

Antihypertensive Drugs

Key Terms

<i>aldosterone</i>	<i>isolated systolic</i>
<i>angiotensin-converting</i>	<i>hypertension</i>
<i>enzyme</i>	<i>lumen</i>
<i>blood pressure</i>	<i>malignant</i>
<i>endogenous</i>	<i>hypertension</i>
<i>essential</i>	<i>orthostatic</i>
<i>hypertension</i>	<i>hypotension</i>
<i>hypertension</i>	<i>postural hypotension</i>
<i>hypokalemia</i>	<i>secondary</i>
<i>hyponatremia</i>	<i>hypertension</i>
	<i>vasodilatation</i>

Chapter Objectives

On completion of this chapter, the student will:

- Discuss the various types of hypertension and risk factors involved.
- Identify normal and abnormal blood pressure levels for adults.
- List the various types of drugs used to treat hypertension.
- Discuss the general drug actions, uses, adverse reactions, contraindications, precautions, and interactions of the antihypertensive drugs.
- Discuss important preadministration and ongoing assessment activities the nurse should perform on the patient taking an antihypertensive drug.
- Explain why blood pressure determinations are important during therapy with an antihypertensive drug.
- List some nursing diagnoses particular to a patient taking an antihypertensive drug.
- Discuss ways to promote an optimal response to therapy, how to manage adverse reactions, and important points to keep in mind when educating patients about the use of an antihypertensive drug.

Blood pressure is the force of the blood against the walls of the arteries. Blood pressure rises and falls throughout the day. When the blood pressure stays elevated over time, hypertension develops. A systolic pressure less than 120 mm Hg and a diastolic blood pressure of less than 80 mm Hg (120/80) are considered optimal. **Hypertension** is usually defined as a systolic pressure above 140 mm Hg and a diastolic pressure above 90 mm Hg. Table 42-1 identifies blood pressure levels for adults and implications of diagnosis. Patients in the high-normal range require frequent blood pressure monitoring; patients in stage 1, 2, or 3 should be under the care of a physician. Hypertension is serious because it causes the heart to work too hard and contributes to atherosclerosis. It increases the risk of heart disease, congestive heart failure, kidney disease, blindness, and stroke.

Most cases of hypertension have no known cause. When there is no known cause of hypertension, the term **essential hypertension** is used. Essential hypertension has been linked to certain risk factors, such as

diet and lifestyle. Display 42-1 identifies the risk factors associated with hypertension.

In the United States, African-Americans are twice as likely as Caucasians to experience hypertension. After age 65 years, African-American women have the highest incidence of hypertension. Essential hypertension cannot be cured but can be controlled. Many individuals experience hypertension as they grow older, but hypertension is not a part of healthy aging. For many older individuals, the systolic pressure gives the most accurate diagnosis of hypertension. Display 42-2 discusses the importance of the systolic pressure.

Once essential hypertension develops, management of this disorder becomes a lifetime task. When a direct cause of the hypertension can be identified, the condition is described as **secondary hypertension**.

Among the known causes of secondary hypertension, kidney disease ranks first, with tumors or other abnormalities of the adrenal glands following. In **malignant hypertension** the diastolic pressure usually exceeds 130 mm Hg. In secondary hypertension,

TABLE 42-1 Blood Pressure Levels for Adults

CATEGORY	SYSTOLIC* (in mm Hg)		DIASTOLIC* (in mm Hg)
Optimal	less than 120	and	less than 80
Normal	less than 130	and	less than 85
High-normal	130–139	and	85–89
HYPERTENSION			
Stage 1	140–159	or	90–99
Stage 2	160–179	or	100–109
Stage 3	180 or higher	or	110 or higher

*If systolic and diastolic pressures fall into different categories, the patient's status is the higher category.
 From the Sixth Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure, National High Blood Pressure Education Program, November 1997. (Online.)
 Available: www.nhlbi.nih.gov/gu.delines/hypertension

taking care of the medical condition causing the hypertension results in the patient regaining a normal blood pressure.

Malignant hypertension is a dangerous condition that develops rapidly and requires immediate medical attention. Patients with malignant hypertension experience organ damage as the result of hypertension. Target organs of hypertension include the heart, kidney, and eyes (retinopathy).

Most primary care providers will prescribe lifestyle changes to reduce risk factors before prescribing drugs. The primary care provider may recommend measures, such as weight loss (if the patient is overweight), reduction of stress, regular aerobic exercise, quitting smoking (if applicable), and dietary changes, such as a decrease in sodium (salt) intake. Most people with hypertension are “salt sensitive,” that is that any salt or sodium more than the minimal bodily need is too much for them and leads to an increase in blood pressure. Dietitians usually recommend the Dietary Approaches to Stop Hypertension (DASH) diet. Studies indicate that blood pressure was reduced by eating a diet low in saturated fat, total fat, and cholesterol and rich in fruits, vegetables, and low-fat dairy foods. The DASH diet includes whole grains, poultry, fish, and nuts and has reduced amounts of fats, red meats, sweets and sugared beverages. The diet is rich in potassium, calcium, magnesium, protein, and fiber. Stress-reducing techniques, such as relaxation techniques, meditation, and yoga, may also be a part of the treatment regimen.

When drug therapy is begun, the primary care provider may first prescribe a diuretic (Chap. 46) or beta () blocker (Chap. 23) because these drugs have been shown to be highly effective. However, as in many other diseases

DISPLAY 42-1 • Risk Factors in Hypertensive Patients

- Smoking
- Age (women older than 65 years and men older than 55 years of age)
- Obesity
- Diabetes
- Lack of physical activity
- Chronic alcohol consumption
- Family history of cardiovascular disease
- Sex (men and postmenopausal women)

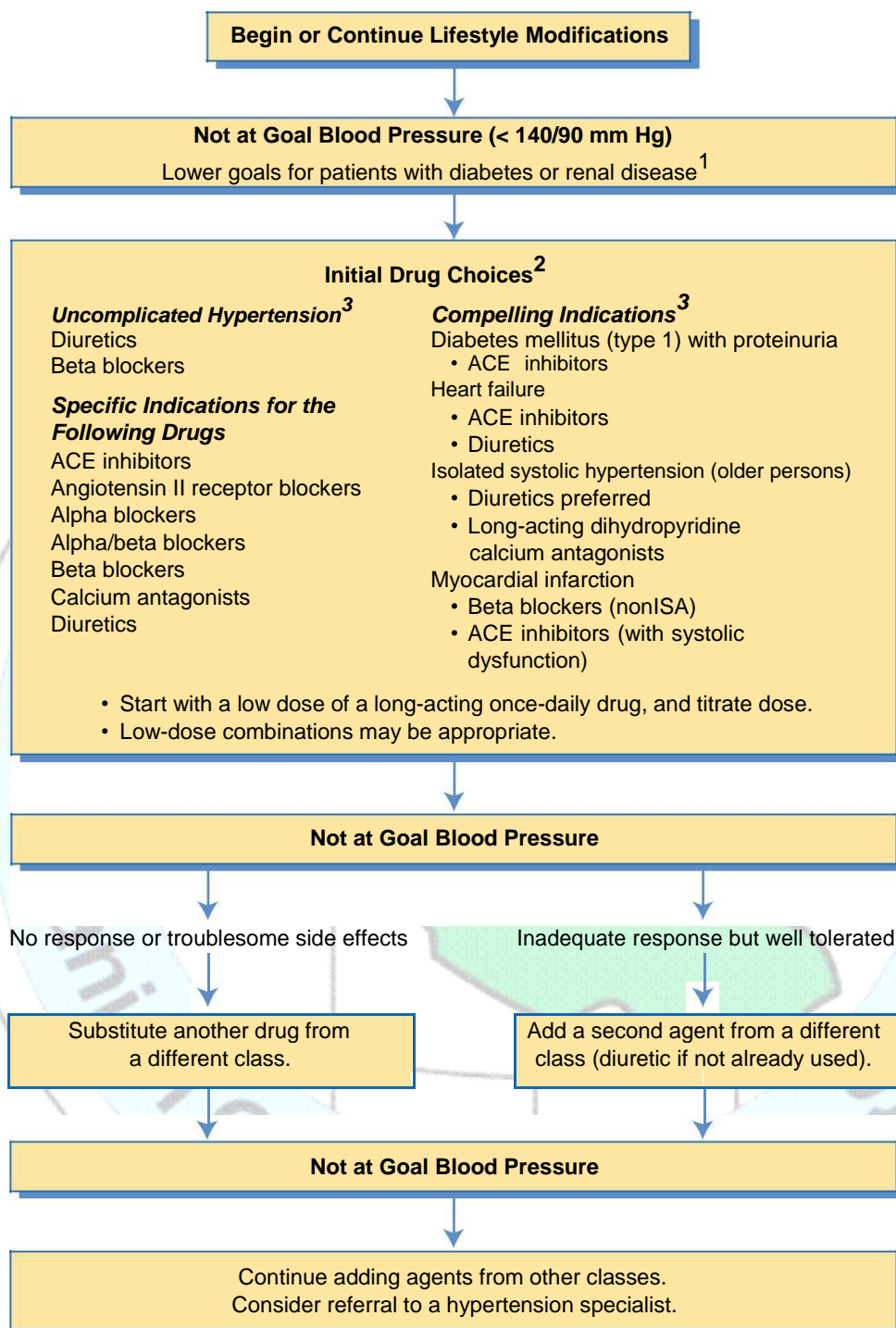
and conditions, there is no “best” single drug, drug combination, or medical regimen for treatment of hypertension. After examination and evaluation of the patient, the primary care provider selects the antihypertensive drug and therapeutic regimen that will probably be most effective. Figure 42-1 shows an algorithm for the treatment of hypertension. In some instances, it may be necessary to change to another antihypertensive drug or add a second antihypertensive drug when the patient does not experience a response to therapy. The primary care provider also recommends that the patient continue with stress reduction, dietary modification, and other lifestyle modifications important in the control of hypertension.

The types of drugs used for the treatment of hypertension include:

- Vasodilating drugs—for example, hydralazine (Apresoline) and minoxidil (Loniten)
- β -adrenergic blocking drugs—for example, atenolol (Tenormin), metoprolol (Lopressor), and propranolol (Inderal)
- Antiadrenergic drugs (centrally acting)—for example, guanabenz (Wytensin) and guanfacine (Tenex)
- Antiadrenergic drugs (peripherally acting)—for example, guanadrel (Hylorol) and guanethidine (Ismelin)
- Alpha ()-adrenergic blocking drugs—for example, doxazosin (Cardura) and prazosin (Minipress)
- Calcium channel blocking drugs—for example, amlodipine (Norvasc) and diltiazem (Cardizem)

DISPLAY 42-2 • Importance of the Systolic Blood Pressure

In most individuals, the systolic pressure increases sharply with age, whereas the diastolic pressure increases until about age 55 years and then declines. Older individuals with an elevated systolic pressure have a condition known as **isolated systolic hypertension (ISH)**. When the systolic pressure is high, blood vessels become less flexible and stiffen, leading to cardiovascular disease and kidney damage. Research indicates that treating ISH saves lives and reduces illness. The treatment is the same for ISH as for other forms of hypertension.



¹ Goal blood pressure for patients with diabetes is < 130/85 mm Hg. Goal blood pressure for patients with renal disease is ≤ 130/85 mm Hg or ≤ 125/75 mm Hg in patients with proteinuria > 1 gram/24 hours.

² Unless contraindicated. ACE, angiotensin-converting enzyme; ISA, intrinsic sympathomimetic activity.

³ Based on randomized controlled trials.

FIGURE 42-1. Algorithm for the treatment of hypertension.

- Angiotensin-converting enzyme (ACE) inhibitors—for example, captopril (Capoten), enalapril (Vasotec), and lisinopril (Prinivil)
- Angiotensin II receptor antagonists—for example, irbesartan (Avapro), losartan (Cozaar), and valsartan (Diovan)
- Diuretics—for example, furosemide (Lasix) and hydrochlorothiazide (HydroDIURIL)

For additional information concerning the antiadrenergic drugs (both centrally and peripherally acting), and the - and -adrenergic blocking drugs, see Chapter 23. For more information on the calcium channel blockers see Chapter 41. Information on the vasodilating drugs and the diuretics can be found in Chapters 41 and 46, respectively. The angiotensin-converting enzyme (ACE) inhibitors and the angiotensin II receptor antagonists are discussed in this chapter.

In addition to these antihypertensive drugs, many antihypertensive combinations are available, such as Ser-Ap-Es, Timolide 10-25, Aldoril, and Lopressor (Table 42-2). Most combination antihypertensive drugs are a combination of an antihypertensive and a diuretic.

ACTIONS

Many antihypertensive drugs lower the blood pressure by dilating or increasing the size of the arterial blood vessels (**vasodilatation**). Vasodilatation creates an increase in the **lumen** (the space or opening within an artery) of the arterial blood vessels, which in turn increases the amount of space available for the blood to circulate. Because blood volume (the amount of blood) remains relatively constant, an increase in the space in which the blood circulates (ie, the blood vessels) lowers the pressure of the fluid (measured as blood pressure) in the blood vessels. Although the method by which anti-hypertensive drugs dilate blood vessels varies, the result

remains basically the same. Antihypertensive drugs that have vasodilating activity include:

- Adrenergic blocking drugs
- Antiadrenergic blocking drugs
- Calcium channel blocking drugs
- Vasodilating drugs

Another type of antihypertensive drug is the diuretic. The mechanism by which the diuretics reduce elevated blood pressure is unknown, but it is thought to be based, in part, on their ability to increase the excretion of sodium from the body. The actions and uses of diuretics are discussed in Chapter 46.

The mechanism of action of the ACE inhibitors is not fully understood. It is believed that these drugs may prevent (or inhibit) the activity of **angiotensin-converting enzyme**, which converts angiotensin I to angiotensin II, a powerful vasoconstrictor. Both angiotensin I and ACE normally are manufactured by the body and are called **endogenous** substances. The vasoconstricting activity of angiotensin II stimulates the secretion of the endogenous hormone aldosterone by the adrenal cortex. **Aldosterone** promotes the retention of sodium and water, which may contribute to a rise in blood pressure. By preventing the conversion of angiotensin I to angiotensin II, this chain of events is interrupted, sodium and water are not retained, and the blood pressure decreases. The angiotensin II receptor antagonists act to block the vasoconstrictor and aldosterone effects of angiotensin II at various receptor sites, resulting in a lowering of the blood pressure (Fig. 42-2).

USES

Antihypertensives are used in the treatment of hypertension. Although many antihypertensive drugs are available, not all drugs may work equally well in a given patient. In some instances, the primary care provider

TABLE 42-2 Examples of Selected Antihypertensive Combinations

TRADE NAME	DIURETIC CONSTITUENT	ANTIHYPERTENSIVE
Aldoril-15	hydrochlorothiazide (15 mg)	methyldopa (250 mg)
Apresazide	hydrochlorothiazide (50 mg)	hydralazine (50 mg)
Combipres	chlorthalidone (15 mg)	clonidine (0.1 mg)
Hydropres-50	hydrochlorothiazide (50 mg)	reserpine (0.125 mg)
Lopressor 100/50	hydrochlorothiazide (50 mg)	metoprolol (100 mg)
Minizide 5	polythiazide (0.5 mg)	prazosin (5 mg)
Ser-Ap-Es	hydrochlorothiazide (15 mg)	reserpine (0.1 mg)
	hydralazine (25 mg)	
Tenoretic 100	chlorthalidone (25 mg)	atenolol (100 mg)
Timolide 10-25	hydrochlorothiazide (25 mg)	timolol maleate (10 mg)
Zestoretic	hydrochlorothiazide (12.5 mg)	lisinopril (20 mg)

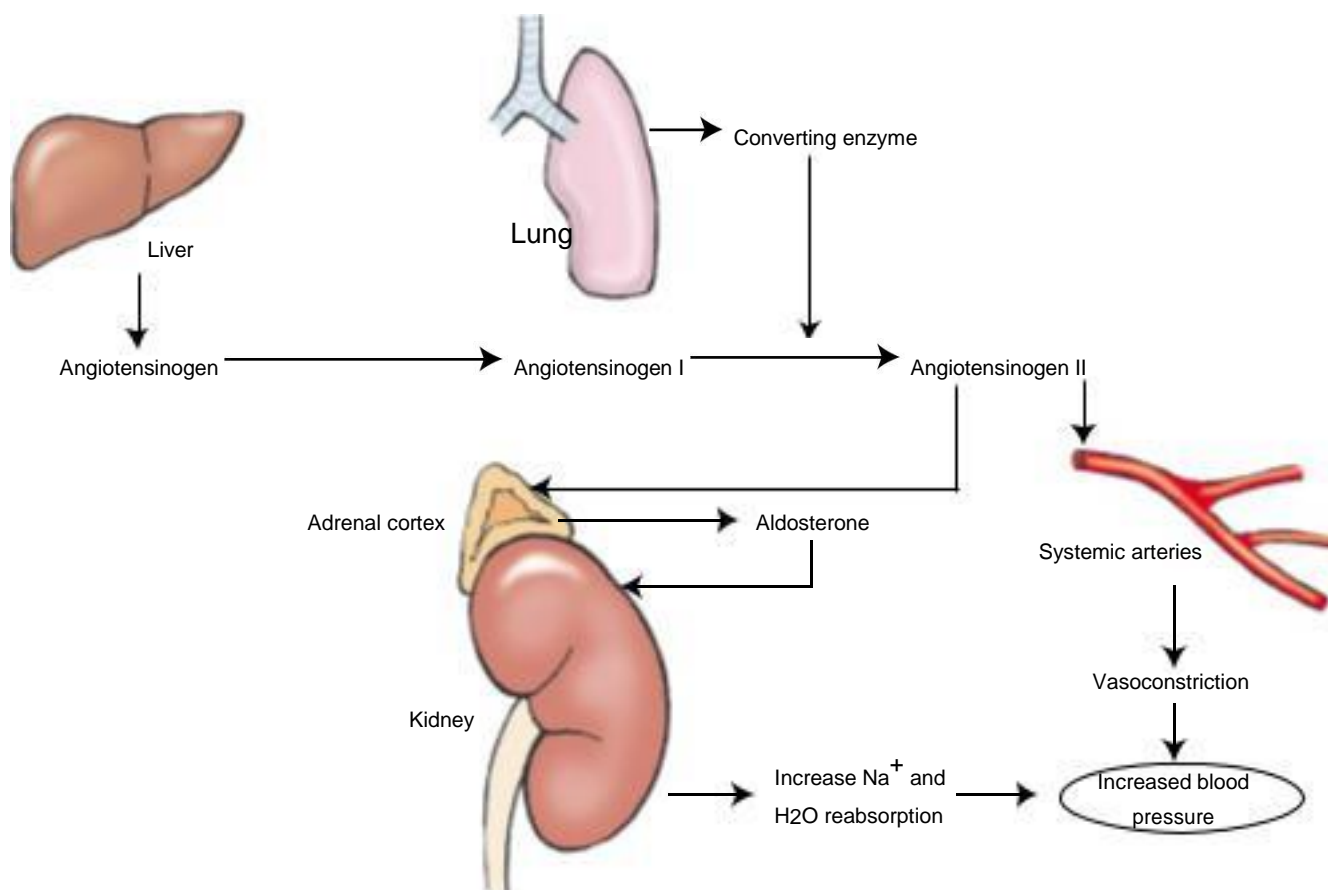


FIGURE 42-2. Activity of angiotensinogen in relation to increased blood pressure. (Adapted from Scanlon & Sanders [1999]. *Essentials of anatomy and physiology* [3rd ed., p. 295]. Philadelphia: FA Davis.)

may find it necessary to prescribe a different antihypertensive drug when the patient experiences no response to therapy. Some antihypertensive drugs are used only in severe cases of hypertension and when other less potent drugs have failed to lower the blood pressure. At times, two antihypertensive drugs may be given together to achieve a better response (see Fig. 42-1).

Diazoxide (Hyperstat IV) and nitroprusside (Nitropress) are examples of intravenous (IV) drugs that may be used to treat hypertensive emergencies. A hypertensive emergency is a case of extremely high blood pressure that does not respond to conventional antihypertensive drug therapy.

individual has been standing in one place for a long time. These reactions can be avoided or minimized by having the patient rise slowly from a lying or sitting position and by avoiding standing in one place for a pro-longed period.

Additional adverse reactions that may be seen when an antihypertensive drug is administered are listed in the Summary Drug Table: Antihypertensive Drugs. For the adverse reactions that may be seen when a diuretic is used as an antihypertensive drug, see the Summary Drug Table: Diuretics in Chapter 46.

CONTRAINDICATIONS

ADVERSE REACTIONS

When any antihypertensive drug is given, postural or orthostatic hypotension may be seen in some patients, especially early in therapy. **Postural hypotension** is the occurrence of dizziness and light-headedness when the individual rises suddenly from a lying or sitting position. **Orthostatic hypotension** occurs when the

Antihypertensive drugs are contraindicated in patients with known hypersensitivity to the individual drugs. When an antihypertensive is administered by a trans-dermal system (eg, clonidine), the system is contraindicated if the patient is allergic to any component of the adhesive layer of the transdermal system. Use of the angiotensin II receptor antagonists during the second and third trimester of pregnancy is contraindicated

(text continues on page 402)

SUMMARY DRUG TABLE ANTIHYPERTENSIVE DRUGS

GENERIC NAME			TRADE NAME*	USES
			ADVERSE REACTIONS DOSAGE RANGES	
Peripheral Vasodilators				
hydralazine HCl hy-dral'-a-zeen	Apresoline, generic	Hypertension	Dizziness, drowsiness, headache, hypotension, diarrhea, nausea, rash, sodium retention, drug-induced lupus syndrome	10—50 mg QID PO up to 300 mg/d
minoxidil mi-nox'-i-dill	Loniten, generic	Severe hypertension	Headache, hypotension, ECG changes, tachycardia, rash, sodium and water retention, hair growth	5—100 mg/d PO; dosage greater than 5 mg given in divided doses
-Adrenergic Blocking Drugs				
acebutolol HCl a-se-byoo'-toe-lole	Sectral, generic	Hypertension, ventricular arrhythmias	Fatigue, hypotension, weakness, impotence, blurred vision, hypotension, congestive heart failure (CHF), bradycardia, pulmonary edema	400—1200 mg/d in single or divided doses PO
atenolol a-ten'-oh-lole	Tenormin, generic	Angina pectoris, hypertension, myocardial infarction (MI)	Fatigue, hypotension, weakness, blurred vision, stuffy nose, impotence, decreased libido, rash, CHF, bradycardia, pulmonary edema	50—100 mg/d PO in single dose; 5 mg IV; may repeat every 10 min up to 2 times
betaxolol HCl be-tax'-oh-lol	Kerlone	Hypertension, glaucoma (ophthalmic)	Fatigue, weakness, drowsiness, impotence, hypotension, CHF, bradycardia, pulmonary edema	10—20 mg once daily PO
bisoprolol fumarate bis-oh'-pro-lole	Zebeta	Hypertension	Fatigue, hypotension, weakness, blurred vision, stuffy nose, rash, CHF, bradycardia, pulmonary edema	2.5—20 mg once daily PO
carteolol HCl kar'-tee-oh-lole	Cartrol	Hypertension, glaucoma (ophthalmic)	Fatigue, orthostatic hypotension, weakness, blurred vision, stuffy nose, impotence, rash, CHF, bradycardia, pulmonary edema	2.5—10 mg/d once daily PO
carvedilol kar-ve'-di-lole	Coreg	Essential hypertension, CHF	Fatigue, dizziness, orthostatic hypotension, diarrhea, hyperglycemia, weakness, impotence, CHF, bradycardia, pulmonary edema	Hypertension: 6.25—25 mg BID PO; CHF: 3.125—25 mg BID PO
labetalol HCl la-bet'-oh-lole	Normodyne, Trandate, generic	Hypertension	Fatigue, weakness, orthostatic hypotension, impotence, drowsiness, bradycardia, pulmonary edema, CHF	200—400 mg BID up to 2400 mg/d; 20—80 mg IV; may give q 10 min up to 300 mg
metoprolol me-toe'-proe-lole	Lopressor, Toprol XL, generic	Hypertension, angina pectoris, MI, heart failure (HF)	Fatigue, weakness, orthostatic hypotension, impotence, drowsiness, bradycardia, pulmonary edema, CHF	Hypertension angina, 100—400 mg/d PO; extended-release products are given once daily; MI: 25—100 mg BID PO; 5 mg q 2 min IV for 3 doses
nadolol nay'-doe-lole	Corgard, generic	Angina pectoris, hypertension	Fatigue, weakness, orthostatic hypotension, impotence, drowsiness, bradycardia, pulmonary edema, CHF	Angina: 40—80 mg/d PO; up to 240 mg/d; hypertension: 40—80 mg/d once daily PO; may increase to 320 mg/d

SUMMARY DRUG TABLE ANTIHYPERTENSIVE DRUGS (Continued)

GENERIC NAME	TRADE NAME*	USES	ADVERSE REACTIONS	DOSAGE RANGES
penbutolol sulfate <i>pen-byoo'-toe-lole</i>	Levatol	Hypertension	Fatigue, weakness, orthostatic hypotension, impotence, drowsiness, bradycardia, pulmonary edema, CHF	20 mg once daily PO
pindolol <i>pin'-doh-lole</i>	Visken, <i>generic</i>	Hypertension	Fatigue, weakness, orthostatic hypotension, impotence, drowsiness, bradycardia, pulmonary edema, CHF	5–60 mg/d, given twice daily PO
propranolol HCl <i>proe-pran'-oh-lole</i>	Inderal, Inderal LA, <i>generic</i>	MI, cardiac arrhythmias, angina pectoris, hypertension, migraine	Fatigue, weakness, orthostatic hypotension, impotence, drowsiness, bradycardia, pulmonary edema, CHF	MI: 180–240 mg/d PO; arrhythmias: 10–30 mg/d PO TID, QID; 1–3 mg IV, may repeat in 2 min and again in 4 h if needed; angina: 80–320 mg/d in 2–4 divided doses or once daily as extended release; hypertension: 80–240 mg/d PO in divided doses; doses up to 640 mg have been given; migraine: 20 mg QID PO or 80 mg as extended release
timolol maleate <i>tim'-oh-lole</i>	Blocadren, <i>generic</i>	Hypertension, MI, migraine prophylaxis, glaucoma (ophthalmic)	Fatigue, weakness, orthostatic hypotension, impotence, drowsiness, bradycardia, pulmonary edema, CHF	Hypertension: 20 mg/d PO up to 60 mg/d; MI: 10 mg PO BID; migraine: 10–30 mg/d PO in one or divided dose
<i>Antiadrenergics—Centrally Acting</i>				
clonidine HCl (oral) <i>kloe'-ni-deen</i>	Catapres, <i>generic</i>	Hypertension	Drowsiness, sedation, dizziness, headache, fatigue that tends to diminish within 4–6 weeks, dry mouth, constipation, impotence, decreased sexual activity	Individualize dosage, 0.1–0.8 mg/d PO in divided doses; maximum dosage, 2.4 mg/d
clonidine HCl (transdermal) <i>kloe'-ni-deen</i>	Catapres-T TS-1, Catapres-T TS-2, Catapres-T TS-3, <i>generic</i>	Hypertension	Drowsiness, dry mouth, transient localized skin reactions, fatigue, headache, constipation, nausea	0.1 mg system–0.3 mg system q7d, may increase up to 2 0.3-mg systems per 24 hours
guanabenz acetate <i>gwahn'-a-benz</i>	Wytensin, <i>generic</i>	Hypertension	Dizziness, weakness, lassitude, syncope, postural or exertional hypotension, diarrhea, bradycardia, fluid retention and edema, inhibition of ejaculation, CHF	Individualize dosage, 4–8 mg BID PO; may increase up to 64 mg/d
guanfacine HCl <i>gwahn'-fa-seen</i>	Tenex	Hypertension	Sedation, weakness, dizziness, dry mouth, constipation, impotence	1–3 mg PO HS
methyl dopa and methyldopate HCl <i>meth-ill-doe'-pa</i>	Aldomet	Hypertension	Sedation, headache, asthenia, weakness, nausea, vomiting, distention, constipation, bradycardia	Methyldopa: 250 mg–3 g/d PO in divided doses; methyldopate: 250 mg–1 g q6h IV

(continued)

SUMMARY DRUG TABLE ANTIHYPERTENSIVE DRUGS (Continued)

GENERIC NAME	TRADE NAME*	USES	ADVERSE REACTIONS	DOSAGE RANGES
<i>Antiadrenergics—Peripherally Acting</i>				
guanadrel <i>gwahn'-a-drel</i>	Hylorel	Hypertension	Fatigue, headache, faintness, drowsiness, visual disturbances, confusion, increased bowel movements, indigestion, constipation, anorexia, shortness of breath on exertion, palpitations, chest pain, coughing, nocturia, urinary urgency or frequency, peripheral edema, ejaculation disturbances, weight loss or gain	10—75 mg/d PO
guanethidine monosulfate <i>gwahn-eth'-i-deen</i>	Ismelin	Hypertension	Dizziness, weakness, lassitude, syncope, postural or exertional hypotension, diarrhea, bradycardia, fluid retention and edema, CHF, inhibition of ejaculation	10—50 mg/d PO
reserpine <i>re-ser'-peen</i>	Generic	Hypertension	Drowsiness, sedation, lethargy, respiratory depression, edema, orthostatic hypotension, nasal congestion	0.5—1 mg/d PO
<i>-Adrenergic Blocking Drugs</i>				
doxazosin mesylate <i>dox-ay'-zoe-sin</i>	Cardura	Hypertension, benign prostatic hypertrophy (BPH)	Headache, fatigue, dizziness, postural hypotension, dizziness, lethargy, vertigo, nausea, dyspepsia, diarrhea, tachycardia, palpitations, edema, sexual dysfunction	Hypertension: 1—16 mg/d PO once a day; BPH: 1—8 mg/d PO
mecamylamine HCl <i>mek-a-mill'-a-meen</i>	Inversine	Severe hypertension	Weakness, fatigue, sedation, anorexia, dry mouth, glossitis, nausea, orthostatic hypotension	5—25 mg/d PO in 2 or 3 doses
prazosin <i>pra'-zoe-sin</i>	Minipress, generic	Hypertension	Dizziness, headache, drowsiness, lethargy, weakness, nausea, palpitations	1—20 mg/d PO in divided doses
terazosin <i>ter-ay'-zoe-sin</i>	Hytrin	Hypertension, BPH	Dizziness, headache, drowsiness, lack of energy, weakness, somnolence, nausea, palpitations, edema, dyspnea, nasal congestion, sinusitis	1—20 mg/d PO at HS
<i>Angiotensin-Converting Enzyme Inhibitors</i>				
benazepril HCl <i>ben-a'-za-pril</i>	Lotensin	Hypertension	Nausea, cough, vomiting, constipation, hypotension, palpitations, rash	10—40 mg/d PO in single or two divided doses
captopril <i>kap'-toe-pril</i>	Capoten, generic	Hypertension, HF, left ventricular dysfunction (LVD) after MI, diabetic nephropathy	Tachycardia, gastric irritation, peptic ulcer, proteinuria, rash, pruritus, cough	Hypertension: 50—450 mg/d PO in divided doses; CHF: 25—450 mg/d in divided doses; LVD: 6.25—150 mg/d PO TID; diabetic nephropathy: 25 mg PO TID

SUMMARY DRUG TABLE ANTIHYPERTENSIVE DRUGS (Continued)

GENERIC NAME	TRADE NAME*	USES	ADVERSE REACTIONS	DOSAGE RANGES
enalapril <i>e-nal'-a-pril</i>	Vasotec, Vasotec IV	Hypertension, HF, asymptomatic LVD	Headache, dizziness, fatigue, nausea, diarrhea, decreased hematocrit and hemoglobin, cough	Hypertension: 5—40 mg/d PO as a single dose or in two divided doses; 0.625—1.25 mg q6h IV; HF: 2.5—40 mg/d in two divided doses PO; LVD: 5—10 mg PO BID
fosinopril sodium <i>foh-sin'-oh-pril</i>	Monopril	Hypertension, HF	Nausea, cough, abdominal pain, vomiting, orthostatic hypotension, palpitation, rash	10—40 mg/d PO in a single or two divided doses
lisinopril <i>lyse-in'-oh-pril</i>	Prinivil, Zestril, generic	Hypertension, HF, acute MI	Headache, dizziness, insomnia, fatigue, gastric irritation, nausea, diarrhea, orthostatic hypotension, proteinuria, angioedema, cough	Hypertension: 10—40 mg/d PO as a single dose; CHF: 5—20 mg/d PO; acute MI: 5—10 mg PO
moexipril HCl <i>mo-ex'-ah-pril</i>	Univasc	Hypertension	Tachycardia, gastric irritation, peptic ulcers, diarrhea, diarrhea, proteinuria, rash, pruritus, flushing, flu-like syndrome, dizziness, cough	7.5—30 mg PO in one or two divided doses
perindopril erbumine <i>pur-in'-doh-pril</i>	Aceon	Essential hypertension	Orthostatic hypotension, headache, dizziness, insomnia, fatigue, proteinuria, gastric irritation, nausea, cough	4—16 mg/d PO
quinapril HCl <i>kwin'-ah-pril</i>	Accupril	Hypertension, HF	Nausea, cough, abdominal pain, vomiting, orthostatic hypotension, palpitation, rash	Hypertension: 10—80 mg/d PO as a single dose or two divided doses; CHF: 5—20 mg PO BID
ramipril <i>ra-mi'-prill</i>	Altace	Hypertension, HF, decrease risk of cardiovascular disease, coronary artery disease (CAD)	Nausea, cough, abdominal pain, vomiting, orthostatic hypotension, palpitation, rash	Hypertension: 2.5—20 mg/d PO as a single dose or in two divided doses; CHF: 2.5—5 mg PO BID; CAD risk: 10 mg/d PO
Angiotensin II Receptor Antagonists				
candesartan cilexetil <i>can-dah-sar'-tan</i>	Atacand	Hypertension	Diarrhea, abdominal pain, nausea, headache, dizziness, upper respiratory infection (URI) symptoms, hypotension, rash	16—32 mg/d PO in divided doses
eprosartan mesylate <i>ep-row-sar'-tan</i>	Teveten	Hypertension	Abdominal pain, fatigue, depression, URI symptoms, hypotension	400—800 mg/d PO in divided doses BID
irbesartan <i>er-bah-sar'-tan</i>	Avapro	Hypertension	Headache, dizziness, diarrhea, abdominal pain, nausea, hypotension, URI symptoms, cough, fatigue	75—300 mg/d PO as one dose
losartan potassium <i>low-sar'-tan</i>	Cozaar	Hypertension	Diarrhea, abdominal pain, nausea, headache, dizziness, hypotension, URI symptoms, cough	25—100 mg/d PO in one or two doses
telmisartan <i>tell-mah-sar'-tan</i>	Micardis	Hypertension	Diarrhea, abdominal pain, nausea, headache, dizziness, light-headedness, URI symptoms, hypotension	40—80 mg/d PO
valsartan <i>val-sar'-tan</i>	Diovan	Hypertension	Headache, dizziness, diarrhea, abdominal pain, nausea, URI symptoms, cough	80—320 mg/d PO

(continued)

SUMMARY DRUG TABLE ANTIHYPERTENSIVE DRUGS (Continued)

GENERIC NAME	TRADE NAME*	USES	ADVERSE REACTIONS	DOSAGE RANGES
<i>Drugs Used for Hypertensive Crisis</i>				
diazoxide, parenteral <i>di-az-ok'-side</i>	Hyperstat IV, <i>generic</i>	Hypertensive crisis retention, hypotension,	Dizziness, weakness, nausea, vomiting, sodium and water myocardial ischemia	1–3 mg/kg IV bolus; maximum dosage: 150 mg
nitroprusside sodium <i>nye-troe-pruss'-ide</i>	Nitropress, <i>generic</i>	Hypertensive crisis	Apprehension, headache, restlessness, nausea, vomiting, palpitations, diaphoresis	3 mcg/kg per minute, not to exceed infusion rate of 10 mcg/min (if blood pressure is not reduced within 10 min, discontinue administration)

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

because use may cause fetal and neonatal injury or death. These drugs are Pregnancy Category C during the first trimester of pregnancy and Pregnancy Category D during the second and third trimesters.

PRECAUTIONS

Antihypertensive drugs are used cautiously in patients with renal or hepatic impairment or electrolyte imbalances, during lactation and pregnancy, and in older patients. ACE inhibitors are used cautiously in patients with sodium depletion, hypovolemia, or coronary or cerebrovascular insufficiency and those receiving diuretic therapy or dialysis. The angiotensin II receptor agonists are used cautiously in patients with renal or hepatic dysfunction, hypovolemia, or volume or salt depletion, and patients receiving high doses of diuretics.

INTERACTIONS

The hypotensive effects of most antihypertensive drugs are increased when administered with diuretics and other antihypertensives. Many drugs can interact with the antihypertensive drugs and decrease their effectiveness (eg, antidepressants, monoamine oxidase inhibitors, antihistamines, and sympathomimetic bronchodilators). When the ACE inhibitors are administered with the NSAIDs, their antihypertensive effect may be decreased. Absorption of the ACE inhibitors may be decreased when administered with the antacids. Administration of potassium-sparing diuretics or potassium supplements concurrently with the ACE inhibitors may cause hyperkalemia. When the angiotensin II receptor agonists are administered with

NSAIDs or phenobarbital, their antihypertensive effects may be decreased.



Herbal Therapy Alert

Various herbs and supplements, such as hawthorn extracts, garlic, onion, ginkgo biloba, vitamin E, and aspirin, may be used by herbalists for hypertension. Although these substances may lower blood pressure in some individuals, their use is not recommended because the effect is slight and usually too gentle to affect moderate to severe hypertension. However, several studies have demonstrated that hypertensive patients may benefit from daily doses of calcium (800 mg) or magnesium (300 mg). Patients should consult the primary health care provider before taking any herbal remedy.

NURSING PROCESS

• The Patient Receiving an Antihypertensive Drug

ASSESSMENT

Preadministration Assessment

Before therapy with an antihypertensive drug is started, the nurse obtains the blood pressure (see Fig. 42-3) and pulse rate on both arms with the patient in standing, sitting, and lying positions. The nurse correctly identifies all readings (eg, the readings on each arm and the three positions used to obtain the readings) and records these on the patient's chart. The nurse also obtains the patient's weight, especially if a diuretic is part of therapy or if the primary care provider prescribes a weight-loss regimen.

Ongoing Assessment

Monitoring and recording the blood pressure is an important part of the ongoing assessment, especially



FIGURE 42-3. The nurse takes the patient's blood pressure prior to administering an antihypertensive drug.

early in therapy. The primary care provider may need to adjust the dose of the drug upward or downward, try a different drug, or add another drug to the therapeutic regimen if the patient does not have an adequate response to drug therapy.

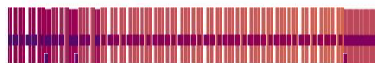
Each time the blood pressure is obtained, the nurse uses the same arm and the patient is placed in the same position (eg, standing, sitting, or lying down). In some instances, the primary care provider may order the blood pressure taken in one or more positions, such as standing and lying down. The nurse monitors the blood pressure and pulse every 1 to 4 hours if the patient has severe hypertension, does not have the expected response to drug therapy, or is critically ill.



Nursing Alert

The blood pressure and pulse rate must be obtained immediately before each administration of an antihypertensive drug and compared with previous readings. If the blood pressure is significantly decreased from baseline values, the nurse should not give the drug but should notify the primary health care provider. In addition, the primary health care provider must be notified if there is a significant increase in the blood pressure.

The nurse obtains daily weights during the initial period of drug therapy. Patients taking an antihypertensive drug will occasionally retain sodium and water, resulting in edema and weight gain. The nurse assesses the patient's weight and examines the extremities for edema. The nurse reports weight gain of 2 lb or more per day and any evidence of edema in the hands, fingers, feet, legs, or sacral area. The patient is also weighed at regular intervals if a weight-reduction diet is used to lower the blood pressure or if the patient is receiving a thiazide or related diuretic as part of antihypertensive therapy.



- ✓ **Risk for Deficient Fluid Volume** related to administration of a diuretic as an antihypertensive drug (when appropriate)
- ✓ **Risk for Injury** related to dizziness or light-headedness secondary to postural or orthostatic hypotensive episodes
- ✓ **Decreased Cardiac Output** related to adverse drug reactions, other factors (specify)

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 an optimal response to therapy (blood pressure maintained in an acceptable range), management of common adverse drug reactions, and an understanding of and compliance with the prescribed therapeutic regimen.

IMPLEMENTATION

Promoting an Optimal Response to Therapy

ADMINISTERING ANTIADRENERGIC DRUGS. Clonidine is available as an oral tablet (Catapres) and transdermal patch (Catapres-TTS). The nurse applies the transdermal patch to a hairless area of intact skin on the upper arm or torso; the patch is kept in place for 7 days. The adhesive overlay is applied directly over the system to ensure the patch remains in place for the required time. A different body area is selected for each application. If the patch loosens before the 7 days, the edges can be reinforced with nonallergenic tape. The date the patch was placed and the date the patch is to be removed can be written on the surface of the patch with a fiber-tipped pen. (See Chapter 23 for additional information concerning the antiadrenergic drugs.)

ADMINISTERING VASODILATING DRUGS. The nurse must carefully monitor the patient receiving minoxidil because the drug increases the heart rate. The primary care provider is notified if any of the following occur:

- Heart rate of 20 bpm or more above the normal rate
- Rapid weight gain of 5 lb or more
- Unusual swelling of the extremities, face, or abdomen
- Dyspnea, angina, severe indigestion, or fainting

ADMINISTERING CALCIUM CHANNEL BLOCKERS. The nurse may give these drugs without regard to meals. If gastrointestinal upset occurs, the drug may be administered

with meals. Bepridil and verapamil are best given with meals or milk because of the tendency of these two drugs to cause gastric upset. The sustained-release capsules should not be crushed, opened, or chewed. Verapamil capsules (not sustained released) may be opened and the contents sprinkled in liquid or on soft foods. Diltiazem may be crushed and mixed with food or fluids for patients who have difficulty swallowing. Sublingual nifedipine may be administered by puncturing the capsule with a sterile needle. The contents can then be squeezed into the buccal pouch.

ADMINISTERING ACE INHIBITORS. The nurse administers captopril and moexipril 1 hour before or 2 hours after meals to enhance absorption. Some patients taking an ACE inhibitor experience a dry cough that does not subside until the drug therapy is discontinued. This reaction may need to be tolerated. If the cough becomes too bothersome, the primary care provider may discontinue use of the drug.

The ACE inhibitors may cause a significant drop in blood pressure after the first dose. This effect can be minimized by discontinuing the diuretic therapy (if the patient is taking a diuretic) or by increasing salt intake for at least 1 week before treatment with the ACE inhibitors is begun or beginning treatment with small doses. After the first dose of an ACE inhibitor, the nurse monitors the blood pressure every 15 to 30 minutes for at least 2 hours and afterward until the blood pressure is stable for 1 hour.

ADMINISTERING ANGIOTENSIN II RECEPTOR ANTAGONISTS. Women of childbearing age must use a reliable contraceptive while taking the angiotensin II receptor antagonists. The primary care provider is notified if pregnancy is suspected. The most serious consequences of these drugs occur during the second and third trimesters of pregnancy.

ADMINISTERING DRUGS FOR HYPERTENSIVE EMERGENCIES. Nitroprusside and diazoxide are drugs used to treat patients with a hypertensive emergency (a systolic pressure of 120 mm Hg or more). When these drugs are used, the nurse frequently monitors the blood pressure, heart rate, and electrocardiogram throughout the course of therapy. Continuous monitoring is preferred. The primary care provider will order the parameters for the blood pressure maintenance.

Nitroprusside infusion bottles are wrapped in aluminum foil or other opaque material to protect the drug from light. The administration tubing does not require a covering. If the solution is protected from light, it remains stable for up to 24 hours. The newly prepared solution normally has a very light brownish tint. The nurse should discard the solution if the mixture becomes blue, green, or dark red.



Nursing Alert

When diazoxide or nitroprusside is used for a hypertensive emergency, the nurse places the patient in a supine position immediately before, as well as after, administration of the drug. The rate of infusion (nitroprusside) or rate of direct IV administration (diazoxide) and the patient's blood pressure are monitored closely during and after administration of the drug because severe hypotension can occur. The blood pressure and pulse rate may need to be monitored every 15 minutes until the blood pressure is reduced to safe levels. The systolic pressure should not drop below 60 mm Hg.



Gerontologic Alert

Older adults are particularly sensitive to the hypotensive effects of nitroprusside. To minimize the hypotensive effects, the drug is initially given in lower dosages. Older adults require more frequent monitoring during the administration of nitroprusside.

Monitoring and Managing Adverse Drug Reactions

The nurse observes the patient for adverse drug reactions because their occurrence may require a change in the dose or the drug. The nurse should notify the primary care provider if any adverse reactions occur. In some instances, the patient may have to tolerate mild adverse reactions, such as dry mouth or mild anorexia.



Nursing Alert

Should it be necessary to discontinue antihypertensive therapy, the nurse should never discontinue use of the drug abruptly. The dosage is gradually reduced over 2 to 4 days to avoid rebound hypertension (a rapid rise in blood pressure).

MANAGING FLUID VOLUME DEFICIT. The patient receiving a diuretic is observed for dehydration and electrolyte imbalances. A fluid volume deficit is most likely to occur if the patient fails to drink a sufficient amount of fluid. This is especially true in the elderly or confused patient. To prevent a fluid volume deficit, the nurse encourages patients to drink adequate oral fluids (up to 3000 mL/d, unless contraindicated).

Electrolyte imbalances that may be seen during therapy with a diuretic include **hyponatremia** (low blood sodium) and **hypokalemia** (low blood potassium), although other imbalances may also be seen. See Chapter 58 and Display 58-2 for the signs and symptoms of electrolyte imbalances. The primary care provider is notified if any signs or symptoms of an electrolyte imbalance occur.

MINIMIZING THE RISK FOR INJURY. Dizziness or weakness along with postural hypotension can occur with the administration of antihypertensive drugs. If postural

Home Care Checklist

PREVENTING ORTHOSTATIC HYPOTENSION

Many patients receiving antihypertensive therapy commonly receive more than one drug, placing them at risk for orthostatic hypotension. If it occurs, your patient may fall and be injured. So teach the following measures to follow while in the acute care facility and at home:

- ✓ Change your position slowly.
- ✓ Sit at the edge of the bed or chair for a few minutes before standing up.
- ✓ Stand for a few minutes before starting to walk.
- ✓ Ask for assistance when necessary.
- ✓ If you feel dizzy or light-headed, sit or lie down immediately.
- ✓ Make sure to drink adequate amounts of fluid throughout the day.

hypotension should occur, the nurse advises the patient to rise slowly from a sitting or lying position. The nurse explains that when rising from a lying position, sitting on the edge of the bed for 1 or 2 minutes often minimizes these symptoms. The nurse informs the patient that rising slowly from a chair and then standing for 1 to 2 minutes also minimizes the symptoms of postural hypotension. When symptoms of postural hypotension, dizziness, or weakness occur, the nurse assists the patient in getting out of bed or a chair and with ambulatory activities.

Educating the Patient and Family

Nurses can do much to educate others on the importance of having their blood pressure checked at periodic intervals. This includes people of all ages because hypertension is not a disease seen only in older individuals. Once hypertension is detected, patient teaching becomes an important factor in successfully returning the blood pressure to normal or near normal levels.

To ensure lifetime compliance with the prescribed therapeutic regimen, the nurse emphasizes the importance of drug therapy, as well as other treatments recommended by the primary care provider. The nurse describes the adverse reactions that may be seen with a particular antihypertensive drug and advises the patient to contact the primary care provider if any should occur.

The primary care provider may want the patient or family to monitor blood pressure during therapy. The nurse teaches the technique of taking a blood pressure and pulse rate to the patient or family member, allowing sufficient time for supervised practice. The nurse instructs the patient to keep a record of the blood pressure and to bring this record to each visit to the primary care provider's office or clinic.

The nurse includes the following points in a teaching plan for the patient receiving an antihypertensive drug:

- Never discontinue use of this drug except on the advice of the primary care provider. These drugs control but do not cure hypertension. Skipping doses of the drug or voluntarily discontinuing the drug may cause severe, rebound hypertension.
- Avoid the use of any nonprescription drugs (some may contain drugs that are capable of increasing the blood pressure) unless approved by the primary care provider.
- Avoid alcohol unless its use has been approved by the primary care provider.
- This drug may produce dizziness or light-headedness when rising suddenly from a sitting or lying position. To avoid these effects, rise slowly from a sitting or lying position (see Home Care Checklist: Preventing Orthostatic Hypotension).
- If the drug causes drowsiness, avoid hazardous tasks such as driving or performing tasks that require alertness. Drowsiness may disappear with time.
- If unexplained weakness or fatigue occurs, contact the primary care provider.
- Contact the primary care provider if adverse drug effects occur.
- Follow the diet restrictions recommended by the primary care provider. Do not use salt substitutes unless a particular brand of salt substitute is approved by the primary care provider.
- Notify the primary care provider if the diastolic pressure suddenly increases to 130 mm Hg or higher; you may have malignant hypertension.

EVALUATION

- The therapeutic effect is achieved and blood pressure controlled.
- Adverse reactions are identified, reported to the primary care provider, and managed successfully through nursing interventions.
- Fluid volume deficit is corrected (when appropriate).
- No evidence of injury is seen.
- The patient complies with the prescribed drug regimen.
- 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. Discuss important preadministration assessments that should be performed on a patient prescribed captopril for hypertension.
2. While working in the medical clinic of a hospital associated health care satellite, the primary care provider asks you to explain to a patient what can be done to avoid dizziness and light-headedness when rising from a sitting or lying down position. When talking to the patient, you discover that he understands little English. Discuss how you might communicate to this patient what he can do to decrease the symptoms of postural and orthostatic hypotension.
3. Mr. Bates, who has been treated for hypertension, is admitted for treatment of a kidney stone. On admission, he had severe pain and his blood pressure was 160/96 mm Hg. For the past 2 days, his blood pressure has been between 140/92 and 148/92 mm Hg. When taking his blood pressure before giving him an oral antihypertensive drug, you find that it now is 118/82 mm Hg. Analyze the situation and discuss what actions you would take.
4. Develop a teaching plan for a patient prescribed verapamil for hypertension. Discuss what information you would need from the patient before developing this plan. Identify important points to include in the plan.
5. Ms. Jones is admitted to the emergency department in hypertensive crisis. Nitroprusside therapy is begun, and you are asked to monitor this patient. Discuss important points that the nurse should keep in mind when administering this drug. Identify methods you would use to monitor the patient and prevent complications.

• Review Questions

1. The nurse instructs the patient using the transdermal system (Catapres TTS) . _____
 - A. to place the patch on the torso and keep it in place for 24 hours
 - B. to change placement of the patch every day after bathing
 - C. to place the patch on the upper arm or torso and keep it in place for 7 days
 - D. avoid getting the patch wet because it might detach from the skin
2. To avoid symptoms associated with orthostatic hypotension, the nurse advises the patient to . _____
 - A. sleep in a side-lying position
 - B. avoid sitting for prolonged periods
 - C. change position slowly
 - D. get up from a sitting position quickly
3. After the first dose of an ACE inhibitor, the nurse monitors . _____
 - A. the patient for a hypotensive crisis
 - B. the vital signs every 4 hours or more often if the patient reports being dizzy
 - C. the blood pressure every hour until it is stable
 - D. the blood pressure every 15 to 30 minutes for at least 2 hours
4. When discontinuing use of an antihypertensive drug, the nurse . _____
 - A. monitors the blood pressure every hour for 8 hours after the drug therapy is discontinued
 - B. expects the primary care provider to order that the drug dosage be gradually decreased during a period of 2 to 4 days to avoid rebound hypertension
 - C. checks the blood pressure and pulse every 30 minutes after discontinuing the drug therapy
 - D. expects to taper the dosage of the drug during a period of 2 weeks to avoid a return of hypertension
5. When administering an antihypertensive drug for a hypertensive emergency, the nurse . _____
 - A. weighs the patient before administering the drug
 - B. places the patient in a supine position
 - C. darkens the room to decrease stimuli
 - D. places the patient in a high Fowler's position

• Medication Dosage Problems

1. Nadolol (Corgard) 80 mg PO is prescribed. The drug is available in 20-mg tablets. The nurse administers _____.
2. Diltiazem 180 mg is prescribed. The drug is available in 60-mg, 90-mg, and 120-mg tablets. Which tablet would you select? _____ How many tablets would you administer? _____