chapter 41

# Antianginal and Peripheral Vasodilating Drugs

## Key Terms

*angina*
*atherosclerosis*
*buccal*
*intermittent claudication*
*lumen*
*prophylaxis*
*sublingual*
*topical*
*transdermal systems*
*vasodilatation*

## Chapter Objectives

*On completion of this chapter, the student will:*

- List the two types of antianginal drugs.
- Discuss the general actions, uses, adverse reactions, contraindications, precautions, and interactions of antianginal and peripheral vasodilating drugs.
- Discuss important preadministration and ongoing assessment activities the nurse should perform on the patient taking an antianginal or peripheral vasodilating drug.
- List some nursing diagnoses particular to a patient taking an antianginal or peripheral vasodilating drug.
- Discuss ways to promote an optimal response to therapy, how to manage common adverse reactions, and important points to keep in mind when educating patients about the use of antianginal and peripheral vasodilating drugs.

Diseases of the arteries can cause serious problems, namely coronary artery disease, cerebral vascular disease, and peripheral vascular disease. Drug therapy for vascular diseases may include drugs that dilate blood vessels and thereby increase blood supply to an area.

**Atherosclerosis** is a disease characterized by deposits of fatty plaques on the inner wall of arteries. These deposits result in a narrowing of the **lumen** (inside diameter) of the artery and a decrease in blood supply to the area served by the artery.

This chapter discusses two different types of drugs whose primary purpose is to increase blood supply to an area by dilating blood vessels: the antianginal and peripheral vasodilating drugs. Vasodilating drugs relax the smooth muscle layer of arterial blood vessels, which results in **vasodilatation,** an increase in the size of blood vessels, primarily small arteries and arterioles. Because peripheral, cerebral, or coronary artery disease usually results in decreased blood flow to an area, drugs that dilate narrowed arterial blood vessels will carry more blood, followed by an increase in blood flow to the affected area. Increasing the blood flow to an area may result in complete or partial relief of symptoms. Vasodilating drugs sometimes relieve the symptoms of vascular disease, but in some cases drug therapy provides only minimal and temporary relief. Many of the vasodilating drugs are also used to treat hypertension. Their use as antihypertensives is discussed in Chapter 42.

## ANTIANGINAL DRUGS

**Angina** is a disorder characterized by atherosclerotic plaque formation in the coronary arteries, which causes decreased oxygen supply to the heart muscle and results in chest pain or pressure. Any activity that increases the workload of the heart, such as exercise or simply climbing stairs, can precipitate an angina attack. Antianginal drugs relieve chest pain or pressure by dilating coronary arteries, increasing the blood supply to the myocardium.

The antianginal drugs include the nitrates and the calcium channel blockers. Chapter 23 and its Summary Drug Table: Adrenergic Blocking Drugs discuss the adrenergic blocking drugs that are also used to treat angina and other disorders.

## ACTIONS

### Nitrates

The nitrates, such as isosorbide (Isordil) and nitroglycerin, have a direct relaxing effect on the smooth muscle layer of blood vessels. The result of this effect is an increase in the lumen of the artery or arteriole and an increase in the amount of blood flowing through these vessels. An increased blood flow results in an increase in the oxygen supply to surrounding tissues.

### Calcium Channel Blockers

Systemic and coronary arteries are influenced by movement of calcium across cell membranes of vascular smooth muscle. The contractions of cardiac and vascular smooth muscle depend on movement of extracellular calcium ions into these walls through specific ion channels. Calcium channel blockers, such as amlodipine (Norvasc), diltiazem (Cardizem), nicardipine (Cardene), nifedipine (Procardia), and verapamil (Calan), inhibit the movement of calcium ions across cell membranes. This results in less calcium available for the transmission of nerve impulses (Fig. 41-1). This drug action of the calcium channel blockers (also known as slow channel blockers) has several effects on the heart, including an effect on the smooth muscle of arteries and arterioles. These drugs dilate coronary arteries and arterioles, which in turn deliver more oxygen to cardiac muscle. Dilation of peripheral arteries reduces the workload of the heart. The end effect of these drugs is the same as that of the nitrates.

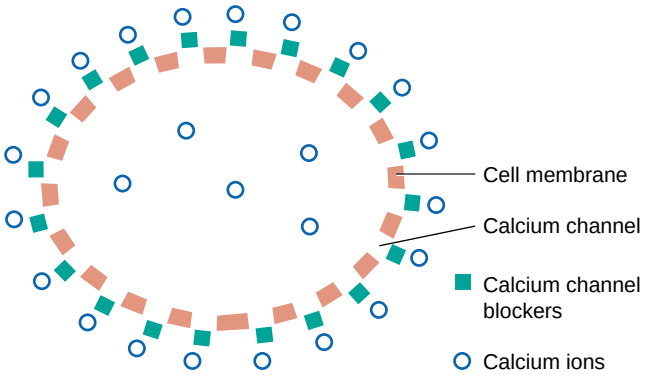


**FIGURE 41-1** Calcium channel blockers inhibit the movement of calcium ions across the cell membrane. When calcium channels are blocked by drug molecules, muscle contraction is decreased, causing the smooth muscles of the arteries and arterioles to dilate.

## USES

### Nitrates

The nitrates are used to treat angina pectoris. Some of these drugs, such as isosorbide dinitrate (Isordil), are used for **prophylaxis** (prevention) and long-term treatment of angina, whereas others, such as sublingual nitroglycerin (Nitrostat), are used to relieve the pain of acute anginal attacks when they occur. See the Summary Drug Table: Antianginal Drugs for additional uses of the nitrates. Intravenous nitroglycerin is used to control perioperative hypertension associated with surgical procedures.

### Calcium Channel Blockers

Calcium channel blockers are primarily used to prevent anginal pain associated with certain forms of angina, such as vasospastic (Prinzmetal's variant) angina and chronic stable angina. They are not used to abort (stop) anginal pain once it has occurred. When angina is caused by coronary artery spasm, these drugs are recommended when the patient cannot tolerate therapy with the beta (β)-adrenergic blocking drugs (see Chap. 23) or the nitrates. Calcium channel blockers used as antianginals are listed in the Summary Drug Table: Antianginal Drugs. Some calcium channel blocking drugs have additional uses. Verapamil affects the conduction system of the heart and may be used to treat cardiac arrhythmias. Diltiazem, nicardipine, nifedipine, and verapamil also are used in the treatment of essential hypertension (see Chap. 42).

## ADVERSE REACTIONS

### Nitrates

The nitrate antianginal drugs all have the same adverse reactions, although the intensity of some reactions may vary with the drug and the dose. A common adverse reaction seen with these drugs is headache, especially early in therapy. Hypotension, dizziness, vertigo, and weakness may also be associated with headache. Flushing caused by dilatation of small capillaries near the surface of the skin may also be seen.

The nitrates are available in various forms (eg, sublingual, transmucosal, translingual spray, and inhalation). Some adverse reactions are a result of the method of administration. For example, sublingual nitroglycerin may cause a local burning or tingling in the oral cavity. However, the patient must be aware that an absence of this effect does not indicate a decrease in the drug's potency. Contact dermatitis may occur from use of the transdermal delivery system.

## SUMMARY DRUG TABLE ANTIANGINAL DRUGS

| GENERIC NAME | TRADE NAME* | USES | ADVERSE REACTIONS | DOSAGE RANGES |
|---|---|---|---|---|
| ***Nitrates*** | | | | |
| amyl nitrite<br>*am-il-nye-trite* | *generic* | Relief of angina pectoris | Headache, hypotension, dizziness, vertigo, weakness, flushing | Crush capsule and wave under nose, taking 1–6 inhalations; may repeat in 3–5 minutes |
| isosorbide mononitrate, oral<br>*eye-soe-sor'-bide* | ISMO, Imdur, Monoket, *generic* | Prevention of angina pectoris | Headache, hypotension, dizziness, vertigo, weakness, flushing | 20 mg BID PO with the two doses given 7h apart; extended-release tablets: 30–60 mg once daily may be increased to 240 mg/d PO |
| isosorbide dinitrate sublingual and chewable<br>*eye-soe-sor'-bide* | Isordil, Sorbitrate, *generic* | Treatment and prevention of angina pectoris | Headache, hypotension, dizziness, vertigo, weakness, flushing | Treatment: 2.5–5 mg sublingual; prevention: 2.5–5 mg SL, 5 mg chewable |
| isosorbide dinitrate, oral<br>*eye-soe-sor'-bide* | Dilatrate SR, Isordil Tembids, Isordil Titradose, Sorbitrate, *generic* | Treatment and prevention of angina pectoris | Headache, hypotension, dizziness, vertigo, weakness, flushing | Initial dose 5–20 mg PO; maintenance dose 10–40 mg BID, TID; sustained release: 40 mg/d; daily maximum dose, 160 mg/d PO |
| nitroglycerin, intravenous<br>*nye-troe-gli'-ser-in* | Nitro-Bid IV, Tridil, *generic* | Control of blood pressure in perioperative hypertension and in immediate post-operative period, CHF associated with acute MI, angina pectoris unresponsive to recommended doses of nitrates or beta blockers | Headache, hypotension, dizziness, vertigo, weakness, flushing | Initially 5 mcg/min via IV infusion pump; may increase to 20 mcg/min |
| nitroglycerin, sublingual<br>*nye-troe-gli'-ser-in* | NitroQuick, Nitrostat | Acute relief of an attack of angina pectoris or prophylaxis of angina pectoris | Headache, hypotension, dizziness, vertigo, weakness, flushing | 1 tablet under tongue or in buccal pouch at first sign of an acute anginal attack; may repeat q5 min until relief or 3 tablets have been taken |
| nitroglycerin, translingual<br>*nye-troe-gli'-ser-in* | Nitrolingual | Acute relief of an attack or prophylaxis of angina pectoris | Headache, hypotension, dizziness, vertigo, weakness, flushing | 1–2 metered dose sprays onto or under the tongue; maximum of 3 metered doses in 15 min |
| nitroglycerin, transmucosal<br>*nye-troe-gli'-ser-in* | Nitrogard | Prevention of angina pectoris | Headache, hypotension, dizziness, vertigo, weakness, flushing | 1 tablet q3–5h between lip and gum or between cheek and gum |
| nitroglycerin, sustained release<br>*nye-troe-gli'-ser-in* | Nitroglyn, Nitrong, Nitro-Time, *generic* | Prevention of angina pectoris | Headache, hypotension, dizziness, vertigo, weakness, flushing | 2.5–2.6 mg TID, QID PO up to 26 mg QID |
| nitroglycerin transdermal systems<br>*nye-troe-gli'-ser-in* | Deponit, Minitran, Nitro-Dur, Transderm-Nitro, *generic* | Prevention of angina pectoris | Headache, hypotension, dizziness, vertigo, weakness, flushing | One system daily 0.2–0.8 mg/h |

## SUMMARY DRUG TABLE ANTIANGINAL DRUGS (*Continued*)

| GENERIC NAME | TRADE NAME* | USES | ADVERSE REACTIONS | DOSAGE RANGES |
|---|---|---|---|---|
| nitroglycerin, topical<br>*nye-troe-gli'-ser in* | Nitrobid, Nitrol, *generic* | Prevention and treatment of angina pectoris | Headache, hypotension, dizziness, vertigo, weakness, flushing | 1–5 inches q4–8h |
| ***Calcium Channel Blocking Drugs*** | | | | |
| amlodipine<br>*am-low'-dih-peen* | Norvasc | Hypertension, chronic stable angina, vasospastic angina (Prinzmetal's angina) | Dizziness, light-headedness, headache, nervousness, nausea, diarrhea, constipation, peripheral edema, angina, bradycardia, AV block, flushing, rash, nasal congestion, cough | Individualize dosage; 5–10 mg PO once daily |
| bepridil HCl<br>*be'-pri-dil* | Vascor | Chronic stable angina | Dizziness, light-headedness, headache, nervousness, nausea, diarrhea, constipation, peripheral edema, angina, bradycardia, AV block, flushing, rash, nasal congestion, cough | Individualize dosage; 200–400 mg/d PO |
| diltiazem HCl<br>*dil-tye'-a-zem* | Cardizem, Cardizem CD, Dilacor XR, Tiamate, Tiazac, *generic* | Oral: Angina pectoris, chronic stable angina, essential hypertension<br>Parenteral: atrial fibrillation or flutter, paroxysmal supraventricular tachycardia | Dizziness, light-headedness, headache, nervousness, nausea, diarrhea, constipation, peripheral edema, angina, bradycardia, AV block, flushing, rash, nasal congestion, cough | Tablets: 30–360 mg/d in divided doses; sustained-release: Cardizem SR 120–360 mg/d; Cardizem CD angina 120–240 mg once daily; Dilacor XR, 180–480 mg once daily PO; Tiazac, 120–240 mg/d for hypertension<br>Parenteral: 0.25 mg/kg IV bolus; 5–15 mg/h IV |
| nicardipine HCl<br>*nye-kar'-de-peen* | Cardene, Cardene IV, Cardene SR, *generic* | Chronic stable angina, hypertension, short-term treatment of hypertension when oral therapy is not desirable | Dizziness, light-headedness, headache, nervousness, nausea, diarrhea, constipation, peripheral edema, angina, bradycardia, AV block, flushing, rash, nasal congestion, cough | Angina: individualize dosage; immediate release only, 20–40 mg TID PO<br>Hypertension: individualize dosage; immediate release, 20–40 mg/d TID PO; sustained release, 30–60 mg BID PO; 0.5–2.2 mg/h IV by infusion |
| nifedipine<br>*nye-fed'-i-peen* | Adalat, Procardia, Procardia XL, *generic* | Vasospastic angina (Prinzmetal's angina), chronic stable angina, hypertension (sustained-release only) | Dizziness, light-headedness, headache, nervousness, nausea, diarrhea, constipation, peripheral edema, angina, bradycardia, AV block, flushing, rash, nasal congestion, cough | 10–20 mg TID PO; may increase to 120 mg/d; sustained release: 30–60 mg/d PO; may increase to 120 mg/d |
| verapamil HCl<br>*ver-ap'-a-mil* | Calan, Calan SR, Isoptin, Isoptin SR, Verelan, *generic* | Angina, arrhythmias, essential hypertension, supraventricular tachycardia (parenteral only), atrial flutter/fibrillation (parenteral only) | Dizziness, light-headedness, headache, nervousness, nausea, diarrhea, constipation, peripheral edema, angina, bradycardia, AV block, flushing, rash, nasal congestion, cough | Individualize dosage; do not exceed 480 mg/d; essential hypertension: 240 mg/d, sustained release 80 mg TID; ER capsules, 100–300 mg HS |

*The term *generic* indicates the drug is available in generic form.

In many instances, the adverse reactions associated with the nitrates lessen and often disappear with prolonged use of the drug. However, for some patients, these adverse reactions become severe, and the primary health care provider may lower the dose until symptoms subside. The dose may then be slowly increased if the lower dosage does not provide relief from the symptoms of angina.

### Calcium Channel Blockers

Adverse reactions to the calcium channel blocking drugs usually are not serious and rarely require discontinuation of the drug therapy. The more common adverse reactions include dizziness, light-headedness, nausea, diarrhea, constipation, peripheral edema, headache, bradycardia, flushing, dermatitis, skin rash, and nervousness. See the Summary Drug Table: Antianginal Drugs for a more specific listing of the adverse reactions of the calcium channel blockers.

## CONTRAINDICATIONS, PRECAUTIONS, AND INTERACTIONS

### Nitrates

The nitrates are contraindicated in patients with known hypersensitivity to the drugs, severe anemia, closed angle glaucoma, postural hypertension, head trauma, cerebral hemorrhage (may increase intracranial hemorrhage), allergy to adhesive (transdermal system), or constrictive pericarditis. Amyl nitrate is contraindicated during pregnancy (Pregnancy Category X).

The nitrates are used cautiously in patients with severe hepatic or renal disease, severe head trauma, acute myocardial infarction (MI), hypothyroidism, and during pregnancy (Pregnancy Category C, except for amyl nitrate) or lactation.

If the nitrates are administered with the antihypertensives, alcohol, calcium channel blockers, or the phenothiazines, there may be an increased hypotensive effect. When nitroglycerin is administered intravenously (IV), the effects of heparin may be decreased. Increased nitrate serum concentrations may occur when the nitrates are administered with aspirin.

### Calcium Channel Blockers

Calcium channel blockers are contraindicated in patients who are hypersensitive to the drugs and those with sick sinus syndrome, second- or third-degree AV block (except with a functioning pacemaker), hypotension (systolic less than 90 mm Hg), ventricular dysfunction, or cardiogenic shock. The calcium channel blockers are used cautiously during pregnancy (Pregnancy Category C) and lactation and in patients with congestive heart failure (CHF), hypotension, or renal or hepatic impairment.

The effects of the calcium channel blockers are increased when administered with cimetidine or ranitidine. A decrease in effectiveness of the calcium channel blockers may occur when the agents are administered with phenobarbital or phenytoin. The calcium channel blockers have an antiplatelet effect (inhibition of platelet function) when administered with aspirin, causing easy bruising, petechiae (pinpoint purplish red spot caused by intradermal hemorrhage), and bleeding. There is an additive depressive effect on the myocardium when the calcium channel blockers are administered with the β-adrenergic blocking drugs. When the calcium channel blockers are administered with digoxin, there is an increased risk for digitalis toxicity.

## NURSING PROCESS

### The Patient Receiving an Antianginal Drug

#### ASSESSMENT

##### *Preadministration Assessment*

Before administering an antianginal drug, the nurse obtains and records a thorough description of the patient's anginal pain. The nurse includes the information in Display 41-1 in the preadministration assessment. The nurse obtains a history of allergy to the nitrates or calcium channel blockers and other disease processes that would contraindicate administration of the drug. The nurse assesses the physical appearance of the patient (ie, skin color, lesions), auscultates the lungs for adventitious sounds, and obtains a baseline ECG

**DISPLAY 41-1 ● Information Regarding Anginal Pain**

**HISTORY**
- Description of the type of pain (eg, sharp, dull, squeezing)
- Whether the pain radiates and to where
- Events that appear to cause anginal pain (eg, exercise, emotion)
- Events that appear to relieve the pain (eg, resting)

**PHYSICAL ASSESSMENT**
- Blood pressure
- Apical and radial pulse rates
- Respiratory rate (after the patient has been at rest for about 10 minutes)
- Weight*
- Inspection of the extremities for edema*
- Auscultation of the lungs*

*These assessments may be appropriate, depending on the type of heart disease.

and vital signs. Any problem with orthostatic hypotension is noted.

### *Ongoing Assessment*

As a part of the ongoing assessment, the nurse monitors the patient for the frequency and severity of any episodes of angina pain. With treatment, episodes of angina should be eliminated or decrease in frequency and severity. The nurse should report to the primary health care provider any chest pain that does not respond to three doses of nitroglycerin given every 5 minutes for 15 minutes.

The nurse takes the patient's vital signs before the drug is administered and frequently during administration of the antianginals or the calcium channel blockers. If the heart rate is below 50 bpm or the systolic blood pressure is below 90 mm Hg, the drug is withheld and the primary health care provider notified. A dosage adjustment may be necessary.

The nurse should assess patients receiving the calcium channel blockers for signs of CHF: dyspnea, weight gain, peripheral edema, abnormal lung sounds (crackles/rales), and jugular vein distention. Any symptoms of CHF are reported immediately to the primary health care provider.

The patient is monitored carefully; vital signs are taken frequently, and the patient is placed on a cardiac monitor while the drug is being titrated to a therapeutic dose. The dosage may be increased more rapidly in hospitalized patients under close supervision.

## NURSING DIAGNOSES

Drug-specific nursing diagnoses are highlighted in the Nursing Diagnoses Checklist. Other nursing diagnoses applicable to these drugs are discussed in depth in Chapter 4.

## PLANNING

The expected outcomes for the patient depend on the reason for administration of an antianginal drug but may include an optimal response to drug therapy, management of common adverse drug reactions, and an understanding of the postdischarge drug regimen.

**Nursing Diagnoses Checklist**

- ✓ **Pain** related to myocardial ischemia secondary to narrowing of the coronary arteries, adverse drug reactions (headache)
- ✓ **Decreased Cardiac Output** related to adverse reactions or disease process
- ✓ **Ineffective Tissue Perfusion: Cardiopulmonary** related to myocardial ischemia

## IMPLEMENTATION

### *Promoting an Optimal Response to Therapy*

NITRATES. The nitrates may be administered by the **sublingual** (under the tongue), **buccal** (between the cheek and gum), oral, IV, or transdermal route. Nitroglycerin may be administered by the sublingual, buccal, topical, transdermal, oral, or IV route. If the buccal form of nitroglycerin has been prescribed, the nurse instructs the patient to place the buccal tablet between the cheek and gum or between the upper lip and gum above the incisors and allow it to dissolve. The nurse shows the patient how and where to place the tablet in the mouth. Absorption of sublingual and buccal forms is dependent on salivary secretion. Dry mouth decreases absorption.

Nitroglycerin may also be administered by a metered spray canister that is used to abort an acute anginal attack. The spray is directed from the canister onto or under the tongue. Each dose is metered so that when the canister top is depressed, the same dose is delivered each time. The nurse instructs the patient not to inhale the spray. For some individuals, this is more convenient than the small tablets placed under the tongue.

**Nursing Alert**

*The dose of sublingual nitroglycerin may be repeated every 5 minutes until pain is relieved or until the patient has received three doses in a 15-minute period. One to two sprays of translingual nitroglycerin may be used to relieve angina, but no more than three metered doses are recommended within a 15-minute period.*

The nurse instructs the patient to call the nurse if the pain is not relieved after three doses. The primary health care provider is notified if the patient frequently has anginal pain, if the pain worsens, or if the pain is not relieved after three doses within a 15-minute period because a change in the dosage of the drug or other treatment may be necessary.

*Administering Topical Nitroglycerin.* The dose of **topical** (ointment) nitroglycerin is measured in inches or millimeters (mm); 1 inch (25 mm) of ointment equals about 15 mg nitroglycerin. Before the drug is measured and applied and after the ambulatory patient has rested for 10 to 15 minutes, the nurse obtains the patient's blood pressure and pulse rate and compares the results with the baseline and previous vital signs. If the blood pressure is appreciably lower or the pulse rate higher than the resting baseline, the nurse contacts the primary health care provider before the drug is applied. Applicator paper is supplied with the drug; one paper is used for each application. While holding the paper, the nurse expresses the prescribed amount of ointment from the tube onto the paper. The nurse must remove

the paper from the previous application and cleanse the area as needed. The nurse uses the applicator or dose-measured paper to gently spread in a thin uniform layer over at least a 2¼- by 3½-inch area. The ointment is usually applied to the chest or back. Application sites are rotated to prevent inflammation of the skin. Areas that may be used for application include the chest (front and back), abdomen, and upper arms and legs.

### Nursing Alert

*The nurse must* not *rub the nitroglycerin ointment into the patient's skin because this will immediately deliver a large amount of the drug through the skin. Exercise care in applying topical nitroglycerin and do not to allow the ointment to come in contact with the fingers or hands while measuring or applying the ointment because the drug will be absorbed through the skin of the person applying the drug. The nurse should wear disposable plastic gloves if drug contact is a problem. After application of the ointment, the nurse may secure the paper with nonallergenic tape.*

*Administering Transdermal Nitroglycerin.* For most people, nitroglycerin **transdermal systems** are more convenient and easier to use because the drug is absorbed through the skin. Transdermal systems have the drug impregnated in a pad. The pad is applied to the skin once a day for 10 to 12 hours.

Tolerance to the vascular and anginal effects of the nitrates may develop, particularly in patients taking higher dosages, those prescribed longer-acting products, or those on more frequent dosing schedules. Patients using the transdermal nitroglycerin patches are particularly prone to tolerance because the nitroglycerin is released at a constant rate, and steady plasma concentrations are maintained. Research has shown that applying the patch in the morning and leaving it in place for 10 to 12 hours, followed by leaving the patch off for 10 to 12 hours, yields better results and delays tolerance to the drug.

When applying the transdermal system, the nurse inspects the skin site to be sure it is dry, free of hair, and not subject to excessive rubbing or movement. If needed, the nurse shaves the application site. The nurse applies the transdermal system at the same time each day and rotates the placement sites. Optimal sites include the chest, abdomen, and thighs. The system is not applied to distal extremities. The best time to apply the transdermal system is after morning care (bed bath, shower, tub bath) because it is important that the skin be thoroughly dry before applying the system. When removing the pad, the nurse cleanses the area as needed. To avoid errors in applying and removing the patch, the person applying the patch can use a fiber-tipped pen to write his or her name (or initials), date, and time of application on the top side of the patch. Patches should be removed before cardioversion or defibrillation to prevent patient burns.

*Administering Oral Nitroglycerin.* Nitroglycerin is also available as oral tablets that are swallowed. The nurse gives this form of nitroglycerin to the patient whose stomach is empty, unless the primary health care provider orders otherwise. If nausea occurs after administration, the nurse notifies the primary health care provider. Taking the tablet or capsule with food may be ordered to relieve nausea. The sustained released preparation may not be crushed or chewed.

Because of the risk of tolerance to oral nitrates developing, the primary care provider may prescribe the short-acting preparations 2 to 3 times daily, with the last dose no later than 7 PM and the sustained release preparations once daily or twice daily at 8 AM and 2 PM.

*Administering IV Nitroglycerin.* The nurse administers IV nitroglycerin diluted in normal saline or 5% dextrose by continuous infusion using an infusion pump to ensure an accurate rate. The nurse administers the drug by using the glass IV bottles and administration sets provided by the manufacturer. When the drug is administered IV, it should be protected from light and extremes in temperature. The nurse regulates the dosage according to the patient's response and the primary health care provider's instructions.

CALCIUM CHANNEL BLOCKERS. With a few exceptions, the calcium channel blockers may be taken without regard to meals. If gastrointestinal upset occurs, the drug may be taken with meals. Verapamil and bepridil frequently cause gastric upset, and the nurse should routinely give them with meals. Verapamil tablets may be opened and sprinkled on foods or mixed in liquids. Sometimes the tablet coverings of verapamil are expelled in the stool. This causes no change in the effect of the drug and should be of no concern to the patient.

For patients who have difficulty swallowing diltiazem, tablets can be crushed and mixed with food or liquids. However, the patient should swallow the sustained-released tablets whole and not chew or divide them. When nifedipine is ordered sublingually, the capsule is punctured with a sterile needle and the liquid squeezed under the tongue or in the buccal pouch.

## Monitoring and Managing Adverse Drug Reactions

The nurse must carefully observe patients receiving these drugs for adverse reactions.

During initial therapy, headache and postural hypotension may occur, and the nurse must notify the primary health care provider because a dose change may be necessary. The nurse assists patients having episodes of postural hypotension with all ambulatory activities. The nurse instructs those with episodes of postural hypotension to take the drug in a sitting or supine position and to remain in that position until symptoms disappear. Hypotension may be accompanied by paradoxical

bradycardia and increased angina pectoris. Adverse reactions such as headache, flushing, and postural hypotension that are seen with the administration of the antianginal drugs often become less severe or even disappear after a period of time.

### Gerontologic Alert

*The older adult may have a greater hypotensive effect after taking the antianginal drugs than younger adults. The nurse must monitor the older adult closely during dosage adjustments.*

If the patient has frequent chest pain or reports dizziness or light-headedness, the nurse monitors the blood pressure frequently. The patient may need help during ambulation if dizziness occurs. In addition, the nurse must evaluate the patient's response to therapy by questioning the patient about the anginal pain. In some patients, the pain may be entirely relieved, whereas in others it may be less intense or less frequent or may occur only with prolonged exercise. The nurse records all information in the patient's chart because this helps the primary health care provider plan future therapy, as well as make dosage adjustments if required.

### Nursing Alert

*If the administration of sublingual or transmucosal nitrate fails to abort an anginal attack, the nurse must* immediately *notify the primary health care provider because additional therapy or tests may be necessary. If an antianginal drug is used to prevent angina but the angina continues to occur, the nurse immediately notifies the primary health care provider. If anginal attacks occur while the patient is receiving a calcium channel-blocking drug, the nurse informs the primary health care provider of this problem because a different approach to therapy for angina may be necessary.*

### Gerontologic Alert

*Angina is a common problem in older adults. When an older adult requires an antianginal drug, the dosage may be reduced to compensate for impaired renal function or heart disease. Older patients are at increased risk for postural hypotension. Blood pressure and ability to ambulate should be monitored closely.*

When the drug regimen for angina pectoris is terminated, the drug dosage is gradually reduced to prevent withdrawal reactions. Abrupt withdrawal of the calcium channel blockers may cause an increase in chest pain. This phenomenon is called rebound angina and is most likely the result of the increased flow of calcium into cells, causing the coronary arteries to spasm. The calcium channel blockers should be gradually withdrawn, rather than discontinued abruptly.

## Educating the Patient and Family

The patient and family must have a thorough understanding of the treatment of chest pain with an antianginal drug. These drugs are used either to prevent angina from occurring or to relieve the pain of angina. The nurse explains the therapeutic regimen (dose, time of day the drug is taken, how often to take the drug, how to take or apply the drug) to the patient. The nurse adapts a teaching plan to the type of prescribed antianginal drug. The nurse should include the following general areas, as well as those points relevant to specific routes of administration of the drug, in a teaching plan.

- Avoid the use of alcohol unless use has been permitted by the primary health care provider.
- Notify the primary health care provider if the drug does not relieve pain or if pain becomes more intense despite use of this drug.
- Follow the recommendations of the primary health care provider regarding frequency of use.
- Take oral capsules or tablets (except sublingual) on an empty stomach unless the primary health care provider directs otherwise.
- Keep an adequate supply of the drug on hand for events, such as vacations, bad weather conditions, and holidays.
- Keep a record of the frequency of acute anginal attacks (date, time of the attack, drug, and dose used to relieve the acute pain), and bring this record to each primary health care provider or clinic visit.

### NITRATES

- Headache is a common adverse reaction but should decrease with continued therapy. If headache persists or becomes severe, notify the primary health care provider because a change in dosage may be needed. In patients who get headaches, the headaches may be a marker of the drug's effectiveness. Patients should not try to avoid headaches by altering the treatment schedule because loss of headache may be associated with simultaneous loss of drug effectiveness. Aspirin or acetaminophen may be used for headache relief.
- Do not change from one brand of nitrates to another without consulting your pharmacist or primary care provider. Products manufactured by different companies may not be equally effective.

### ORAL NITRATES

- When taking nitroglycerin for an acute attack of angina, sit or lie down. To relieve severe light-headedness or dizziness, lie down, elevate the extremities, move the extremities, and breathe deeply.

- Keep capsules and tablets in their original containers because nitroglycerin must be kept in a dark container and protected from exposure to light. Never mix this drug with any other drug in a container. Nitroglycerin will lose its potency in containers made of plastic or if mixed with other drugs.
- Always replace the cover or cap of the container as soon as the oral drug or ointment is removed from the container or tube. Replace caps or covers tightly because the drug deteriorates on contact with air.
- If chest pain persists, changes character, increases in severity, or is not relieved by following the recommended dosing regimen, seek prompt medical attention.

### SUBLINGUAL OR BUCCAL ADMINISTRATION

- Do not handle the tablets labeled as sublingual any more than necessary.
- Check the expiration date on the container of sublingual tablets. If the expiration date has passed, do not use the tablets. Instead, purchase a new supply. Unused tablets should be discarded 6 months after the original bottle is opened.
- Do not swallow or chew sublingual or transmucosal tablets; allow them to dissolve slowly. The tablet may cause a burning or tingling in the oral cavity. Absence of this effect does not indicate a decrease in potency. Older adults are less likely to report a burning or tingling sensation on administration.

### TRANSLINGUAL/TRANSMUCOSAL

- The directions for use of translingual nitroglycerin are supplied with the product. Follow the instructions regarding using and cleaning the canister.
- This drug may be used prophylactically 5 to 10 minutes before engaging in activities that precipitate an attack.
- At the onset of an anginal attack, spray 1 to 2 metered doses onto or under the tongue. Do not exceed three metered doses within 15 minutes.
- When using the transmucosal form, insert the tablet between the lip and gum above the incisors or between the cheek and gum.

### TOPICAL OINTMENT OR TRANSDERMAL SYSTEM

- Instructions for application of the topical ointment or transdermal system are available with the product. Read these instructions carefully.
- Apply the topical ointment or transdermal system at approximately the same time each day.
- Be sure the area is clean and thoroughly dry before applying the topical ointment or transdermal system, and rotate the application sites. Apply the transdermal system to the chest (front and back), abdomen, and upper or lower arms and legs. Firmly press the patch to ensure contact with the skin. If the transdermal system comes off or becomes loose, apply a new system. Apply the topical ointment to the front or the back of the chest. If applying to the back, another person should apply the ointment.
- When using the topical ointment form or transdermal system, cleanse old application sites with soap and warm water as soon as the ointment or transdermal system is removed.
- To use the topical ointment, apply a thin layer on the skin using the paper applicator (the patient or family member may need instructions regarding this technique). Avoid finger contact with the ointment.
- Wash the hands before and after applying the ointment.

### CALCIUM CHANNEL BLOCKERS

- Do not chew or divide sustained-released tablets. Swallow them whole.
- Notify the primary health care provider if any of the following occurs: increased severity of chest pain or discomfort, irregular heartbeat, palpitations, nausea, shortness of breath, swelling of the hands or feet, or severe and prolonged episodes of light-headedness and dizziness.
- If the primary health care provider prescribes one of these drugs plus a nitrate, take both drugs exactly as directed to obtain the best results of the combined drug therapy.
- Make position changes slowly to minimize hypotensive effects.
- These drugs can cause dizziness or drowsiness. Do not drive or engage in hazardous activities until response to the drug is known.

## EVALUATION

- The therapeutic effect is achieved and pain is relieved.
- Adverse reactions are identified, reported to the primary health care provider, and managed successfully through nursing interventions.
- The patient verbalizes an understanding of the treatment modalities.
- The patient and family demonstrate an understanding of the drug regimen.

# PERIPHERAL VASODILATING DRUGS

In contrast to the antianginal drugs, which are used primarily for angina, the peripheral vasodilating drugs are given for disorders that affect blood vessels of the extremities. Unfortunately, although these drugs increase blood flow to nonischemic areas (areas with adequate blood

## SUMMARY DRUG TABLE PERIPHERAL VASODILATORS AND MISCELLANEOUS VASODILATING DRUGS

| GENERIC NAME | TRADE NAME* | USES | ADVERSE REACTIONS | DOSAGE RANGES |
|---|---|---|---|---|
| isoxsuprine HCl<br>*eye-soks-u'-preen* | Vasodilan, Voxsuprine, *generic* | Peripheral vascular disease (PVD), Raynaud's disease | Hypotension, tachycardia, chest pain, nausea, vomiting, abdominal distress, rash, weakness, palpitations | 10–20 mg PO TID, QID |
| papaverine HCL<br>*pa-pav'-er-reen* | Pavabid Plateau, Pavagen, *generic* | Relief of cerebral and peripheral ischemia associated with arterial spasm, myocardial ischemia complicated by arrhythmias | Nausea, abdominal distress, vertigo, sweating, flushing, rash, excessive sedation | 150–300 mg PO q12h |
| ***Miscellaneous Drugs*** | | | | |
| cilostazol<br>*sill-oh-stay'-zole* | Pletal | Reduction of symptoms of intermittent claudication | Headache, diarrhea, palpitations, dizziness, nausea, rhinitis, abdominal pain, tachycardia | 100 mg BID PO |

*The term *generic* indicates the drug is available in generic form.

flow), there is no conclusive evidence that blood flow is increased in ischemic areas (areas that lack adequate blood flow) that are in critical need of improved perfusion. Because of the lack of evidence of the effectiveness of the peripheral vasodilating drugs, most are labeled as "possibly effective" in the treatment of peripheral vascular disorders. These drugs are not as widely used today as they were in the past. Many of the peripheral dilating drugs are used for hypertension and are discussed in Chapter 40.

A new drug, cilostazol (Pletal), is a phosphodiesterase II inhibitor (drug that inhibits platelet aggregation and dilates vascular beds, particularly in the femoral area). The drug reduces the symptoms of **intermittent claudication** (increased pain when walking) associated with peripheral vascular disease. This drug increases the walking distance in those with intermittent claudication. This drug is listed under Miscellaneous Drugs in the Summary Drug Table: Peripheral Vasodilators and Miscellaneous Vasodilating Drugs.

## ACTIONS

Peripheral vasodilating drugs, such as isoxsuprine (Vasodilan), act on the smooth muscle layers of peripheral blood vessels, primarily by blocking alpha (α)-adrenergic nerves and stimulating β-adrenergic nerves. For a review of the effect of stimulation and blocking (or blockade) effects on adrenergic nerve fibers, see Chapters 22 and 23. Cilostazol (Pletal) inhibits platelet aggregation and dilates vascular beds, particularly in the femoral area. The exact mechanism of action is unknown.

## USES

Peripheral vasodilating drugs are chiefly used in the treatment of peripheral vascular diseases, such as arteriosclerosis obliterans, Raynaud's phenomenon, and spastic peripheral vascular disorders. Short-term use is rarely beneficial or permanent. Improvement, if it occurs, takes place gradually during weeks of therapy.

The peripheral vasodilating drugs also have other uses, such as the relief of symptoms associated with cerebral vascular insufficiency and circulatory disturbances of the inner ear. More specific uses of individual peripheral vasodilating drugs are given in the Summary Drug Table: Peripheral Vasodilators and Miscellaneous Vasodilating Drugs.

Intermittent claudication is a group of symptoms characterized by pain in the calf muscle of one or both legs, caused by walking and relieved by rest. It is a manifestation of peripheral vascular disease, in which atherosclerotic lesions develop in the femoral artery, diminishing blood supply to the lower leg. Cilostazol is used to treat intermittent claudication.

## ADVERSE REACTIONS

Adverse reactions associated with these drugs are variable. Some of the more common adverse reactions are listed in the Summary Drug Table: Peripheral Vasodilators and Miscellaneous Vasodilating Drugs. Because these drugs dilate peripheral arteries, some degree of hypotension may be associated with their

administration. Along with hypotension, there is a physiologic increase in the pulse rate (tachycardia). Some of these drugs also cause flushing of the skin, which can range from mild to moderately severe. Nausea, vomiting, flushing, headache, and dizziness may also be seen with the use of these drugs. Adverse results associated with cilostazol include headache, diarrhea, palpitations, dizziness, pharyngitis, hypotension, and cardiac arrhythmias.

## CONTRAINDICATIONS, PRECAUTIONS, AND INTERACTIONS

The peripheral vasodilating drugs are contraindicated in patients with known hypersensitivity to the drugs, women in the immediate postpartum period (isoxsuprine causes uterine relaxation), and in patients with arterial bleeding. Safe use during pregnancy has not been established (Pregnancy Category C). Cilostazol is contraindicated in patients with CHF and during pregnancy (Pregnancy Category C). These drugs are used cautiously in patients with bleeding tendencies, severe cerebrovascular or cardiovascular disease, and after a myocardial infarction. There are no significant drug–drug interactions.

### Herbal Alert: L-arginine

*L-arginine is commonly sold in health food specialty shops as a supplement capable of improving vascular health and sexual function in men. The herb may be beneficial in improving health in individuals with congestive heart failure, peripheral artery disease, angina, hypertension, hyperlipidemia, and type 2 diabetes. The herb appears to increase nitric oxide concentrations. Abnormalities of the vascular endothelial cells may cause vasoconstriction, inflammation, and thrombolytic activity. These abnormalities are partially attributable to degradation of nitric oxide. L-arginine's ability to increase nitric oxide is the basis for its effectiveness in improving some vascular disease states. Oral doses of 9 to 30 g per day are well tolerated. No adverse reactions were reported in those taking 9 g/d. Higher doses may cause nausea and mild diarrhea. L-arginine may exacerbate sickle cell crisis and should be used with caution in those with sickle cell anemia.*

## NURSING PROCESS

### The Patient Receiving a Peripheral Vasodilating Drug

### ASSESSMENT

#### *Preadministration Assessment*

Before administering the first dose of a peripheral vasodilating drug, the nurse obtains a thorough history of the patient's symptoms. The physical assessment is based on the patient's diagnosis. If cerebral vascular disease is present, the nurse evaluates the patient's mental status. If the diagnosis is a peripheral vascular disorder, the nurse examines the involved areas for general appearance, such as the color of the skin and evidence of drying or scaling. The nurse notes the skin temperature (warm, cool, cold) of the involved area and compares it with other areas of the body and to the extremities not affected by peripheral vascular disease. The nurse then records these findings in the patient's record. The nurse palpates the peripheral pulses in the affected extremities and records the strength and amplitude of each peripheral pulse. Vital signs are obtained and recorded. For patients taking cilostazol for intermittent claudication, a baseline walking distance is taken to monitor drug effectiveness.

#### *Ongoing Assessment*

Therapeutic results obtained from the administration of a peripheral vasodilating drug may not occur immediately. In some instances, results are minimal. The nurse assesses involved extremities daily for changes in color and temperature and records the patient's comments regarding relief from pain or discomfort. The nurse should monitor the blood pressure and pulse one to two times per day because these drugs may cause a decrease in blood pressure. The anticipated result of therapy for cerebral vascular disease is an improvement in the patient's mental status. When the drug is taken for intermittent claudication, the nurse assesses the patient for increased walking distance without pain.

### NURSING DIAGNOSES

Drug-specific nursing diagnoses are highlighted in the Nursing Diagnoses Checklist. Other nursing diagnoses applicable to these drugs are discussed in depth in Chapter 4.

### PLANNING

The expected outcomes for the patient may include relief of pain, management of common adverse drug reactions, absence of injury, and an understanding of and compliance with the prescribed therapeutic regimen.

### IMPLEMENTATION

#### *Promoting an Optimal Response to Therapy*

These drugs are often prescribed for outpatient use. Positive results of therapy for a peripheral vascular

**Nursing Diagnoses Checklist**

- ✓ **Pain** related to narrowing of peripheral arteries, decreased blood supply to the extremities
- ✓ **Risk for Injury** related to hypotension, dizziness, lightheadedness secondary to drug actions

disorder may include a decrease in pain, discomfort, and cramping; increased warmth in the extremities; and an increase in amplitude of the peripheral pulses. Patients taking these drugs for relief of symptoms associated with peripheral vascular disorders often become discouraged about the lack of effectiveness of drug therapy. The nurse encourages the patient to continue with the prescribed drug regimen and to follow the primary health care provider's recommendations regarding additional methods of treating the disorder. The patient is reminded that although signs of improvement may be rapid, improvement usually occurs slowly during the course of many weeks. The nurse examines the patient's affected areas at the time of each visit to a primary health care provider's office or outpatient clinic and records the findings in the patient's record. The nurse administers cilostazol at least 30 minutes before or 2 hours after meals. The drug is not administered with grapefruit juice because the juice may increase blood concentrations of the drug.

### Monitoring and Managing Adverse Drug Reactions

If adverse reactions occur, the nurse should notify the primary health care provider. It is important to note the severity of the adverse reactions on the patient's record. In some instances, adverse reactions are mild and the patient may need to tolerate them.

Some patients may experience dizziness and lightheadedness, especially during early therapy. If these effects should occur, the nurse assists the patient with all ambulatory activities and instructs the patient to ask for help when getting out of bed or ambulating.

### Educating the Patient and Family

To ensure compliance to the drug regimen, the nurse tells the patient and family that improvement will most likely be gradual, although some improvement may be noted in a few days. The nurse encourages the patient to continue with drug therapy and to follow the primary health care provider's recommendations regarding care of the affected extremities, even though improvement may be slow. The nurse includes the following in a teaching plan:

- If nausea, vomiting, or diarrhea occurs, contact the primary health care provider. These drugs may also cause flushing, sweating, headache, tiredness, jaundice, skin rash, anorexia, and abdominal distress. Notify the primary health care provider if these effects become pronounced.
- Dizziness may occur. Avoid driving and other potentially dangerous tasks, as well as sudden changes in position. Dangle the legs over the side of the bed for a few minutes when getting up in the morning or after lying down. If dizziness persists, contact the primary health care provider.
- Use caution when walking up or down stairs or when walking on ice, snow, a slick pavement, or slippery floors.
- Stop smoking (if applicable).
- For peripheral vascular disease, follow the primary health care provider's recommendations regarding exercise, avoiding exposure to cold, keeping the extremities warm, and avoiding injury to the extremities.
- Therapeutic effects when taking the drugs for peripheral vascular disease may not be seen for 2 weeks and may take up to 12 weeks.
- Take cilostazol (Pletal) 30 minutes before or 2 hours after meals. Do not take the drug with grapefruit juice.

## EVALUATION

- The therapeutic effect is achieved and pain is relieved.
- Adverse reactions are identified, reported to the primary health care provider, and managed successfully through appropriate nursing interventions.
- No evidence of injury is seen.
- The patient and family demonstrate an understanding of the drug regimen.
- The patient verbalizes the importance of complying with the prescribed therapeutic regimen.

## ● Critical Thinking Exercises

1. *Ms. Moore is admitted with severe chest pain and a possible myocardial infarction. After tests are done, her primary health care provider prescribes transdermal nitroglycerin for her angina. Develop a teaching plan that will show Ms. Moore how and when to apply the transdermal form of nitroglycerin.*
2. *Mr. Billings is prescribed sublingual nitroglycerin for his angina. Develop a teaching plan that incorporates when and how to take the drug and what precautions he should take regarding handling and storage of the drug.*
3. *Mr. Crawford has peripheral vascular disease and is prescribed isoxsuprine hydrochloride (Vasodilan). Discuss the important aspects of the preadministration and ongoing assessment for Mr. Crawford.*

## ● Review Questions

1. When administering the nitrates for angina pectoris, the nurse monitors the patient for the most common adverse reaction, which is _____.
   - **A.** hyperglycemia
   - **B.** headache
   - **C.** fever
   - **D.** anorexia
2. When teaching a patient about prescribed sublingual nitroglycerin, the nurse informs the patient that if

pain is not relieved, the dose can be repeated in _____ minute(s).

**A.** 1
**B.** 5
**C.** 15
**D.** 30

**3.** When administering nitroglycerin ointment, the nurse _____.

**A.** rubs the ointment into the skin
**B.** applies the ointment every hour or until the angina is relieved
**C.** applies the ointment to a clean, dry area
**D.** rubs the ointment between her palms and then spreads it evenly onto the patient's chest

**4.** A patient taking a calcium channel blocker experiences orthostatic hypotension. The nurse instructs the patient with orthostatic hypotension to _____.

**A.** remain in a supine position until the effects subside
**B.** make position changes slowly to minimize hypotensive effects
**C.** increase the dosage of the calcium channel blocker
**D.** discontinue use of the calcium channel blocker until the hypotensive effects diminish

**5.** When administering cilostazol (Pletal), the nurse instructs the patient _____.

**A.** that drugs used to treat peripheral vascular disease may take 2 to 4 weeks before improvement is seen
**B.** to take the drug with food to enhance absorption
**C.** to increase the dose if no response is seen within the first week
**D.** the drug must be given for short periods only (up to 4 to 8 weeks)

**6.** The peripheral vasodilating drugs are contraindicated in patients _____.

**A.** with arthritis
**B.** with hypertension
**C.** with elevated blood cholesterol levels
**D.** during the immediate postpartum period

## ● *Medication Dosage Problems*

**1.** The primary care provider prescribed verapamil HCl (Calan) 120 mg TID PO. The drug is available in 40-mg tablets. The nurse administers _____.

**2.** The patient is prescribed isosorbide (Isordil) 40 mg PO BID. The drug form available is 20-mg tablets. The nurse administers _____.