
- f. Inform the client that a local anesthetic will be administered before catheter insertion.
- g. Inform the client that she or he may feel a fluttery feeling as the catheter passes through the heart, a flushed and warm feeling when the dye is injected, a desire to cough, and palpitations caused by heart irritability.
- h. The insertion site is prepared by shaving or clipping the hair and cleaning with an antiseptic solution.
- i. Administer preprocedure medications such as sedatives if prescribed.
- j. Insert an IV line if prescribed.



If a client taking metformin is scheduled to

undergo a procedure requiring the administration of iodine dye, the metformin is withheld for 24 hours prior to the procedure because of the risk of lactic acidosis. The medication is not resumed until prescribed by the PHCP (usually 48 hours after the procedure or after renal function studies are done and the results are evaluated).



3. Postprocedure interventions

- a. Monitor vital signs and cardiac rhythm for dysrhythmias at least every 30 minutes for 2 hours initially.
- b. Assess for chest pain and, if dysrhythmias or chest pain occurs, notify the PHCP.
- c. Monitor peripheral pulses and the color, warmth, and sensation of the extremity distal to the insertion site at least every 30 minutes for 2 hours initially.
- d. Notify the PHCP if the client reports numbness and tingling; if the extremity becomes cool, pale, or cyanotic; or if loss of the peripheral pulses occurs. This could indicate clot formation and is an emergency.
- e. Apply a sandbag or compression device (if prescribed) to the insertion site to provide additional pressure if required.
- f. Monitor for bleeding; if bleeding occurs, apply manual pressure immediately and notify the PHCP.
- g. Monitor for hematoma; if a hematoma develops, notify the PHCP.
- h. Keep the extremity extended for 4 to 6 hours, as prescribed, keeping the leg straight to prevent arterial occlusion.
- i. Maintain strict bed rest for 6 to 12 hours, as prescribed; however, the client may turn from side to side. Do not elevate the head of the bed more than 15 degrees.
- j. If the antecubital vessel was used, immobilize the arm with an armboard.
- k. If the PHCP uses a vascular closure device to seal the arterial puncture site, there is no need for prolonged

compression or bed rest, and clients may be out of bed in 1 to 2 hours.

- l. Encourage fluid intake, if not contraindicated, to promote renal excretion of the dye and to replace fluid loss caused by the osmotic diuretic effect of the dye.
- m. Monitor for nausea, vomiting, rash, or other signs of hypersensitivity to the dye.

Y. Intravascular ultrasonography (IVUS): A catheter with a transducer is used as an alternative to injecting a dye into the coronary arteries and detects plaque distribution and composition; it also detects arterial dissection and the degree of stenosis of an occluded artery.

III. Therapeutic Management

A. Percutaneous transluminal coronary angioplasty (PTCA)

1. Description (Fig. 52-3)

- a. An invasive, nonsurgical technique in which 1 or more coronary arteries are dilated with a balloon catheter to open the vessel lumen and improve arterial blood flow
- b. PTCA may be used for clients with an evolving MI, alone or in combination with medications, to achieve reperfusion.
- c. The client can experience reocclusion after the procedure; thus, the procedure may need to be repeated.
- d. Complications can include arterial dissection or rupture, embolization of plaque fragments, spasm, and acute MI.



- e. Firm commitment is needed on the client's part to stop smoking, adhere to diet restrictions, lose weight, alter the exercise pattern, and stop any behaviors that lead to progressive artery occlusion.



2. Preprocedure interventions

- a. Similar to preprocedure interventions for cardiac catheterization
- b. The PHCP may prescribe preprocedure medications, including acetylsalicylic

acid.

- c. Instruct the client that chest pain may occur during balloon inflation and to report it if it does occur.



3. Postprocedure interventions

- a. Similar to postprocedure intervention following cardiac catheterization
- b. Administer anticoagulants and antiplatelets as prescribed to prevent thrombus formation.
- c. IV nitroglycerin may be prescribed to prevent coronary artery vasospasm.
- d. Encourage fluids, if not contraindicated, to enhance renal excretion of dye.
- e. Instruct the client in the administration of prescribed medications; daily acetylsalicylic acid (aspirin) may be prescribed.
- f. Assist the client with planning lifestyle modifications.

B. Laser-assisted angioplasty

1. Description

- a. A laser probe is advanced through a cannula similar to that used for PTCA.
- b. Used for clients with small occlusions in the coronary arteries, also the distal superficial femoral, proximal popliteal, and common iliac arteries.
- c. Heat from the laser vaporizes the plaque to open the occluded artery.

2. Preprocedure and postprocedure interventions

- a. Care is similar to that for PTCA.
- b. Monitor for complications of coronary dissection, acute occlusion, perforation, embolism, and MI.

C. Coronary artery stents

1. Description



- a. Coronary artery stents are used with PTCA to provide a supportive scaffold to eliminate the risk of acute coronary vessel closure and to improve long-term patency of the vessel.
- b. A balloon catheter bearing the stent is inserted into the coronary artery and

3. The opening on the surface of the heart heals; however, the main channels remain and perfuse the myocardium.

F. Coronary artery bypass grafting (Fig. 52-4)



1. Description

- a. The occluded coronary arteries are bypassed with the client's own venous or arterial blood vessels.
- b. The saphenous vein, internal mammary artery, or other arteries may be used to bypass lesions in the coronary arteries.
- c. Coronary artery bypass grafting is performed when the client does not respond to medical management of coronary artery disease or when vessels are severely occluded.
- d. A minimally invasive direct coronary artery bypass (MIDCAB) may be an option for some clients who have a lesion in the LAD artery; a sternal incision is not required (usually a 2-inch [5-cm] left thoracotomy incision is done), and cardiopulmonary bypass is not required in this procedure.

2. Preoperative interventions

- a. Familiarize the client and family with the cardiac surgical critical care unit.
- b. Inform the client to expect a sternal incision, possible arm or leg incision(s), 1 or 2 chest tubes, a Foley catheter, and several IV fluid catheters.
- c. Inform the client that an endotracheal tube will be in place for a short period of time and that she or he will be unable to speak.
- d. Advise the client that she or he will be on mechanical ventilation and to breathe with the ventilator and not fight it.
- e. Instruct the client that postoperative pain is expected and that pain medication will be available.
- f. Instruct the client in how to splint the chest incision, cough and deep breathe, use the incentive spirometer, and perform arm and leg exercises.
- g. Encourage the client and family to

discuss anxieties and fears related to surgery.

- h. Note that prescribed medications may be discontinued preoperatively (usually, diuretics 2 to 3 days before surgery, digoxin 12 hours before surgery, and aspirin and anticoagulants 1 week before surgery).
 - i. Administer medications as prescribed, which may include potassium chloride, antihypertensives, antidysrhythmics, and antibiotics.
3. Cardiac surgical unit postoperative interventions
- a. Mechanical ventilation is maintained for 6 to 24 hours as prescribed.
 - b. The heart rate and rhythm, pulmonary artery and arterial pressures, urinary output, and neurological status are monitored closely.
 - c. Mediastinal and pleural chest tubes to the water seal drainage system with prescribed suction are present; drainage exceeding 100 to 150 mL/hr is reported to the PHCP.
 - d. Epicardial pacing wires are covered with sterile caps or connected to a temporary pacemaker generator; all equipment in use must be properly grounded to prevent microshock.
 - e. Fluid and electrolyte balance is monitored closely; fluids are usually restricted to 1500 to 2000 mL, because the client usually has edema.
 - f. The **blood pressure** is monitored closely, because hypotension can cause collapse of a vein graft; hypertension can cause increased pressure, promoting leakage from the suture line, causing bleeding.
 - g. Temperature is monitored and rewarming procedures are initiated using warm or thermal blankets if the temperature drops below 96.8° F (36.0° C); rewarm the client no faster than 1.8 degrees/hr to prevent shivering, and discontinue rewarming procedures when the temperature approaches 98.6° F (37.0° C).

- h. Potassium is administered intravenously as prescribed to maintain the potassium level between 4 and 5 mEq/L (4 to 5 mmol/L) to prevent dysrhythmias.
- i. The client is monitored for signs of cardiac tamponade, which will include sudden cessation of previously heavy mediastinal drainage, jugular vein distention with clear lung sounds, equalization of right atrial (RA) pressure and pulmonary artery wedge pressure, and pulsus paradoxus.
- j. Pain is monitored, differentiating sternotomy pain from anginal pain, which would indicate graft failure.

4. Alarm safety and alarm fatigue: Refer to [Chapter 69](#).



unit

5. Transfer of the client from the cardiac surgical

- a. Monitor vital signs, level of consciousness, and peripheral perfusion.
- b. Monitor for dysrhythmias.
- c. Auscultate lungs and assess respiratory status.
- d. Encourage the client to splint the incision, cough, deep breathe, and use the incentive spirometer to raise secretions and prevent atelectasis.
- e. Monitor temperature and white blood cell count, which, if elevated after 3 to 4 days, indicate infection.
- f. Provide adequate fluids and hydration as prescribed to liquefy secretions.
- g. Assess suture line and chest tube insertion sites for redness, purulent discharge, and signs of infection.
- h. Assess sternal suture line for instability, which may indicate infection.
- i. Guide the client to gradually resume activity.
- j. Assess the client for tachycardia, **postural (orthostatic) hypotension**, and fatigue before, during, and after activity.
- k. Discontinue activities if the BP drops more than 10 to 20 mm Hg or if the

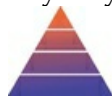
pulse increases more than 10 beats per minute.

- l. Monitor episodes of pain closely.
- m. See [Box 52-2](#) for home care instructions.

G. Heart transplantation

1. A donor heart from an individual with a comparable body weight and ABO compatibility is transplanted into a recipient within less than 6 hours of procurement.
2. The surgeon removes the diseased heart, leaving the posterior portion of the atria to serve as an anchor for the new heart.
3. Because a remnant of the client's atria remains, 2 unrelated P waves are noted on the ECG.
4. The transplanted heart is denervated and unresponsive to vagal stimulation; because the heart is denervated, clients do not experience angina.
5. Symptoms of heart rejection include hypotension, dysrhythmias, weakness, fatigue, and dizziness.
6. Endomyocardial biopsies are performed at regularly scheduled intervals and whenever rejection is suspected.
7. The client requires lifetime immunosuppressive therapy.
8. Strict aseptic technique and vigilant hand washing must be maintained when caring for the posttransplantation client because of increased risk for infection from immunosuppression.
9. The heart rate approximates 100 beats per minute and responds slowly to exercise or stress with regard to increases in heart rate, **contractility**, and **cardiac output**.

IV. Cardiac Dysrhythmias



A. Normal sinus rhythm ([Fig. 52-5](#))

1. Rhythm originates from the SA node.
2. Description
 - a. Atrial and ventricular rhythms are regular.
 - b. Atrial and ventricular rates are 60 to 100 beats per minute ([Fig. 52-6](#) and [Box 52-3](#)).
 - c. PR interval and QRS width are within normal limits.

B. Sinus bradycardia

1. Description
 - a. Atrial and ventricular rhythms are

regular.



- b. Atrial and ventricular rates are less than 60 beats per minute.
- c. PR interval and QRS width are within normal limits.
- d. Treatment may be necessary if the client is symptomatic (signs of decreased cardiac output).
- e. A low heart rate may be normal for some individuals, such as athletes.



2. Interventions

- a. Attempt to determine the cause of sinus bradycardia; withhold medication suspected of causing the bradycardia and notify the PHCP.
- b. Administer oxygen as prescribed for the symptomatic client.
- c. Administer atropine sulfate as prescribed to increase the heart rate to 60 beats per minute.
- d. Be prepared to apply a noninvasive (transcutaneous) pacemaker initially if the atropine sulfate does not increase the heart rate sufficiently.
- e. Avoid additional doses of atropine sulfate, because this will induce tachycardia.
- f. Monitor for hypotension and administer fluids intravenously as prescribed.
- g. Depending on the cause of the bradycardia, the client may need a permanent pacemaker.

C. Sinus tachycardia

1. Description



- a. Atrial and ventricular rates are 100 to 180 beats per minute.
- b. Atrial and ventricular rhythms are regular.
- c. PR interval and QRS width are within normal limits.

2. Interventions

- a. Identify the cause of the tachycardia.
- b. Decrease the heart rate to normal by treating the underlying cause.

D. Atrial fibrillation (Fig. 52-7)



1. Description

- a. Multiple rapid impulses from many foci depolarize in the atria in a totally disorganized manner at a rate of 350 to 600 times per minute.
- b. The atria quiver, which can lead to the formation of thrombi.
- c. Usually no definitive P wave can be observed, only fibrillatory waves before each QRS.



2. Interventions

- a. Administer oxygen.
- b. Administer anticoagulants as prescribed because of the risk of emboli.
- c. Administer cardiac medications as prescribed to control the ventricular rhythm and assist in the maintenance of cardiac output.
- d. Prepare the client for cardioversion as prescribed.
- e. Instruct the client in the use of medications as prescribed to control the dysrhythmia.

E. Premature ventricular contractions (PVCs; Fig. 52-8 and Box 52-4)

1. Description

- a. Early ventricular contractions result from increased irritability of the ventricles.
- b. PVCs frequently occur in repetitive patterns such as bigeminy, trigeminy, and quadrigeminy.
- c. The QRS complexes may be unifocal or multifocal.



2. Interventions

- a. Identify the cause and treat on the basis of the cause.
- b. Evaluate oxygen saturation to assess for hypoxemia, which can cause PVCs.
- c. Evaluate electrolytes, particularly the potassium level, because hypokalemia can cause PVCs.
- d. Oxygen and medication may be

prescribed in the case of acute myocardial ischemia or MI.



For the client experiencing PVCs, notify

the PHCP or cardiologist if the client complains of chest pain or if the PVCs increase in frequency, are multifocal, occur on the T wave (R-on-T), or occur in runs of ventricular tachycardia.

F. Ventricular tachycardia (VT; Fig. 52-9)



1. Description

- a. VT occurs because of a repetitive firing of an irritable ventricular ectopic focus at a rate of 140 to 250 beats per minute or more.
- b. VT may present as a paroxysm of 3 self-limiting beats or more, or may be a sustained rhythm.
- c. VT can lead to cardiac arrest.



2. Stable client with sustained VT (with pulse

and no signs or symptoms of decreased cardiac output)

- a. Administer oxygen as prescribed.
- b. Administer antidysrhythmics as prescribed.



3. Unstable client with VT (with pulse and signs

and symptoms of decreased cardiac output)

- a. Administer oxygen and antidysrhythmic therapy as prescribed.
- b. Prepare for synchronized cardioversion if the client is unstable.
- c. The PHCP may attempt cough cardiopulmonary resuscitation (CPR) by asking the client to cough hard every 1 to 3 seconds.

4. Pulseless client with VT: Defibrillation and CPR

G. Ventricular fibrillation (VF; Fig. 52-10)



1. Description

- a. Impulses from many irritable foci in the ventricles fire in a totally disorganized manner.
- b. VF is a chaotic rapid rhythm in which the ventricles quiver and there is no

- cardiac output.
- c. VF is fatal if not successfully resolved within 3 to 5 minutes.
 - d. Client is unconscious with no pulse, BP, respirations, or heart sounds.



2. Interventions

- a. Initiate CPR until a defibrillator is available.
- b. The client is defibrillated immediately with 120 to 200 joules (biphasic defibrillator) or 360 joules (monophasic defibrillator); check the entire length of the client 3 times to make sure no one is touching the client or the bed; when clear, proceed with defibrillation.
- c. CPR is continued for 2 minutes, and the cardiac rhythm is reassessed to determine the need for further countershock.
- d. Administer oxygen as prescribed.
- e. Administer antidysrhythmic therapy as prescribed.

H. Guidelines for performing adult CPR

1. Follow CAB (compressions, airway, breathing) guidelines. If a victim is noted not breathing or only gasping, activate the emergency response system and obtain an automated external defibrillator (AED) or monophasic or biphasic defibrillator depending on the setting and equipment available.
2. Check the carotid pulse for a maximum of 10 seconds.
3. If no pulse is felt, begin chest compressions (100 to 120 per minute) at a depth of 2 inches (5 cm) for 2 minutes or 5 cycles of 30 compressions to 2 ventilations using a barrier device or bag valve mask.
4. To provide ventilations, the head-tilt chin-lift maneuver, or jaw thrust technique is used if neck injury is suspected.
5. Check rhythm and for presence of a pulse every 2 minutes or after 5 cycles (depending on the setting and equipment available, deliver a shock if indicated).
6. Switch compression and ventilation roles if another rescuer is available, to avoid fatigue.
7. Continue this process until the victim gains consciousness, starts breathing, or has a pulse.
8. If the victim has a pulse but is not breathing, continue with rescue breathing until help arrives and advanced cardiovascular life support measures are instituted.

9. For updated information, refer to American Heart Association: *Guidelines for CPR and ECC, 2015 and Focused Updates, 2017*. Retrieved from <https://eccguidelines.heart.org/index.php/circulation/c-ecc-guidelines-2/>

V. Management of Dysrhythmias

A. Vagal maneuvers

1. Description: Vagal maneuvers induce vagal stimulation of the cardiac conduction system and are used to terminate supraventricular tachydysrhythmias.
2. Carotid sinus massage
 - a. The PHCP instructs the client to turn the head away from the side to be massaged.
 - b. The PHCP massages over 1 carotid artery for a few seconds to determine whether a change in cardiac rhythm occurs.
 - c. The client must be on a cardiac monitor; an electrocardiographic rhythm strip before, during, and after the procedure should be documented on the chart.
 - d. Have a defibrillator and resuscitative equipment available.
 - e. Monitor vital signs, cardiac rhythm, and level of consciousness following the procedure.
3. Valsalva maneuver
 - a. The PHCP instructs the client to bear down or induces a gag reflex in the client to stimulate a vagal response.
 - b. Monitor the heart rate, rhythm, and BP.
 - c. Observe the cardiac monitor for a change in rhythm.
 - d. Record an electrocardiographic rhythm strip before, during, and after the procedure.
 - e. Provide an emesis basin if the gag reflex is stimulated, and initiate precautions to prevent aspiration.
 - f. Have a defibrillator and resuscitative equipment available.

B. Cardioversion

1. Description
 - a. Cardioversion is synchronized countershock to convert an

- undesirable rhythm to a stable rhythm.
- b. Cardioversion can be an elective procedure performed by the PHCP for stable tachydysrhythmias resistant to medical therapies or an emergent procedure for hemodynamically unstable ventricular or supraventricular tachydysrhythmias.
 - c. A lower amount of energy is used than with defibrillation.



d. The defibrillator is synchronized

to the client's R wave to avoid discharging the shock during the vulnerable period (T wave).



e. If the defibrillator is not

synchronized, it could discharge on the T wave and cause VF.

2. Preprocedure interventions

- a. If an elective procedure, ensure that informed consent is obtained.
- b. Administer sedation as prescribed.
- c. If an elective procedure, hold digoxin for 48 hours preprocedure as prescribed to prevent postcardioversion ventricular irritability.



d. If an elective procedure for

atrial fibrillation or atrial flutter, the client should receive anticoagulant therapy for 4 to 6 weeks preprocedure, and a transesophageal echocardiogram (TEE) should be performed to rule out clots in the atria prior to the procedure.



3. During the procedure

- a. Ensure that the skin is clean and dry in the area where the electrode pads/hands-off pads will be placed.
- b. Stop the oxygen during the procedure to avoid a fire hazard.
- c. Be sure that no one is touching the bed or the client when delivering the countershock (check the entire length of the client 3 times).



4. Postprocedure interventions

- a. Priority assessment includes ability of the client to maintain the airway and breathing.
- b. Resume oxygen administration as prescribed.
- c. Assess vital signs.
- d. Assess level of consciousness.
- e. Monitor cardiac rhythm.
- f. Monitor for indications of successful response, such as conversion to sinus rhythm, strong peripheral pulses, an adequate BP, and adequate urine output.
- g. Assess the skin on the chest for evidence of burns from the edges of the pads.

C. Defibrillation

1. Defibrillation is an asynchronous countershock used to terminate pulseless VT or VF.
2. The defibrillator is charged to 120 to 200 joules (biphasic) or 360 joules (monophasic) for 1 countershock from the defibrillator, and then CPR is resumed immediately and continued for 5 cycles or about 2 minutes.
3. Reassess the rhythm after 2 minutes, and if VF or pulseless VT continues, the defibrillator is charged to give a second shock at the same energy level previously used.
4. Resume CPR after the shock, and continue with the life support protocol.



Before defibrillating a client, be sure that the oxygen is shut off to avoid the hazard of fire and be sure that no one is touching the bed or the client.

D. Use of pad electrodes

1. One pad is placed at the third intercostal space to the right of the sternum; the other is placed at the fifth intercostal space on the left midaxillary line.
2. Apply firm pressure of at least 25 lb to each of the pads.
3. Be sure that no one is touching the bed or the client when delivering the countershock.
4. Pads for hands-off biphasic defibrillation may be applied in an anterior-posterior position or apex-

posterior position, and placement directly over breast tissue should be avoided.



E. Automated external defibrillator (AED)

1. An AED is used by laypersons and emergency medical technicians for prehospital cardiac arrest.
2. Place the client on a firm, dry surface.
3. Turn on the AED and follow the voice prompts.
4. Place the electrode patches in the correct position on the client's chest.
5. Stop CPR.
6. Ensure that no one is touching the client to avoid motion artifact during rhythm analysis.
7. The machine will advise whether a shock is necessary.
8. Shocks are recommended for pulseless VT or VF only (usually 3 shocks are delivered).
9. If unsuccessful, CPR is continued for 1 minute and then another series of shocks is delivered.

F. Automated implantable cardioverter-defibrillator (AICD)

1. Description



2. Client education

- a. An AICD monitors cardiac rhythm and detects and terminates episodes of VT and VF by delivering 25 to 30 joules up to 4 times, if necessary.
- b. An AICD is used in clients with episodes of spontaneous sustained VT or VF unrelated to an MI or in clients whose medication therapy has been unsuccessful in controlling life-threatening dysrhythmias.
- c. Transvenous electrode leads are placed in the right atrium and ventricle in contact with the endocardium; leads are used for sensing, pacing, and delivery of cardioversion or defibrillation.
- d. The generator is most commonly implanted in the left pectoral region.
- e. Instruct the client in the basic functions of the AICD.
- f. Know the rate cutoff of the AICD and the number of consecutive shocks that it will deliver.
- g. Wear loose-fitting clothing over the AICD generator site.

- h. Instruct the client on activities to avoid, including contact sports, to prevent trauma to the AICD generator and lead wires.
- i. Report any fever, redness, swelling, or drainage from the insertion site.
- j. Report symptoms of fainting, nausea, weakness, blackouts, and rapid pulse rates to the PHCP.
- k. During shock discharge, the client may feel faint or short of breath.
- l. Instruct the client to sit or lie down if she or he feels a shock and to notify the PHCP.
- m. Advise the client to maintain a log of the date, time, and activity preceding the shock; the symptoms preceding the shock; and postshock sensations.
- n. Instruct the client and family in how to access the emergency medical system.
- o. Encourage the family to learn CPR.
- p. Instruct the client to avoid electromagnetic fields directly over the AICD, because they can inactivate the device.
- q. Instruct the client to move away from the magnetic field immediately if beeping tones are heard, and to notify the PHCP.
- r. Keep an AICD identification card in the wallet and obtain and wear a MedicAlert bracelet.
- s. Inform all PHCPs that an AICD has been inserted; certain diagnostic tests, such as MRI, and procedures using diathermy or electrocautery interfere with AICD function.

VI. Pacemakers

A. Description: Temporary or permanent device that provides electrical stimulation and maintains the heart rate when the client's intrinsic pacemaker fails to provide an adequate rate

B. Settings

1. A synchronous (demand) pacemaker senses the client's rhythm and paces only if the client's intrinsic rate falls below the set pacemaker rate for stimulating depolarization.
2. An asynchronous (fixed rate) pacemaker paces at a preset rate regardless of the client's intrinsic rhythm

and is used when the client is asystolic or profoundly bradycardic.

3. Overdrive pacing suppresses the underlying rhythm in tachydysrhythmias so that the sinus node will regain control of the heart.



C. Spikes

1. When a pacing stimulus is delivered to the heart, a spike (straight vertical line) is seen on the monitor or ECG strip.
2. Spikes precede the chamber being paced; a spike preceding a P wave indicates that the atrium is paced, and a spike preceding the QRS complex indicates that the ventricle is being paced.
3. An atrial spike followed by a P wave indicates atrial depolarization, and a ventricular spike followed by a QRS complex represents ventricular depolarization; this is referred to as *capture*.

D. Temporary pacemakers

1. Noninvasive transcutaneous pacing
 - a. Noninvasive transcutaneous pacing is used as a temporary emergency measure in the profoundly bradycardic or asystolic client until invasive pacing can be initiated.
 - b. Large electrode pads are placed on the client's chest and back and connected to an external pulse generator.
 - c. Wash the skin with soap and water before applying electrodes.
 - d. It is not necessary to shave the hair or apply alcohol or tinctures to the skin.
 - e. Place the posterior electrode between the spine and left scapula behind the heart, avoiding placement over bone.
 - f. Place the anterior electrode between V2 and V5 positions over the heart.
 - g. Do not place the anterior electrode over female breast tissue; rather, displace breast tissue and place the electrode under the breast.
 - h. Do not take the pulse or BP on the left side; the results will not be accurate because of the muscle twitching and electrical current.
 - i. Ensure that electrodes are in good contact with the skin.
 - j. Set pacing rate as prescribed; establish

stimulation threshold to ensure capture.

- k. If loss of capture occurs, assess the skin contact of the electrodes and increase the current until capture is regained.
 - l. Evaluate the client for discomfort from cutaneous and muscle stimulation; administer analgesics as needed.
2. Invasive transvenous pacing
 - a. Pacing lead wire is placed through the antecubital, femoral, jugular, or subclavian vein into the right atrium or right ventricle, so that it is in direct contact with the endocardium.
 - b. Monitor the pacemaker insertion site.
 - c. Restrict client movement to prevent lead wire displacement.
 3. Invasive epicardial pacing — applied by using a transthoracic approach; the lead wires are threaded loosely on the epicardial surface of the heart after cardiac surgery.



4. Reducing the risk of microshock

- a. Use only inspected and approved equipment.
- b. Insulate the exposed portion of wires with plastic or rubber material (fingers of rubber gloves) when wires are not attached to the pulse generator; cover with nonconductive tape.
- c. Ground all electrical equipment, using a 3-pronged plug.
- d. Wear gloves when handling exposed wires.
- e. Keep dressings dry.



Vital signs are monitored and cardiac

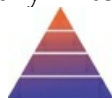
monitoring is done continuously for the client with a temporary pacemaker.

E. Permanent pacemakers

1. Pulse generator is internal and surgically implanted in a subcutaneous pocket below the clavicle.
2. The leads are passed transvenously via the cephalic or subclavian vein to the endocardium on the right side of the heart; postoperatively, limitation of arm movement on the operative side is required to

- prevent lead wire dislodgement.
3. Permanent pacemakers may be single-chambered, in which the lead wire is placed in the chamber to be paced; or dual-chambered, with lead wires placed in both the right atrium and the right ventricle.
 4. Biventricular pacing of the ventricles allows for synchronized depolarization and is used for moderate to severe heart failure to improve cardiac output.
 5. A permanent pacemaker is programmed when inserted and can be reprogrammed if necessary by noninvasive transmission from an external programmer to the implanted generator.
 6. Pacemakers may be powered by a lithium battery with an average life span of 10 years, nuclear-powered with a life span of 20 years or longer, or designed to be recharged externally.
 7. Pacemaker function can be checked in the PHCP's office or clinic by a pacemaker interrogator or programmer or from home, using a special telephone transmitter device.
 8. The client may be provided with a device placed over the pacemaker battery generator with an attachment to the telephone; the heart rate then can be transmitted to the clinic.
 9. Client teaching (Box 52-5).

VII. Coronary Artery Disease



A. Description

1. Coronary artery disease is a narrowing or obstruction of 1 or more coronary arteries as a result of atherosclerosis, which is an accumulation of lipid-containing plaque in the arteries (Fig. 52-11).
2. The disease causes decreased perfusion of myocardial tissue and inadequate myocardial oxygen supply, leading to hypertension, angina, dysrhythmias, MI, heart failure, and death.
3. Collateral circulation, more than 1 artery supplying a muscle with blood, is normally present in the coronary arteries, especially in older persons.
4. The development of collateral circulation takes time and develops when chronic ischemia occurs to meet the metabolic demands; therefore, an occlusion of a coronary artery in a younger individual is more likely to be lethal than one in an older individual.
5. Symptoms occur when the coronary artery is occluded to the point that inadequate blood supply to the muscle occurs, causing ischemia.
6. Coronary artery narrowing is significant if the lumen

- diameter of the left main artery is reduced at least 50%, or if any major branch is reduced at least 75%.
7. The goal of treatment is to alter the atherosclerotic progression.

B. Assessment

1. Possibly normal findings during asymptomatic periods
2. Chest pain
3. Palpitations
4. Dyspnea
5. Syncope
6. Cough or hemoptysis
7. Excessive fatigue

C. Diagnostic studies

1. Electrocardiography
 - a. When blood flow is reduced and ischemia occurs, ST-segment depression, T-wave inversion, or both is noted; the ST segment returns to normal when the blood flow returns.
 - b. With infarction, cell injury results in ST-segment elevation, followed by T-wave inversion and an abnormal Q wave.
2. Cardiac catheterization: Cardiac catheterization shows the presence of atherosclerotic lesions.
3. Blood lipid levels
 - a. Blood lipid levels may be elevated.
 - b. Cholesterol-lowering medications may be prescribed to reduce the development of atherosclerotic plaques.



D. Interventions

1. Assist the client to identify risk factors that can be modified and to set goals to promote lifestyle changes to reduce the impact of risk factors.
2. Assist the client to identify barriers to adherence with the therapeutic plan and to identify methods to overcome barriers.
3. Instruct the client regarding a low-calorie, low-sodium, low-cholesterol, and low-fat diet, with an increase in dietary fiber.
4. Stress that dietary changes should be incorporated for the rest of the client's life; instruct the client regarding prescribed medications.
5. Provide community resources to the client regarding exercise, smoking cessation, and stress reduction as appropriate.



E. Surgical procedures

1. PTCA to compress the plaque against the walls of the artery and dilate the vessel
2. Laser angioplasty to vaporize the plaque
3. Atherectomy to remove the plaque from the artery
4. Vascular stent to prevent the artery from closing and to prevent restenosis
5. Coronary artery bypass grafting past the occluded artery to improve blood flow to the myocardial tissue at risk for ischemia or infarction

F. Medications

1. Nitrates to dilate the coronary arteries and decrease **preload** and **afterload**
2. Calcium channel blockers to dilate coronary arteries and reduce vasospasm
3. Cholesterol-lowering medications to reduce the development of atherosclerotic plaques
4. Beta blockers to reduce the BP in individuals who are hypertensive

VIII. Angina

A. Description

1. Angina is chest pain resulting from myocardial ischemia caused by inadequate myocardial blood and oxygen supply.
2. Angina is caused by an imbalance between oxygen supply and demand.
3. Causes include obstruction of coronary blood flow resulting from atherosclerosis, coronary artery spasm, or conditions increasing myocardial oxygen consumption.



The goal of treatment for angina is to provide relief from the acute attack, correct the imbalance between myocardial oxygen supply and demand, and prevent the progression of the disease and further attacks to reduce the risk of MI.

B. Patterns of angina

1. Stable angina
 - a. Also called exertional angina
 - b. Occurs with activities that involve exertion or emotional stress; relieved with rest or nitroglycerin
 - c. Usually has a stable pattern of onset, duration, severity, and relieving factors
2. Unstable angina
 - a. Also called preinfarction angina

- b. Associated with worsening cardiac ischemia
- c. Occurs with an unpredictable degree of exertion or emotion and increases in occurrence, duration, and severity over time
- d. Lasts longer than 15 minutes
- e. Pain may not be relieved with nitroglycerin.

3. Variant angina

- a. Also called Prinzmetal's or vasospastic angina
- b. Results from coronary artery spasm
- c. May occur at rest
- d. Attacks may be associated with ST-segment elevation noted on the ECG.

4. Intractable angina is a chronic, incapacitating angina unresponsive to interventions.



C. Assessment

1. Pain

- a. Pain can develop slowly or quickly.
- b. Pain usually is described as mild or moderate.
- c. Substernal, crushing, squeezing pain may occur.
- d. Pain may radiate to the shoulders, arms, jaw, neck, or back.
- e. Pain intensity is unaffected by inspiration and expiration.
- f. Pain usually lasts less than 5 minutes; however, pain can last up to 15 to 20 minutes.
- g. Pain is relieved by nitroglycerin or rest.

2. Dyspnea

3. Pallor

4. Sweating

5. Palpitations and tachycardia

6. Dizziness and syncope

7. Hypertension

8. Digestive disturbances



D. Diagnostic studies

- 1. Electrocardiography: Readings are normal during rest, with ST depression or T-wave inversion during an episode of pain.
- 2. Stress testing: Chest pain or changes in the ECG or

- vital signs during testing may indicate ischemia.
3. Troponin and cardiac enzyme levels: Findings are normal in angina.
 4. Cardiac catheterization: Provides a definitive diagnosis by providing information about the patency of the coronary arteries.



E. Interventions

1. Immediate management

- a. Assess pain; institute pain relief measures.
- b. Administer oxygen by nasal cannula as prescribed.
- c. Assess vital signs and provide continuous cardiac monitoring and nitroglycerin as prescribed to dilate the coronary arteries, reduce the oxygen requirements of the myocardium, and relieve the chest pain.
- d. Ensure that bed rest is maintained, place the client in semi-Fowler's position, and stay with the client.
- e. Obtain a 12-lead ECG.
- f. Establish an IV access route.



2. Following the acute episode

- a. See section VII, D (Coronary Artery Disease, Interventions).
- b. Assist the client to identify angina-precipitating events.
- c. Instruct the client to stop activity and rest if chest pain occurs; sit down and take nitroglycerin as prescribed; the client is usually instructed to call emergency medical services if the nitroglycerin does not relieve the pain, and many PHCPs recommend that the client also chew an aspirin.

F. Surgical procedures: See section VII, E (Coronary Artery Disease, Surgical procedures).

G. Medications

1. See section VII, F (Coronary Artery Disease, Medications).
2. Antiplatelet therapy may be prescribed to inhibit platelet aggregation and reduce the risk of developing an acute MI.

IX. Myocardial Infarction



A. Description

1. MI occurs when myocardial tissue is abruptly and severely deprived of oxygen.
2. Ischemia can lead to necrosis of myocardial tissue if blood flow is not restored.
3. Infarction does not occur instantly but evolves over several hours.
4. Obvious physical changes do not occur in the heart until 6 hours after the infarction, when the infarcted area appears blue and swollen.
5. After 48 hours, the infarct turns gray, with yellow streaks developing as neutrophils invade the tissue.
6. By 8 to 10 days after infarction, granulation tissue forms.
7. Over 2 to 3 months, the necrotic area develops into a scar; scar tissue permanently changes the size and shape of the ventricle.
8. Not all clients experience the classic symptoms of an MI.
9. Women may experience atypical discomfort, shortness of breath, or fatigue and often present with non-ST-elevation myocardial infarction (NSTEMI) or T-wave inversion.
10. An older client may experience shortness of breath, pulmonary edema, dizziness, altered mental status, or a dysrhythmia.

B. Location of MI (see [Fig. 52-1](#))

1. Obstruction of the LAD artery results in anterior wall or septal MI, or both.
2. Obstruction of the circumflex artery results in posterior wall MI or lateral wall MI.
3. Obstruction of the right coronary artery results in inferior wall MI.



C. Risk factors

1. Atherosclerosis
2. Coronary artery disease
3. Elevated cholesterol levels
4. Smoking
5. Hypertension
6. Obesity
7. Physical inactivity
8. Impaired glucose tolerance
9. Stress



D. Diagnostic studies

1. Troponin level: Level rises within 3 hours and remains elevated for up to 7 to 10 days.
2. Total CK level: Level rises within 6 hours after the onset of chest pain and peaks within 18 hours after damage and death of cardiac tissue.
3. CK-MB isoenzyme: Peak elevation occurs 18 hours after the onset of chest pain and returns to normal 48 to 72 hours later.
4. Myoglobin: Level rises within 2 hours after cell death, with a rapid decline in the level after 7 hours.
5. White blood cell count: An elevated white blood cell count appears on the second day following the MI and lasts up to 1 week.
6. Electrocardiogram
 - a. ECG shows either ST segment elevation MI (STEMI), T-wave inversion, or NSTEMI; an abnormal Q wave may also present.
 - b. Hours to days after the MI, ST- and T-wave changes will return to normal, but the Q-wave changes usually remain permanently.
7. Cardiac catheterization may be done emergently to determine the extent and location of obstructions of the coronary arteries; this allows for use of PTCA and restoration of bloodflow to the myocardium.
8. Diagnostic tests following the acute stage
 - a. Exercise tolerance test or stress test to assess for electrocardiographic changes and ischemia and to evaluate for medical therapy or identify clients who may need invasive therapy.
 - b. Thallium scans to assess for ischemia or necrotic muscle tissue.
 - c. Multigated cardiac blood pool imaging scans may be used to evaluate left ventricular function.
 - d. If not done urgently, cardiac catheterization to determine the coronary artery obstructions will be done after the client is stabilized.



E. Assessment

1. Pain

- a. Client may experience crushing substernal pain.
- b. Pain may radiate to the jaw, back, and left arm.

- c. Pain may occur without cause, primarily early in the morning.
 - d. Pain is unrelieved by rest or nitroglycerin and is relieved only by opioids.
 - e. Pain lasts 30 minutes or longer.
2. Nausea and vomiting
 3. Diaphoresis
 4. Dyspnea
 5. Dysrhythmias
 6. Feelings of fear and anxiety, impending doom
 7. Pallor, cyanosis, coolness of extremities

F. Complications of MI (Box 52-6)



G. Interventions, acute stage



Pain relief increases oxygen supply to the myocardium; administer morphine as a priority in managing pain in the client having an MI.

1. Obtain a description of the chest discomfort.
2. Administer oxygen and institute pain relief measures (morphine, nitroglycerin as prescribed).
3. Assess vital signs and cardiovascular status and maintain cardiac monitoring.
4. Assess respiratory rate and breath sounds for signs of heart failure, as indicated by the presence of crackles or wheezes or dependent edema.
5. Ensure bed rest and place the client in a semi-Fowler's position to enhance comfort and tissue oxygenation; stay with the client.
6. Establish an IV access route.
7. Obtain a 12-lead ECG.
8. Monitor laboratory values.
9. Monitor for cardiac dysrhythmias, because tachycardia and PVCs frequently occur in the first few hours after MI; administer antidysrhythmics as prescribed.
10. Administer thrombolytic therapy, which may be prescribed within the first 6 hours of the coronary event if cardiac catheterization is not to be done emergently; monitor for signs of bleeding if the client is receiving thrombolytic therapy.
11. Assess distal peripheral pulses and skin temperature, because poor cardiac output may be identified by cool diaphoretic skin and diminished or absent pulses.
12. Monitor the BP closely after the administration of medications; if the **systolic pressure** is lower than

100 mm Hg or 25 mm Hg lower than the previous reading, lower the head of the bed and notify the PHCP.

13. Administer beta blockers as prescribed to slow the heart rate and increase myocardial perfusion while reducing the force of myocardial contraction.
14. Provide reassurance to the client and family.



H. Interventions following the acute episode

1. Maintain bed rest as prescribed.
2. Allow the client to stand to void or use a bedside commode if prescribed.
3. Provide range-of-motion exercises to prevent thrombus formation and maintain muscle strength.
4. Progress to dangling legs at the side of the bed or out of bed to the chair for 30 minutes 3 times a day as prescribed.
5. Progress to ambulation in the client's room and to the bathroom and then in the hallway 3 times a day.
6. Monitor for complications.
7. Administer angiotensin-converting enzyme (ACE) inhibitors, angiotensin-II receptor blockers (ARBs), calcium channel blockers, aspirin, thienopyridines (clopidogrel), and lipid-lowering agents as prescribed.
8. Encourage the client to verbalize feelings regarding the MI.

I. Cardiac rehabilitation: Process of actively assisting the client with cardiac disease to achieve and maintain a vital and productive life within the limitations of the heart disease; also refer to section VII, D (Coronary Artery Disease, Interventions).

X. Heart Failure



A. Description

1. Heart failure is the inability of the heart to maintain adequate cardiac output to meet the metabolic needs of the body because of impaired pumping ability.
2. Diminished cardiac output results in inadequate peripheral tissue perfusion.
3. Congestion of the lungs and periphery may occur; the client can develop acute pulmonary edema.

B. Classification

1. Acute heart failure occurs suddenly.
2. Chronic heart failure develops over time; however, a client with chronic heart failure can develop an acute episode.

C. Types of heart failure

1. Right ventricular failure, left ventricular failure

- a. Because the 2 ventricles of the heart represent 2 separate pumping systems, it is possible for 1 to fail alone for a short period.
 - b. Most heart failure begins with left ventricular failure and progresses to failure of both ventricles.
 - c. Acute pulmonary edema, a medical emergency, results from left ventricular failure.
 - d. If pulmonary edema is not treated, death will occur from suffocation because the client literally drowns in her or his own fluids.
2. Forward failure, backward failure
- a. In forward failure, an inadequate output of the affected ventricle causes decreased perfusion to vital organs.
 - b. In backward failure, blood backs up behind the affected ventricle, causing increased pressure in the atrium behind the affected ventricle.
3. Low output, high output
- a. In low-output failure, not enough cardiac output is available to meet the demands of the body.
 - b. High-output failure occurs when a condition causes the heart to work harder to meet the demands of the body.
4. Systolic failure, diastolic failure
- a. Systolic failure, also known as heart failure with reduced ejection fraction (HFrEF), leads to problems with contraction and ejection of blood.
 - b. Diastolic failure, also known as heart failure with preserved ejection fraction (HFpEF), leads to problems with the heart relaxing and filling with blood.



D. Compensatory mechanisms

1. Compensatory mechanisms act to restore cardiac output to near-normal levels.
2. Initially, these mechanisms increase cardiac output; however, they eventually have a damaging effect on pump action.
3. Compensatory mechanisms contribute to an increase in myocardial oxygen consumption; when this occurs,

myocardial reserve is exhausted and clinical manifestations of heart failure develop.

4. Compensatory mechanisms include increased heart rate, improved **stroke volume**, arterial vasoconstriction, sodium and water retention, and myocardial hypertrophy.



E. Assessment ([Table 52-1](#))

1. Right- and left-sided heart failure
2. Acute pulmonary edema
 - a. Severe dyspnea
 - b. Tachycardia, tachypnea
 - c. Nasal flaring; use of accessory breathing muscles
 - d. Wheezing and crackles on auscultation; gurgling respirations
 - e. Expectoration of large amounts of blood-tinged, frothy sputum
 - f. Acute anxiety, apprehension, restlessness
 - g. Profuse sweating
 - h. Cold, clammy skin
 - i. Cyanosis



Signs of left ventricular failure are evident

in the pulmonary system. Signs of right ventricular failure are evident in the systemic circulation.

F. Immediate management of acute episode (see [Priority Nursing Actions](#))



G. Following the acute episode

1. Assist the client to identify precipitating risk factors of heart failure and methods of eliminating these risk factors.
2. Encourage the client to verbalize feelings about the lifestyle changes required as a result of the heart failure.
3. Instruct the client in the prescribed medication regimen, which may include digoxin, a diuretic, ACE inhibitors, low-dose beta blockers, and vasodilators.
4. Advise the client to notify the PHCP if side effects occur from the medications.
5. Advise the client to avoid over-the-counter medications.
6. Instruct the client to contact the PHCP if she or he is unable to take medications because of illness.

7. Instruct the client to avoid large amounts of caffeine, found in coffee, tea, cocoa, chocolate, and some carbonated beverages.
8. Instruct the client about the prescribed low-sodium, low-fat, and low-cholesterol diet.
9. Provide the client with a list of potassium-rich foods, because diuretics can cause hypokalemia (except for potassium-retaining diuretics).
10. Instruct the client regarding fluid restriction, if prescribed, advising the client to spread the fluid out during the day and to suck on hard candy to reduce thirst.
11. Instruct the client to balance periods of activity and rest.
12. Advise the client to avoid isometric activities, which increase pressure in the heart.
13. Instruct the client to monitor daily weight.
14. Instruct the client to report signs of fluid retention such as edema or weight gain.

XI. See [Chapter 69](#) for a discussion on cardiogenic shock and associated invasive monitoring.

XII. Inflammatory Diseases of the Heart



A. Pericarditis

1. Description

- a. Pericarditis is an acute or chronic inflammation of the pericardium.
- b. Chronic pericarditis, a chronic inflammatory thickening of the pericardium, constricts the heart, causing compression.
- c. The pericardial sac becomes inflamed.
- d. Pericarditis can result in loss of pericardial elasticity or an accumulation of fluid within the sac.
- e. Heart failure or cardiac tamponade may result.

2. Assessment

- a. Pain in the anterior chest that radiates to the left side of the neck, shoulder, or back



- b. Pain is grating and is

aggravated by breathing (particularly inspiration), coughing, and swallowing



- c. Pain is worse when in the supine

position and may be relieved by leaning forward.

- d. Pericardial friction rub (scratchy, high-pitched sound) is heard on auscultation and is produced by the rubbing of the inflamed pericardial layers.
- e. Fever and chills
- f. Fatigue and malaise
- g. Elevated white blood cell count
- h. Electrocardiographic changes with acute pericarditis; ST-segment elevation with the onset of inflammation; atrial fibrillation is common.
- i. Signs of right ventricular failure in clients with chronic constrictive pericarditis

3. Interventions

a. Assess the nature of the pain.



b. Place the client in a high-

Fowler's position, or upright and leaning forward.

c. Administer oxygen.

d. Administer analgesics, nonsteroidal anti-inflammatory drugs (NSAIDs), or corticosteroids for pain as prescribed.

e. Auscultate for a pericardial friction rub.

f. Check results of blood culture to identify the causative organism.

g. Administer antibiotics for bacterial infection as prescribed.

h. Administer diuretics and digoxin as prescribed to the client with chronic constrictive pericarditis; surgical incision of the pericardium (pericardial window) or pericardiectomy may be necessary.



i. Monitor for signs of cardiac tamponade.

j. Notify the PHCP if signs of cardiac tamponade occur.

B. Myocarditis

1. Description: Acute or chronic inflammation of the myocardium as a result of pericarditis, systemic

infection, or allergic response

2. Assessment

- a. Fever
- b. Dyspnea
- c. Tachycardia
- d. Chest pain
- e. Pericardial friction rub
- f. Gallop rhythm
- g. Murmur that sounds like fluid passing an obstruction
- h. Pulsus alternans
- i. Signs of heart failure

3. Interventions

- a. Assist the client to a position of comfort, such as sitting up and leaning forward.
- b. Administer oxygen as prescribed.
- c. Administer analgesics, salicylates, and NSAIDs as prescribed to reduce fever and pain.
- d. Administer digoxin as prescribed.
- e. Administer antidysrhythmics as prescribed.
- f. Administer antibiotics as prescribed to treat the causative organism.
- g. Monitor for complications, which can include thrombus, heart failure, and cardiomyopathy.



C. Endocarditis

1. Description

- a. Endocarditis is an inflammation of the inner lining of the heart and valves.
- b. Occurs primarily in clients who are IV drug users, have had valve replacements or repair of valves with prosthetic materials, or have other structural cardiac defects
- c. Ports of entry for the infecting organism include the oral cavity (especially if the client has had a dental procedure in the previous 3 to 6 months), infections (cutaneous, genitourinary, gastrointestinal, and systemic), and surgery or invasive procedures, including IV line placement.

2. Assessment

- a. Fever
- b. Anorexia, weight loss

- c. Fatigue
- d. Cardiac murmurs
- e. Heart failure
- f. Embolic complications from vegetation fragments traveling through the arterial circulation
- g. Petechiae
- h. Splinter hemorrhages in the nailbeds
- i. Osler's nodes (reddish, tender lesions) on the pads of the fingers, hands, and toes
- j. Janeway lesions (nontender hemorrhagic lesions) on the fingers, toes, nose, or earlobes
- k. Splenomegaly
- l. Clubbing of the fingers

3. Interventions

- a. Provide adequate rest balanced with activity to prevent thrombus formation.
- b. Monitor for signs of heart failure.
- c. Monitor for splenic emboli, as evidenced by sudden abdominal pain radiating to the left shoulder and the presence of rebound abdominal tenderness on palpation.
- d. Monitor for renal emboli, as evidenced by flank pain radiating to the groin, hematuria, and pyuria.
- e. Monitor for confusion, aphasia, or dysphasia, which may indicate central nervous system emboli.
- f. Monitor for pulmonary emboli as evidenced by pleuritic chest pain, dyspnea, and cough.
- g. Assess skin, mucous membranes, and conjunctiva for petechiae.
- h. Assess nailbeds for splinter hemorrhages.
- i. Assess for Osler's nodes on the pads of the fingers, hands, and toes.
- j. Assess for Janeway lesions on the fingers, toes, nose, or earlobes.
- k. Assess for clubbing of the fingers.
- l. Evaluate blood culture results.
- m. Administer antibiotics intravenously as prescribed.
- n. Plan and arrange for discharge,

providing resources required for the continued administration of IV antibiotics.

4. Client education ([Box 52-7](#))

XIII. Cardiac Tamponade



A. Description

1. A pericardial effusion occurs when the space between the parietal and visceral layers of the pericardium fills with fluid.
2. Pericardial effusion places the client at risk for cardiac tamponade, an accumulation of fluid in the pericardial cavity.
3. Tamponade restricts ventricular filling, and cardiac output drops.



Acute cardiac tamponade can occur when small volumes (20 to 50 mL) of fluid accumulate rapidly in the pericardium.



B. Assessment

1. Pulsus paradoxus
2. Increased CVP
3. Jugular venous distention with clear lungs
4. Distant, muffled heart sounds
5. Decreased cardiac output
6. Narrowing **pulse pressure**

C. Interventions

1. The client needs to be placed in a critical care unit for hemodynamic monitoring.
2. Administer fluids intravenously as prescribed to manage decreased cardiac output.
3. Prepare the client for chest x-ray or echocardiography.
4. Prepare the client for pericardiocentesis to withdraw pericardial fluid if prescribed.
5. Monitor for recurrence of tamponade following pericardiocentesis.
6. If the client experiences recurrent tamponade or recurrent effusions or develops adhesions from chronic pericarditis, a portion (pericardial window) or all of the pericardium (pericardiectomy) may be removed to allow adequate ventricular filling and contraction.

XIV. Valvular Heart Disease

A. Description

1. Valvular heart disease occurs when the heart valves cannot open fully (stenosis) or close completely (insufficiency or regurgitation).
2. Valvular heart disease prevents efficient blood flow through the heart.

B. Types

1. Mitral stenosis: Valvular tissue thickens and narrows the valve opening, preventing blood from flowing from the left atrium to the left ventricle.
2. Mitral insufficiency, regurgitation: Valve is incompetent, preventing complete valve closure during systole.
3. Mitral valve prolapse: Valve leaflets protrude into the left atrium during **systole**.
4. Aortic stenosis: Valvular tissue thickens and narrows the valve opening, preventing blood from flowing from the left ventricle into the aorta.
5. Aortic insufficiency: Valve is incompetent, preventing complete valve closure during **diastole**.
6. For aortic disorders, see [Table 52-2](#).
7. For tricuspid disorders, see [Table 52-3](#).
8. For pulmonary valve disorders, see [Table 52-4](#).

C. Repair procedures

1. Percutaneous balloon valvuloplasty
 - a. A balloon catheter is passed from the femoral vein through the atrial septum to the mitral valve or through the femoral artery to the aortic valve.
 - b. The balloon is inflated to enlarge the orifice.
 - c. Monitor for bleeding from the catheter insertion site.
 - d. Institute precautions for arterial puncture if appropriate; site care and monitoring is similar to that after cardiac catheterization.
 - e. Monitor for signs of systemic emboli.
 - f. Monitor for signs of a regurgitant valve by monitoring cardiac rhythm, heart sounds, and cardiac output.
2. Mitral annuloplasty: Tightening and suturing the malfunctioning valve annulus to eliminate or greatly reduce regurgitation; percutaneous or open surgical approach.
3. Commissurotomy, valvotomy
 - a. Thrombi are removed and calcium deposits are debrided; the valve is incised and widened.

- b. Percutaneous route or open heart surgical approach.

D. Valve replacement procedures

1. Mechanical prosthetic valves: These prosthetic valves are durable
2. Risk of clot formation is high as the body reacts to the artificial materials; anticoagulation is required.



Thromboembolism can be a problem following valve replacement with a mechanical prosthetic valve, and lifetime anticoagulant therapy is required.

3. Bioprosthetic valves

- a. Biological grafts are xenografts (valves from other species)—porcine valves (pig), bovine valves (cow), or homografts (human cadavers). These valves are less durable than mechanical prosthetic valves.
- b. The risk of clot formation is small; therefore, long-term anticoagulation may not be indicated.

4. Open heart surgical approach.

5. Preoperative interventions: Consult with the PHCP regarding discontinuing anticoagulants 72 hours before surgery.



6. Postoperative interventions

- a. Monitor closely for signs of bleeding.
- b. Monitor cardiac output and for signs of heart failure.
- c. Administer digoxin as prescribed to maintain cardiac output and prevent atrial fibrillation.



- d. Client education (Box 52-8).

XV. Cardiomyopathy (Table 52-5)

A. Description

1. Cardiomyopathy is a subacute or chronic disorder of the heart muscle.
2. Treatment is palliative, not curative, and the client needs to deal with numerous lifestyle changes and a shortened life span.

B. Types, signs and symptoms, and treatment (see Table 52-5)

XVI. Vascular Disorders

A. Venous thrombosis

1. Description

- a. Thrombus can be associated with an inflammatory process.
- b. When a thrombus develops, inflammation occurs, thickening the vein wall and leading to embolization.

2. Types

- a. Thrombophlebitis: Thrombus associated with vein inflammation
- b. Phlebothrombosis: Thrombus without vein inflammation
- c. Phlebitis: Vein inflammation associated with invasive procedures, such as IV lines
- d. Deep vein thrombophlebitis: More serious than a superficial thrombophlebitis because of the risk for pulmonary embolism



3. Risk factors for thrombus formation

- a. Venous stasis from varicose veins, heart failure, immobility
- b. Hypercoagulability disorders
- c. Injury to the venous wall from IV injections; administration of vessel irritants (chemotherapy, hypertonic solutions)
- d. Following surgery, particularly orthopedic and abdominal surgery
- e. Pregnancy
- f. Ulcerative colitis
- g. Use of oral contraceptives
- h. Certain malignancies
- i. Fractures or other injuries of the pelvis or lower extremities



B. Phlebitis

1. Assessment

- a. Red, warm area radiating up the vein and extremity
- b. Pain
- c. Swelling

2. Interventions

- a. Apply warm, moist soaks as prescribed to dilate the vein and promote circulation (assess temperature of soak before applying).
- b. Assess for signs of complications such

as tissue necrosis, infection, or pulmonary embolus.



C. Deep vein thrombophlebitis

1. Assessment

- a. Calf or groin tenderness or pain with or without swelling
- b. Positive Homans' sign may be noted; however, false-positive results are common, so this is not a reliable assessment measure.
- c. Warm skin that is tender to touch

2. Interventions

- a. Provide bed rest as prescribed.
- b. Elevate the affected extremity above the level of the heart as prescribed.
- c. Avoid using the knee gatch or a pillow under the knees.
- d. Do not massage the extremity.
- e. Provide thigh-high or knee-high antiembolism stockings as prescribed to reduce venous stasis and assist in the venous return of blood to the heart; teach how to apply and remove stockings.
- f. Administer intermittent or continuous warm, moist compresses as prescribed.
- g. Palpate the site gently, monitoring for warmth and edema.
- h. Measure and record the circumferences of the thighs and calves.
- i. Monitor for shortness of breath and chest pain, which can indicate pulmonary emboli.
- j. Administer thrombolytic therapy (tissue plasminogen activator) if prescribed, which must be initiated within 5 days after the onset of symptoms.
- k. Administer heparin therapy as prescribed to prevent enlargement of the existing clot and prevent the formation of new clots.
- l. Monitor activated partial thromboplastin time during heparin therapy.
- m. Administer warfarin as prescribed following heparin therapy when the symptoms of deep vein

- thrombophlebitis have resolved.
- n. Monitor prothrombin time and international normalized ratio during warfarin therapy.
 - o. Monitor for the adverse effects associated with anticoagulant therapy.



p. Client education (Box 52-9)

D. Venous insufficiency

1. Description

- a. Venous insufficiency results from prolonged venous hypertension, which stretches the veins and damages the valves.
- b. The resultant edema and venous stasis cause venous stasis ulcers, swelling, and cellulitis.
- c. Treatment focuses on decreasing edema and promoting venous return from the affected extremity.
- d. Treatment for venous stasis ulcers focuses on healing the ulcer and preventing stasis and ulcer recurrence.



2. Assessment

- a. Stasis dermatitis or brown discoloration along the ankles, extending up to the calf
- b. Edema
- c. Ulcer formation: Edges are uneven, ulcer bed is pink, and granulation is present; usually located on the lateral malleolus.

3. Interventions



For venous insufficiency, leg elevation is usually prescribed to assist with the return of blood to the heart.

- a. Instruct the client to wear elastic or compression stockings during the day and evening if prescribed (instruct the client to put on elastic stockings on awakening, before getting out of bed); it may be necessary to wear the stockings for the remainder of the client's life.
- b. Instruct the client to avoid prolonged

sitting or standing, constrictive clothing, or crossing the legs when seated.

- c. Instruct the client to elevate the legs above the level of the heart for 10 to 20 minutes every few hours each day.
- d. Instruct the client in the use of an intermittent sequential pneumatic compression system, if prescribed (used twice daily for 1 hour in the morning and evening).
- e. Advise the client with an open ulcer that the compression system is applied over a dressing.

4. Wound care

- a. Provide care to the wound as prescribed.
- b. Assess the client's ability to care for the wound, and initiate home care resources as necessary.
- c. If an Unna boot (dressing constructed of gauze moistened with zinc oxide) is prescribed, the PHCP will change it weekly.
- d. The wound is cleansed with normal saline before application of the Unna boot; povidone-iodine and hydrogen peroxide are not used, because they destroy granulation tissue.
- e. The Unna boot is covered with an elastic wrap that hardens to promote venous return and prevent stasis.
- f. Monitor for signs of arterial occlusion from an Unna boot that may be too tight.
- g. Keep tape off the client's skin.
- h. Occlusive dressings such as polyethylene film or a hydrocolloid dressing may be used to cover the ulcer.

5. Medications

- a. Apply topical agents to the wound as prescribed to debride the ulcer, eliminate necrotic tissue, and promote healing.
- b. When applying topical debriding agents, apply an oil-based agent such as petroleum jelly on surrounding skin

- to protect healthy tissue.
- c. Administer antibiotics as prescribed if infection or cellulitis occurs.

E. Varicose veins

1. Description

- a. Distended, protruding veins that appear darkened and tortuous.
- b. Vein walls weaken and dilate, and valves become incompetent.



2. Assessment

- a. Pain in the legs with dull aching after standing
- b. A feeling of fullness in the legs
- c. Ankle edema



3. Trendelenburg's test

- a. Place the client in a supine position with the legs elevated.
- b. When the client sits up, if varicosities are present, veins fill from the proximal end; veins normally fill from the distal end.

4. Interventions

- a. Emphasize the importance of antiembolism stockings as prescribed.
- b. Instruct the client to elevate the legs as much as possible.
- c. Instruct the client to avoid constrictive clothing and pressure on the legs.
- d. Prepare the client for sclerotherapy or vein stripping as prescribed.

5. Sclerotherapy

- a. A solution is injected into the vein, followed by the application of a pressure dressing.
- b. Incision and drainage of the trapped blood in the sclerosed vein is performed 14 to 21 days after the injection, followed by the application of a pressure dressing for 12 to 18 hours.

6. Laser therapy: A laser fiber is used to heat and close the main vessel contributing to the varicosity.

7. Vein stripping: Varicose veins may be removed if they are larger than 4 mm in diameter or if they are in clusters; other treatments are usually tried before vein

stripping.

XVII. Arterial Disorders



A. Peripheral arterial disease

1. Description

- a. Chronic disorder in which partial or total arterial occlusion deprives the lower extremities of oxygen and nutrients
- b. Tissue damage occurs below the level of the arterial occlusion.
- c. Atherosclerosis is the most common cause of peripheral arterial disease.



2. Assessment

- a. Intermittent claudication (pain in the muscles resulting from an inadequate blood supply)
- b. Rest pain, characterized by numbness, burning, or aching in the distal portion of the lower extremities, which awakens the client at night and is relieved by placing the extremity in a dependent position
- c. Lower back or buttock discomfort
- d. Loss of hair and dry scaly skin on the lower extremities
- e. Thickened toenails
- f. Cold and gray-blue color of skin in the lower extremities
- g. Elevational pallor and dependent rubor in the lower extremities
- h. Decreased or absent peripheral pulses
- i. Signs of arterial ulcer formation occurring on or between the toes or on the upper aspect of the foot that are characterized as painful
- j. BP measurements at the thigh, calf, and ankle are lower than the brachial pressure (normally, BP readings in the thigh and calf are higher than those in the upper extremities).

3. Interventions



Because swelling in the extremities prevents arterial blood flow, the client with peripheral arterial disease is instructed to elevate

the feet at rest but to refrain from elevating them above the level of the heart, because extreme elevation slows arterial blood flow to the feet. In severe cases of peripheral arterial disease, clients with edema may sleep with the affected limb hanging from the bed, or they may sit upright (without leg elevation) in a chair for comfort.

- a. Assess pain.
 - b. Monitor the extremities for color, motion and sensation, and pulses.
 - c. Obtain BP measurements.
 - d. Assess for signs of ulcer formation or signs of gangrene.
 - e. Assist in developing an individualized exercise program, which is initiated gradually and increased slowly to improve arterial flow through the development of collateral circulation.
 - f. Instruct the client to walk to the point of claudication pain, stop and rest, and then walk a little farther.
 - g. Instruct the client with peripheral arterial disease to avoid crossing the legs, which interferes with blood flow.
 - h. Instruct the client to avoid exposure to cold (causes vasoconstriction) to the extremities and to wear socks or insulated shoes for warmth at all times.
 - i. Instruct the client never to apply direct heat to the limb, such as with a heating pad or hot water, because the decreased sensitivity in the limb can cause burning.
 - j. Instruct the client to inspect the skin on the extremities daily and to report any signs of skin breakdown.
 - k. Instruct the client to avoid tobacco and caffeine because of their vasoconstrictive effects.
 - l. Instruct the client in the use of hemorheological and antiplatelet medications as prescribed.
4. Procedures to improve arterial blood flow
- a. Percutaneous transluminal angioplasty, with or without intravascular stent
 - b. Laser-assisted angioplasty
 - c. Atherectomy
 - d. Peripheral arterial bypass surgery:
Graft material is sutured above and below the occlusion to facilitate blood

flow around the occlusion. Inflow procedures bypass the occlusion above the superficial femoral arteries and include aortoiliac, aortofemoral, and axillofemoral bypasses; outflow procedures bypass the occlusion at or below the superficial femoral arteries and include femoropopliteal and femorotibial bypass (Fig. 52-12).

5. Preoperative interventions

- a. Assess baseline vital signs and peripheral pulses.
- b. Insert an IV line and urinary catheter as prescribed.
- c. Maintain a central venous catheter and/or arterial line if inserted.

6. Postoperative interventions

- a. Assess vital signs and notify the PHCP if changes occur.
- b. Monitor for hypotension, which may indicate hypovolemia
- c. Monitor for hypertension, which may place stress on the graft and cause clot formation.
- d. Maintain bed rest for 24 hours as prescribed.
- e. Instruct the client to keep the affected extremity straight, limit movement, and avoid bending the knee and hip.
- f. Monitor for warmth, redness, and edema, which often are expected outcomes because of increased blood flow.
- g. Monitor for vessel or graft occlusion, which often occurs within the first 24 hours.
- h. Assess peripheral pulses and for adverse changes in color and temperature of the extremity.
- i. Assess the incision for drainage, warmth, or swelling.
- j. Monitor for excessive bleeding (a small amount of bloody drainage is expected).
- k. Monitor the area over the graft for hardness, tenderness, and warmth, which may indicate infection; if this occurs, notify the PHCP immediately.

- l. Instruct the client about proper foot care and measures to prevent ulcer formation.
- m. Assist the client in modifying lifestyle to prevent further plaque formation.
- n. Following arterial revascularization, monitor for a sharp increase in pain, because pain is frequently the first indicator of postoperative graft occlusion. If signs of graft occlusion occur, notify the PHCP immediately.



B. Raynaud's disease

1. Description

- a. Raynaud's disease is vasospasm of the arterioles and arteries of the upper and lower extremities.
- b. Vasospasm causes constriction of the cutaneous vessels.
- c. Attacks occur with exposure to cold or stress.
- d. Affects primarily fingers, toes, ears, and cheeks

2. Assessment

- a. Blanching of the extremity, followed by cyanosis from vasoconstriction
- b. Reddened tissue when the vasospasm is relieved
- c. Numbness, tingling, swelling, and a cold temperature at the affected body part

3. Interventions

- a. Monitor pulses.
- b. Administer vasodilators as prescribed.
- c. Instruct the client regarding medication therapy.
- d. Assist the client to identify and avoid precipitating factors such as cold and stress.
- e. Instruct the client to avoid smoking.
- f. Instruct the client to wear warm clothing, socks, and gloves in cold weather.
- g. Advise the client to avoid injuries to fingers and hands.



C. Buerger's disease (thromboangiitis obliterans)

1. Description

- a. Buerger's disease is an occlusive disease of the median and small arteries and veins.
- b. The distal upper and lower limbs are affected most commonly.

2. Assessment

- a. Intermittent claudication
- b. Ischemic pain occurring in the digits while at rest
- c. Aching pain that is more severe at night
- d. Cool, numb, or tingling sensation
- e. Diminished pulses in the distal extremities
- f. Extremities that are cool and red in the dependent position
- g. Development of ulcerations in the extremities

3. Interventions: See Raynaud's disease

XVIII. Aortic Aneurysms

A. Description

1. An aortic aneurysm is an abnormal dilation of the arterial wall caused by localized weakness and stretching in the medial layer or wall of the aorta.
2. The aneurysm can be located anywhere along the abdominal aorta.
3. The goal of treatment is to limit the progression of the disease by modifying risk factors, controlling the BP to prevent strain on the aneurysm, recognizing symptoms early, and preventing rupture.

B. Types of aortic aneurysm

1. Fusiform: Diffuse dilation that involves the entire circumference of the arterial segment
2. Saccular: Distinct localized outpouching of the artery wall
3. Dissecting: Created when blood separates the layers of the artery wall, forming a cavity between them
4. False (pseudoaneurysm): Occurs when the clot and connective tissue are outside the arterial wall as a result of vessel injury or trauma to all 3 layers of the arterial wall.



C. Assessment

1. Thoracic aneurysm

- a. Pain extending to neck, shoulders, lower back, or abdomen
- b. Syncope
- c. Dyspnea

- d. Increased pulse
- e. Cyanosis
- f. Hoarseness, difficulty swallowing
because of pressure from the aneurysm

2. Abdominal aneurysm

- a. Prominent, pulsating mass in abdomen,
at or above the umbilicus
- b. Systolic bruit over the aorta
- c. Tenderness on deep palpation
- d. Abdominal or lower back pain



3. Rupturing aneurysm

- a. Severe abdominal or back pain
- b. Lumbar pain radiating to the flank and
groin
- c. Hypotension
- d. Increased pulse rate
- e. Signs of shock
- f. Hematoma at flank area

4. Diagnostic tests

- a. Diagnostic tests are done to confirm the
presence, size, and location of the
aneurysm.
- b. Tests include abdominal ultrasound,
computed tomography scan, and
arteriography.

5. Interventions

- a. Monitor vital signs.
- b. Obtain information regarding back or
abdominal pain.
- c. Question the client regarding the
sensation of pulsation in the abdomen.
- d. Check peripheral circulation, including
pulses, temperature, and color.
- e. Observe for signs of rupture.
- f. Note any tenderness over the abdomen.
- g. Monitor for abdominal distention.

6. Nonsurgical interventions

- a. Modify risk factors.
- b. Instruct the client regarding the
procedure for monitoring BP.
- c. Instruct the client on the importance of
regular PHCP visits to follow the size
of the aneurysm.
- d. Instruct the client that if severe back or
abdominal pain or fullness, soreness
over the umbilicus, sudden
development of discoloration in the

extremities, or a persistent elevation of BP occurs, to notify the PHCP immediately.



Instruct the client with an aortic aneurysm

to report immediately the occurrence of chest or back pain, shortness of breath, difficulty swallowing, or hoarseness.

D. Pharmacological interventions

1. Administer antihypertensives to maintain the BP within normal limits and to prevent strain on the aneurysm.
2. Instruct the client about the purpose of the medications.
3. Instruct the client about the side effects and schedule of the medication.



E. Abdominal aortic aneurysm resection

1. Description: Surgical resection or excision of the aneurysm; the excised section is replaced with a graft that is sewn end to end (Fig. 52-13).
2. Preoperative interventions
 - a. Assess all peripheral pulses as a baseline for postoperative comparison.
 - b. Instruct the client in coughing and deep-breathing exercises.
3. Postoperative interventions
 - a. Monitor vital signs.
 - b. Monitor peripheral pulses distal to the graft site.
 - c. Monitor for signs of graft occlusion, including changes in pulses, cool to cold extremities below the graft, white or blue extremities or flanks, severe pain, or abdominal distention.
 - d. Limit elevation of the head of the bed to 45 degrees to prevent flexion of the graft.
 - e. Monitor for hypovolemia and kidney failure resulting from significant blood loss during surgery.
 - f. Monitor urine output hourly, and notify the PHCP if it is lower than 30 to 50 mL/hr.
 - g. Monitor serum creatinine and blood urea nitrogen levels daily.
 - h. Monitor respiratory status and

- auscultate breath sounds to identify respiratory complications.
- i. Encourage turning, coughing and deep breathing, and splinting the incision.
 - j. Ambulate as prescribed.
 - k. Prepare the client for discharge by providing instructions regarding pain management, wound care, and activity restrictions.
 - l. Instruct the client not to lift objects heavier than 15 to 20 lb for 6 to 12 weeks.
 - m. Advise the client to avoid activities requiring pushing, pulling, or straining.
 - n. Instruct the client not to drive a vehicle until approved by the PHCP.
 - o. Endovascular aneurysm grafting involves insertion of a graft using a vascular catheter; it does not require an abdominal incision. The preoperative and postoperative care is similar to that of a surgical abdominal aneurysm repair.

F. Thoracic aneurysm repair

1. Description

- a. A thoracotomy or median sternotomy approach is used to enter the thoracic cavity.
- b. The aneurysm is exposed and excised, and a graft or prosthesis is sewn onto the aorta.
- c. Total cardiopulmonary bypass is necessary for excision of aneurysms in the ascending aorta.
- d. Partial cardiopulmonary bypass is used for clients with an aneurysm in the descending aorta.

2. Postoperative interventions

- a. Monitor vital signs and neurological and renal status.
- b. Monitor for signs of hemorrhage, such as a drop in BP and increased pulse rate and respirations, and report them to the PHCP immediately.
- c. Monitor chest tubes for an increase in chest drainage, which may indicate bleeding or separation at the graft site.

- d. Assess sensation and motion of all extremities and notify the PHCP if deficits are noted, which can occur because of a lack of blood supply to the spinal cord during surgery.
- e. Monitor respiratory status and auscultate breath sounds to identify respiratory complications.
- f. Encourage turning, coughing, and deep breathing while splinting the incision.
- g. Prepare the client for discharge by providing instructions regarding pain management, wound care, and activity restrictions.
- h. Instruct the client not to lift objects heavier than 15 to 20 lb for 6 to 12 weeks.
- i. Advise the client to avoid activities requiring pushing, pulling, or straining.
- j. Instruct the client not to drive a vehicle until approved by the PHCP.

XIX. Embolectomy

A. Description

1. Embolectomy is removal of an embolus from an artery, using a catheter.
2. A patch graft may be required to close the artery.

B. Preoperative interventions

1. Obtain a baseline vascular assessment.
2. Administer anticoagulants as prescribed.
3. Administer thrombolytics as prescribed.
4. Place a bed cradle on the bed to keep the weight of linens from causing pain and pressure.
5. Avoid bumping or jarring the bed.
6. Maintain the extremity in a slightly dependent position.



C. Postoperative interventions

1. Assess cardiac, respiratory, and neurological status.
2. Monitor affected extremity for color, temperature, and pulse.
3. Assess sensory and motor function of the affected extremity.
4. Monitor for signs and symptoms of new thrombi or emboli.
5. Administer oxygen as prescribed.
6. Monitor pulse oximetry.
7. Monitor for complications caused by reperfusion of

- the artery, such as spasms and swelling of the skeletal muscles.
8. Monitor for signs of swollen skeletal muscles such as edema, pain on passive movement, poor capillary refill, numbness, and muscle tenseness.
 9. Maintain bed rest initially, with the client in a semi-Fowler's position.
 10. Place a bed cradle on the bed.
 11. Check the incision site for bleeding or hematoma.
 12. Administer anticoagulants as prescribed.
 13. Monitor laboratory values related to anticoagulant therapy.
 14. Instruct the client to recognize the signs and symptoms of infection and edema.
 15. Instruct the client to avoid prolonged sitting or crossing the legs when sitting.
 16. Instruct the client to elevate the legs when sitting.
 17. Instruct the client to wear antiembolism stockings as prescribed and how to remove and reapply the stockings.
 18. Instruct the client to ambulate daily.



19. Instruct the client about anticoagulant therapy and the hazards associated with anticoagulants.

XX. Vena Cava Filter

- A. Vena cava filter: Insertion of an intracaval filter (umbrella) that partially occludes the inferior vena cava and traps emboli to prevent pulmonary emboli (Fig. 52-14)
- B. The filter is placed through a catheter placed in a large vein in the neck or groin and advanced to the inferior vena cava.
- C. Preoperative interventions: If the client has been taking an anticoagulant, consult with the PHCP regarding discontinuation of the medication preoperatively to prevent hemorrhage.



- D. Postoperative interventions: similar to care after embolectomy.



XXI. Hypertension

A. Description

1. For an adult (ages 18 years and older), a normal BP is a systolic BP below 120 mm Hg and a diastolic pressure below 80 mm Hg.
2. Elevated blood pressure is defined as a systolic BP between 120 and 129 mm Hg and a diastolic BP below 80 mm Hg.
3. Hypertension (Stage 1) is defined as an SBP between 130 and 139 mm Hg or a diastolic BP between 80 and

89 mm Hg.

4. Hypertension (Stage 2) is defined as a SBP at least 140 mm Hg or a diastolic BP at least 90 mm Hg.
5. If either the SBP or DBP is outside of a range, the higher measurement will determine the classification.
6. Hypertension is a major risk factor for coronary, cerebral, renal, and peripheral vascular disease.
7. The disease is initially asymptomatic.
8. The goals of treatment include reduction of the BP and preventing or lessening the extent of organ damage.
9. Nonpharmacological approaches, such as lifestyle changes, may be prescribed initially; if the BP cannot be decreased after 1 to 3 months, the client may require pharmacological treatment.

B. Primary or essential hypertension



1. Risk factors

- a. Aging
- b. Family history
- c. African American race
- d. Obesity
- e. Smoking
- f. Stress
- g. Excessive alcohol
- h. Hyperlipidemia
- i. Increased intake of salt or caffeine

C. Secondary hypertension

1. Secondary hypertension occurs as a result of other disorders or conditions.
2. Treatment depends on the cause and the organs involved.
3. Precipitating disorders or conditions
 - a. Cardiovascular disorders
 - b. Renal disorders
 - c. Endocrine system disorders
 - d. Pregnancy
 - e. Medications (e.g., estrogens, glucocorticoids, mineralocorticoids)



D. Assessment

1. May be asymptomatic
2. Headache
3. Visual disturbances
4. Dizziness
5. Chest pain
6. Tinnitus
7. Flushed face

8. Epistaxis

E. Interventions

1. Goals: To reduce the BP and to prevent or lessen the extent of organ damage
2. Question the client regarding the signs and symptoms of hypertension.
3. Obtain the BP 2 or more times on both arms, with the client supine and standing.
4. Compare the BP with prior documentation.
5. Determine family history of hypertension.
6. Identify current medication therapy.
7. Obtain weight.
8. Evaluate dietary patterns and sodium intake.
9. Assess for visual changes or retinal damage.
10. Assess for cardiovascular changes such as distended neck veins, increased heart rate, and dysrhythmias.
11. Evaluate chest x-ray for heart enlargement.
12. Assess the neurological system.
13. Evaluate renal function.
14. Evaluate results of diagnostic and laboratory studies.

F. Nonpharmacological interventions

1. Weight reduction, if necessary, or maintenance of ideal weight
2. Dietary sodium restriction to 2 g daily as prescribed
3. Moderate intake of alcohol and caffeine-containing products
4. Initiation of a regular exercise program
5. Avoidance of smoking
6. Relaxation techniques and biofeedback therapy
7. Elimination of unnecessary medications that may contribute to the hypertension

G. Pharmacological interventions

1. Medication therapy is individualized for each client, and the selection of the medication is based on such factors as the client's age, presence of coexisting conditions, severity of the hypertension, and client's preferences.
2. See [Chapter 53](#) for medications to treat hypertension.

H. See [Box 52-10](#) for client education.

XXII. Hypertensive Crisis

A. Description

1. A hypertensive crisis is an acute and life-threatening condition requiring immediate reduction in BP.
2. Emergency treatment is required, because target organ damage (brain, heart, kidneys, retina of the eye) can occur quickly.
3. Death can be caused by stroke, kidney failure, or cardiac disease.

B. Assessment

1. An extremely high BP; systolic over 180 mm Hg and/or diastolic over 120 mm Hg
2. Headache
3. Drowsiness and confusion
4. Blurred vision
5. Changes in neurological status
6. Tachycardia and tachypnea
7. Dyspnea
8. Cyanosis
9. Seizures

C. Interventions

1. Maintain a patent airway.
2. Administer antihypertensive medications intravenously as prescribed.
3. Monitor vital signs, assessing the BP every 5 minutes.
4. Monitor neurological status.
5. Maintain bed rest, with the head of the bed elevated at 45 degrees.
6. Assess for hypotension during the administration of antihypertensives; place the client in a supine position if hypotension occurs.
7. Have emergency medications and resuscitation equipment readily available.
8. Monitor IV therapy, assessing for fluid overload.
9. Insert a Foley catheter as prescribed.
10. Monitor intake and urinary output; if oliguria or anuria occurs, notify the PHCP.

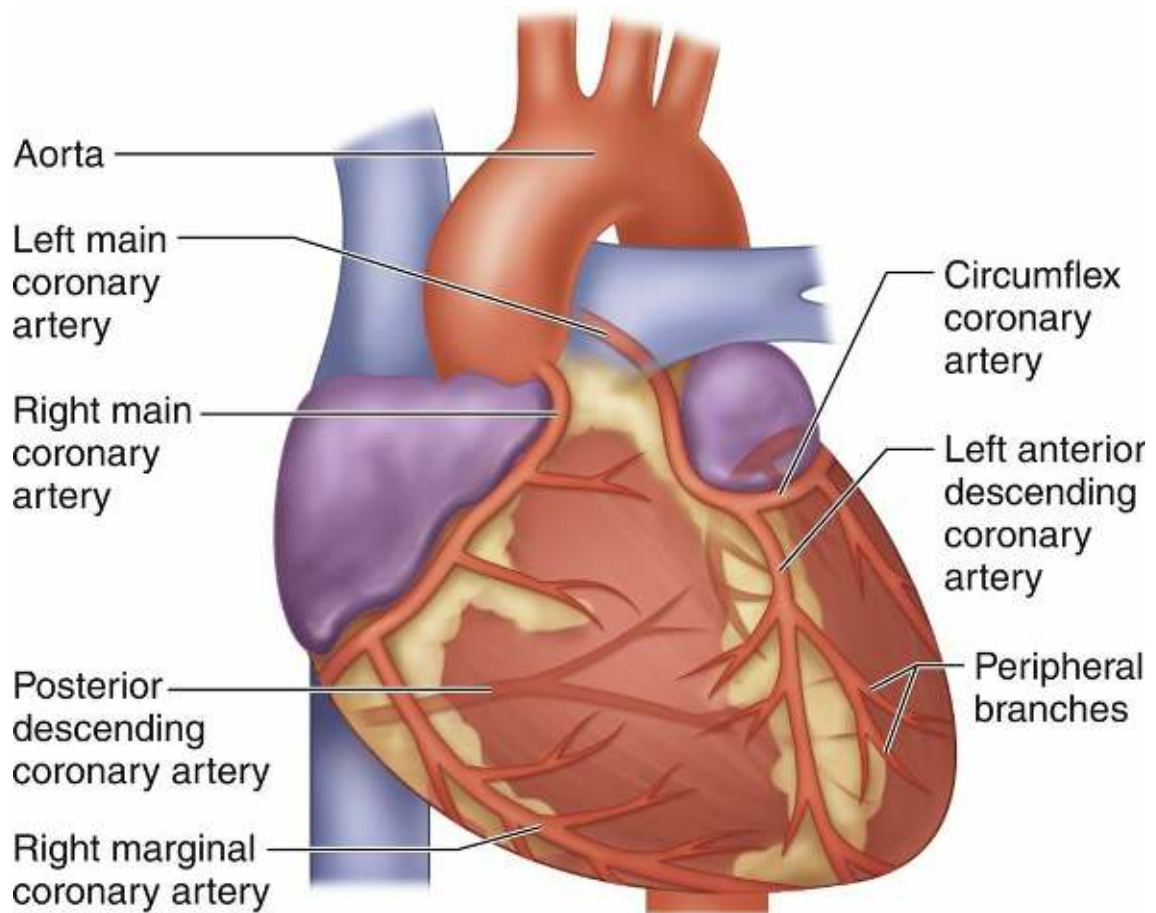


FIG. 52-1 Coronary arterial system.

Box 52-1

Basics of Electrocardiography

- An electrocardiogram (ECG) reflects the electrical activity of cardiac cells and records electrical activity at a speed of 25 mm/second.
- An electrocardiographic strip consists of horizontal lines representing seconds and vertical lines representing voltage.
- Each small square represents 0.04 second.
- Each large square represents 0.20 second.
- The P wave represents atrial depolarization.
- The PR interval represents the time it takes an impulse to travel from the atria through the atrioventricular node, bundle of His, and bundle branches to the Purkinje fibers.
- Normal PR interval duration ranges from 0.12 to 0.2 second.
- The PR interval is measured from the beginning of the P wave to the end of the PR segment.
- The QRS complex represents ventricular depolarization.

- Normal QRS complex duration ranges from 0.04 to 0.1 second.
- The Q wave appears as the first negative deflection in the QRS complex and reflects initial ventricular septal depolarization.
- The R wave is the first positive deflection in the QRS complex.
- The S wave appears as the second negative deflection in the QRS complex.
- The J point marks the end of the QRS complex and the beginning of the ST segment.
- The QRS duration is measured from the end of the PR segment to the J point.
- The ST segment represents early ventricular repolarization.
- The T wave represents ventricular repolarization and ventricular diastole.
- The U wave may follow the T wave.
- A prominent U wave may indicate an electrolyte abnormality, such as hypokalemia.
- The QT interval represents ventricular refractory time or the total time required for ventricular depolarization and repolarization.
- The QT interval is measured from the beginning of the QRS complex to the end of the T wave.
- The QT interval normally lasts 0.32 to 0.4 second but varies with the client's heart rate, age, and gender.

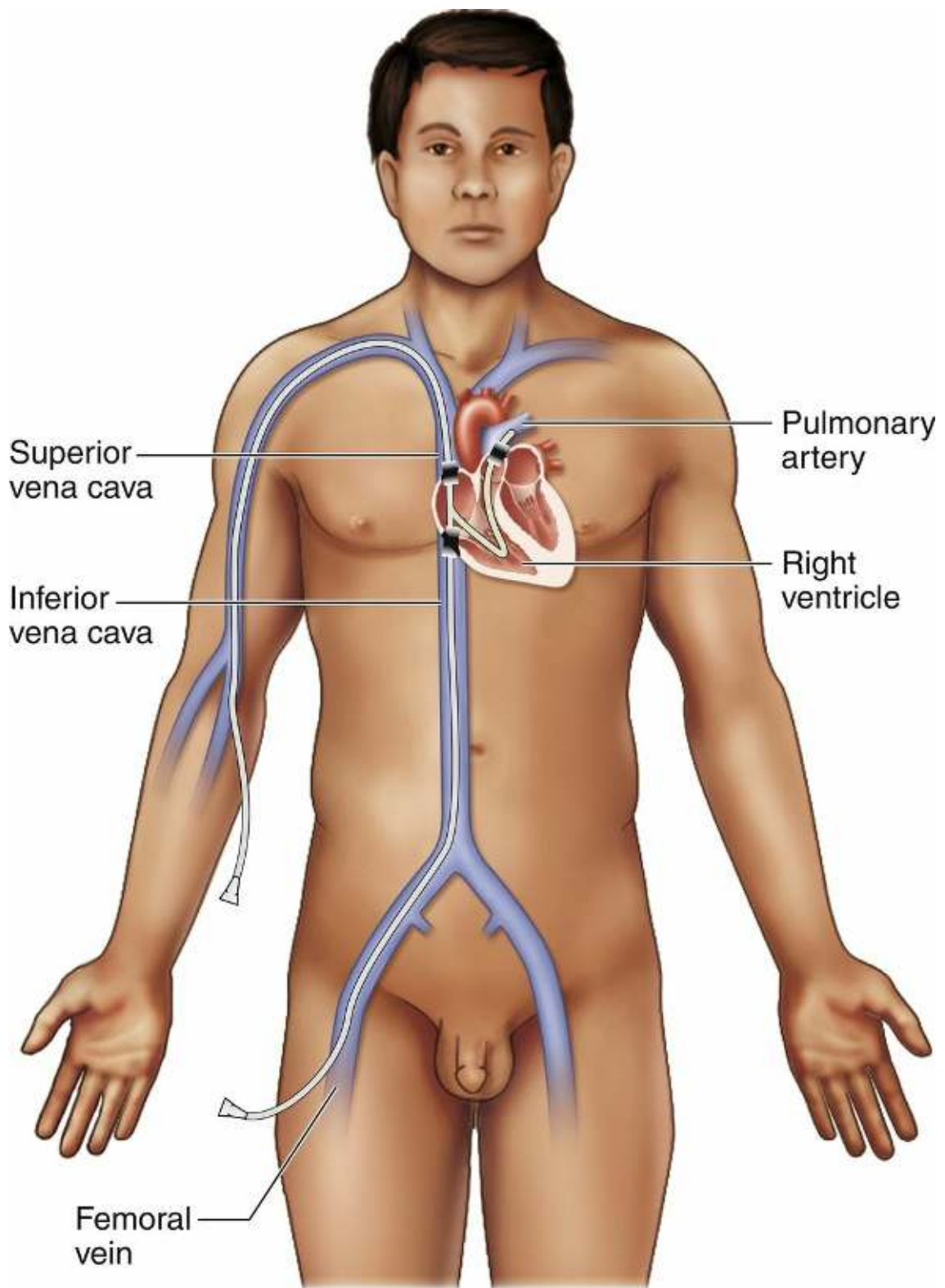


FIG. 52-2 Right-sided heart catheterization. The catheter is inserted into the femoral vein and advanced into the inferior vena cava (or, if into an antecubital or basilic vein, through the superior vena cava), right atrium, right ventricle, and pulmonary artery.

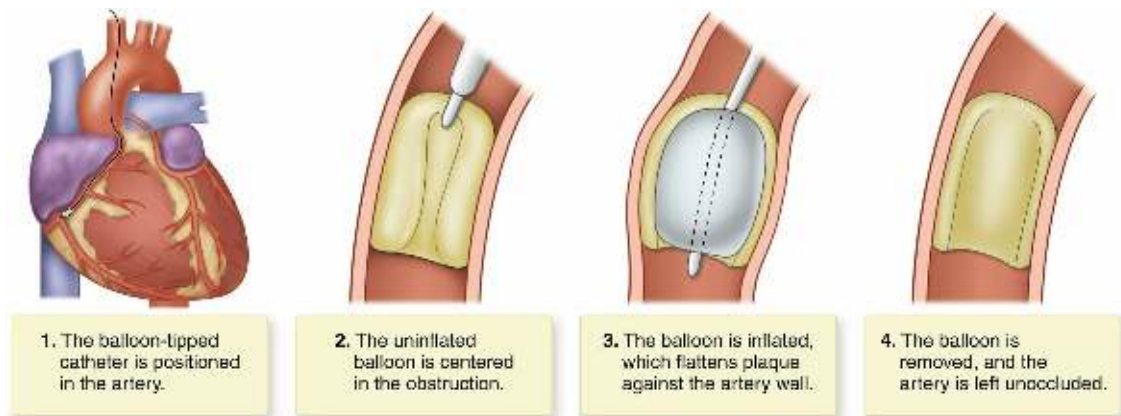


FIG. 52-3 Percutaneous transluminal coronary angioplasty.

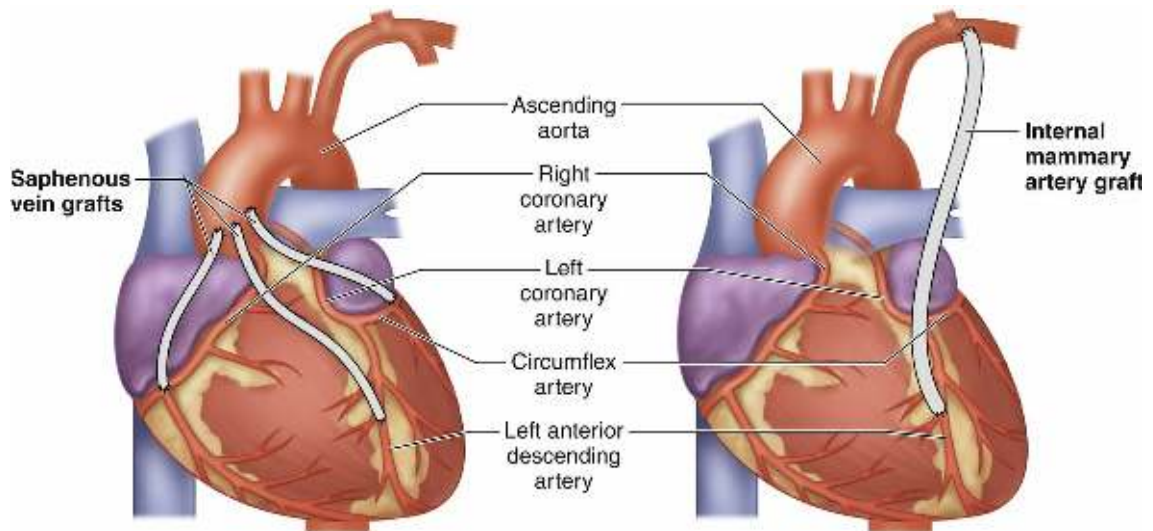


FIG. 52-4 Two methods of coronary artery bypass grafting. The procedure used depends on the nature of the coronary disease, the condition of the vessels available for grafting, and the client's health status.

Box 52-2

Home Care Instructions for the Client After Cardiac Surgery

- Progressive return to activities at home
- Limiting of pushing or pulling activities for 6 weeks following discharge
- Maintenance of incisional care and recording signs of redness, swelling, or drainage
- Sternotomy incision heals in about 6 to 8 weeks
- Avoidance of crossing legs; wearing elastic hose as prescribed until edema subsides, and elevating the surgical limb (if used to obtain the graft) when

sitting in a chair

- Use of prescribed medications
- Dietary measures, including the avoidance of saturated fats and cholesterol and the use of salt
- Resumption of sexual intercourse on the advice of the primary health care provider or cardiologist after exercise tolerance is assessed (usually, if the client can walk 1 block or climb 2 flights of stairs without symptoms, she or he can resume sexual activity safely)



FIG. 52-5 Normal sinus rhythm. Both atrial and ventricular rhythms are essentially regular (a slight variation in rhythm is normal). Atrial and ventricular rates are both 83 beats per minute. There is one P wave before each QRS complex, and all P waves are of a consistent morphology, or shape. The PR interval measures 0.18 seconds and is constant; the QRS complex measures 0.06 seconds and is constant.



FIG. 52-6 Each segment between the dark lines (above the monitor strip) represents 3 seconds when the monitor is set at a speed of 25 mm/second. To estimate the ventricular rate, count the QRS complexes in a 6-second strip and then multiply that number by 10 to estimate the heart rate for 1 minute. In this example, there are 9 QRS complexes in 6 seconds. Therefore, the heart rate can be estimated as 90 beats per minute.

Box 52-3

Determination of Heart Rate Using 6-Second Strip Method

- The method can be used to determine heart rate for regular and irregular rhythms.
- To determine atrial rate, count the number of P waves in 6 seconds and multiply by 10 to obtain a full minute rate.
- To determine ventricular rate, count the number of R waves or QRS complexes in 6 seconds and multiply by 10 to obtain a full minute rate.

- For accuracy, timing should begin on the P wave or the QRS complex and end exactly at 30 large blocks later.



FIG. 52-7 Atrial dysrhythmias—atrial fibrillation.



FIG. 52-8 Ventricular dysrhythmias—normal sinus rhythm with multifocal premature ventricular contractions (PVCs; one negative and the other positive).

Box 52-4

Premature Ventricular Contractions

Bigeminy: Premature ventricular contraction (PVC) every other heartbeat

Trigeminy: PVC every third heartbeat

Quadrigeminy: PVC every fourth heartbeat

Couplet or pair: Two sequential PVCs

Unifocal: Uniform upward or downward deflection, arising from the same ectopic focus

Multifocal: Different shapes, with the impulse generation from different sites

R-on-T phenomenon: PVC falls on the T wave of the preceding beat; may precipitate ventricular fibrillation

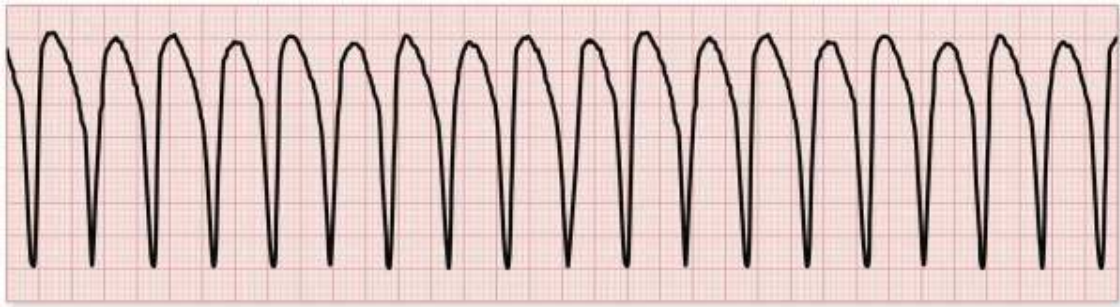


FIG. 52-9 Ventricular dysrhythmias—sustained ventricular tachycardia at a rate of 166 beats per minute.



FIG. 52-10 Ventricular dysrhythmias—coarse ventricular fibrillation.

Box 52-5

Pacemakers: Client Education

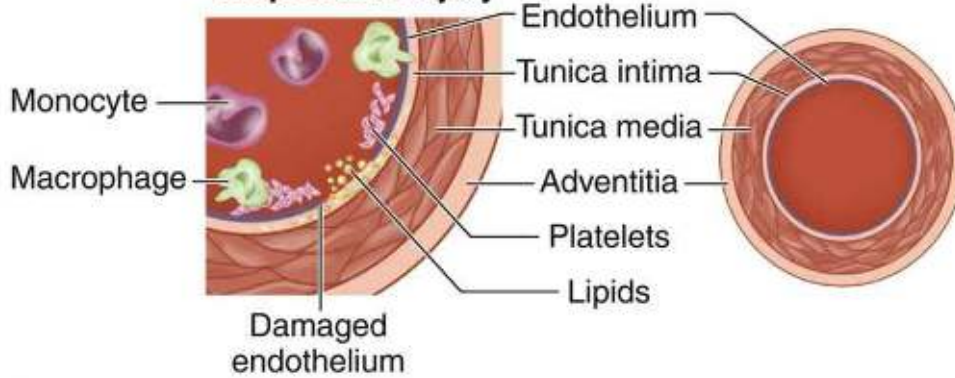
- Instruct the client about the pacemaker, including the programmed rate.
- Instruct the client in the signs of battery failure and when to notify the primary health care provider (PHCP) or cardiologist.
- Instruct the client to report any fever, redness, swelling, or drainage from the insertion site.
- Report signs of dizziness, weakness or fatigue, swelling of the ankles or legs, chest pain, or shortness of breath.
- Keep a pacemaker identification card in the wallet and obtain and wear a MedicAlert bracelet.
- Instruct the client in how to take the pulse, to take the pulse daily, and to maintain a diary of pulse rates.
- Wear loose-fitting clothing over the pulse generator site.
- Avoid contact sports.
- Inform all PHCPs that a pacemaker has been inserted.
- Instruct the client to inform airport security that she or he has a pacemaker, because the pacemaker may set off the security detector.
- Instruct the client that most electrical appliances can be used without any interference with the functioning of the pacemaker; however, advise the client not to operate electrical appliances directly over the pacemaker site.
- Avoid transmitter towers and antitheft devices in stores.

- Instruct the client that if any unusual feelings occur when near any electrical devices, to move 5 to 10 feet away and check the pulse.
- Instruct the client about the methods of monitoring the function of the device.
- Emphasize the importance of follow-up with the PHCP.
- Use cellphones on the side opposite the pacemaker.

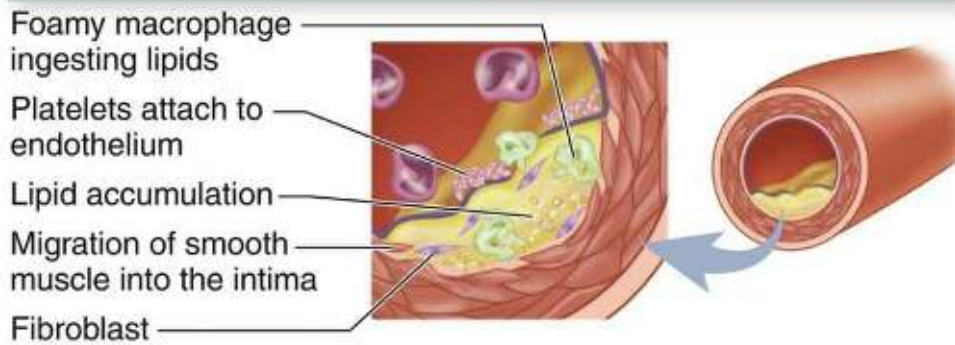
Chronic Causes of Endothelial Injury:

- Hemodynamic factors
- Hypertension
- Toxins
- Hyperhomocysteinemia
- Immune reactions
- Viruses
- Hyperlipidemia
- Smoking

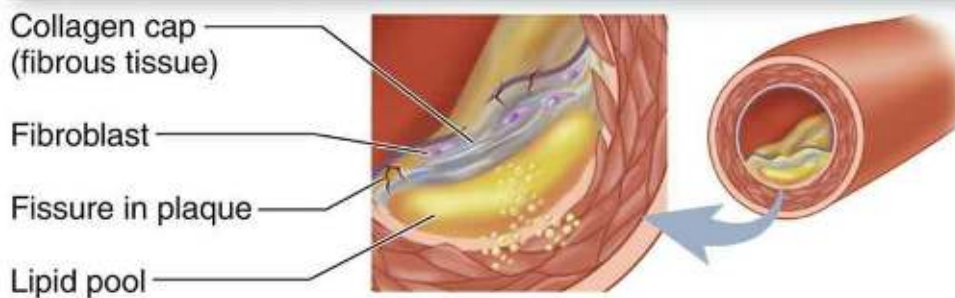
Response to injury



Fatty streak



Fibrous plaque



Complicated lesion

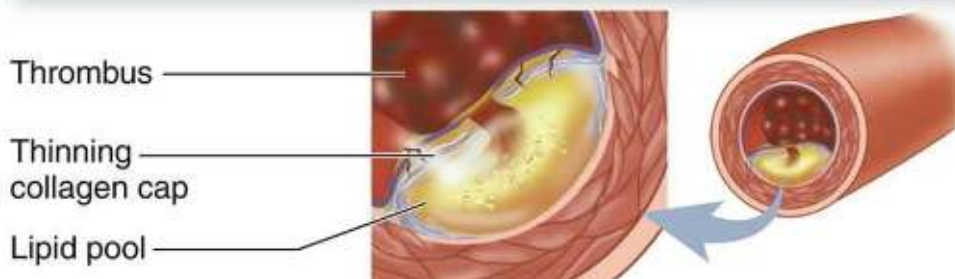


FIG. 52-11 Cross-sections of an atherosclerotic coronary artery.

Box 52-6

Complications of Myocardial Infarction

- Dysrhythmias
- Heart failure
- Pulmonary edema
- Cardiogenic shock
- Thrombophlebitis
- Pericarditis
- Mitral valve insufficiency
- Postinfarction angina
- Ventricular rupture
- Dressler’s syndrome (a combination of pericarditis, pericardial effusion, and pleural effusion, which can occur several weeks to months following a myocardial infarction)

Table 52-1

Clinical Manifestations of Right-Sided and Left-Sided Heart Failure

Right-Sided Heart Failure	Left-Sided Heart Failure
Dependent edema (legs and sacrum)	Signs of pulmonary congestion
Jugular venous distention	Dyspnea
Abdominal distention	Tachypnea
Hepatomegaly	Crackles in the lungs
Splenomegaly	Dry, hacking cough
Anorexia and nausea	Paroxysmal nocturnal dyspnea
Weight gain	Increased BP (from fluid volume excess) or decreased BP (from pump failure)
Nocturnal diuresis	
Swelling of the fingers and hands	
Increased BP (from fluid volume excess) or decreased BP (from pump failure)	

BP, Blood pressure.

Box 52-7

Home Care Instructions for the Client with Infective Endocarditis

- Teach the client to maintain aseptic technique during setup and administration

of intravenous (IV) antibiotics.

- Instruct the client to administer IV antibiotics at scheduled times to maintain the blood level.
- Instruct the client to monitor IV catheter sites for signs of infection and report this immediately to the primary health care provider (PHCP) or cardiologist.
- Instruct the client to record the temperature daily for up to 6 weeks and to report fever.
- Encourage oral hygiene at least twice a day with a soft toothbrush and rinse well with water after brushing.
- Client should avoid use of oral irrigation devices and flossing to avoid bacteremia.
- Teach the client to cleanse any skin lacerations thoroughly and apply an antibiotic ointment as prescribed.
- Client should inform all PHCPs of history of endocarditis and ask about the use of prophylactic antibiotics prior to invasive respiratory procedures and dentistry.
- Teach the client to observe for signs and symptoms of embolic conditions and heart failure.

Table 52-2

Aortic Valve Disorders

Aortic Stenosis	Aortic Insufficiency
Symptoms	
Dyspnea on exertion	Dyspnea
Angina	Angina
Syncope on exertion	Tachycardia
Fatigue	Fatigue
Orthopnea	Orthopnea
Paroxysmal nocturnal dyspnea	Paroxysmal nocturnal dyspnea
Harsh systolic crescendo-decrescendo murmur	Blowing decrescendo diastolic murmur
Interventions	
Refer to the section on repair procedures.	
Prepare the client for valve replacement as indicated.	

Table 52-3

Tricuspid Valve Disorders

Tricuspid Stenosis	Tricuspid Insufficiency
Symptoms	
Easily fatigued	Asymptomatic in mild situations
Effort intolerance	Signs of right ventricular failure, including ascites, hepatomegaly, peripheral edema
Reports fluttering sensations in the neck (obstructed venous flow)	Pleural effusion
Cyanosis	Systolic murmur heard at the left sternal border, fourth intercostal space
Signs of right ventricular failure, including ascites, hepatomegaly, peripheral edema, jugular vein distention with clear lung fields	
Symptoms of decreased cardiac output	
Rumbling diastolic murmur	
Interventions	
Refer to the section on repair procedures.	
Prepare the client for valve replacement as indicated.	

Table 52-4

Pulmonary Valve Disorders

Pulmonary Stenosis	Pulmonary Insufficiency
Symptoms	
Asymptomatic in a mild condition	Asymptomatic in mild condition
Dyspnea	Dyspnea
Fatigue	Fatigue
Syncope	Syncope
Signs of right ventricular failure, including ascites, hepatomegaly, peripheral edema	Signs of right ventricular failure, including ascites, hepatomegaly, peripheral edema
Systolic thrill heard at left sternal border	Systolic thrill heard at left sternal border
Interventions	
Refer to the section on repair procedures.	Refer to the section on repair procedures.
Prepare the client for pulmonary valve commissurotomy as indicated.	Prepare the client for pulmonary valve replacement as indicated.

Box 52-8

Client Instructions Following Valve Replacement

- Adequate rest is important, and fatigue is common.
- Anticoagulant therapy is necessary if a mechanical prosthetic valve has been inserted.
- Instruct the client concerning hazards related to anticoagulant therapy and to notify the primary health care provider (PHCP) or cardiologist if bleeding or excessive bruising occurs.
- Instruct the client concerning the importance of good oral hygiene to reduce the risk of infective endocarditis.
- Brush teeth twice daily with a soft toothbrush, followed by oral rinses.
- Avoid irrigation devices, electric toothbrushes, and flossing, because these

activities can cause the gums to bleed, allowing bacteria to enter the mucous membranes and bloodstream.

- Monitor incision and report any drainage or redness.
- Avoid any dental procedures for 6 months.
- Heavy lifting (more than 10 lb [4.5 kg]) is to be avoided, and exercise caution when in an automobile to prevent injury to the sternal incision.
- If a prosthetic valve was inserted, a soft, audible, clicking sound may be heard.
- Instruct the client concerning the importance of prophylactic antibiotics before any invasive procedure and the importance of informing all PHCPs of history of valve replacement or repair.
- Obtain and wear a MedicAlert bracelet.

Table 52-5**Pathophysiology, Signs and Symptoms, and Treatment of
Cardiomyopathies**

Hypertrophic Cardiomyopathy			
Dilated Cardiomyopathy	Nonobstructed	Obstructed	Restrictive Cardiomyopathy
Pathophysiology			
<ul style="list-style-type: none"> • Fibrosis of myocardium and endocardium • Dilated chambers • Mural wall thrombi prevalent 	<ul style="list-style-type: none"> • Hypertrophy of the walls • Hypertrophied septum • Relatively small chamber size 	<ul style="list-style-type: none"> • Same as for nonobstructed except for obstruction of left ventricular outflow tract associated with the hypertrophied septum and mitral valve incompetence 	<ul style="list-style-type: none"> • Mimics constrictive pericarditis • Fibrosed walls cannot expand or contract • Chambers narrowed; emboli common
Signs and Symptoms			
<ul style="list-style-type: none"> • Fatigue and weakness • Heart failure (left side) • Dysrhythmias or heart block • Systemic or pulmonary emboli • S₃ and S₄ gallops • Moderate to severe cardiomegaly 	<ul style="list-style-type: none"> • Dyspnea • Angina • Fatigue, syncope, palpitations • Mild cardiomegaly • S₄ gallop • Ventricular dysrhythmias • Sudden death common • Heart failure 	<ul style="list-style-type: none"> • Same as for nonobstructed except with mitral regurgitation murmur • Atrial fibrillation 	<ul style="list-style-type: none"> • Dyspnea and fatigue • Heart failure (right side) • Mild to moderate cardiomegaly • S₃ and S₄ gallops • Heart block • Emboli
Treatment			
<ul style="list-style-type: none"> • Symptomatic treatment of heart failure • Vasodilators • Control of dysrhythmias • Surgery: Heart transplant 	For both nonobstructed and obstructed: <ul style="list-style-type: none"> • Symptomatic treatment • Beta blockers • Conversion of atrial fibrillation • Surgery: Ventriculomyotomy or muscle resection with mitral valve replacement • Digoxin, nitrates, and other vasodilators contraindicated with the obstructed form 		<ul style="list-style-type: none"> • Supportive treatment of symptoms • Treatment of hypertension • Conversion from dysrhythmias • Exercise restrictions • Emergency treatment of acute pulmonary edema

Adapted from Ignatavicius D, Workman ML: *Medical-surgical nursing: patient-centered collaborative care*, ed 7, Philadelphia, 2013, Saunders.

Box 52-9**Instructions for the Client with Deep Vein Thrombophlebitis**

- Instruct the client concerning the hazards of anticoagulation therapy.
- Recognize the signs and symptoms of bleeding.
- Avoid prolonged sitting or standing, constrictive clothing, or crossing the legs when seated.
- Elevate the legs for 10 to 20 minutes every few hours each day.
- Plan a progressive walking program.
- Inspect the legs for edema, and measure the circumference of the legs.
- Wear antiembolism stockings as prescribed.
- Avoid smoking.
- Avoid any medications unless prescribed by the primary health care provider (PHCP) or cardiologist.
- Instruct the client concerning the importance of follow-up PHCP visits and laboratory studies.
- Obtain and wear a MedicAlert bracelet.

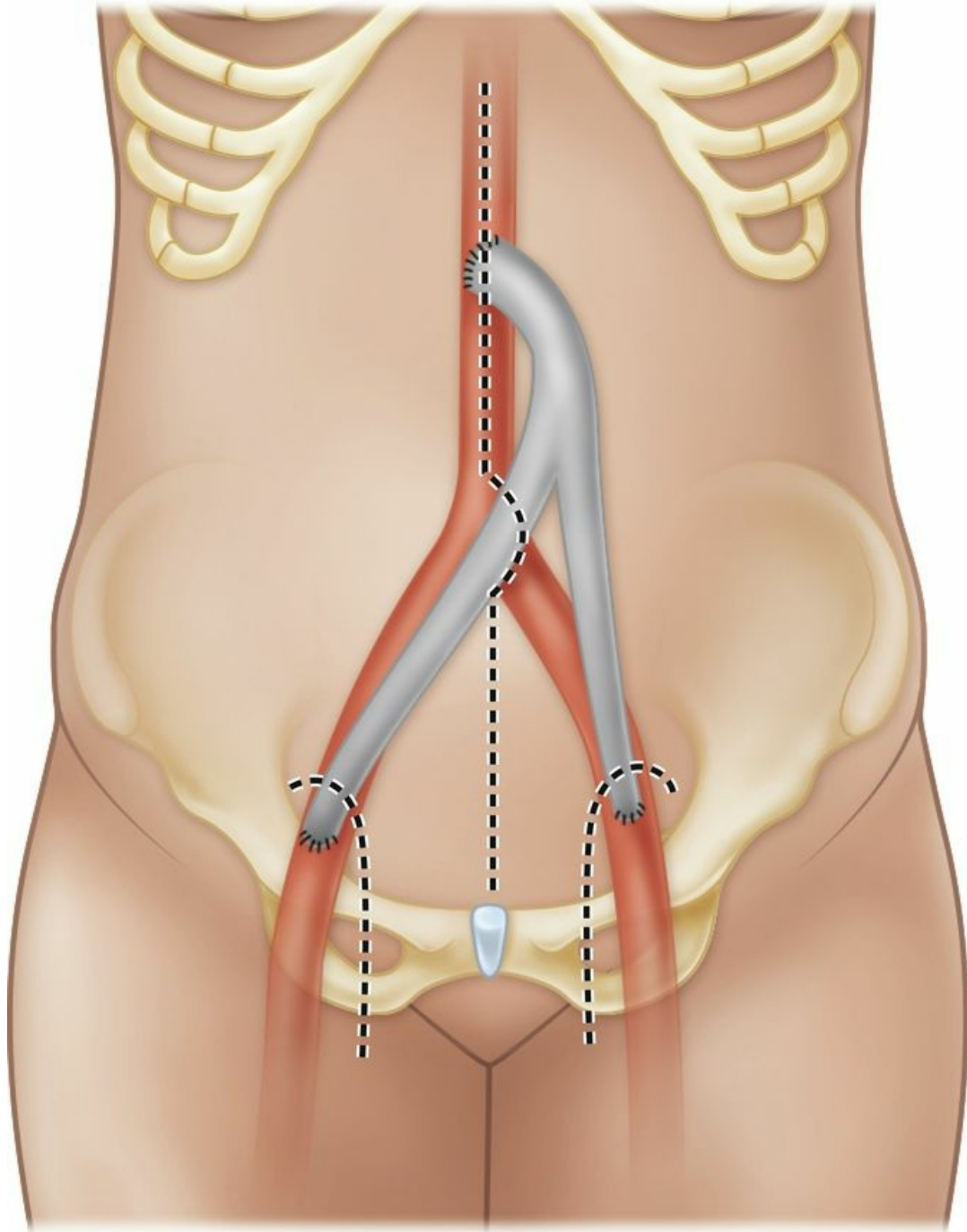


FIG. 52-12 In aortoiliac and aortofemoral bypass surgery, a midline incision into the abdominal cavity is required, with an additional incision in each groin.

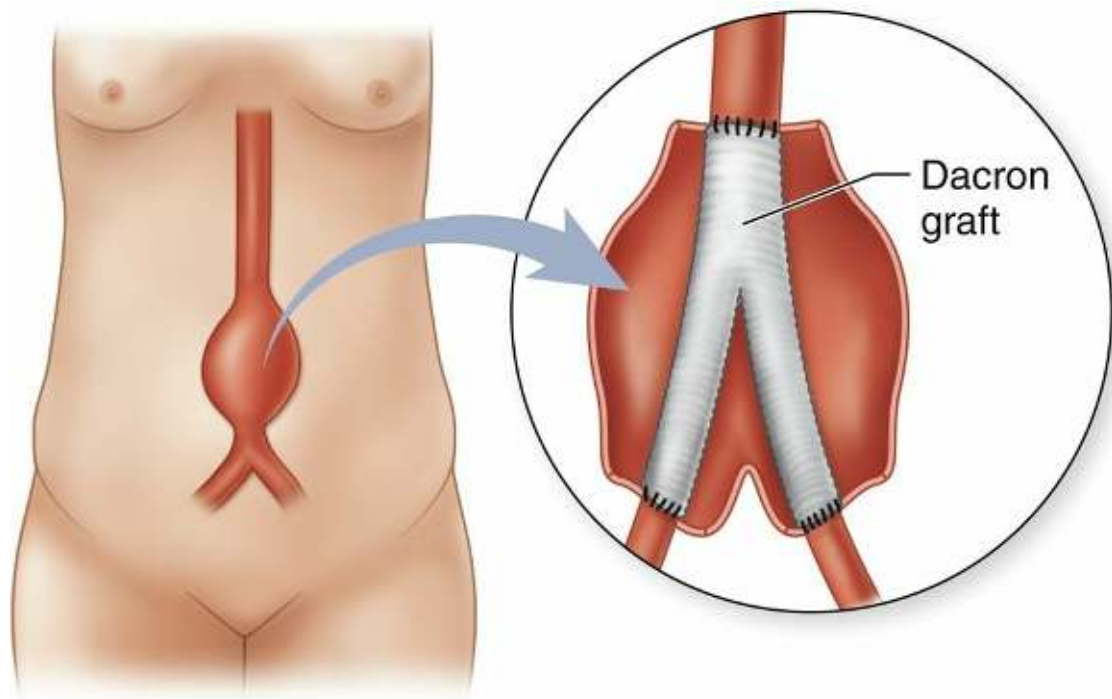


FIG. 52-13 Surgical repair of an abdominal aortic aneurysm with a woven Dacron graft.

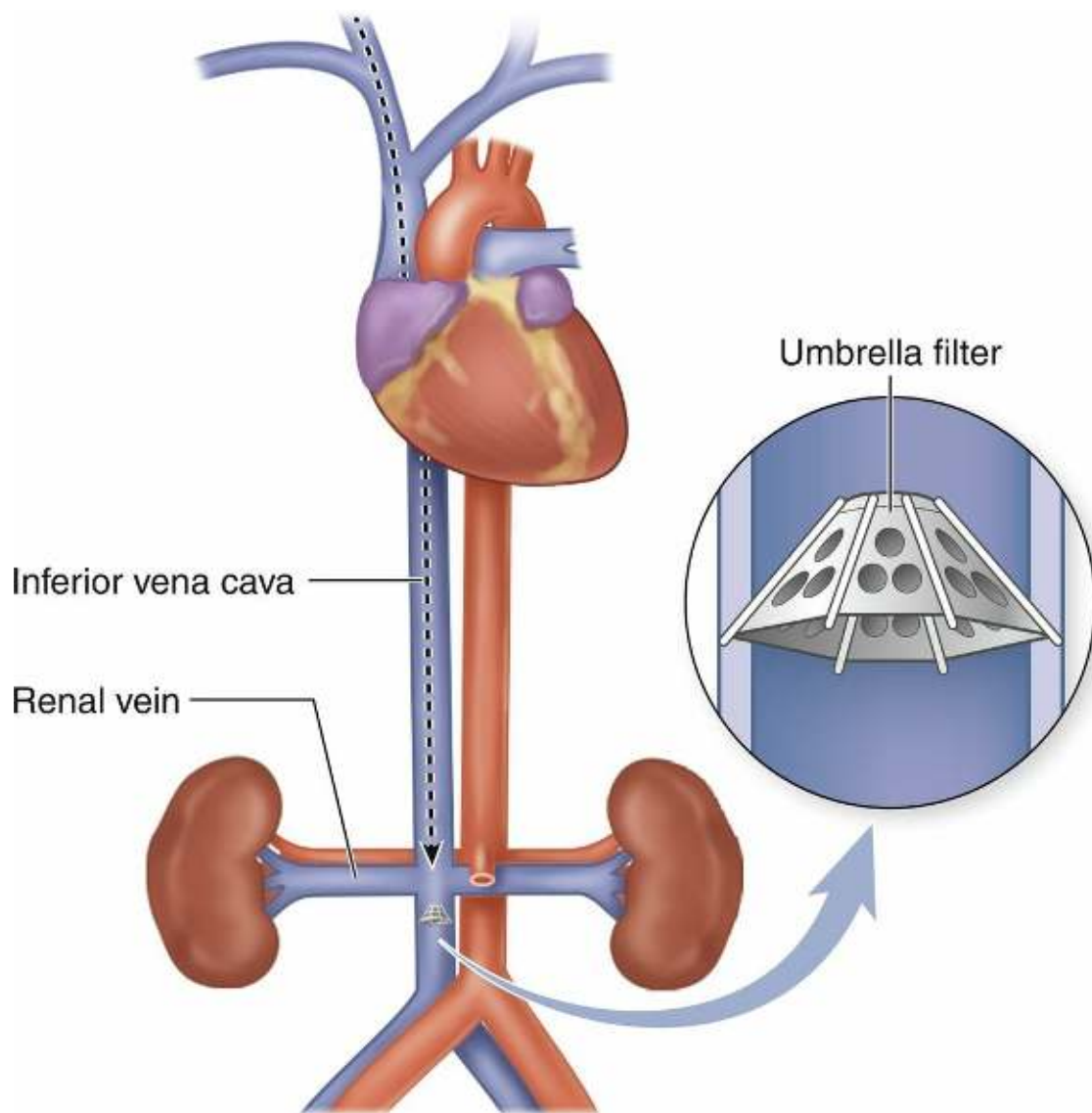


FIG. 52-14 An inferior vena cava filter.

Box 52-10

Education for the Client with Hypertension

- Describe the importance of adherence with the treatment plan.
- Describe the disease process, explaining that symptoms usually do not develop until organs have suffered damage.
- Initiate and assist the client in planning a regular exercise program, avoiding heavy weight-lifting and isometric exercises.
- Emphasize the importance of beginning the exercise program gradually.
- Encourage the client to express feelings about daily stress.

- Assist the client to identify ways to reduce stress.
- Teach relaxation techniques.
- Instruct the client in how to incorporate relaxation techniques into the daily living pattern.
- Instruct the client and family in the technique for monitoring blood pressure (BP).
- Instruct the client to maintain a diary of BP readings.
- Emphasize the importance of lifelong medication.
- Instruct the client and family about dietary restrictions, which may include sodium, fat, calories, and cholesterol.
- Instruct the client in how to shop for and prepare low-sodium meals.
- Provide a list of products that contain sodium.
- Instruct the client to read labels of products to determine sodium content, focusing on substances listed as sodium, NaCl, or MSG (monosodium glutamate).
- Instruct the client to bake, roast, or boil foods; avoid salt in preparation of foods; and avoid using salt at the table.
- Instruct the client that fresh foods are best to consume, and to avoid canned foods.
- Instruct the client about the actions, side effects, and scheduling of medications.
- Advise the client that if uncomfortable side effects occur, to contact the primary health care provider or cardiologist and not to stop the medication.
- Instruct the client to avoid over-the-counter medications.
- Stress the importance of follow-up care.

Priority Nursing Actions

Pulmonary Edema

1. Place the client in a high-Fowler's position.
2. Administer oxygen.
3. Assess the client quickly, including assessing lung sounds.
4. Ensure that an intravenous (IV) access device is in place.
5. Prepare for the administration of a diuretic and morphine sulfate.
6. Insert a Foley catheter as prescribed.
7. Prepare for intubation and ventilator support, if required.
8. Document the event, actions taken, and the client's response.

Practice Questions

600. A client is admitted to the emergency department with chest pain that is consistent with myocardial infarction based on elevated troponin levels.

Heart sounds are normal. The nurse should alert the primary health care provider because the vital sign changes and client assessment are **most** consistent with which complication? **Refer to chart.**

Client's Chart				
Time:	11:00 a.m.	11:15 a.m.	11:30 a.m.	11:45 a.m.
Pulse:	92 beats/min	96 beats/min	104 beats/min	118 beats/min
Respiratory rate:	24 breaths/min	26 breaths/min	28 breaths/min	32 breaths/min
Blood pressure:	140/88 mm Hg	128/82 mm Hg	104/68 mm Hg	88/58 mm Hg

1. Cardiogenic shock
 2. Cardiac tamponade
 3. Pulmonary embolism
 4. Dissecting thoracic aortic aneurysm
601. A client with a history of type 2 diabetes is admitted to the hospital with chest pain. The client is scheduled for a cardiac catheterization. Which medication would need to be withheld for 24 hours before the procedure and for 48 hours after the procedure?
1. Glipizide
 2. Metformin
 3. Repaglinide
 4. Regular insulin
602. A client in sinus bradycardia, with a heart rate of 45 beats per minute and blood pressure of 82/60 mm Hg, reports dizziness. Which intervention should the nurse anticipate will be prescribed?
1. Administer digoxin.
 2. Defibrillate the client.
 3. Continue to monitor the client.
 4. Prepare for transcutaneous pacing.
603. The nurse in a medical unit is caring for a client with heart failure. The client suddenly develops extreme dyspnea, tachycardia, and lung crackles. The nurse immediately asks another nurse to contact the primary health care provider and prepares to implement which **priority** interventions? **Select all that apply.**
1. Administering oxygen
 2. Inserting a Foley catheter
 3. Administering furosemide
 4. Administering morphine sulfate intravenously
 5. Transporting the client to the coronary care unit
 6. Placing the client in a low-Fowler's side-lying position
604. A client with myocardial infarction suddenly becomes tachycardic, shows signs of air hunger, and begins coughing frothy, pink-tinged sputum. Which finding would the nurse anticipate when auscultating the client's breath sounds?
1. Stridor

2. Crackles
 3. Scattered rhonchi
 4. Diminished breath sounds
605. A client with myocardial infarction is developing cardiogenic shock. What condition should the nurse carefully assess the client for?
1. Pulsus paradoxus
 2. Ventricular dysrhythmias
 3. Rising diastolic blood pressure
 4. Falling central venous pressure
606. A client who had cardiac surgery 24 hours ago has had a urine output averaging 20 mL/hr for 2 hours. The client received a single bolus of 500 mL of intravenous fluid. Urine output for the subsequent hour was 25 mL. Daily laboratory results indicate that the blood urea nitrogen level is 45 mg/dL (16 mmol/L) and the serum creatinine level is 2.2 mg/dL (194 mcmol/L). On the basis of these findings, the nurse would anticipate that the client is at risk for which problem?
1. Hypovolemia
 2. Acute kidney injury
 3. Glomerulonephritis
 4. Urinary tract infection
607. The nurse is reviewing an electrocardiogram rhythm strip. The P waves and QRS complexes are regular. The PR interval is 0.16 seconds, and QRS complexes measure 0.06 seconds. The overall heart rate is 64 beats per minute. Which action should the nurse take?
1. Check vital signs.
 2. Check laboratory test results.
 3. Monitor for any rhythm change.
 4. Notify the primary health care provider.
608. A client is wearing a continuous cardiac monitor, which begins to sound its alarm. The nurse sees no electrocardiographic complexes on the screen. Which is the **priority** nursing action?
1. Call a code.
 2. Check the client's status.
 3. Call the health care provider.
 4. Document the lack of complexes.
609. The nurse is watching the cardiac monitor and notices that a client's rhythm suddenly changes. There are no P waves, the QRS complexes are wide, and the ventricular rate is regular but more than 140 beats per minute. The nurse determines that the client is experiencing which dysrhythmia?
1. Sinus tachycardia
 2. Ventricular fibrillation
 3. Ventricular tachycardia
 4. Premature ventricular contractions
610. A client has frequent bursts of ventricular tachycardia on the cardiac monitor. What should the nurse be **most** concerned about with this dysrhythmia?
1. It can develop into ventricular fibrillation at any time.
 2. It is almost impossible to convert to a normal rhythm.

3. It is uncomfortable for the client, giving a sense of impending doom.
 4. It produces a high cardiac output with cerebral and myocardial ischemia.
611. A client is having frequent premature ventricular contractions. The nurse should place **priority** on assessment of which item?
1. Causative factors, such as caffeine
 2. Sensation of fluttering or palpitations
 3. Blood pressure and oxygen saturation
 4. Precipitating factors, such as infection
612. The client has developed atrial fibrillation, with a ventricular rate of 150 beats per minute. The nurse should assess the client for which associated signs and/or symptoms? **Select all that apply.**
1. Syncope
 2. Dizziness
 3. Palpitations
 4. Hypertension
 5. Flat neck veins
613. The nurse is watching the cardiac monitor, and a client's rhythm suddenly changes. There are no P waves; instead, there are fibrillatory waves before each QRS complex. How should the nurse interpret the client's heart rhythm?
1. Atrial fibrillation
 2. Sinus tachycardia
 3. Ventricular fibrillation
 4. Ventricular tachycardia
614. The nurse is assisting to defibrillate a client in ventricular fibrillation. After placing the pads on the client's chest and before discharging the device, which intervention is a **priority**?
1. Ensure that the client has been intubated.
 2. Set the defibrillator to the "synchronize" mode.
 3. Administer an amiodarone bolus intravenously.
 4. Confirm that the rhythm is ventricular fibrillation.
615. A client in ventricular fibrillation is about to be defibrillated. To convert this rhythm effectively, the monophasic defibrillator machine should be set at which energy level (in joules, J) for the first delivery?
1. 50 J
 2. 120 J
 3. 200 J
 4. 360 J
616. The nurse should evaluate that defibrillation of a client was **most** successful if which observation was made?
1. Arousable, sinus rhythm, blood pressure (BP) 116/72 mm Hg
 2. Nonarousable, sinus rhythm, BP 88/60 mm Hg
 3. Arousable, marked bradycardia, BP 86/54 mm Hg

4. Nonarousable, supraventricular tachycardia, BP 122/60 mm Hg
617. The nurse is evaluating a client's response to cardioversion. Which assessment would be the **priority**?
1. Blood pressure
 2. Airway patency
 3. Oxygen flow rate
 4. Level of consciousness
618. The nurse is caring for a client who has just had implantation of an automatic internal cardioverter-defibrillator. The nurse should assess which item based on **priority**?
1. Anxiety level of the client and family
 2. Activation status and settings of the device
 3. Presence of a MedicAlert card for the client to carry
 4. Knowledge of restrictions on postdischarge physical activity
619. A client's electrocardiogram strip shows atrial and ventricular rates of 110 beats per minute. The PR interval is 0.14 seconds, the QRS complex measures 0.08 seconds, and the PP and RR intervals are regular. How should the nurse interpret this rhythm?
1. Sinus tachycardia
 2. Sinus bradycardia
 3. Sinus dysrhythmia
 4. Normal sinus rhythm
620. The nurse is assessing the neurovascular status of a client who returned to the surgical nursing unit 4 hours ago after undergoing aortoiliac bypass graft. The affected leg is warm, and the nurse notes redness and edema. The pedal pulse is palpable. How should the nurse interpret the client's neurovascular status?
1. The neurovascular status is normal because of increased blood flow through the leg.
 2. The neurovascular status is moderately impaired, and the surgeon should be called.
 3. The neurovascular status is slightly deteriorating and should be monitored for another hour.
 4. The neurovascular status shows adequate arterial flow, but venous complications are arising.
621. The nurse is evaluating the condition of a client after pericardiocentesis performed to treat cardiac tamponade. Which observation would indicate that the procedure was **effective**?
1. Muffled heart sounds
 2. Client reports dyspnea
 3. A rise in blood pressure
 4. Jugular venous distention
622. The nurse is caring for a client who had a resection of an abdominal aortic aneurysm yesterday. The client has an intravenous (IV) infusion at a rate of 150 mL/hr, unchanged for the last 10 hours. The client's urine output for the last 3 hours has been 90, 50, and 28 mL (28 mL is most recent). The client's blood urea nitrogen level is 35 mg/dL (12.6 mmol/L), and the serum creatinine level is 1.8 mg/dL (159 μmol/L), measured this morning. Which

nursing action is the **priority**?

1. Check the serum albumin level.
 2. Check the urine specific gravity.
 3. Continue monitoring urine output.
 4. Call the primary health care provider (PHCP).
623. A client with variant angina is scheduled to receive an oral calcium channel blocker twice daily. Which statement by the client indicates the **need for further teaching**?
1. "I should notify my cardiologist if my feet or legs start to swell."
 2. "I am supposed to report to my cardiologist if my pulse rate decreases below 60."
 3. "Avoiding grapefruit juice will definitely be a challenge for me, since I usually drink it every morning with breakfast."
 4. "My spouse told me that since I have developed this problem, we are going to stop walking in the mall every morning."
624. The nurse notes that a client with sinus rhythm has a premature ventricular contraction that falls on the T wave of the preceding beat. The client's rhythm suddenly changes to one with no P waves, no definable QRS complexes, and coarse wavy lines of varying amplitude. How should the nurse interpret this rhythm?
1. Asystole
 2. Atrial fibrillation
 3. Ventricular fibrillation
 4. Ventricular tachycardia

Answers

600. *Answer:* 1

Rationale: Cardiogenic shock occurs with severe damage (more than 40%) to the left ventricle. Classic signs include hypotension; a rapid pulse that becomes weaker; decreased urine output; and cool, clammy skin. Respiratory rate increases as the body develops metabolic acidosis from shock. Cardiac tamponade is accompanied by distant, muffled heart sounds and prominent neck vessels. Pulmonary embolism presents suddenly with severe dyspnea accompanying the chest pain. Dissecting aortic aneurysms usually are accompanied by back pain.

Test-Taking Strategy: Note the **strategic word**, *most*. Recalling that the early serious complications of myocardial infarction include dysrhythmias, cardiogenic shock, and sudden death will direct you to the correct option. No information in the question is associated with the remaining options.

Level of Cognitive Ability: Synthesizing

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Analysis

Content Area: Complex Care: Shock

Health Problem: Adult Health: Cardiovascular: Shock

Priority Concepts: Clinical Judgment; Perfusion

Reference: Ignatavicius, Workman (2016), p. 741.

601. *Answer: 2*

Rationale: Metformin needs to be withheld 24 hours before and for 48 hours after cardiac catheterization because of the injection of contrast medium during the procedure. If the contrast medium affects kidney function, with metformin in the system the client would be at increased risk for lactic acidosis. The medications in the remaining options do not need to be withheld before and after cardiac catheterization.

Test-Taking Strategy: Eliminate glipizide and repaglinide first because they are **comparable or alike**. Although these medications may be withheld on the morning of the procedure because of the client's NPO (nothing by mouth) status, there is no indication for withholding the medication on the day prior to the procedure and postprocedure. Regular insulin may be administered if elevated blood glucose levels from infused intravenous solutions occur on the day of the procedure.

Level of Cognitive Ability: Analyzing

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Planning

Content Area: Pharmacology: Endocrine: Oral hypoglycemic

Health Problem: Adult Health: Cardiovascular: Coronary Artery Disease

Priority Concepts: Perfusion; Safety

Reference: Ignatavicius, Workman (2016), pp. 643, 1310.

602. *Answer: 4*

Rationale: Sinus bradycardia is noted with a heart rate less than 60 beats per minute. This rhythm becomes a concern when the client becomes symptomatic. Hypotension and dizziness are signs of decreased cardiac output. Transcutaneous pacing provides a temporary measure to increase the heart rate and thus perfusion in the symptomatic client. Defibrillation is used for treatment of pulseless ventricular tachycardia and ventricular fibrillation. Digoxin will further decrease the client's heart rate. Continuing to monitor the client delays necessary intervention.

Test-Taking Strategy: Focus on the **subject**, interventions for sinus bradycardia. Eliminate the option indicating to continue to monitor the client, because the client is symptomatic and requires intervention. Digoxin is eliminated because it will further decrease the client's heart rate. Defibrillation is used for treatment of pulseless ventricular tachycardia and ventricular fibrillation, so that option can be eliminated.

Level of Cognitive Ability: Applying

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Planning

Content Area: Complex Care: Emergency Situations/Management

Health Problem: Adult Health: Cardiovascular: Dysrhythmias

Priority Concepts: Gas Exchange; Perfusion

Reference: Ignatavicius, Workman (2016), p. 664.

603. *Answer: 1, 2, 3, 4*

Rationale: Extreme dyspnea, tachycardia, and lung crackles in a client with heart

failure indicate pulmonary edema, a life-threatening event. In pulmonary edema, the left ventricle fails to eject sufficient blood, and pressure increases in the lungs because of the accumulated blood. Oxygen is always prescribed, and the client is placed in a high-Fowler's position to ease the work of breathing. Furosemide, a rapid-acting diuretic, will eliminate accumulated fluid. A Foley catheter is inserted to measure output accurately. Intravenously administered morphine sulfate reduces venous return (preload), decreases anxiety, and also reduces the work of breathing. Transporting the client to the coronary care unit is not a priority intervention. In fact, this may not be necessary at all if the client's response to treatment is successful.

Test-Taking Strategy: Note the **strategic word**, *priority*, and focus on the client's diagnosis. Recall the pathophysiology associated with pulmonary edema and use the **ABCs—airway, breathing, and circulation**—to help determine priority interventions.

Level of Cognitive Ability: Synthesizing

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Implementation

Content Area: Complex Care: Emergency Situations/Management

Health Problem: Adult Health: Cardiovascular: Heart Failure

Priority Concepts: Gas Exchange; Perfusion

Reference: Ignatavicius, Workman (2016), pp. 688-689.

604. *Answer:* 2

Rationale: Pulmonary edema is characterized by extreme breathlessness, dyspnea, air hunger, and the production of frothy, pink-tinged sputum. Auscultation of the lungs reveals crackles. Rhonchi and diminished breath sounds are not associated with pulmonary edema. Stridor is a crowing sound associated with laryngospasm or edema of the upper airway.

Test-Taking Strategy: Focus on the **subject**, breath sounds characteristic of pulmonary edema. Recalling that fluid produces sounds that are called *crackles* will assist you in eliminating the incorrect options.

Level of Cognitive Ability: Analyzing

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Assessment

Content Area: Complex Care: Emergency Situations/Management

Health Problem: Adult Health: Cardiovascular: Myocardial Infarction

Priority Concepts: Gas Exchange; Perfusion

Reference: Ignatavicius, Workman (2016), p. 699.

605. *Answer:* 2

Rationale: Dysrhythmias commonly occur as a result of decreased oxygenation and severe damage to greater than 40% of the myocardium. Classic signs of cardiogenic shock as they relate to myocardial ischemia include low blood pressure and tachycardia. The central venous pressure would rise as the backward effects of the severe left ventricular failure became apparent. Pulsus paradoxus is a finding associated with cardiac tamponade.

Test-Taking Strategy: Focus on the **subject**, cardiogenic shock, and note the words *myocardial ischemia*. Recall that ischemia makes the myocardium irritable, producing dysrhythmias. Also, knowledge of the classic signs of shock helps eliminate the incorrect options.

Level of Cognitive Ability: Analyzing

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Assessment

Content Area: Complex Care: Emergency Situations/Management

Health Problem: Adult Health: Cardiovascular: Shock

Priority Concepts: Clinical Judgment; Perfusion

Reference: Ignatavicius, Workman (2016), p. 759.

606. *Answer:* 2

Rationale: The client who undergoes cardiac surgery is at risk for renal injury from poor perfusion, hemolysis, low cardiac output, or vasopressor medication therapy. Renal injury is signaled by decreased urine output and increased blood urea nitrogen (BUN) and creatinine levels. Normal reference levels are BUN, 10 to 20 mg/dL (3.6 to 7.1 mmol/L), and creatinine 0.6 to 1.2 mg/dL (53 to 106 μmol/L) for males and 0.5 to 1.1 mg/dL (44 to 97 μmol/L) for females. The client may need medications to increase renal perfusion and possibly could need peritoneal dialysis or hemodialysis. No data in the question indicate the presence of hypovolemia, glomerulonephritis, or urinary tract infection.

Test-Taking Strategy: Eliminate glomerulonephritis and urinary tract infection first because they are **comparable or alike** in that there are no data indicating infection or inflammation. Noting that the creatinine level is elevated and the minimal urinary response to the fluid bolus will assist you in eliminating hypovolemia.

Level of Cognitive Ability: Synthesizing

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Analysis

Content Area: Adult Health: Renal and Urinary

Health Problem: Adult Health: Cardiovascular: Coronary Artery Disease

Priority Concepts: Clinical Judgment; Perfusion

References: Ignatavicius, Workman (2016), p. 777; Lewis et al. (2014), p. 1102.

607. *Answer:* 3

Rationale: Normal sinus rhythm is defined as a regular rhythm, with an overall rate of 60 to 100 beats per minute. The PR and QRS measurements are normal, measuring between 0.12 and 0.20 seconds and 0.04 and 0.10 seconds, respectively. There are no irregularities in this rhythm currently, so there is no immediate need to check vital signs or laboratory results, or to notify the primary health care provider. Therefore, the nurse would continue to monitor the client for any rhythm change.

Test-Taking Strategy: Focus on the **subject**, electrocardiogram rhythm strip measurements. A baseline knowledge of normal electrocardiographic measurements is needed to answer this question. Focusing on the **data in the question** and recalling

the characteristics of normal sinus rhythm will help you prioritize your actions.

Level of Cognitive Ability: Analyzing

Client Needs: Physiological Integrity

Integrated Process: Nursing Process: Implementation

Content Area: Adult Health: Cardiovascular

Health Problem: Adult Health: Cardiovascular: Dysrhythmias

Priority Concepts: Clinical Judgment; Perfusion

Reference: Ignatavicius, Workman (2016), p. 656.

608. *Answer:* 2

Rationale: Sudden loss of electrocardiographic complexes indicates ventricular asystole or possibly electrode displacement. Accurate assessment of the client is necessary to determine the cause and identify the appropriate intervention. The remaining options are secondary to client assessment.

Test-Taking Strategy: Note the **strategic word**, *priority*. Use the **steps of the nursing process**. Always assess the client directly before taking any action related to equipment. The correct option is the only one that addresses assessment.

Level of Cognitive Ability: Applying

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Assessment

Content Area: Complex Care: Emergency Situations/Management

Health Problem: Adult Health: Cardiovascular: Dysrhythmias

Priority Concepts: Clinical Judgment; Perfusion

Reference: Lewis et al. (2014), p. 790.

609. *Answer:* 3

Rationale: Ventricular tachycardia is characterized by the absence of P waves, wide QRS complexes (longer than 0.12 seconds), and typically a rate between 140 and 180 impulses per minute. The rhythm is regular.

Test-Taking Strategy: Focus on the **subject**, the characteristics of an electrocardiogram pattern, and note the **data in the question**. Eliminate sinus tachycardia first, because there are no P waves. Premature ventricular contractions are isolated ectopic beats superimposed on an underlying rhythm, so that option is eliminated next. Recalling that there are no true QRS complexes with ventricular fibrillation will direct you to the correct option from those remaining.

Level of Cognitive Ability: Analyzing

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Assessment

Content Area: Complex Care: Emergency Situations/Management

Health Problem: Adult Health: Cardiovascular: Dysrhythmias

Priority Concepts: Clinical Judgment; Perfusion

Reference: Lewis et al. (2014), pp. 794, 799-800.

610. *Answer:* 1

Rationale: Ventricular tachycardia is a life-threatening dysrhythmia that results from an irritable ectopic focus that takes over as the pacemaker for the heart. Ventricular tachycardia can deteriorate into ventricular fibrillation at any time. Clients frequently experience a feeling of impending doom. The low cardiac output that results can lead quickly to cerebral and myocardial ischemia. Ventricular tachycardia is treated with antidysrhythmic medications, cardioversion (if the client is awake), or defibrillation (loss of consciousness).

Test-Taking Strategy: Note the **strategic word**, *most*. The option indicating that it is impossible to convert is incorrect and is eliminated first. From the remaining options, focusing on the **strategic word** will direct you to the correct option because this option identifies the life-threatening condition.

Level of Cognitive Ability: Analyzing

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Analysis

Content Area: Complex Care: Emergency Situations/Management

Health Problem: Adult Health: Cardiovascular: Dysrhythmias

Priority Concepts: Clinical Judgment; Perfusion

Reference: Ignatavicius, Workman (2016), p. 670.

611. *Answer:* 3

Rationale: Premature ventricular contractions can cause hemodynamic compromise. Therefore, the priority is to monitor the blood pressure and oxygen saturation. The shortened ventricular filling time can lead to decreased cardiac output. The client may be asymptomatic or may feel palpitations. Premature ventricular contractions can be caused by cardiac disorders; states of hypoxemia; any number of physiological stressors, such as infection, illness, surgery, or trauma; and intake of caffeine, nicotine, or alcohol.

Test-Taking Strategy: Note the **strategic word**, *priority*. Use the **ABCs—airway, breathing, and circulation**—to direct you to the correct option.

Level of Cognitive Ability: Analyzing

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Assessment

Content Area: Complex Care: Emergency Situations/Management

Health Problem: Adult Health: Cardiovascular: Dysrhythmias

Priority Concepts: Clinical Judgment; Perfusion

Reference: Lewis et al. (2014), p. 799.

612. *Answer:* 1, 2, 3

Rationale: The client with uncontrolled atrial fibrillation with a ventricular rate more than 100 beats per minute is at risk for low cardiac output because of loss of atrial kick. The nurse assesses the client for palpitations, chest pain or discomfort, hypotension, pulse deficit, fatigue, weakness, dizziness, syncope, shortness of breath, and distended neck veins. Hypertension and flat neck veins are not associated with the loss of cardiac output.

Test-Taking Strategy: Focus on the **subject**, signs and/or symptoms associated

with atrial fibrillation. Flat neck veins are normal or indicate hypovolemia, so this option can be eliminated. From the remaining options, think of the consequences of a falling cardiac output to direct you to the correct option.

Level of Cognitive Ability: Analyzing

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Assessment

Content Area: Complex Care: Emergency Situations/Management

Health Problem: Adult Health: Cardiovascular: Dysrhythmias

Priority Concepts: Clinical Judgment; Perfusion

Reference: Lewis et al. (2014), p. 707.

613. **Answer:** 1

Rationale: Atrial fibrillation is characterized by a loss of P waves and fibrillatory waves before each QRS complex. The atria quiver, which can lead to thrombus formation.

Test-Taking Strategy: Focus on the **subject**, interpreting a heart rhythm. Note the **data in the question**. Noting the words *There are no P waves* should direct you to the correct option. Loss of P waves is characteristic of this dysrhythmia.

Level of Cognitive Ability: Analyzing

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Assessment

Content Area: Complex Care: Emergency Situations/Management

Health Problem: Adult Health: Cardiovascular: Dysrhythmias

Priority Concepts: Clinical Judgment; Perfusion

Reference: Ignatavicius, Workman (2016), pp. 666-667.

614. **Answer:** 4

Rationale: Until the defibrillator is attached and charged, the client is resuscitated by using cardiopulmonary resuscitation. Once the defibrillator has been attached, the electrocardiogram is checked to verify that the rhythm is ventricular fibrillation or pulseless ventricular tachycardia. Leads also are checked for any loose connections. A nitroglycerin patch, if present, is removed. The client does not have to be intubated to be defibrillated. The machine is not set to the synchronous mode because there is no underlying rhythm with which to synchronize.

Test-Taking Strategy: Note the **strategic word**, *priority*. Focus on the **subject**, ventricular fibrillation. Note that the correct option directly addresses this subject and also addresses assessment of the client.

Level of Cognitive Ability: Analyzing

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Assessment

Content Area: Complex Care: Basic Life Support/Cardiopulmonary Resuscitation/Cardiac Arrest

Health Problem: Adult Health: Cardiovascular: Dysrhythmias

Priority Concepts: Perfusion; Safety

Reference: Lewis et al. (2014), pp. 801-802.

615. *Answer: 4*

Rationale: The energy level used for all defibrillation attempts with a monophasic defibrillator is 360 joules.

Test-Taking Strategy: Focus on the **subject**, monophasic defibrillation. As a general rule, though, remember that lower levels of energy are used for cardioversion and biphasic defibrillation. Higher levels are used in monophasic defibrillation.

Level of Cognitive Ability: Analyzing

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Implementation

Content Area: Complex Care: Basic Life Support/Cardiopulmonary Resuscitation/Cardiac Arrest

Health Problem: Adult Health: Cardiovascular: Dysrhythmias

Priority Concepts: Perfusion; Safety

Reference: Lewis et al. (2014), p. 802.

616. *Answer: 1*

Rationale: After defibrillation, the client requires continuous monitoring of electrocardiographic rhythm, hemodynamic status, and neurological status. Respiratory and metabolic acidosis develop during ventricular fibrillation because of lack of respiration and cardiac output. These can cause cerebral and cardiopulmonary complications. Arousable status, adequate BP, and a sinus rhythm indicate successful response to defibrillation.

Test-Taking Strategy: Note the **strategic word**, *most*. Eliminate the options that contain the word *nonarousable*. From the remaining options, select the correct option, because a sinus rhythm is a more successful response compared with marked bradycardia.

Level of Cognitive Ability: Evaluating

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Evaluation

Content Area: Complex Care: Basic Life Support/Cardiopulmonary Resuscitation/Cardiac Arrest

Health Problem: Adult Health: Cardiovascular: Dysrhythmias

Priority Concepts: Evidence; Perfusion

Reference: Ignatavicius, Workman (2016), p. 672.

617. *Answer: 2*

Rationale: Nursing responsibilities after cardioversion include maintenance first of a patent airway, and then oxygen administration, assessment of vital signs and level of consciousness, and dysrhythmia detection.

Test-Taking Strategy: Note the **strategic word**, *priority*. Use the **ABCs—airway, breathing, and circulation**—to direct you to the correct option.

Level of Cognitive Ability: Analyzing

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Assessment
Content Area: Adult Health: Cardiovascular
Health Problem: Adult Health: Cardiovascular: Dysrhythmias
Priority Concepts: Clinical Judgment; Perfusion
Reference: Ignatavicius, Workman (2016), p. 668.

618. *Answer:* 2

Rationale: The nurse who is caring for the client after insertion of an automatic internal cardioverter-defibrillator needs to assess device settings, similar to after insertion of a permanent pacemaker. Specifically, the nurse needs to know whether the device is activated, the heart rate cutoff above which it will fire, and the number of shocks it is programmed to deliver. The remaining options are also nursing interventions but are not the priority.

Test-Taking Strategy: Note the **strategic word**, *priority*. Use **Maslow's Hierarchy of Needs theory**. The correct option is the one that identifies the physiological need.

Level of Cognitive Ability: Analyzing

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Assessment

Content Area: Adult Health: Cardiovascular

Health Problem: Adult Health: Cardiovascular: Dysrhythmias

Priority Concepts: Perfusion; Safety

Reference: Lewis et al. (2014), p. 803.

619. *Answer:* 1

Rationale: Sinus tachycardia has the characteristics of normal sinus rhythm, including a regular PP interval and normal-width PR and QRS intervals; however, the rate is the differentiating factor. In sinus tachycardia, the atrial and ventricular rates are greater than 100 beats per minute.

Test-Taking Strategy: Focus on the **subject**, interpreting a cardiac rhythm. Eliminate sinus bradycardia and normal sinus rhythm first, because the ventricular rate is 110 beats per minute. Next eliminate sinus dysrhythmia, because this is an irregular rhythm, with changing PP and RR intervals.

Level of Cognitive Ability: Analyzing

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Assessment

Content Area: Adult Health: Cardiovascular

Health Problem: Adult Health: Cardiovascular: Dysrhythmias

Priority Concepts: Clinical Judgment; Perfusion

Reference: Ignatavicius, Workman (2016), pp. 662-663.

620. *Answer:* 1

Rationale: An expected outcome of aortoiliac bypass graft surgery is warmth, redness, and edema in the surgical extremity because of increased blood flow. The remaining options are incorrect interpretations.

Test-Taking Strategy: Focus on the **subject**, expected outcomes following aortoiliac bypass graft surgery. Venous complications from immobilization resulting from surgery would not be apparent within 4 hours, so eliminate option 4. From the remaining options, note that the pedal pulse is unchanged from admission and think about the effects of sudden reperfusion in an ischemic limb. There would be redness from new blood flow and edema from the sudden change in pressure in the blood vessels.

Level of Cognitive Ability: Synthesizing

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Assessment

Content Area: Adult Health: Cardiovascular

Health Problem: Adult Health: Cardiovascular: Vascular disorders

Priority Concepts: Clinical Judgment; Perfusion

Reference: Lewis et al. (2014), p. 839.

621. *Answer:* 3

Rationale: Following pericardiocentesis, the client usually expresses immediate relief. Heart sounds are no longer muffled or distant and blood pressure increases. Distended neck veins are a sign of increased venous pressure, which occurs with cardiac tamponade.

Test-Taking Strategy: Focus on the **subject**, expected outcome following pericardiocentesis, and note the **strategic word**, *effective*. Successful therapy is measured by the disappearance of the original signs and symptoms of cardiac tamponade. This will direct you to the correct option.

Level of Cognitive Ability: Evaluating

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Evaluation

Content Area: Complex Care: Emergency Situations/Management

Health Problem: Adult Health: Cardiovascular: Cardiac Tamponade

Priority Concepts: Evidence; Perfusion

Reference: Lewis et al. (2014), pp. 815-816.

622. *Answer:* 4

Rationale: Following abdominal aortic aneurysm resection or repair, the nurse monitors the client for signs of acute kidney injury. Acute kidney injury can occur because often much blood is lost during the surgery and, depending on the aneurysm location, the renal arteries may be hypoperfused for a short period during surgery. Normal reference levels are BUN 10 to 20 mg/dL (3.6 to 7.1 mmol/L), and creatinine 0.6 to 1.2 mg/dL (53 to 106 mcmmol/L) for males and 0.5 to 1.1 mg/dL (44 to 97 mcmmol/L) for females. Continuing to monitor urine output or checking other parameters can wait. Urine output lower than 30 mL/hr is reported to the PHCP for urgent treatment

Test-Taking Strategy: Note the **strategic word**, *priority*. Focus on the **data in the question** and the abnormal assessment data. This question indicates elevations in blood urea nitrogen and creatinine levels and a significant drop in hourly urine

output. These assessment findings should direct you to an option that includes active collaboration with the PHCP.

Level of Cognitive Ability: Synthesizing

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Implementation

Content Area: Complex Care—Emergency Situations/Management

Health Problem: Adult Health: Cardiovascular: Vascular Disorders

Priority Concepts: Clinical Judgment; Perfusion

Reference: Lewis et al. (2014), pp. 841-843.

623. *Answer:* 4

Rationale: Variant angina, or Prinzmetal's angina, is prolonged and severe and occurs at the same time each day, most often at rest. The pain is a result of coronary artery spasm. The treatment of choice is usually a calcium channel blocker, which relaxes and dilates the vascular smooth muscle, thus relieving the coronary artery spasm in variant angina. Adverse effects can include peripheral edema, hypotension, bradycardia, and heart failure. Grapefruit juice interacts with calcium channel blockers and should be avoided. If bradycardia occurs, the client should contact the primary health care provider or cardiologist. Clients should also be taught to change positions slowly to prevent orthostatic hypotension. Physical exertion does not cause this type of angina; therefore, the client should be able to continue morning walks with her or his spouse.

Test-Taking Strategy: Note the **strategic words**, *need for further teaching*, and focus on the **data in the question**. These words indicate a **negative event query** and the need to select the incorrect client statement. Recall that walking is a low-impact exercise and is usually recommended for clients with heart problems.

Level of Cognitive Ability: Evaluating

Client Needs: Physiological Integrity

Integrated Process: Teaching and Learning

Content Area: Adult Health: Cardiovascular

Health Problem: Adult Health: Cardiovascular: Coronary artery disease

Priority Concepts: Client Education; Safety

Reference: Ignatavicius, Workman (2016), pp. 759, 763.

624. *Answer:* 3

Rationale: Ventricular fibrillation is characterized by irregular chaotic undulations of varying amplitudes. Ventricular fibrillation has no measurable rate and no visible P waves or QRS complexes and results from electrical chaos in the ventricles.

Test-Taking Strategy: Focus on the **subject**, the characteristics of ventricular fibrillation. Note the words, *no definable QRS complexes*. The lack of visible QRS complexes eliminates atrial fibrillation and ventricular tachycardia. Recalling that asystole is lack of any electrical activity of the heart will direct you to the correct option.

Level of Cognitive Ability: Analyzing

Client Needs: Physiological Integrity

Integrated Process: Nursing Process—Assessment

Content Area: Complex Care: Emergency Situations/Management

Health Problem: Adult Health: Cardiovascular: Dysrhythmias

Priority Concepts: Clinical Judgment; Perfusion

Reference: Ignatavicius, Workman (2016), pp. 670-671.