

● Assessment and Management of Patients With Hypertension

LEARNING OBJECTIVES

On completion of this chapter, the learner will be able to:

1. Define blood pressure and identify risk factors for hypertension.
2. Explain the difference between normal blood pressure and hypertension and discuss the significance of hypertension.
3. Describe the treatment approach for hypertension, including lifestyle changes and medication therapy.
4. Use the nursing process as a framework for care of the patient with hypertension.
5. Describe the necessity for immediate treatment of hypertensive crisis.

Blood pressure is the product of cardiac output multiplied by peripheral resistance. Cardiac output is the product of the heart rate multiplied by the stroke volume. In normal circulation, pressure is exerted by the flow of blood through the heart and blood vessels. High blood pressure, known as hypertension, can result from a change in cardiac output, a change in peripheral resistance, or both. The medications used for treating hypertension decrease peripheral resistance, blood volume, or the strength and rate of myocardial contraction.

Hypertension Defined

Hypertension is defined as a systolic blood pressure greater than 140 mm Hg and a diastolic pressure greater than 90 mm Hg based on the average of two or more correct blood pressure measurements taken during two or more contacts with a health care provider (Chobanian et al., 2003). Table 32-1 shows the classification of blood pressure established by the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) in 2003. The categories of blood pressure from normal to stage 2 hypertension are designed to emphasize the direct relationship between the risk of morbidity and mortality from increasing levels of blood pressure and the specific levels of both the systolic and diastolic blood pressures. The higher either the systolic or diastolic pressure, the greater the risk (Lewington, Clarke, Qizilbash, Peto, & Collins, 2002).

JNC 7 defines a blood pressure of <120/<80 mm Hg as normal; 120–139/80–89 mm Hg as prehypertension; and then, as shown in Table 32-1, two stages of hypertension. The term “stage” was used specifically to define the two levels of hypertension so that, as with cancer progression, the public and health care professionals would be aware that sustained elevations in blood pressure are associated with increased risks to health. The JNC 7 introduced the new category, prehypertension, into the categorization of blood pressure levels to emphasize the growing awareness that persons whose blood pressure begins to rise above 120/80 mm Hg are likely to progress to definite hypertension. To prevent or delay progression to hypertension, the JNC 7 Committee hopes that health care providers will encourage persons with blood pressures in the prehypertension category to begin lifestyle modifications such as nutritional changes and exercise. The JNC 7 report recommends that persons with hypertension be treated with medications and be evaluated by their health care provider about every month until their blood pressure goal is reached, and about every 3 to 6 months thereafter. Persons with higher levels of blood pressure (Stage 2) or other complicating conditions need to be evaluated more frequently.

Primary Hypertension

Between 21% and 36% of the adult population in the United States has hypertension (Hajjar & Kotchen, 2003). Of this population, between 90% and 95% have **primary hypertension**, meaning that the reason for the elevation in blood pressure cannot be identified. The remaining 5% to 10% of this group have high blood pressure related to specific causes, such as narrowing of the renal arteries, renal parenchymal disease, hyperaldosteronism (mineralocorticoid hypertension) certain medications, pregnancy, and coarctation of the aorta (Kaplan, 2001). **Secondary hypertension** is the term used to signify high blood pressure from an identified cause. Table 32-2 lists the most frequent causes of secondary hypertension.

Hypertension is sometimes called “the silent killer” because people who have it are often symptom free. In a national survey (1999 to 2000), 31% of people who had pressures exceeding 140/90 mm Hg were unaware of their elevated blood pressure (Hajjar & Kotchen, 2003). Once identified, elevated blood pressure should be monitored at regular intervals because hypertension is a lifelong condition.

Hypertension often accompanies risk factors for atherosclerotic heart disease, such as **dyslipidemia** (abnormal blood fat levels) and diabetes mellitus. The incidence of hypertension is higher in the southeastern United States, particularly among African Americans. Cigarette smoking does not cause high blood pressure; however, if a person with hypertension smokes, his or her risk of dying from heart disease or related disorders increases significantly.

High blood pressure can be viewed in three ways: as a sign, a risk factor for atherosclerotic cardiovascular disease, or a disease. As a sign, nurses and other health care professionals use blood pressure to monitor a patient’s clinical status. Elevated pressure may indicate an excessive dose of vasoconstrictive medication or other problems. As a risk factor, hypertension contributes to the rate at which atherosclerotic plaque accumulates within arterial walls. As a disease, hypertension is a major contributor to death from cardiac, renal, and peripheral vascular disease.

Prolonged blood pressure elevation eventually damages blood vessels throughout the body, particularly in target organs such as the heart, kidneys, brain, and eyes. The usual consequences of prolonged, uncontrolled hypertension are myocardial infarction, heart failure, renal failure, strokes, and impaired vision. The left ventricle of the heart may become enlarged (left ventricular hypertrophy) as it works to pump blood against the elevated pressure. An echocardiogram is the recommended method of determining whether hypertrophy (enlargement) has occurred.

Pathophysiology

Although the precise cause for most cases of hypertension cannot be identified, it is understood that hypertension is a multifactorial

Glossary

dyslipidemia: abnormally high or low blood lipid levels

hypertensive emergency: a situation in which blood pressure must be lowered immediately to prevent damage to target organs

hypertensive urgency: a situation in which blood pressure must be lowered within a few hours to prevent damage to target organs

JNC 7: Seventh Joint National Committee on the Prevention, Detection, Evaluation and Treatment of High Blood Pressure; committee established to study and make recommendations about hypertension in the United States. Findings and recommendations of JNC 7 are contained in an extensive report published in 2003.

monotherapy: medication therapy with a single medication

primary hypertension: also called essential hypertension; denotes high blood pressure from an unidentified cause

rebound hypertension: pressure that is controlled with therapy and that becomes uncontrolled (abnormally high) with the discontinuation of therapy

secondary hypertension: high blood pressure from an identified cause, such as renal disease

Table 32-1 • Classification and Management of Blood Pressure for Adults*

BP CLASSIFICATION	SBP* (MMHG)	DBP* (MMHG)	LIFESTYLE MODIFICATION	INITIAL DRUG THERAPY	
				Without Compelling Indication	With Compelling Indications (See Table 8)
<i>Normal</i>	<120	and <80	Encourage		
<i>Prehypertension</i>	120–139	or 80–89	Yes	No antihypertensive drug indicated.	Drug(s) for compelling indications.‡
<i>Stage 1 Hypertension</i>	140–159	or 90–99	Yes	Thiazide-type diuretics for most. May consider ACEI, ARB, BB, CCB, or combination.	Drug(s) for the compelling indications.‡ Other antihypertensive drugs (diuretics, ACEI, ARB, BB, CCB) as needed.
<i>Stage 2 Hypertension</i>	≥160	or ≥100	Yes	Two-drug combination for most† (usually thiazide-type diuretic and ACEI or ARB or BB or CCB).	

DBP, diastolic blood pressure; SBP, systolic blood pressure.

Drug abbreviations: ACEI, angiotensin converting enzyme inhibitor; ARB, angiotensin receptor blocker; BB, beta-blocker; CCB, calcium channel blocker.

*Treatment determined by highest BP category.

†Initial combined therapy should be used cautiously in those at risk for orthostatic hypotension.

‡Treat patients with chronic kidney disease or diabetes to BP goal of <130/80 mmHg.

From the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. (2003). *JAMA*, 289(19), 2560–2572.

condition. Because hypertension is a sign, it is most likely to have many causes, just as fever has many causes. For hypertension to occur, there must be a change in one or more factors affecting peripheral resistance or cardiac output (some of these factors are outlined in Figure 32-1). In addition, there must also be a problem with the control systems that monitor or regulate pressure. Single gene mutations have been identified for a few rare types of hypertension, but most types of high blood pressure are thought to be polygenic (mutations in more than one gene) (Dominiczak et al., 2000).

Several hypotheses about the pathophysiologic bases of elevated blood pressure are associated with the concept of hypertension as a multifactorial condition. Given the overlap among these hypotheses, it is likely that aspects of all of them will eventually prove correct. Hypertension may be caused by one or more of the following:

- Increased sympathetic nervous system activity related to dysfunction of the autonomic nervous system
- Increased renal reabsorption of sodium, chloride, and water related to a genetic variation in the pathways by which the kidneys handle sodium
- Increased activity of the renin-angiotensin-aldosterone system, resulting in expansion of extracellular fluid volume and increased systemic vascular resistance
- Decreased vasodilation of the arterioles related to dysfunction of the vascular endothelium

- Resistance to insulin action, which may be a common factor linking hypertension, type 2 diabetes mellitus, hypertriglyceridemia, obesity, and glucose intolerance



Gerontologic Considerations

Structural and functional changes in the heart and blood vessels contribute to increases in blood pressure that occur with age. The changes include accumulation of atherosclerotic plaque, fragmentation of arterial elastins, increased collagen deposits, and impaired vasodilation. The result of these changes is a decrease in the elasticity of the major blood vessels. Consequently, the aorta and large arteries are less able to accommodate the volume of blood pumped out by the heart (stroke volume), and the energy that would have stretched the vessels instead elevates the systolic blood pressure. Isolated systolic hypertension is more common in older adults.

Clinical Manifestations

Physical examination may reveal no abnormalities other than high blood pressure. Occasionally, retinal changes such as hemorrhages, exudates (fluid accumulation), arteriolar narrowing, and cotton-wool spots (small infarctions) occur. In severe hypertension, papilledema (swelling of the optic disc) may be seen. People with hypertension can be asymptomatic and remain so for many years. However, when specific signs and symptoms appear, they usually indicate vascular damage, with specific manifestations related to the organs served by the involved vessels. Coronary artery disease with angina or myocardial infarction is a common consequence of hypertension. Left ventricular hypertrophy occurs in response to the increased workload placed on the ventricle as it contracts against higher systemic pressure. When heart damage is extensive, heart failure ensues. Pathologic changes in the kidneys (indicated by increased blood urea nitrogen [BUN] and creatinine levels) may manifest as nocturia. Cerebrovascular involvement may lead to a stroke or transient ischemic attack (TIA), manifested by alterations in vision or speech, dizziness, weakness, a sudden fall, or temporary paralysis on one side (hemiplegia). Cerebral infarctions account for most of the strokes and TIAs in patients with hypertension.

Table 32-2 • Identifiable Causes of Hypertension

Sleep apnea
 Drug-induced or related causes
 Chronic kidney disease
 Primary aldosteronism
 Renovascular disease
 Chronic steroid therapy and Cushing's syndrome
 Pheochromocytoma
 Coarctation of the aorta
 Thyroid or parathyroid disease

From the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. (2003). *JAMA*, 289(19), 2560–2572.



Physiology/Pathophysiology

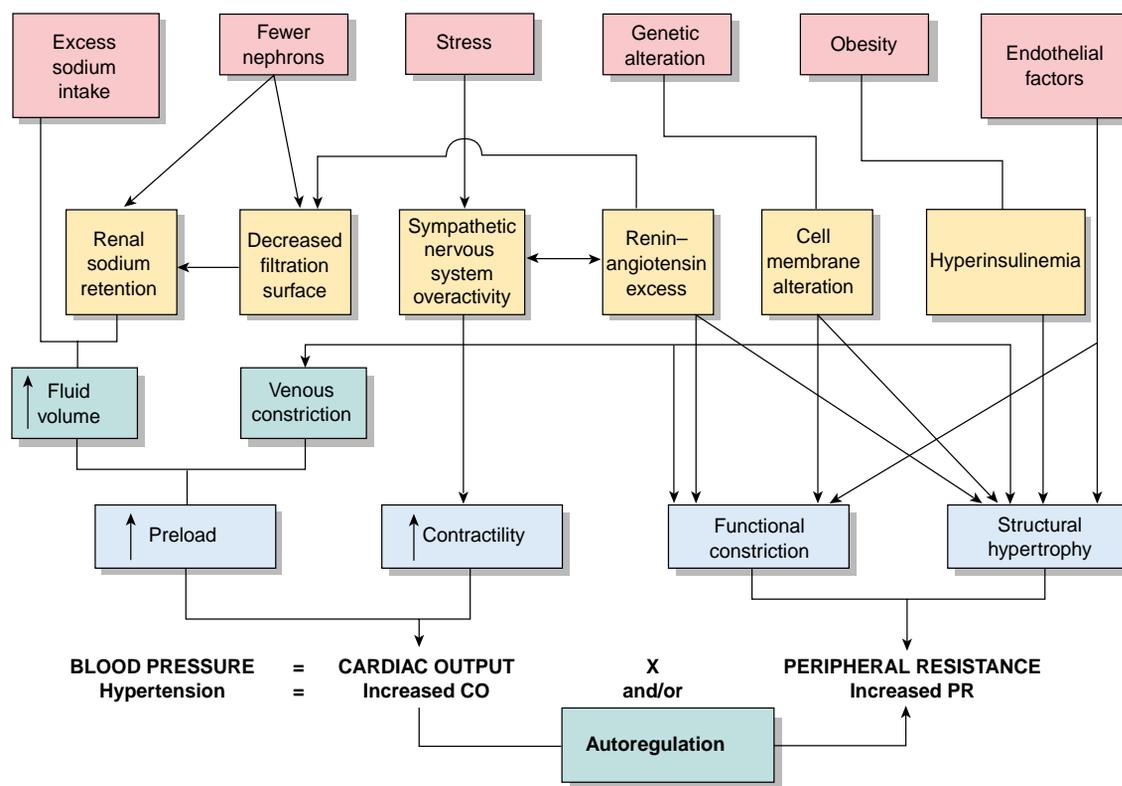


FIGURE 32-1 Factors involved in control of blood pressure, which is cardiac output multiplied by peripheral resistance. Adapted from Kaplan, N. M., Lieberman, E., & Neal, W. (2002). *Kaplan's clinical hypertension* (8th ed.). Philadelphia: Lippincott Williams & Wilkins.

Assessment and Diagnostic Evaluation

A thorough health history and physical examination are necessary. The retinas are examined, and laboratory studies are performed to assess possible target organ damage. Routine laboratory tests include urinalysis, blood chemistry (ie, analysis of sodium, potassium, creatinine, fasting glucose, and total and high-density lipoprotein [HDL] cholesterol levels), and a 12-lead electrocardiogram. Left ventricular hypertrophy can be assessed by echocardiography. Renal damage may be suggested by elevations in BUN and creatinine levels or by microalbuminuria or macroalbuminuria. Additional studies, such as creatinine clearance, renin level, urine tests, and 24-hour urine protein, may be performed.

A risk factor assessment, as advocated by the JNC 7, is needed to classify and guide treatment of hypertensive people at risk for cardiovascular damage. Risk factors and cardiovascular problems related to hypertension are presented in Chart 32-1.

Medical Management

The goal of hypertension treatment is to prevent death and complications by achieving and maintaining the arterial blood pressure at 140/90 mm Hg or lower. The JNC 7 (2003) specified a lower goal pressure of 130/80 mm Hg for people with diabetes mellitus or chronic kidney disease, defined as (1) a reduced glomerular filtration rate resulting in a serum creatinine >1.3 mg/dL in women or >1.5 mg/dL in men, or (2) an albuminuria

of >300 mg/day. The optimal management plan is inexpensive, simple, and causes the least possible disruption in the patient's life.

The management options for hypertension are summarized in Table 32-3, which lists recommended lifestyle modifications, and in the treatment algorithm issued by the JNC 7 (2003) (Fig. 32-2). The clinician uses the algorithm with the risk factor assessment data and the patient's blood pressure category to choose the initial and subsequent treatment plans for patients. Research findings demonstrate that weight loss, reduced alcohol and sodium intake, and regular physical activity are effective lifestyle adaptations to reduce blood pressure (Appel et al., 1997; Cushman et al., 1998; Hagberg et al., 2000; Sacks et al., 2001). Studies show that diets high in fruits, vegetables, and low-fat dairy products can prevent the development of hypertension and can lower elevated pressures. Table 32-4 delineates the Dietary Approaches to Stop Hypertension (DASH) diet.

PHARMACOLOGIC THERAPY

For patients with uncomplicated hypertension and no specific indications for another medication, the recommended initial medications include diuretics, beta-blockers, or both. Patients are first given low doses of medication. If blood pressure does not fall to less than 140/90 mm Hg, the dose is increased gradually, and additional medications are included as necessary to achieve control. Table 32-5 describes the various pharmacologic agents used in



Chart 32-1

Cardiovascular Risk Factors

Major Risk Factors

- Hypertension*
- Cigarette smoking
- Obesity* (body mass index ≥ 30 kg/m²)
- Physical inactivity
- Dyslipidemia*
- Diabetes mellitus*
- Microalbuminuria or estimated GFR < 60 mL/min
- Age (older than 55 for men, 65 for women)
- Family history of premature cardiovascular disease (men under age 55 or women under age 65)

Target Organ Damage

Heart

- Left ventricular hypertrophy
- Angina or prior myocardial infarction
- Prior coronary revascularization
- Heart failure

Brain

- Stroke or transient ischemic attack

Chronic kidney disease

Peripheral arterial disease

Retinopathy

GFR, glomerular filtration rate.

*Components of the metabolic syndrome.

Adapted from the Seventh Report of the Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. (2003). *JAMA*, 289(19), 2560–2572.

treating hypertension. When the blood pressure has been less than 140/90 mm Hg for at least 1 year, gradual reduction of the types and doses of medication is recommended. To promote compliance, clinicians try to prescribe the simplest treatment schedule possible, ideally one pill once each day.



Gerontologic Considerations

Hypertension, particularly elevated systolic blood pressure in persons over age 50, increases the risk of death and complications (JNC 7, 2003). Treatment reduces this risk. Like younger patients, elderly patients should begin treatment with lifestyle modifications. If medications are needed to achieve the blood pressure goal of less than 140/90 mm Hg, the starting dose should be one-half that used in younger patients.

NURSING PROCESS:
THE PATIENT WITH HYPERTENSION

Assessment

When hypertension is initially detected, nursing assessment involves carefully monitoring the blood pressure at frequent intervals and then, after diagnosis, at routinely scheduled intervals. The American Heart Association and the American Society of Hypertension have defined the standards for blood pressure measurement, including conditions required before measurements are made, equipment specifications, and techniques for measuring blood pressure to obtain accurate and reliable readings (Chart 32-2) (American Society of Hypertension, 1992; Perloff et al., 1993). When the patient begins an antihypertensive treatment regimen, blood pressure assessments are needed to determine the effectiveness of medication therapy and to detect any changes in blood pressure that indicate the need for a change in the treatment plan.

A complete history is obtained to assess for symptoms that indicate target organ damage (whether other body systems have been affected by the elevated blood pressure). Such symptoms may include anginal pain; shortness of breath; alterations in speech, vision, or balance; nosebleeds; headaches; dizziness; or nocturia.

During the physical examination, the nurse must also pay specific attention to the rate, rhythm, and character of the apical and peripheral pulses to detect effects of hypertension on the

Table 32-3 • Lifestyle Modifications to Manage Hypertension*†

MODIFICATION	RECOMMENDATION	APPROXIMATE SBP REDUCTION (RANGE)
Weight reduction	Maintain normal body weight (body mass index 18.5–24.9 kg/m ²).	5–20 mm Hg/ 10 kg weight loss
Adopt DASH eating plan	Consume a diet rich in fruits, vegetables, and low-fat dairy products with a reduced content of saturated and total fat.	8–14 mm Hg
Dietary sodium reduction	Reduce dietary sodium intake to no more than 100 mmol per day (2.4 g sodium or 6 g sodium chloride).	2–8 mm Hg
Physical activity	Engage in regular aerobic physical activity such as brisk walking (at least 30 min per day, most days of the week).	4–9 mm Hg
Moderation of alcohol consumption	Limit consumption to no more than 2 drinks (1 oz or 30 mL ethanol; e.g., 24 oz beer, 10 oz wine, or 3 oz 80-proof whiskey) per day in most men and to no more than 1 drink per day in women and lighter-weight persons.	2–4 mm Hg

DASH, Dietary Approaches to Stop Hypertension.

*For overall cardiovascular risk reduction, stop smoking.

†The effects of implementing these modifications are dose and time dependent, and could be greater for some individuals.

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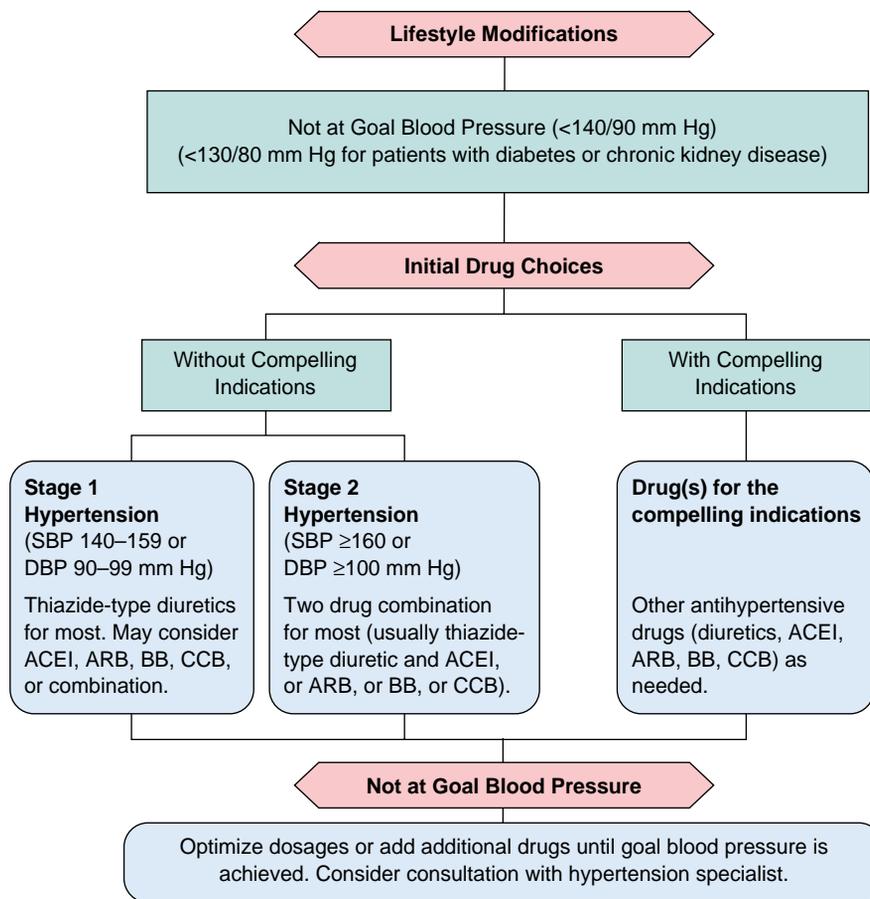


FIGURE 32-2 Algorithm for treatment of hypertension. Treatment begins with lifestyle modifications and continues with various medication regimens. Adapted from the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. (2003). *JAMA*, 289(19), 2560–2572.

DBP, diastolic blood pressure; SBP, systolic blood pressure.
 Drug abbreviations: ACEI, angiotensin converting enzyme inhibitor; ARB, angiotensin receptor blocker; BB, beta-blocker; CCB, calcium channel blocker.

heart and blood vessels. A thorough assessment can yield valuable information about the extent to which the hypertension has affected the body and about any other personal, social, or financial factors related to the condition.

Diagnosis

NURSING DIAGNOSES

Based on the assessment data, nursing diagnoses for the patient may include the following:

- Deficient knowledge regarding the relation between the treatment regimen and control of the disease process
- Noncompliance with therapeutic regimen related to side effects of prescribed therapy

COLLABORATIVE PROBLEMS/POTENTIAL COMPLICATIONS

Based on the assessment data, potential complications that may develop include the following:

- Left ventricular hypertrophy
- Myocardial infarction
- Heart failure
- TIAs
- Cerebrovascular accident (stroke or brain attack)
- Renal insufficiency and failure
- Retinal hemorrhage

Planning and Goals

The major goals for the patient include understanding of the disease process and its treatment, participation in a self-care program, and absence of complications.

Nursing Interventions

The objective of nursing care for hypertensive patients focuses on lowering and controlling the blood pressure without adverse effects and without undue cost. To achieve these goals, the nurse must

(text continues on page 864)

Table 32-4 • The DASH (Dietary Approaches to Stop Hypertension) Diet*

FOOD GROUP	NO. SERVINGS PER DAY
Grains and grain products	7–8
Vegetables	4–5
Fruits	4–5
Lowfat or fat-free dairy foods	2–3
Meat, fish, and poultry	2 or fewer
Nuts, seeds, and dry beans	4–5 weekly

*Based on 2000 calories per day.
 Source: www.nhlbi.nih.gov/health/public/heart/hbp/dash/new_dash.pdf

Table 32-5 • Medication Therapy for Hypertension

MEDICATIONS	MAJOR ACTION	ADVANTAGES AND CONTRAINDICATIONS	EFFECTS AND NURSING CONSIDERATIONS	
Purpose: To maintain blood pressure within normal ranges by the simplest and safest means possible with the fewest side effects for each individual patient				
Diuretics and Related Drugs				
<i>Thiazide Diuretics</i>				
chlorothiazide (Diuril)	Decrease of blood volume, renal blood flow, and cardiac output	Relatively inexpensive	Side effects include dry mouth, thirst, weakness, drowsiness, lethargy, muscle aches, muscular fatigue, tachycardia, GI disturbance. Postural hypotension may be potentiated by alcohol, barbiturates, opioids, or hot weather. Because thiazides cause loss of sodium, potassium, and magnesium, monitor for signs of electrolyte imbalance. Encourage intake of potassium-rich foods (eg, fruits). <i>Gerontological Considerations:</i> Risk of postural hypotension is significant because of volume depletion; measure blood pressure in three positions; caution patient to rise slowly.	
chlorthalidone (Hygroton)	Depletion of extracellular fluid	Effective orally		
hydrochlorothiazide (Microzide, HydroDiuril)	Negative sodium balance (from natriuresis), mild hypokalemia	Effective during long-term administration		
indapamide (Lozol)		Mild side effects		
metolazone (Mykrox, Zaroxolyn)	Directly affect vascular smooth muscle	Enhance other antihypertensive medications		
polythiazide (Renese)		Counter sodium retention effect of other antihypertensive medications		
quinethazone (Hydromox)		<i>Contraindications:</i> Gout, known sensitivity to sulfonamide-derived medications, severely impaired kidney function and history of hyponatremia		
<i>Loop Diuretics</i>				
bumetanide (Bumex)	Volume depletion	Action rapid		
furosemide (Lasix)	Blocks reabsorption of sodium, chloride, and water in kidney	Potent		
torsemide (Demadex)		Used when thiazides fail or patient needs rapid diuresis		
		<i>Contraindications:</i> Same as for thiazides		
<i>Potassium-Sparing Diuretics</i>				
amiloride (Midamor)	Acts on distal tubule independently of aldosterone	Triamterene causes retention of potassium.	Drowsiness, lethargy, headache—decrease dosage. Monitor for hyperkalemia if given with ACE inhibitor. Diarrhea and other GI symptoms—administer medication after meals. Skin eruptions, urticaria Mental confusion, ataxia (with triamterene)—dosage may need to be reduced. Gynecomastia (not for triamterene)	
triamterene (Dyrenium)		<i>Contraindications:</i> Renal disease, azotemia, severe hepatic disease, hyperkalemia		

(continued)

Table 32-5 • Medication Therapy for Hypertension (Continued)

MEDICATIONS	MAJOR ACTION	ADVANTAGES AND CONTRAINDICATIONS	EFFECTS AND NURSING CONSIDERATIONS
<p><i>Aldosterone Receptor Blockers</i></p> <p>eplerenone (Inspra) spironolactone (Aldactone)</p>	Competitive inhibitors of aldosterone binding	<p>Indicated for persons with history of myocardial infarction or symptomatic ventricular dysfunction.</p> <p>Spirolactone is effective in treating hypertension accompanying primary aldosteronism.</p> <p>Spirolactone causes retention of potassium.</p> <p>Contraindicated in persons with hyperkalemia and impaired renal function.</p> <p>Eplerenone contraindicated in diabetes mellitus with microralbuminuria.</p>	<p>Monitor patients carefully for hyperkalemia if given with an ACE inhibitor</p> <p>Avoid use of potassium supplements or salt substitutes.</p> <p>Teach patients signs and symptoms of hyperkalemia</p>
<p><i>Central Alpha₂ Agonists and Other Centrally Acting Medications</i></p> <p>clonidine hydrochloride (Catapres) clonidine patch (Catapres-TTS)</p>	Exact mode of action not understood, but acts through the central nervous system, apparently through centrally mediated alpha-adrenergic stimulation in the brain, producing blood pressure reduction	<p>Little or no orthostatic effect.</p> <p>Moderately potent, and sometimes is effective when other medications fail to lower blood pressure.</p> <p><i>Contraindications:</i> Severe coronary artery disease, pregnancy, children</p>	<p>Most common side effects are dry mouth, drowsiness, sedation, and occasional headaches and fatigue. Anorexia, malaise, and vomiting with mild disturbance of liver function have been reported.</p> <p>Rebound or withdrawal hypertension is relatively common; monitor blood pressure when stopping medication.</p>
guanfacine (Tenex)	Stimulates central alpha-2 adrenergic receptors	Reduces heart rate and causes vasodilation. Serious adverse reactions are uncommon. Use with caution in persons with diminished liver function, recent myocardial infarction, or known cardiovascular disease.	Common side effects include dry mouth, dizziness, sleepiness, fatigue, headache, constipation, and impotence.
methyldopa (Aldomet)	Dopa-decarboxylase inhibitor; displaces norepinephrine from storage sites	<p>Drug of choice for pregnant women with hypertension</p> <p>Useful in patients with renal failure or prostatism</p> <p>Does not decrease cardiac output or renal blood flow</p> <p>Does not induce oliguria</p> <p><i>Contraindications:</i> Liver disease</p>	<p>Drowsiness, dizziness</p> <p>Dry mouth; nasal stuffiness (troublesome at first but then tends to disappear)</p> <p>Hemolytic anemia (a hypersensitization reaction)—positive Coombs' test</p> <p><i>Gerontologic Considerations:</i> May produce mental and behavioral changes in the elderly.</p>
reserpine (Serpasil)	Impairs synthesis and re-uptake of norepinephrine	<p>Slows pulse, which counteracts tachycardia of hydralazine</p> <p><i>Contraindications:</i> History of depression, psychosis, obesity, chronic sinusitis, peptic ulcer</p>	<p>May cause severe depression; report manifestations, as this may require that drug be omitted.</p> <p>Nasal stuffiness, which may require nasal vasoconstrictor.</p> <p>Increases appetite—therefore, weight control may be difficult.</p> <p>Recurrence of peptic ulcer—administer with meals or milk.</p> <p><i>Gerontologic Considerations:</i> Depression and postural hypotension common in elderly</p>

(continued)

Table 32-5 • Medication Therapy for Hypertension (Continued)

MEDICATIONS	MAJOR ACTION	ADVANTAGES AND CONTRAINDICATIONS	EFFECTS AND NURSING CONSIDERATIONS
<p><i>Beta-Blockers</i></p> atenolol (Tenormin) betaxolol (Kerlone) bisoprolol (Zebeta) metoprolol (Lopressor) metoprolol extended release (Toprol XL) nadolol (Corgard) propranolol (Inderal) propranolol long-acting (Inderal LA) timolol (Blocadren)	Block the sympathetic nervous system (beta-adrenergic receptors), especially the sympathetics to the heart, producing a slower heart rate and lowered blood pressure	Reduces pulse rate in patients with tachycardia and blood pressure elevation Indicated for patients who also have stable angina pectoris or have had a myocardial infarction. <i>Contraindications:</i> Bronchial asthma, allergic rhinitis, right ventricular failure from pulmonary hypertension, congestive heart failure, depression, diabetes mellitus, dyslipidemia, heart block, peripheral vascular disease, heart rate under 60 bpm	Mental depression manifested by insomnia, lassitude, weakness, and fatigue. Lightheadedness and occasional nausea, vomiting, and epigastric distress Check heart rate before giving. <i>Gerontologic Considerations:</i> Risk of toxicity is increased for elderly patients with decreased renal and liver function. Take blood pressure in three positions and observe for hypotension.
<p><i>Beta-blockers With Intrinsic Sympathomimetic Activity</i></p> acebutolol (Sectral) penbutolol (Levatrol) pindolol (Visken)	Block both cardiac beta ₁ - and beta ₂ -receptors. Also have antiarrhythmic activity by slowing atrioventricular conduction.	Contraindicated in heart failure, cardiac shock, or heart block. Use with caution if hepatic or renal impairment or failure.	May cause fatigue, dizziness, or lightheadedness Caution patients not to stop taking without consulting care giver as rebound hypertension can occur. Check heart rate before giving.
<p><i>Alpha₁ Blocker</i></p> doxazosin (Cardura) prazosin hydrochloride (Minipress) terazosin (Hytrin)	Peripheral vasodilator acting directly on the blood vessel; similar to hydralazine	Acts directly on the blood vessel and is an effective agent in patients with adverse reactions to hydralazine <i>Contraindications:</i> Angina pectoris and coronary artery disease. Induces tachycardia if not preceded by administration of propranolol and a diuretic.	Occasional vomiting and diarrhea, urinary frequency, and cardiovascular collapse, especially if given in addition to hydralazine without lowering the dose of the latter. Patients occasionally experience drowsiness, lack of energy, and weakness.
<p><i>Combined Alpha and Beta Blockers</i></p> carvedilol (Coreg) labetalol hydrochloride (Normodyne, Trandate)	Blocks alpha- and beta-adrenergic receptors; causes peripheral dilation and decreases peripheral vascular resistance	Fast-acting No decrease in renal blood flow <i>Contraindications:</i> Asthma, cardiogenic shock, severe tachycardia, heart block	Orthostatic hypotension, tachycardia
<p><i>Vasodilators</i></p> fenoldopam mesylate	Stimulates dopamine and alpha ₂ adrenergic receptors	Given intravenously for hypertensive emergencies. Use with caution in persons with glaucoma, recent stroke (brain attack), asthma, hypokalemia, or diminished liver function.	Headache, flushing, hypotension, sweating, tachycardia caused by vasodilation Observe for local reactions at the injection site.
hydralazine hydrochloride (Apresoline)	Decreases peripheral resistance but concurrently elevates cardiac output Acts directly on smooth muscle of blood vessels	Not used as initial therapy; used in combination with other medications. Used also in pregnancy-induced hypertension <i>Contraindications:</i> Angina or coronary disease, congestive heart failure, hypersensitivity	Headache, tachycardia, flushing, and dyspnea may occur—can be prevented by pretreating with reserpine. Peripheral edema may require diuretics. May produce lupus erythematosus-like syndrome
minoxidil (Loniten)	Direct vasodilating action on arteriolar vessels, causing decreased peripheral vascular resistance; reduces systolic and diastolic pressures	Hypotensive effect more pronounced than with hydralazine No effect on vasomotor reflexes so does not cause postural hypotension <i>Contraindications:</i> Pheochromocytoma	Tachycardia, angina pectoris, ECG changes, edema Take blood pressure and apical pulse before administration. Monitor intake and output and daily weights. Causes hirsutism

(continued)

Table 32-5 • Medication Therapy for Hypertension (Continued)

MEDICATIONS	MAJOR ACTION	ADVANTAGES AND CONTRAINDICATIONS	EFFECTS AND NURSING CONSIDERATIONS
sodium nitroprusside (Nipride, Nitropress) nitroglycerin (Nitro-Bid IV, Tridil) diazoxide (Hyperstat)	Peripheral vasodilation by relaxation of smooth muscle	Fast-acting Used only in hypertensive emergencies <i>Contraindications:</i> Sepsis, azotemia, high intracranial pressure.	Dizziness, headache, nausea, edema, tachycardia, palpitations. Can cause thiocyanate and cyanide intoxication.
Angiotensin-Converting Enzyme (ACE) Inhibitors			
benazepril (Lotensin) captopril (Capoten) enalapril (Vasotec) enalaprilat (Vasotec IV) lisinopril (Prinivil, Zestril) moexipril (Univasc) perindopril (Aceon) quinapril (Accupril) ramipril (Altace) trandolapril (Mavik)	Inhibit conversion of angiotensin I to angiotensin II Lower total peripheral resistance	Fewer cardiovascular side effects Can be used with thiazide diuretic and digitalis Hypotension can be reversed by fluid replacement. <i>Contraindications:</i> Renal impairment, pregnancy	<i>Gerontologic Considerations:</i> Require reduced dosages and the addition of loop diuretics when there is renal dysfunction
Angiotensin II Antagonists			
candesartan (Atacand) eprosartan (Teveten) irbesartan (Avapro) losartan (Cozaar) olmesartan (Benicar) telmisartan (Micardis) valsartan (Diovan)	Block the effects of angiotensin II at the receptor Reduce peripheral resistance	Minimal side effects <i>Contraindications:</i> Pregnancy, renovascular disease	Monitor for hypokalemia
Calcium Channel blockers			
<i>Nondihydropyridines</i>			
diltiazem hydrochloride (Cardizem SR, Cardizem CD, Dilacor XR, Tiazac) diltiazem long-acting (Cardizem LA)	Inhibits calcium ion influx Reduces cardiac afterload	Inhibits coronary artery spasm not controlled by beta-blockers or nitrates <i>Contraindications:</i> Sick sinus syndrome; AV block; hypotension; heart failure	Do not discontinue suddenly. Observe for hypotension. Report irregular heartbeat, dizziness, edema. Instruct on regular dental care because of potential gingivitis.
verapamil immediate release (Calan, Isoptin) verapamil long-acting (Calan SR, Isoptin SR) verapamil-Coer (Covera HS, Verelan PM)	Inhibits calcium ion influx Slows velocity of conduction of cardiac impulse	Effective antiarrhythmic Rapid IV onset Blocks SA and AV node channels <i>Contraindications:</i> Sinus or AV node disease; severe heart failure; severe hypotension	Administer on empty stomach or before meal. Do not discontinue suddenly. Depression may subside when medication is discontinued. To relieve headaches, reduce noise, monitor electrolytes. Decrease dose for patients with liver or renal failure.
<i>Dihydropyridines</i>			
amlodipine (Norvasc) felodipine (Plendil) isradipine (DynaCirc CR) nicardipine sustained release (Cardene SR) nifedipine long-acting (Adalat CC, Procardia XL) nisoldipine (Sular)	Inhibit calcium ion influx across membranes Vasodilating effects on coronary and peripheral arteriole Decrease cardiac work and energy consumption, increase delivery of oxygen to myocardium	Rapid action Effective by oral or sublingual route No tendency to slow SA nodal activity or prolong AV node conduction Isolated systolic hypertension <i>Contraindications:</i> None (except heart failure for nifedipine)	Administer on empty stomach. Use with caution in diabetic patients. Small frequent meals if nausea. Muscle cramps, joint stiffness, sexual difficulties may disappear when dose decreased. Report irregular heartbeat, constipation, shortness of breath, edema. May cause dizziness.

Chart
32-2

Measuring Blood Pressure

Instructions for Patient

- Avoid smoking cigarettes or drinking caffeine for 30 minutes before blood pressure is measured.
- Sit quietly for 5 minutes before the reading.
- Sit comfortably with the forearm supported at heart level on a firm surface, with both feet on the ground; avoid talking during measurement.

Equipment for Practitioner

- Mercury sphygmomanometer, recently calibrated aneroid manometer, or validated electronic device
- Choose from several cuffs of different size so that rubber bladder width is at least 40% and length at least 80% of the arm circumference

Equipment for Patient at Home

- Automatic or semiautomatic device with digital display of readings

Procedure

Assessment is based on the average of at least two readings. (If two readings differ by more than 5 mm Hg, additional readings are taken and an average reading is calculated from the results.)

Conclusion

Inform patient of the numeric blood pressure value and what it means. Emphasize the need for periodic reassessment, and encourage patients who measure blood pressure at home to keep a written record of readings.

support and teach the patient to adhere to the treatment regimen by implementing necessary lifestyle changes, taking medications as prescribed, and scheduling regular follow-up appointments with the health care provider to monitor progress or identify and treat any complications of disease or therapy.

INCREASING KNOWLEDGE

The patient needs to understand the disease process and how lifestyle changes and medications can control hypertension. The nurse needs to emphasize the concept of controlling hypertension rather than curing it. The nurse can encourage the patient to consult a dietitian to help develop a plan for weight loss. The program usually consists of restricting sodium and fat intake, increasing intake of fruits and vegetables, and implementing regular physical activity. Explaining that it takes 2 to 3 months for the taste buds to adapt to changes in salt intake may help the patient adjust to reduced salt intake. The patient should be advised to limit alcohol intake (see Table 32-3 for specific recommendations), and tobacco should be avoided—not because smoking is related to hypertension, but because anyone with high blood pressure is already at increased risk for heart disease, and smoking amplifies this risk. Support groups for weight control, smoking cessation, and stress reduction may be beneficial for some patients; others can benefit from the support of family and friends. The nurse assists the patient to develop and adhere to an appropriate exercise regimen, because regular activity is a significant factor in weight reduction and a blood pressure–reducing intervention in the absence of any loss in weight (JNC 7, 2003).

PROMOTING HOME AND COMMUNITY-BASED CARE

Blood pressure screenings with the sole purpose of case finding are not recommended by the National High Blood Pressure Education Program because approximately 70% of persons with hypertension are already aware of their blood pressure levels (JNC 7, 2003). If

asked to participate in a blood pressure screening, the nurse should be sure that proper blood pressure measurement technique is being used (see Chart 32-2), that the manometers used are calibrated (Perloff et al., 1993), and that provision has been made to provide follow-up for any person identified as having an elevated blood pressure. Adequate time should also be allowed to teach people what the blood pressure numbers mean. Each person should be given a written record of his or her blood pressure at the screening.

Teaching Patients Self-Care

The therapeutic regimen is the responsibility of the patient in collaboration with the health care provider. Education about high blood pressure and how to manage it, including medications, lifestyle changes of diet, weight control, and exercise (see Table 32-3), setting goal blood pressures, and assistance with social support, can help the patient achieve blood pressure control. Involving family members in education programs enables them to support the patient's efforts to control hypertension. The American Heart Association and the National Heart Lung and Blood Institute provide printed and electronic patient education materials.

Written information about the expected effects and side effects of medications is important. When side effects occur, patients need to understand the importance of reporting them and to whom they should be reported. Patients need to be informed that **rebound hypertension** can occur if antihypertensive medications are suddenly stopped. Female and male patients should be informed that some medications, such as beta-blockers, may cause sexual dysfunction and that, if a problem with sexual function or satisfaction occurs, other medications are available. The nurse can encourage and teach patients to measure their blood pressure at home. This practice involves patients in their own care and emphasizes the fact that failing to take medications may result in an identifiable rise in blood pressure. Patients need to know that blood pressure varies continuously and that the range within which their pressure varies should be monitored.

Continuing Care

Regular follow-up care is imperative so that the disease process can be assessed and treated, depending on whether control or progression is found. A history and physical examination should be completed at each clinic visit. The history should include all data that pertain to any potential problem, specifically medication-related problems such as postural (orthostatic) hypotension (experienced as dizziness or lightheadedness).

Deviation from the therapeutic program is a significant problem for people with hypertension and other chronic conditions requiring lifetime management. It is estimated that 50% discontinue their medications within 1 year of beginning to take them. Blood pressure control is achieved by only 34% (JNC 7, 2003). However, when patients actively participate in self-care, including self-monitoring of blood pressure and diet, compliance increases—possibly because patients receive immediate feedback and have a greater sense of control.

Considerable effort is required by patients with hypertension to adhere to recommended lifestyle modifications and to take regularly prescribed medications. The effort needed to follow the therapeutic plan may seem unreasonable to some, particularly when they have no symptoms without medications but do have side effects with medications. The recommended lifestyle changes are listed in Table 32-3. Continued education and encouragement are usually needed to enable patients to formulate an acceptable plan that helps them live with their hypertension and adhere to the treatment plan. Compromises may have to be made about some aspects of therapy to achieve success in higher-priority

goals. The nurse can assist with behavior change by supporting patients in making small changes with each visit that move them toward their goals. Another important factor is following up at each visit to see how the patient has progressed with the plans made at the prior visit. If the patient has had difficulty with a particular aspect of the plan, the patient and nurse can work together to develop an alternative or modification to the plan that the patient believes will be more successful.

MONITORING AND MANAGING POTENTIAL COMPLICATIONS

Symptoms suggesting that hypertension is progressing to the extent that target organ damage is occurring must be detected early so that appropriate treatment can be initiated accordingly. When the patient returns for follow-up care, all body systems must be assessed to detect any evidence of vascular damage. Examining the eyes with an ophthalmoscope is particularly important because retinal blood vessel damage indicates similar damage elsewhere in the vascular system. The patient is questioned about blurred vision, spots in front of the eyes, and diminished visual acuity. The heart, nervous system, and kidneys are also carefully assessed and examined. Any significant findings are promptly reported to determine whether additional diagnostic studies are required. Based on the findings, medications may be changed to improve blood pressure control.



Gerontologic Considerations

Compliance with the therapeutic program may be more difficult for elderly people. The medication regimen can be difficult to remember, and the expense can be a problem. **Monotherapy** (treatment with a single agent), if appropriate, may simplify the medication regimen and make it less expensive. Special care must be taken to ensure that the elderly patient understands the regimen and can see and read instructions, open the medication container, and get the prescription refilled. The elderly person's family or caregivers should be included in the teaching program so that they can understand the patient's needs, encourage adherence to the treatment plan, and know when and whom to call if problems arise or information is needed.

NURSING ALERT The patient and caregivers should be cautioned that antihypertensive medications can cause hypotension. Low blood pressure or postural hypotension should be reported immediately. Because elderly people have impaired cardiovascular reflexes, they are often more sensitive than younger people to the extracellular volume depletion caused by diuretic therapy and to the sympathetic inhibition caused by adrenergic antagonists. The nurse teaches patients to change positions slowly when moving from a lying or sitting position to a standing position. The nurse also counsels elderly patients to use supportive devices such as hand rails and walkers when necessary to prevent falls that could result from dizziness.

Evaluation

EXPECTED PATIENT OUTCOMES

Expected patient outcomes may include the following:

1. Maintains adequate tissue perfusion
 - a. Maintains blood pressure at less than 140/90 mm Hg (or less than 130/80 mm Hg for persons with diabetes mellitus or chronic kidney disease) with lifestyle modifications, medications, or both
 - b. Demonstrates no symptoms of angina, palpitations, or vision changes
 - c. Has stable BUN and serum creatinine levels
 - d. Has palpable peripheral pulses
2. Complies with the self-care program
 - a. Adheres to the dietary regimen as prescribed: reduces calorie, sodium, and fat intake; increases fruit and vegetable intake
 - b. Exercises regularly
 - c. Takes medications as prescribed and reports any side effects
 - d. Measures blood pressure routinely
 - e. Abstains from tobacco and excessive alcohol intake
 - f. Keeps follow-up appointments
3. Has no complications
 - a. Reports no changes in vision
 - b. Exhibits no retinal damage on vision testing
 - c. Maintains pulse rate and rhythm and respiratory rate within normal ranges
 - d. Reports no dyspnea or edema
 - e. Maintains urine output consistent with intake
 - f. Has renal function test results within normal range
 - g. Demonstrates no motor, speech, or sensory deficits
 - h. Reports no headaches, dizziness, weakness, changes in gait, or falls

Hypertensive Crises

There are two hypertensive crises that require nursing intervention: hypertensive emergency and hypertensive urgency. Hypertensive emergencies and urgencies may occur in patients whose hypertension has been poorly controlled or in those who have abruptly discontinued their medications. Once the hypertensive crisis has been managed, a complete evaluation is performed to review the patient's ongoing treatment plan and strategies to minimize the occurrence of subsequent hypertensive crises.

HYPERTENSIVE EMERGENCY

Hypertensive emergency is a situation in which blood pressure must be lowered immediately (not necessarily to less than 140/90 mm Hg) to halt or prevent damage to the target organs. Conditions associated with hypertensive emergency include acute myocardial infarction, dissecting aortic aneurysm, and intracranial hemorrhage. Hypertensive emergencies are acute, life-threatening blood pressure elevations that require prompt treatment in an intensive care setting because of the serious target organ damage that may occur. The medications of choice in hypertensive emergencies are those that have an immediate effect. Intravenous vasodilators, including sodium nitroprusside (Nipride, Nitropress), nicardipine hydrochloride (Cardene), fenoldopam mesylate (Corlopam), enalaprilat (Vasotec I.V.), and nitroglycerin (Nitro-Bid IV, Tridil), have an immediate action that is short lived (minutes to 4 hours), and they are therefore used as the initial treatment. Table 32-5 provides for more information about these medications.

HYPERTENSIVE URGENCY

Hypertensive urgency is a situation in which blood pressure must be lowered within a few hours. Severe perioperative hypertension is considered a hypertensive urgency. Hypertensive urgencies are managed with oral doses of fast-acting agents such as loop diuretics (bumetanide [Bumex], furosemide [Lasix]), beta-blockers (propranolol [Inderal], metoprolol [Lopressor], nadolol [Corgard]), angiotensin-converting enzyme inhibitors (benazepril [Lotensin], captopril [Capoten], enalapril [Vasotec]), calcium antagonists (dil-

tiazem [Cardizem], verapamil [Isoptin SR, Calan SR, Covera HS]), or alpha₂-agonists, such as clonidine (Catapres) and guanfacine (Tenex) (see Table 32-5).

Extremely close hemodynamic monitoring of the patient's blood pressure and cardiovascular status is required during treatment of hypertensive emergencies and urgencies. The exact frequency of monitoring is a matter of clinical judgment and varies with the patient's condition. The nurse may think that taking vital signs every 5 minutes is appropriate if the blood pressure is changing rapidly or may check vital signs at 15 or 30 minutes intervals if the situation is more stable. A precipitous drop in blood pressure can occur, which would require immediate action to restore blood pressure to an acceptable level.



Critical Thinking Exercises

1. You are a nursing student assigned to a hypertension clinic. One of the patients is a 58-year-old telemarketer. During the physical assessment, the patient, who is 5 feet 6 inches tall and weighs 180 lb, asks you what he can do to reduce his blood pressure. How would you answer this patient's question? Identify what additional data you need to consider before you answer the patient's question. How would your assessment and plan change if the patient also had degenerative arthritis of his knees?

2. You are a home care nurse. One of your patients is an elderly man who lives alone and who has hypertension along with other health problems, including heart failure and atrial fibrillation. During a home visit, you learn that he has difficulty taking his medications as directed. What questions come to mind as you consider the situation? How will you direct your assessment to identify factors contributing to this problem? Using the factors identified, develop a sample follow-up home care teaching plan for this patient.

REFERENCES AND SELECTED READINGS

Books

- Braunwald, E., Zipes, D. P., & Libby, P. (Eds.) (2001). *Heart disease: A textbook of cardiovascular medicine*. (6th ed.) Philadelphia: W. B. Saunders.
- Kaplan, N. (2002). *Clinical hypertension* (8th ed.). Philadelphia: Lippincott Williams & Wilkins.

Journals

- American Society of Hypertension. (1992). Recommendations for routine blood pressure measurement by indirect cuff sphygmomanometry. *American Journal of Hypertension*, 5 (4, Pt. 1), 207–209.
- Appel, L. J., Moore, T. J., Obarzanek, E., Vollmer, W. M., Svetkey, L. P., Sacks, F. M., et al. (1997). A clinical trial of the effects of dietary patterns on blood pressure. *New England Journal of Medicine*, 336(16), 1117–1124.
- Burnier, M., & Brunner, H. R. (2000). Angiotensin II receptor antagonists. *Lancet*, 355(9204), 637–645.
- Chase, S. L. (2000). Hypertensive crisis. *RN*, 63(6), 62–68.
- Chobanian, A. V., Bakris, G. L., Black, H. R., Cushman, W. C., Green, L. A., Izzo, J. L., Jr., et al. (2003). The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: The JNC 7 report (Erratum in: *JAMA*, 2003 Jul 9; 290[2]:197). *JAMA*, 289(19), 2560–2572.
- Cushman, W. C., Cutler, J. A., Hanna, E., Bingham, S. F., Follmann, D., Harford, T., et al. (1998). Prevention and treatment of

hypertension study (PATHS): Effects of an alcohol treatment program on blood pressure. *Archives of Internal Medicine*, 158(11), 1197–1207.

- Dominiczak, A. F., Negrin, D. C., Clark, J. S., Brosnan, M. J., McBride, M. W., & Alexander, M. Y. (2000). Genes and hypertension: From gene mapping in experimental models to vascular gene transfer strategies. *Hypertension*, 35 (1, Pt. 2), 164–172.
- Gress, T. W., Nieto, F. J., Shahar, E., Wofford, M. R., & Brancati, F. L. (2000). Hypertension and antihypertensive therapy as risk factors for type 2 diabetes mellitus. *New England Journal of Medicine*, 342(13), 905–912.
- Gus, M., Fuchs, F. D., Pimentel, M., Rosa, D., Melo, A. G., & Moreira, L. B. (2001). Behavior of ambulatory blood pressure surrounding episodes of headache in mildly hypertensive patients. *Archives of Internal Medicine*, 161(2), 252–255.
- Hagberg, J. M., Park, J. J., & Brown, M. D. (2000). The role of exercise training in the treatment of hypertension: An update. *Sports Medicine*, 30(3), 193–206.
- Hajjar, L., & Kotchen, T. A. (2003). Trends in prevalence, awareness, treatment, and control of hypertension in the United States, 1988–2000. *JAMA*, 290(2), 199–206.
- Lewington, S., Clarke, R., Qizilbash, N., Peto, R., & Collins, R. (2002). Age-specific relevance of usual blood pressure to vascular mortality: A meta-analysis of individual data for one million adults in 61 prospective studies. *Lancet*, 360(9349), 1903–1913.
- McAlister, F. A., & Straus, S. E. (2001). Evidence based treatment of hypertension. Measurement of blood pressure: An evidence based review. *British Medical Journal*, 322(7291), 908–911.
- Miller, N. H., Hill, M., Kottke, T., & Ockene, I. S. (1997). The multi-level compliance challenge: Recommendations for a call to action. A statement for healthcare professionals. *Circulation*, 95(4), 1085–1090.
- Neal, B., MacMahon, S., & Chapman, N. (2000). Effects of ACE inhibitors, calcium antagonists, and other blood-pressure-lowering drugs: Results of prospectively designed overviews of randomised trials. Blood Pressure Lowering Treatment Trialists' Collaboration. *Lancet*, 356(9246), 1955–1964.
- Perloff, D., Grim, C., Flack, J., Frohlich, E. D., Hill, M., McDonald, M., et al. (1993). Human blood pressure determination by sphygmomanometry. *Circulation*, 88, (5, Pt. 1), 2460–2467.
- Perry, H. M., Jr., Davis, B. R., Price, T. R., Applegate, W. B., Fields, W. S., Guralnik, J. M., et al. (2000). Effect of treating isolated systolic hypertension on the risk of developing various types and subtypes of stroke: The Systolic Hypertension in the Elderly Program (SHEP). *Journal of the American Medical Association*, 284(4), 465–471.
- Pickering, T. G. (1999). Contempo 1999: Advances in the treatment of hypertension. *Journal of the American Medical Association*, 281(2), 114–116.
- Sacks, F. M., Svetkey, L. P., Vollmer, W. M., Appel, L. J., Bray, G. A., Harsha, D., et al. (2001). Effects on blood pressure of reduced dietary sodium and the dietary approaches to stop hypertension (DASH) diet. *New England Journal of Medicine*, 344(1), 3–10.

RESOURCES AND WEBSITES

- American Heart Association National Center, 7272 Greenville Ave., Dallas, TX 75231-4596; 1-214-373-6300; fax, 1-214-706-1191; <http://www.americanheart.org/hbp/>.
- Centers for Disease Control and Prevention (CDC), 600 Clifton Rd., Atlanta, GA 30333; cardiovascular health program: 1-404-639-3534 or 1-800-311-3435; <http://www.cdc.gov/nccdphp/cvd/>.
- Heart and Stroke Foundation of Canada, 222 Queen St., Suite 1402, Ottawa, Ontario K1P5V9, 1-613-569-4361; fax, 1-613-569-3278; <http://www.heartandstroke.ca/>.
- National Heart, Lung, and Blood Institute, NHLBI Information Center, P.O. Box 30105, Bethesda, MD 20824-0105; Health Information: High Blood Pressure Information, <http://www.nhlbi.nih.gov/health/public/heart/index.html>.
- World Health Association (WHO), Avenue Appia 20, 1211 Geneva 27 Switzerland; cardiovascular diseases: <http://www.who.int/ncd/cvd/index.htm>.

