

CHAPTER 12

HIGH BLOOD PRESSURE

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INTRODUCTION

High blood pressure, or hypertension as the disease is known medically, is our most common chronic illness. Estimates of exactly how many Americans have high blood pressure vary—the American Heart Association and the National Heart, Lung, and Blood Institute put the figure at about 55–60 million, but some of the individuals included in this estimate may only have had transient elevation of pressure; a more accurate estimate is probably 35–40 million. In either calculation, the number of people affected and the amount of the nation’s health budget that goes toward treating high blood pressure or its complications are huge.

Because high blood pressure is the leading cause of strokes and a major risk factor for heart attacks, one of the most important aspects of preventive cardiology should be to identify as many people who have the disease as possible and to take steps to lower the blood pressure before it causes damage to the blood vessels, heart, kidneys, eyes, and other organs. Fortunately, the last 30 to 35 years have seen remarkable advances in the treatment of high blood pressure, with major payoffs. The death toll from strokes is down by more than 54 percent and heart attack mortality has dropped by more than 45 percent

since 1973–74. At that time, the National High Blood Pressure Education Program directed at both physicians and the general public raised consciousness about the dangers of untreated high blood pressure and the importance of early effective treatment. We are now reaping the benefits of this and other major programs.

Even so, it’s still too early to declare victory over high blood pressure. Despite massive public education programs, misconceptions about the disease abound. Many people still harbor misconceptions about what constitutes an elevated blood pressure (see box, “Common Facts and Myths”), and there probably still are many people whose high blood pressure has not been diagnosed—especially in minority populations. There also are several millions of others whose hypertension has been diagnosed but who are not being adequately treated to normal blood pressure levels.

WHAT IS HIGH BLOOD PRESSURE OR HYPERTENSION

To understand why lowering high blood pressure is so important in preventing heart and blood vessel

Common Facts and Myths

Myth: Tense, uptight people are the most likely to develop high blood pressure.

Fact: Many people have the mistaken notion that the term "hypertension" refers to a person's emotional or psychological state. In fact, hypertension refers to the excessive ("hyper") pressure ("tension") exerted against the artery walls, and has nothing to do with psychological stress or tension. Stress or tension may produce a temporary rise in blood pressure, but many calm people have hypertension, and, conversely, many tense, jittery people have normal blood pressure.

Myth: Older people need a higher blood pressure to ensure a steady supply of blood to the brain.

Fact: Normal blood pressure, even in the very elderly, produces adequate blood to the brain. In fact, numerous studies show that older people with normal blood pressure have a lower death rate than those with hypertension.

Myth: Side effects from drugs that lower high blood pressure are worse than the disease.

Fact: Doctors today have dozens of antihypertensive medications that they can use to structure a treatment program. If one medication causes side effects, chances are that alternatives exist that are equally effective and that can be easily tolerated. There is also no evidence to support claims that antihypertensive drugs themselves cause damage to the brain, heart, or kidneys or increase mortality. In fact, scores of studies show just the opposite; when medications are used to reduce high blood pressure, the death rate and incidence of complications fall.

Myth: High blood pressure is mostly a disease of aging.

Fact: People of all ages develop high blood pressure. While it is true that blood pressure tends to rise with age, hypertension is most often diagnosed in early adulthood or middle age.

Myth: The damage caused by high blood pressure cannot be reversed.

Fact: Many people have the mistaken idea that it does little good to treat high blood pressure once it has damaged the heart, kidneys, or blood vessels. This assumption is not true. Treatment of even advanced high blood pressure can reverse varying degrees of damage. For example, recent studies show that treatment can help reverse enlargement of the heart's main pumping chamber (a condition called left ventricular hypertrophy) and thereby help prevent heart failure.

diseases, it is important to know something about the basic physiology involved. As noted in Chapter 1, the blood circulates through some 60,000 miles of blood vessels. (See color atlas, #4.) With each heartbeat, 2 or 3 ounces of freshly oxygenated blood are forced out of the heart's main pumping chamber, the left ventricle, into the aorta, the body's largest artery.

The circulatory system can be likened to a tree. The aorta is comparable to the main tree trunk. It branches into smaller arteries (like the thick branches that come off the main trunk), which in turn divide into even smaller vessels (like smaller branches and twigs) called arterioles, which carry blood to the capillaries (like the leaves). Capillaries are the microscopic vessels that supply blood, with its load of oxygen and other nutrients, to each cell in the body. After the oxygen is used up, the blood returns to the heart via a branching system of veins.

A certain amount of force is needed to keep blood moving through this intricate system of blood vessels. The amount of force that is exerted on the artery walls as blood flows through them is what we refer to as *blood pressure*. The "head" of pressure comes from the heart, but it is the smallest arteries, the arterioles, that actually determine how much pressure is registered in the blood vessels. To raise blood pressure, the arterioles narrow or *constrict* to lower it, they open up or dilate.

Exactly how much pressure is needed varies according to the body's activities. For example, the heart does not need to beat as fast or as hard to keep blood circulating when you are resting as it does when you are exercising. During exercise, however, more blood is needed to carry oxygen to the muscles, so blood pressure rises to meet increased demand. The heart pumps faster and pushes out more blood with each beat. In other situations, such as when someone stands up suddenly after lying down, the body must make an almost instantaneous adjustment in blood pressure in order to ensure a steady supply of blood to the brain. Blood vessels in the abdomen and legs constrict and the heart speeds up. Sometimes there may be a slight delay in this adjustment, and as a result, you may feel dizzy for a few seconds. This is more common in older people whose blood vessel reflexes might be impaired. A longer delay can bring on a fainting spell, which is the body's way of increasing the flow of blood to the brain (when someone lies down, blood flow to the brain increases).

Similarly, some people feel light-headed, or even faint, after standing for long periods, during which time blood may collect or "pool" in the legs, thereby reducing the amount that is available to carry oxygen

to the brain. Good examples of this bodily response are the numerous instances of healthy soldiers who fainted after standing at attention for long periods of time in hot weather. Other reflexes may be triggered and result in a sudden loss of blood to the brain and an episode of light-headedness or fainting. These episodes are not serious but can be frightening. An example of this response is fainting after only a small amount of blood is drawn for a blood test. A nerve reflex slows the heart and causes blood vessels to dilate or open up. Less blood gets to the brain and fainting occurs. As we all know, if the affected individual rests quietly for just a few minutes, all is well.

Blood pressure is regulated by an intricate system of hormonal controls and nerve sensors, and it may vary considerably during the course of a day. Typically, blood pressure is low when you are resting or asleep, and higher when you are moving about or under stress. For example, when you are frightened or angry, the adrenal glands pump out epinephrine and norepinephrine, stress hormones that are commonly referred to as adrenaline. These hormones, which are responsible for the body's fight-or-flight response, signal the heart to beat faster and harder, resulting in increased blood pressure and flow to the muscles. It is apparent that pressures are typically lowest between 1:00 and 4:00 or 5:00 A.M., rise rapidly during "arousal" from sleep between 6:00 and 8:00 A.M., remain at approximately the same levels during the afternoon and evening, and decrease from about 11:00 to 12:00 at night.

WHAT CONSTITUTES HIGH BLOOD PRESSURE?

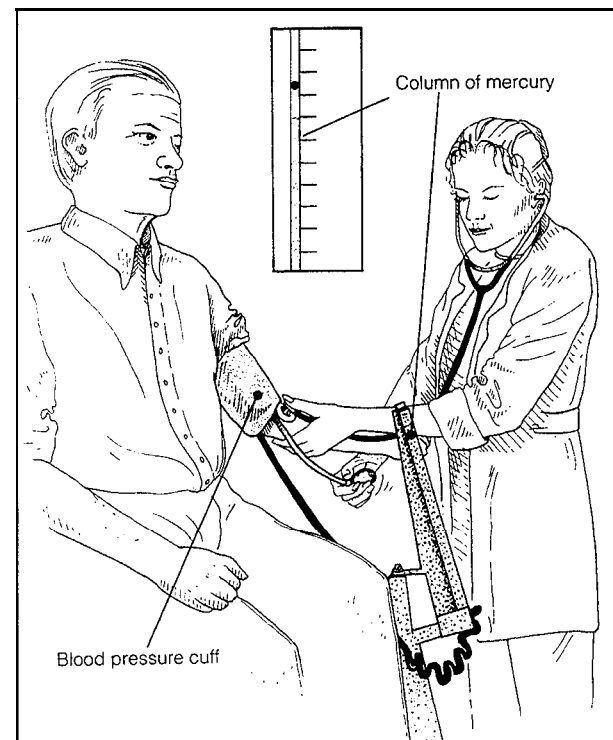
Blood does not flow in a steady stream; instead, it moves through the circulatory system in spurts that correlate with the heart's beats. The heart beats about 60 to 70 times a minute at rest and may speed up to 120 to 140 or higher during vigorous exercise. It is not contracting or squeezing all the time, however; after each contraction, the heart muscle rests and gets ready for the next beat. Blood pressure rises and falls with each beat. Thus, blood pressure is expressed in two numbers, such as 120 over 80, or 120/80. The higher number, which is called systolic pressure, represents the maximum force that is exerted on the walls of the blood vessels during a heartbeat. The lower number, which is referred to as the diastolic

pressure, is the amount of force exerted when the heart is resting momentarily between beats.

Blood pressure is usually measured with a device called a sphygmomanometer (pronounced sfig-moe-man-om-e-ter), which consists of an inflatable rubber cuff, an air pump, and a column of mercury or a dial or digital readout reflecting pressure in an air column. Readings are expressed in millimeters of mercury or mm Hg. (See Figure 12.1.) The cuff is wrapped around the upper arm, and the inflatable cuff is tightened until blood flow through the large artery in the arm is halted. As air is pumped into the cuff, it pushes up a column of mercury or air, in the case of the simpler machines.

The person measuring the blood pressure places a stethoscope over the artery just below the cuff and listens for a cessation of the sound of blood coursing through the artery. He or she then begins to release air from the cuff, allowing blood to flow through the artery again. As air is released, the column of mercury or air begins to fall, and the person listens for the first thumping sound that signals a return of blood flow into the vessel over which the stethoscope has been placed. The height of the column of mercury or the air pressure on the dial at this sound indicates the systolic (or higher) pressure. More air is released

Figure 12.1
Blood pressure is measured using a device called a sphygmomanometer, which consists of an inflatable cuff that goes around the arm. The blood pressure reading is obtained from the height of a column of mercury which is connected to the cuff.



Monitoring Your Own Blood Pressure.

Most people with hypertension do not need to measure their blood pressures at home. Some, however, find home monitoring reassuring. It is important to remember that an occasional high reading does not necessarily mean that your blood pressure is “out of control.”

in some instances, home monitoring may provide useful information for your doctor, especially if you are starting a new drug regimen or experiencing symptoms, such as dizziness. If you do monitor your blood pressure at home, you should take your machine with you periodically when you visit your doctor so that he or she can check whether it is correctly calibrated.

Before starting home monitoring, ask your doctor or nurse to show you the proper way to use your machine. Most people find the electronic machines that do not have a separate stethoscope easier to use than the nonautomated ones. But they may not be quite as accurate. Whichever model you use, follow the instructions from the manufacturer and your doctor. Special points to remember include:

- Avoid caffeine (coffee, tea, colas, etc.) for at least 30 minutes before measuring your blood pressure. The same goes for cigarettes or nicotine gum. Both caffeine and nicotine raise blood pressure and can give a falsely high reading.
- If you are experiencing dizziness or feelings of faintness, try taking your blood pressure immediately after standing up to see if it differs from pressure taken while sitting.

from the cuff, and pressure continues to fall. The height of the mercury or the level of air pressure when the thumping sound of blood ceases, indicating the pause between heartbeats, is the diastolic pressure.

People with high blood pressure can learn to monitor their own pressure (See box, “Monitoring Your Own Blood Pressure”), although for most it is not necessary.

As noted earlier, blood pressure varies considerably during the course of an average day. It also varies according to age—a baby’s blood pressure may normally be 70/50, whereas the average blood pressure in an adult is about 120/80. Until recent years, there was no clear agreement among physicians as to what constituted high blood pressure, but now it is generally agreed that blood pressure readings that

are consistently above 140/90 warrant a diagnosis of hypertension, and the higher the readings, the more serious the disease. (See Table 12.1.) A reading of about 140/90 does not necessarily indicate that the condition requires immediate therapy, but it does suggest follow up and some treatment.

STEPS IN ESTABLISHING A DIAGNOSIS OF HIGH BLOOD PRESSURE

A diagnosis of high blood pressure should not be based on a single reading, except when it is extremely high—for example, above 170–180/105–110. Other-

Table 12.1
Recommendations for Management of Various Blood Pressure Levels

Range (mm Hg)	Diagnosis	Recommended activity
<i>Diastolic</i>		
below 85	Normal blood pressure	Recheck within 2 years.
85-89	High normal blood pressure	Recheck within 1 year.
90-104	Mild hypertension	Confirm within 2 months.
105-114	Moderate hypertension	Therapy should be undertaken.
above 115	Severe hypertension	Begin therapy with medication
Isolated <i>systolic</i> hypertension, when diastolic blood pressure is below 90 (mostly seen in older individuals)		
below 140	Normal blood pressure	Recheck within 2 years.
140-159	Borderline isolated systolic hypertension	Confirm within 2 months.
160-199	Isolated systolic hypertension	Confirm within 2 months. Therapy should be instituted if pressure remain elevated.
above 200	Isolated systolic hypertension	Begin therapy with medication

wise several measurements taken over a period of time are generally needed to confirm a diagnosis. This is why single readings obtained at health fairs or other blood pressure screening events are often misleading. In addition, the electronic machines used for self-measurement at airports or in pharmacies are often poorly calibrated or improperly used and may give false readings (usually on the high side). Although hypertension screening has its place, people should understand that readings obtained are only an indication to follow up more carefully, and do not justify a definite diagnosis of high blood pressure or hypertension. Unfortunately, many people are unduly frightened, on the basis of just one blood pressure recording, into thinking they have hypertension.

The circumstances under which blood pressure is measured must also be taken into consideration. For example, a blood pressure reading taken when a person is under severe stress maybe misleadingly high. Similarly, a high reading may be obtained if blood pressure is measured soon after a person has had a couple of cups of coffee or smoked a few cigarettes. Thus, if possible, a person should avoid smoking and/or drinking coffee, cola, or other sources of caffeine for about one to two hours before having blood pressure measured.

In a physician's office or clinic, blood pressure is usually measured after the doctor has asked questions about the patient's health history. This also gives the patient a few minutes to relax, although some people remain anxious. (See box, "White-Coat Hypertension.") Two readings may be taken—the first with the person seated, and the second while standing. The reading while standing may be especially useful in older persons whose pressures may fall when they stand up. And it can help to guide treatment decisions, since some blood-pressure-lowering drugs may cause a greater decrease in standing than in sitting blood pressures. Blood pressure may be measured several times during the visit, especially if the first reading was on the high side. The results of all the readings are then usually averaged.

In an adult, blood pressure recordings need only be repeated every one to two years if pressures are below 140/90. If the average falls in the mild to moderate range of high blood pressure, about 140/90 to 160/100, an appointment for additional measurements will be made to confirm the diagnosis. However, very high diastolic blood pressure readings (more than 110 to 115 mm Hg) during the course of an office visit justify starting treatment. If an elevated blood pressure is present in individuals below 60 years of age, both the systolic and diastolic levels are

usually high—for example, above 140 systolic and 90 diastolic. In older people, however, there is a form of hypertension called isolated systolic hypertension. The systolic, or upper, reading may be high, for example, 150–180, but the diastolic, or lower, reading is below 90. (See Table 12.1.) This type of hypertension also results in an increased risk of stroke, heart attack, or heart failure.

In addition to measuring blood pressure, the doctor will also look for signs of organ damage, if the readings are high. Specifically, the examination will include:

- *Inspection of the eyes.* The eyes are the only place in the body where blood vessels can be looked at directly. By shining a bright light into the eye and inspecting its interior with an ophthalmoscope (a special magnifying device), the doctor can inspect the blood vessels for thickening or narrowing, changes that are characteristic of high blood pressure. He or she will also look for tiny hemorrhages inside the eye, another possible sign of damage from high blood pressure.
- *Examination of the heart.* This includes a careful examination using a stethoscope to listen for any unusual sounds or beats and palpation of

White-Coat Hypertension

Some people have elevated blood pressure readings in a doctor's office, but their blood pressures will be normal or near-normal when measured at home or at work. This is referred to as *white-coat hypertension*. Some doctors believe that it is not necessary to treat this type of high blood pressure on the theory that if the pressure is normal most of the time and elevated due to the stress of being in a doctor's office, this elevation is of little importance.

While it is true that some patients are nervous in a doctor's office and therefore may experience a rise in blood pressure, we believe that white-coat hypertension should not be ignored. If blood pressure rises in a doctor's office, chances are it goes up at other times, too. We are all under some kind of stress daily. Research indicates that these spikes in blood pressure are significant, and that appropriate treatment to avoid them should be instituted. In a follow-up study of patients with labile (unstable) or high normal blood pressure, it was found that enlargement of the heart may occur over time. In general, treatment guidelines are the same as for sustained high blood pressure.

the heart impulse to judge heart size. An electrocardiogram will measure the heart's electrical activity and help to determine if the heart is enlarged.

- **A check of blood flow in the arteries.** Pulses will be felt at various parts of the body, including the wrists, neck, and ankles. The doctor may use a stethoscope to listen to blood flowing through the carotid artery, the large blood vessel in the neck that carries blood to the brain. A humming noise (called a bruit) may indicate a narrowing of this artery. Similarly, the doctor will probably listen for bruits in the abdominal arteries that carry blood to the kidneys. If a specific kind of bruit or murmur is found it may indicate that the high blood pressure has resulted from a narrowing of one of the arteries of the kidneys.

- **Examination of the kidneys.** By pressing on the abdomen, a doctor may be able to tell if the kidneys are enlarged, which may indicate a specific type of hypertension. This type of high blood pressure is rare.
- **A check for an enlarged thyroid.** A swelling in the neck (a goiter) may be a sign of an overactive or underactive thyroid, conditions that can elevate blood pressure.

In addition to the physical examination, the doctor will likely order a urinalysis to check for possible kidney damage or a bladder infection, and blood tests, especially to measure blood sugar (glucose) and cholesterol levels and to estimate kidney function. Any abnormality in either the physical examination or lab studies that indicates possible damage to the heart, kidneys, eyes, or blood vessels (the major "target")

Tests, That Are Often Overused

In the majority of patients, hypertension and possible target-organ damage can be diagnosed on the basis of a routine patient history and a physical examination that includes an electrocardiogram, a few blood tests, and a urinalysis. Additional testing may be warranted in special cases, but often, expensive tests and procedures fail to provide additional information that is of value in determining effective treatment. As a general rule, a test is not needed unless it is likely to produce information that alters therapy or helps determine prognosis. Some of the most overused tests in the management of high blood pressure include the following.

ECHOCARDIOGRAM

In this test, high-frequency sound waves are "bounced off" the heart to create an image of its structures. Many doctors recommend echocardiograms, which cost from \$250 to as much as \$450, for hypertensive patients to determine whether they have an enlarged heart or thickened heart muscle, a common consequence of long-term high blood pressure. It may be of academic interest to know whether a patient has an enlarged heart. In our experience, however, the knowledge is unlikely to alter the approach to treatment, especially in dealing with mild to moderate high blood pressure without evidence of heart failure.

24-HOUR BLOOD-PRESSURE MONITORING

This test, which costs \$200 to \$300, requires that a patient wear a portable device that measures

and records blood pressure every 15 or 30 minutes over a 24-hour period. The theory is that such monitoring may provide useful additional information about fluctuations in a patient's blood pressure as he or she goes about normal activities. There is no scientific evidence, however, that such a test is better than periodic blood pressure measurements in a doctor's office or pressures taken at various intervals at home. The National High Blood Pressure Program concurs that such testing is not indicated for the vast majority of patients with high blood pressure.

EXERCISE TOLERANCE OR STRESS TEST

This examination entails taking a continuous electrocardiogram and periodic blood pressure measurements while exercising, typically on a treadmill or stationary cycle. Many doctors urge an exercise test for patients with high blood pressure, presumably to detect possible coronary artery disease. An exercise test may be justified for patients who plan to embark on a rigid exercise conditioning program, especially if they have other cardiovascular risk factors such as a family history of early heart attacks or elevated blood cholesterol, or if they smoke. But for most patients with mild to moderate high blood pressure, an exercise test is not needed to establish a diagnosis or to institute effective treatment. A typical exercise tolerance test costs \$200 to \$300, an expense that cannot be justified for most patients with high blood pressure in the absence of other evidence of heart disease.

organs of high blood pressure) may warrant additional testing. (See box, “Tests That Are Often Overused.”) In most cases, however, a diagnosis of high blood pressure and its severity can be established accurately by repeated measurements with a sphygmomanometer and a few simple tests.

WHAT CAUSES HIGH BLOOD PRESSURE?

In the majority of cases—over 90 percent—no specific cause for the elevated blood pressure can be identified. In this case, the elevated blood pressure is referred to as primary or *essential* hypertension. Some researchers believe that this type of high blood pressure may be due to hormonal factors relating to the handling of salt by the kidneys and/or to the elaboration of certain substances that cause constriction of blood vessels. These are probably genetically determined, but certain environmental factors, such as a high-salt, low-potassium diet and *chronic* stress, may play some role.

In up to 10 percent of patients, high blood pressure may be a consequence of another disorder, or a side effect of medication. This type of hypertension is referred to as secondary hypertension. *It is important to remember that these cases are relatively uncommon.* However, some of the more common causes of secondary hypertension include the following.

KIDNEY DISORDERS

About 4 percent of all cases of high blood pressure can be traced to some type of kidney (renal) disorder. The kidneys work in several ways to help regulate blood pressure. For example, they are instrumental in regulating the body’s fluid volume and its balance of sodium (salt) and water. If the kidneys conserve too much sodium, the body’s fluid volume increases. In turn, this increased fluid volume puts an increased burden on the heart to maintain an adequate flow of blood to tissues and causes blood pressure to rise. The kidneys also produce renin, an enzyme that plays a key role in regulating blood pressure. (See the discussion below of renovascular hypertension.)

About 2 to 3 percent of all cases of high blood pressure are the result of recurrent kidney infection or a bout of nephritis (a kidney infection caused by

strep bacteria). But almost any chronic kidney disorder can result in elevated blood pressure. An example is damage to the kidney’s blood vessels caused by diabetes.

As a rule, doctors will probably suggest specific tests of kidney function in cases of high blood pressure that do not respond to conventional antihypertensive (blood-pressure-lowering) therapy, especially if a urinalysis shows protein in the urine—an indication of impaired kidney function. It should be noted, however, that long-standing, poorly controlled hypertension by itself can cause kidney damage. In fact, about 25 percent of patients who require kidney dialysis have renal failure that is due to hypertension. This is especially true in the African-American population.

RENOVASCULAR HYPERTENSION

The renal arteries, which carry blood to the two kidneys, branch off from the abdominal aorta. A narrowing in one or both of the renal arteries results in reduced blood flow to the kidneys. This prompts the kidneys to attempt to raise blood pressure in order to improve their own blood supply. To do this, the kidneys increase their secretion of renin, an enzyme that, through a series of biochemical changes in the kidneys and lungs, gives rise to a substance called *angiotensin II*. This is a powerful vasoconstrictor, a medical term used to describe substances that cause blood vessels to narrow, or constrict. This constriction results in increased blood pressure. This substance also increases the secretion of a hormone, aldosterone, which leads to a retention of salt and water—further increasing blood pressure.

Renovascular hypertension is rare (accounting for 1 to 2 percent of all cases of hypertension), but it is relatively more common in elderly persons who may have widespread hardening of the arteries. It tends to occur more frequently in smokers. It sometimes occurs in children, as a result of infection or an inflammatory condition. In fact, renovascular hypertension is one of the more common causes of high blood pressure in young children, and should be suspected in any youngster under the age of 10 to 12 with elevated blood pressure. Less commonly, renovascular hypertension may be due to an inflammatory disorder that affects the muscles that encircle the arteries and control their diameter. This type of renovascular hypertension occurs more frequently in young women, although it is occasionally seen in men. It also tends to develop more frequently in smokers than in nonsmokers.

MAJOR CARDIOVASCULAR DISORDERS

Renovascular hypertension can be diagnosed by studies in which a contrast dye is injected into a vein or artery to visualize the kidneys' blood vessels on X-ray film. Widening or opening up the narrowed renal artery will often cure this type of high blood pressure. The widening may be accomplished by angioplasty, a procedure in which a catheter with a balloon tip is inserted into the renal artery. The balloon is inflated at the site of narrowing to stretch the artery and increase blood flow. In some cases, surgery may be necessary to put in a bypass graft or bridge around the narrowed segment of the artery. The cure rate is high in carefully selected cases.

ADRENAL TUMORS

The two adrenal glands, which rest atop each kidney, secrete a number of hormones, including aldosterone. This hormone is instrumental in maintaining the body's fluid and electrolyte or mineral balance by regulating potassium secretion and prompting the kidneys to conserve sodium. In rare instances (fewer than 0.5 percent of all cases of hypertension), an adrenal tumor develops and production of aldosterone is increased. The elevated aldosterone results in the body's excreting too much potassium and conserving too much sodium. The extra sodium increases the body's fluid volume, leading to high blood pressure. These tumors are benign except in extremely rare instances.

This type of hypertension is rare, but should be suspected if a person develops high blood pressure and experiences other symptoms, such as muscle weakness, thirst, and excessive urination. Younger women are more susceptible to this disease than other people. But one should also keep in mind that excessive thirst and urination may be symptoms of other illnesses, such as diabetes. A diagnosis can be established by blood and urine studies and a computed tomography (CT) scan of the adrenal glands. CT scan is an examination that uses a computer to create a cross-sectional view of internal organs from multiple X-rays. Removal of the adrenal tumor usually cures the high blood pressure. If, however, excessive aldosterone secretion is due to overactive adrenal glands instead of a specific tumor, medication can be prescribed to block the hormone's action.

PHEOCHROMOCYTOMA

This is another very rare type of secondary hypertension that is related to a different type of a tumor

of the adrenal gland called a pheochromocytoma. This type of tumor, which is benign in about 90 percent of all cases, produces different types of hormones, specifically adrenaline-like substances. As noted earlier, these hormones are instrumental in the body's fight-or-flight response. They serve to get us ready for emergencies or help us to exercise vigorously. Adrenaline increases the heart rate, elevates blood pressure, and helps increase blood flow to leg muscles. In addition to elevated blood pressure, the hormone elaborated by a pheochromocytoma may cause palpitations, tremors, clammy skin, jittery feelings, and facial and body sweating even in a cool room. The symptoms, including high blood pressure, may come and go.

The tumor usually develops on the adrenal glands, but in fewer than 10 percent of even these rare cases, it arises elsewhere in the body, usually along the aorta or spine, in the chest, or in the bladder. There are, however, only a few of these tumors reported yearly worldwide. If a pheochromocytoma is suspected, the patient may be asked to collect his or her urine over a 24-hour period; this is then analyzed for excessive amounts of adrenaline. X-ray studies or a CT scan may be ordered to locate the tumor(s), which can then be removed surgically. This removal usually cures the high blood pressure unless it has been present for some time, in which case antihypertensive medication may still be needed to keep blood pressure within normal limits.

DRUGS

Some drugs that are used for other conditions can raise blood pressure. Examples include birth control pills, the use of which may result in a *small* rise of 5 to 10 mm Hg in many women and a greater increase in about 1 in 30 to 50 women. The use of cortisone or other steroid medications and of certain nonprescription drugs, including some cold remedies, diet pills, arthritis medications such as the nonsteroidal anti-inflammatory agents Indocin, Naprosyn, etc., and nasal decongestants, may also increase blood pressure. Glycyrrhizic acid, an ingredient in natural licorice candy, can also raise blood pressure if consumed in large quantities. In almost all of these cases, blood pressure usually returns to normal when the causative substance is stopped. In some instances, the use of one of these medications may unmask a previously undiagnosed case of hypertension.

HYPERTENSION IN PREGNANCY

There is a type of hypertension that may develop in the last three months of pregnancy as part of toxemia of pregnancy. (See Chapter 19.) Since blood pressure levels in pregnancy are usually on the low side of normal (90–110/70–75), any increase to levels of above 135–140/85–90 should be considered as elevated, and some treatment should be instituted.

WHO DEVELOPS HIGH BLOOD PRESSURE?

High blood pressure develops in all social and economic groups, and affects both men and women. It generally begins in adulthood between the ages of 35 and 50, although it also occurs to a lesser extent among children and younger adults. Hypertension is rather uncommon in preadolescent children, but blood pressure should be checked at age 2 to 3 and again at age 13 to pick up the rare cases. The younger the age, the more probable that a secondary cause of hypertension will be found. Some people are more susceptible to hypertension than others, including:

- *African-Americans.* Not only are blacks twice as likely as whites to develop hypertension, but their disease is also more severe.
- *People with a family history of the disease.* Babies born to parents who have hypertension tend to have higher-than-average or more variable blood pressures throughout infancy and childhood, and are more likely to develop hypertension at a relatively early age. This tendency strongly suggests that there is a genetic basis for at least some cases of high blood pressure. It does not mean, however, that if both parents have hypertension the offspring will always develop high blood pressure.
- *People with diabetes.*
- *People who are overweight.*

Epidemiological, or population, studies suggest a number of other factors that may increase the risk of having high blood pressure. These include consuming large amounts of salt (sodium) and alcohol (more than the equivalent of 3 to 4 ounces of alcohol daily), smoking cigarettes, and following a diet low in po-

tassium. The exact mechanisms by which these factors raise blood pressure have not been clearly identified; some people appear to be more susceptible to them than others. For example, a high-salt diet may raise blood pressure only in people who have a genetic tendency to conserve sodium. Similarly, many people who consume excessive amounts of alcohol have normal blood pressures.

LONG-TERM EFFECTS

Hypertension is often referred to as the silent killer because it usually does not produce definite symptoms until it reaches an advanced stage. The first indication of high blood pressure maybe an event such as a stroke or heart attack. Untreated high blood pressure is the major cause of strokes; it is also one of the major risk factors for a heart attack. Even before one of these events occurs, however, and even though a person may feel well, hypertension, if untreated, is taking its toll on vital organs throughout the body. Fortunately, as noted earlier, the consequences of hypertension can be largely prevented by lowering high blood pressure into the normal range and keeping it there.

ARTERIES

High blood pressure speeds up the process of hardening of the arteries in both large blood vessels such as the aorta and its major branches and the smaller arteries. The increased pressure on the inner walls of blood vessels makes them more vulnerable to a buildup of fatty deposits, a process called atherosclerosis. This blood-vessel damage may not produce symptoms until it reaches an advanced stage, and then symptoms or findings will depend upon the site of the atherosclerosis. For example, angina, the chest pains that are a sign that the heart muscle is not getting enough blood, is caused by severely narrowed and clogged coronary arteries. Narrowed arteries in the lower legs can make it painful and difficult to walk, a condition called *intermittent claudication*. (See Chapter 17.)

Clots, or *thrombi* as they are known medically, are more likely to form in arteries that have been narrowed by deposits of fatty material. A clot in a coronary artery (a coronary thrombosis) can result in a

heart attack; one in the carotid artery or a blood vessel in the brain (a cerebral *thrombosis*) can cause a stroke.

High blood pressure that persists untreated for many years also increases the likelihood of an aneurysm, the ballooning out of a weakened segment of an artery (similar to a blister that forms over a weakened spot of a balloon). In time, these aneurysms may rupture, often with life-threatening consequences. For example, a ruptured aneurysm in the brain can cause a cerebral hemorrhage and a stroke. A ruptured aneurysm of the aorta can lead to fatal internal hemorrhaging if it is not repaired immediately.

High blood pressure also damages the small arteries, but in a different reamer. The muscles that form the lining of these vessels become thickened, constricting the vessels and obstructing blood flow through them. If this happens to the arterioles in the kidney, it can lead to progressive renal damage. Similarly, a thickening and hemorrhaging of the tiny arteries in the eyes can result in a loss of vision.

HEART

The heart is one of the major target organs of long-term hypertension. Hypertension forces the heart to work harder in order to sustain an adequate blood flow to the tissues, resulting in an enlarged heart. The heart is composed mostly of muscle tissue, and any muscle that is strained will become larger (witness what happens to the biceps muscles of weight lifters). In the early stages, the enlarged heart muscle has the added strength needed to pump blood against the increased pressure in the arteries. In time, however, the enlarged heart may become stiff and weak, and unable to pump efficiently. This can lead to heart failure, a condition in which the heart is unable to pump enough blood to meet the body's needs. Just a few decades ago, heart failure usually progressed rapidly, with increasing disability and eventual death. Today, however, it can generally be controlled with medications, enabling most patients to lead normal lives for many years. And most important, recent studies show that with effective treatment of high blood pressure, much of the heart enlargement actually can be reversed. In the 1940s and early 1950s, the most common cause of heart failure was hypertension. Today this complication is extremely rare—high blood pressure is being effectively treated, and heart enlargement and heart failure are actually being prevented.

BRAIN

The circulatory system is designed to ensure a steady supply of blood and oxygen to the brain. When the body senses a decrease in blood flow to the brain, it takes immediate action to remedy the situation by raising blood pressure and by diverting blood from other organs and sending it to the head. The heart speeds up and vessels in the abdomen and legs contract, allowing more blood to get to the brain. If the carotid artery and other blood vessels that supply blood to the brain become clogged with fatty deposits, vital blood flow to the brain maybe diminished. In such a situation, the risk of a stroke increases. For example, a stroke may occur if a portion of a vessel is blocked by a clot. Blood flow to a portion of the brain ceases and the tissue supplied by the clotted vessel is damaged. More seriously, a stroke may be caused by a cerebral hemorrhage. A stroke may occur when an artery that is weakened by long-term hypertension or atherosclerosis develops an aneurysm and ruptures.

Often, the blockage is temporary, causing only a brief interruption of blood flow. This is called a *transient ischemic attack* (TIA) or *ministroke*. (See box in Chapter 18, “Common Warning Signs of Stroke and Transient Ischemic Attack.”) Although the episode usually passes within minutes, it warrants medical attention, because TIAs may be precursors of full-blown strokes. In addition, repeated TIAs may result in some loss of mental function, known as *17A dementia*. If portions of the brain are repeatedly subjected to periods of lack of oxygen, brain tissue may be permanently injured. (See Chapter 18.)

KIDNEYS

Each kidney contains a million or more tiny filtering units called nephrons. Each day, more than 400 gallons of blood flow through the kidneys, where waste products are filtered out and excreted in the urine and nutrients and other useful substances are returned to the bloodstream. Sustained high blood pressure forces the kidneys to work even harder. The increased blood pressure may eventually damage some of the tiny blood vessels within the kidney and reduce the amount of blood available to the filtering units. In time their ability to filter the blood efficiently is reduced. Protein may be excreted in the urine rather than returned to the bloodstream because of damage to the delicate excreting mechanism, and waste products that are normally eliminated from the

body may build up in the blood. This accumulation can lead to a condition called *uremia*, and eventually to kidney failure, requiring periodic dialysis to cleanse the blood.

Like the other organs that may be damaged by high blood pressure, the kidneys can be spared if effective antihypertensive treatment is started early and normal blood pressure maintained. Unfortunately, some patients still avoid drug treatment of their high blood pressure because of erroneous reports that diuretics or other antihypertensive drugs will cause rather than prevent kidney damage. There is no scientific evidence to back these reports; indeed, numerous well-controlled studies show just the opposite—that treatment with diuretics and other medications markedly lower the risk of kidney failure caused by high blood pressure if blood pressure is maintained at normal levels.

EYES

As noted earlier, the eyes contain tiny blood vessels that are vulnerable to damage from high blood pressure. After many years of poorly controlled hypertension, the retina or the screen in back of the eye may be damaged because of a decrease in blood supply; hemorrhages and/or fatty deposits may occur. This condition is referred to as *retinopathy*. This situation is more common in people with poorly controlled diabetes; the risk is increased if the patient also has high blood pressure.

At one time, poorly controlled high blood pressure was a major cause of diminished vision and blindness. This is no longer true, thanks to effective antihypertensive drug therapy.

TREATMENT OF HIGH BLOOD PRESSURE

The development of a variety of effective medications to control high blood pressure is one of major accomplishments of medical science since the 1950s. Before then, treatment was limited to strict restriction of sodium, radical surgical procedures, and drugs such as phenobarbital that were not particularly effective. All too often, patients developed malignant or accelerated hypertension, a complication marked

by rapidly rising blood pressure, usually culminating in a stroke, heart or kidney failure, or some other catastrophic event. In fact, this is what led to a crippling stroke in President Woodrow Wilson in 1917 and what killed President Franklin Roosevelt in 1945. In the late 1940s, it was not uncommon to find that every third or fourth bed in a hospital was occupied by a patient with some kind of complication of hypertension. A decade later, the first effective antihypertensive drugs were introduced, and today, dozens of medications that lower blood pressure are available. As a result, malignant hypertension is now so rare that it is considered a medical oddity. Even at a major center like the Yale–New Haven Hospital, it is unusual to find more than just a few patients in the entire facility who are there because of high blood pressure. This change is exciting.

Many misconceptions persist about when and how high blood pressure should be treated. Most doctors agree that even mild hypertension (repeated readings over 140/90) should be treated. (Treatment may not

'Illustrative "Case

The following case illustrates the reason why we feel strongly that readings above 140/90 should not be ignored.

About four years ago, a 48-year-old man came in complaining of a slight early-morning headache in the back of his head, and some shortness of breath. He was not a person who had neglected himself. He was relatively thin, did not smoke, and exercised regularly. He noted that his blood pressure had been elevated at pressures of about 145/90 to 160/95–100 for the past five years; he had been told by his doctor to reduce stress and salt intake, to exercise, and not to worry. His pressure had remained within this range, but he had developed symptoms and had come because he did not feel well (he had felt fine for three to four years). On examination, his blood pressure was 160/100. The electrocardiogram showed evidence of some heart enlargement, and he had some narrowing of the blood vessels in his eyes. In other words, he had begun to show changes indicating damage from his untreated high blood pressure. We started him on medication and his pressure returned to normal; his heart size also normalized. However, not everyone with untreated elevated blood pressure and target-organ damage does well. We know that we can still help at this point, but the outcome is usually better if treatment is started early, before damage occurs.

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merely imply the use of drugs, as discussed below.) Some dissenters, however, advocate waiting until blood pressure reaches a higher level (blood pressures above 145–160/95–105) before initiating treatment. (See box, “Illustrative Case.”)

Numerous studies showing decreased mortality and target-organ damage document the benefits of treating mild high blood pressure. These studies, carried out in the United States, Europe, and Australia, have involved over 40,000 men and women between about 40 and 80 years of age. They have demonstrated not only that lowering blood pressure will prevent progression to more severe hypertension, but that effective therapy also prevents heart attacks, heart enlargement, heart failure, strokes and stroke death, and progression of kidney damage. In other words, the occurrence of cardiovascular disease can be markedly decreased in both sexes and, importantly, in both young and elderly individuals by modern treatment of high blood pressure. Before initiating drug therapy, however, most doctors put patients on a trial of three to six months of non-pharmacologic life-style modifications, unless pressures are very high (greater than 160–180/100–110). These nondrug treatments include the following.

REDUCING SODIUM INTAKE

Early in the century, doctors first recognized that sodium restriction lowered high blood pressure. (Ordinary table salt is made up of sodium and chloride, and sodium is a major ingredient in many flavorings and preservatives.) Before the development of effective antihypertensive medications, a strict low-salt diet such as the rice and fruit diet developed by Dr. Walter Kempner at Duke University Medical Center was one of the most effective treatments for high blood pressure. The problem, of course, was that most patients had difficulty sticking to such a restrictive diet. In the days when we had nothing else to offer, some patients did stay on this diet for long periods of time. Today's low-salt diet allows many more foods and flavorings and does not have to be nearly as rigid. Care must be taken in selecting from a large variety of processed foods—our major source of sodium—if sodium is to be restricted. (See Table 12.2.) If it proves ineffective, other methods of treatment are available.

In reducing sodium intake—as in all aspects of life-style modification—common sense and moderation should prevail. Contrary to popular belief, scientific data do not confirm that salt is a major cause of high

blood pressure or that eliminating it from your diet will always prevent high blood pressure. Sodium is probably a contributing factor only among people who are salt-sensitive, i.e., whose blood pressure goes up or down as they eat more or less sodium. Only about a third of hypertensive Americans may fall into this category. For reasons that are not completely understood, African-Americans tend to be more sodium-sensitive than Caucasians. Since many of the ethnic dishes favored by African-Americans are high in salt, this may be one reason that high blood pressure is more prevalent and severe in this segment of the population.

The typical American diet provides about 10 to 15 grams of salt (about 3–4 teaspoonfuls) a day, which is far more than we need. For most people, this extra sodium is not a hazard. The exceptions are the hypertensive patients who may be salt-sensitive. The American Heart Association believes that there is enough justification to urge all people to reduce their salt intake. The latest federal dietary guidelines also urge reducing salt intake. Still, many health experts feel that these guidelines are too broad, and that they should be applied mostly to those who are likely to be salt-sensitive, especially those with a strong family history of high blood pressure.

So, what should you do if you have a strong family history of hypertension in both parents and you hope to prevent hypertension, or you have a higher blood pressure than normal and you would like to lower it without any drugs?

Try to reduce your salt intake to about 1–1½ teaspoonfuls (about 4–6 grams) a day. You can do this by

- Not using salt on food at the table.
- Avoiding obviously salty foods—processed meats, peanuts, pretzels, ketchup, and so forth.
- Using less salt in cooking and using other spices or condiments, such as salt-free herb mixtures.

If you are salt-sensitive, this degree of sodium restriction will probably work in many cases; if not, other measures can be used to lower blood pressure.

Some individuals are able to restrict salt to a great degree (to about 2 grams or less per day) without being miserable. It is possible that this degree of restriction may be more helpful in either preventing or treating high blood pressure—but there is no guarantee, and it does represent a sacrifice and a major change in life-style.

Table 12.2
Common High-Salt Foods

Food	Amount	Sodium (mg)	Calories	Food	Amount	Sodium (mg)	Calories
Bacon [Canadian broiled/fried]	1 slice	442	65	Peas (canned)	1 cup	493	150
Biscuits	1 oz	185	104	Peanuts (roasted and salted)	1 oz	138	170
Broth (canned beef or chicken)	1 cup	782	16	Pickle (dill medium)	1	928	5
Bologna (beef)	1 slice	230	72	Pickle relish (sweet)	1 tbsp	107	21
Bouillon				Pizza (cheese, regular crust)	¼ of a 12-inch pie	673	326
beef	1 cup	1,358	19	Potato chips (Lay's)	102	260	150
chicken	1 cup	1,484	21	Pretzel twists (hard)	10	1,010	235
Catsup (Heinz Ketchup)	1 tbsp	156	16	Salmon (canned pink)	2/5 cup	387	141
Cheese (cheddar)	1 oz	176	114	Saltines	4 oz	123	48
Coffee cake (made with self-rising flour)	1 medium piece	310	232	Sardines (canned in oil)	402	735	175
Corned beef	1 slice	294	46	Sauerkraut (canned)	2/3 cup	666	21
Corn chips	1 oz	218	153	Sausage (pork)	1 link	1,020	265
"Fast foods"				Soups (commercially prepared)			
Big Mac	1	963	541	chunky chicken, canned, ready to serve	1 cup	887	178
Vanilla shake	1	250	324	chicken noodle, canned, made with water	1 cup	1,107	75
Frankfurter (beef)	1	461	145	chicken noodle, dry	1 cup	1,284	53
Ham (regular, 11% fat)	1 slice	373	52	Soy sauce (La Choy)	1 tbsp	975	8
Lima beans (canned)	8½ oz	536	41	Spinach (canned)	7¾ oz	519	42
Milk				Tomato juice (canned or bottled)	1 cup	878	45
1% fat	1 cup	123	102	Tuna (canned light in water)	6½ oz	523	184
chocolate, 1% fat	1 cup	152	158	Worcestershire sauce	1 tbsp	147	12
Olives (green)	3	385	15				
Pancakes	102	412	164				

MAINTAINING A MODERATE ALCOHOL INTAKE

As noted earlier, there is some evidence that a moderate intake of alcohol may actually help lower the risk of cardiovascular disease. There is also evidence that an intake of more than 3 ounces of alcohol a day may increase the risk of developing high blood pressure or cardiovascular disease. The Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure recommends that people should drink "no more than 1 ounce of ethanol a day." This amount is contained in 2 ounces of 100-proof whiskey, about 8 ounces of wine, or about 24 ounces of beer.

All bets are off, however, if there is a strong family history of alcoholism or a sensitivity to small amounts of alcohol. In these cases, a person should not drink any alcohol regardless of the recommendations.

The good news is that alcohol in moderation is acceptable in most people. But drinking more than a few drinks a day might be harmful, not only to the brain and liver, but also to the cardiovascular system. In a number of cases blood pressure has become easy to control once patients have reduced their excessive intakes of alcohol.

LOSING EXCESS WEIGHT

It has long been known that people who are obese (20 percent or more above desirable weight) have an increased incidence of high blood pressure. They also are more likely to have high blood cholesterol and to develop diabetes. In many of these overweight and/or diabetic patients, losing excess weight will normalize blood pressure and may also control the di-

abetes. *This improbably the most important thing other than stopping smoking that someone can do to reduce his or her risk of heart disease and possibly to reduce blood pressure.*

A common-sense diet that reduces the intake of total calories and fats (especially animal and other saturated fats) and emphasizes complex carbohydrates (starches) as the major diet component (55 to 60 percent of calories consumed) may help control many of the risk factors that predispose to early cardiovascular disease. Crash diets should be avoided. Although they may produce a fast weight loss, in more than 90 percent of cases, the pounds are quickly regained once the diet is stopped. Instead, strive for gradual weight loss—1 or 2 pounds a week—and undertake a moderate increase in physical activity. Such a program is more likely to achieve long-term weight control than a crash diet. (See Chapter 5.) There are no miracle diets. If the first ten miracle diets really worked, they would still be in use. Instead we have a new miracle diet—seven-day, four-week, Beverly Hills, Scarsdale, California, and on and on—every few months, just long enough for the book author or the diet center to get rich and walk away. *Consumers beware when it comes to the quick fix in the world of diets.*

INCREASING PHYSICAL ACTIVITY

Moderate exercise, combined with weight reduction and a low-salt diet, is an important component in any nondrug treatment program for high blood pressure. Some studies have shown that increased exercise can produce a modest lowering of blood pressure. It also helps burn up some calories and control excess weight, and it adds to the sense of well-being. A recent well-controlled 4-month study reported, however, that blood pressure was no more reduced in those who completed a regimen of vigorous aerobic exercise than it was in the control group.

Exercise need not be a regimented or rigorous cardiovascular conditioning program—activities such as taking a brisk walk, playing tennis regularly, cycling, and swimming all provide excellent means of relaxation and provide almost all of the benefits in terms of reducing cardiovascular risk that are derived from vigorous exercise. (See Chapter 7.) Nor is it necessary to set aside a time to exercise everyday unless you want to—studies show that 15 to 30 minutes of moderate exercise three times a week provide the desired results. The exercise should be convenient and enjoyable; otherwise, you're likely to give up after

an initial burst of enthusiasm. Remember, too, that many day-to-day activities—walking up two or three flights of stairs, working around the house or yard—are excellent forms of exercise. A long-term study of nearly 17,000 Harvard alumni found that those who burned an extra 2,000 calories a week in moderate activities such as recreational sports, or walking or climbing up several flights of stairs a day, had a lower death rate than their more sedentary counterparts. (Again, see Chapter 7.)

A moderate exercise program plus a low-salt diet may lower blood pressure by anywhere from 1 to 10 mm Hg systolic and 1 to 8 mm Hg diastolic. If you start with a pressure of 145/95 and are one of the lucky responders, your pressure may decrease to below 140/90 and you will not have to take medication. Unfortunately, and contrary to what some popular media tell us, nondrug treatment methods will be effective in only 20 to 25 percent of cases of high blood pressure. Moreover, some nondrug treatments are highly questionable. (See box, “Alternative Nondrug Treatments of Questionable Value.”) So although we all would like to be in control of our own destiny and not depend on medications, the majority of individuals with hypertension will have to take some medication to bring their blood pressures down to normal levels.

ANTIHYPERTENSIVE DRUGS

Unfortunately, many misconceptions persist regarding antihypertensive drugs; some of these are based on exaggerated reports of negative side effects. Pressure from industry to make newer drugs seem better also results in dissemination of the “dangerous” side effects of the older drugs. Reports maybe misleading or based on inconclusive or incomplete data.

The public and doctors alike should not be pressured by pharmaceutical companies to change treatment practices. The bottom line is, if you are feeling well and your blood pressure is well controlled, do not let yourself or your doctor be persuaded to change medication unless there is a very good reason.

As already noted, many well-controlled studies have demonstrated that drug therapy for mild, moderate, or severe high blood pressure results in lowered death rates and fewer complications such as heart attacks and strokes.

Many patients have been lead to believe that anti-

Alternative Nondrug Treatments of Questionable Value

A number of so-called natural therapies have been advocated in the treatment of high blood pressure. Patients with high blood pressure are understandably swayed by glowing reports of supposedly effective treatments that do not require drugs, dietary restrictions, and other facets of traditional blood-pressure-lowering therapy. The major problem is that little scientific evidence demonstrates that these treatments have a sustained or reliable effect in lowering high blood pressure. Some may be beneficial adjuncts to medical treatment, but they are not acceptable alternatives or substitutes. The most common alternative therapies are the following,

BIOFEEDBACK TRAINING

Biofeedback is a process in which a person learns to control certain bodily functions that normally are involuntary. During biofeedback training, special equipment is used to show the patient how he or she can alter physical responses. The patient is hooked up to sensors, typically electrodes that are attached to the scalp or hand-held devices that measure heart rate and temperature changes. These changes are transformed into electronic impulses and presented on a video screen. By observing the screen, the patient can learn to alter some physiologic responses.

When used to treat hypertension, the sensors monitor changes in blood pressure. The patient watches the monitor and observes what seems to lower it, and then consciously tries to control blood pressure by concentrating on whatever it is that produces the reduction. The objective is eventually to control blood pressure without having to use the biofeedback equipment. A person may be able to produce a transient reduction in blood pressure using biofeedback techniques. Some studies have suggested that regular biofeedback sessions can produce more sustained reductions, but these results have not been replicated in long-term control led scientific experiments. Biofeedback requires a great deal of discipline and dedication—beyond what can be expected of a typical patient. Thus, any short-term reduction in blood pressure is unlikely to be sustained once he or she resumes normal activities. Biofeedback, therefore, has little use as a definitive treatment of hypertension, other than in a small number of people.

HYPNOSIS

During hypnosis, a person enters a trancelike state in which his or her entire concentration is focused on a specific object or subject. It is akin to being totally absorbed in a daydream and oblivious to what is going on around you. During hypnosis, breathing and pulse rates slow down, and blood pressure may drop. There is also a reduced sensation in the peripheral nervous system. (This results in reduced sensitivity to pain, explaining why a person under hypnosis can perform such painful tasks as walking on nails or hot coals.) Like biofeedback, hypnosis may produce a temporary reduction in blood pressure, but there is no evidence of long-term benefits.

MEDITATION, YOGA, AND OTHER RELAXATION TECHNIQUES

These techniques are useful in overcoming tension or stress. Typically, the person is taught to relax by sitting quietly with eyes closed and taking slow, deep breaths while concentrating on a calming image or word. After a few minutes of such activities, there may be a modest lowering in blood pressure. Practiced regularly, these techniques can help a person achieve a more relaxed outlook and enhanced sense of well-being. They may even enable a person to reduce his or her dosage of medication. But they are not considered a definitive alternative therapy for high blood pressure.

FAD DIETS

Every few years, a new diet comes on the scene that promises to lower blood pressure (and cure a variety of other ailments) without resorting to drugs. Usually, these diets allow a limited number of low-salt, low-fat foods (for example, rice, grapefruit, oatmeal, and other such foods). Such a regimen may result in a loss of weight and a lowering of blood pressure. But it is also a boring, nutritionally unbalanced regimen that is difficult if not impossible to maintain. Before long, the person resumes his or her former eating habits, and weight as well as blood pressure go back up. These diets are not to be recommended as preferred therapy for high blood pressure.

hypertensive drugs always produce some side effects—ranging from lethargy and mental depression to impotence—that can make life miserable. While all drugs, even simple aspirin, may cause side effects in some people, the fact is that fewer than 5 to 10 percent of people experience annoying reactions to blood-pressure-lowering drugs. There are now so many

drugs to choose from that if one produces side effects or is not effective, a satisfactory alternative almost always can be found. Patients should nevertheless be aware of the possible side effects of a particular drug so that they can report them to the doctor. (See box, “Questions You Should Ask Your Doctor About Your Therapy.”)

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In arriving at the most appropriate antihypertensive regimen for an individual patient, a physician considers many factors, including the patient's age and race and the presence of other disorders such as diabetes, kidney failure, or heart disease. Cost may also be a consideration, since some of the newer drugs are much more expensive than older medications that may be just as effective. Even so, it may be necessary to try a number of drugs before arriving at the best regimen that controls blood pressure with minimum side effects. The major classes of antihypertensive drugs are outlined below; specific medications and their cost and side effects are described in more detail in Chapter 23.

DIURETICS

Diuretics, commonly referred to as water pills, lower blood pressure by increasing the kidney's excretion of sodium, which in turn reduces the volume of blood. Their long-term effect is to dilate blood vessels, which reduces pressure in the blood vessel walls. These are among the older antihypertensive agents, having been introduced for use in the United States in 1957. They are still widely used, either alone or in conjunction with other antihypertensive drugs. There are several types of diuretics, which are classified according to their site of action in the kidney. The thiazide diuretics, which work in the tubules (the structures that transport urine in the kidneys), are the most commonly used.

The loop diuretics, more potent than the thiazides, are so named because their site of action is in the loop of Henle, the area near where waste is filtered from the blood. They are usually prescribed when a thiazide diuretic proves insufficient or for patients with heart failure or compromised kidney function.

A third type, the potassium-sparing diuretics, works in the area where potassium is excreted. They prevent the excessive loss of potassium that sometimes occurs with the thiazides. Since they have a less potent antihypertensive effect, they are often given in conjunction with a thiazide or loop diuretic.

Diuretics are highly effective, generally well-tolerated, and less expensive than most other antihypertensive medications. (See Chapter 23 for details.)

BETA BLOCKERS

These drugs, which were first introduced in the United States in the 1960s to treat angina, lower blood pressure by working through the autonomic (auto-

Questions You Should Ask Your Doctor About Your Therapy

If you are diagnosed as having high blood pressure, you undoubtedly will have many questions, especially if you are given medications. Don't hesitate to question your doctor, and if you experience side effects, let him or her know about them. It may be a good idea to take notes or ask your doctor for printed material. (An excellent booklet entitled *High Blood Pressure and What You Can Do About It* is available free of charge from the National High Blood Pressure Information Center, 120/80 NIH, Bethesda, MD 20892.) If the cost of your medication is a problem, ask your doctor if there is a generic equivalent or other medication that is less expensive but equally effective. Other questions you should ask regarding antihypertensive medications include:

- How often should I take my medication? Should I take it with food or on an empty stomach?
- What medications, including over-the-counter remedies, should I avoid?
- Are there foods or drinks (including alcohol) that I should avoid?
- What should I do if I forget to take my medication as scheduled?
- What are the possible side effects? Which ones are likely to pass with time? Which are signs to call you?
- How often should I have a medical checkup and pressure reading?

Source: Adapted from the National High Blood Pressure Education Program, National Institutes of Health, 1989.

matic) nervous system. Specifically, they block responses from the beta nerve receptors. This serves to slowdown the heart rate and to reduce the amount of blood that the heart pumps every minute. Blood pressure is lowered. Beta blockers also block the effects of some of the hormones that regulate blood pressure.

Beta blockers may be prescribed as the initial drug to lower blood pressure, or they may be given along with a diuretic or other antihypertensive drug. In general, beta blockers are more effective in younger patients with rapid heartbeats. Since they relieve angina, they may be the drug of choice for patients who have this problem along with high blood pressure. For reasons that are not fully understood (it may be related to different levels of a hormone from the kid-

ney), African-Americans do not seem to respond as well as Caucasians to beta blockers, although there are exceptions. Since beta blockers may constrict peripheral blood vessels, they generally are not recommended for patients with circulatory problems in their hands or legs. They also are contraindicated for patients with asthma or heart failure because their use tends to cause a narrowing of the bronchial tubes in the lungs (especially at higher doses), in addition to reducing the strength of the heart's pumping action.

Most patients, however, tolerate beta blockers well, especially if they are administered in low doses along with a diuretic or other antihypertensive drug. In some patients, however, they may cause sexual impotence. Other possible side effects include depression, vivid dreams, and feelings of lethargy. (See Chapter 23.)

CALCIUM-CHANNEL BLOCKERS

These are relatively new drugs that work by blocking the passage of calcium into the muscle cells that control the size of blood vessels. All muscles need calcium in order to constrict; when the muscles of the arteries are prevented from constricting, blood vessels open up (dilate), allowing blood to flow more easily through them. Blood pressure is reduced.

Calcium-channel blockers are effective as initial treatment in about 30 to 40 percent of patients. They also may be added to a diuretic or other antihypertensive medication. They are generally well tolerated, but they are more costly than diuretics and beta blockers. Thus, many doctors still recommend that these older drugs be used first. (See Chapter 23.)

ANGIOTENSIN CONVERTING ENZYME (ACE) INHIBITORS

These are also relatively new drugs. They work by preventing the formation of angiotensin II, a substance derived from the action of renin, an enzyme produced by the kidneys, and angiotensin I, a naturally occurring body chemical. Angiotensin II is a powerful vasoconstrictor that raises blood pressure by causing the arterioles to narrow. Angiotensin II also stimulates the release of aldosterone, the hormone that promotes the retention of sodium and fluid.

ACE inhibitors do not appear to be as effective as diuretics or calcium blockers in lowering blood pres-

sure in African-Americans. However, they may be among the first-choice drugs for hypertensive patients with kidney disease, diabetes, or heart failure. They are more effective when combined with small doses of a diuretic. They may be an appropriate alternative for patients who suffer impotence from beta blockers, diuretics, or other medications. Their high cost may be a drawback for many patients. (See Chapter 23.)

ALPHA-BLOCKING DRUGS

Like beta blockers, these agents work through the autonomic nervous system, but they block a different type of nerve receptor, the alpha receptors that promote constriction of the arterioles. Blocking constriction promotes dilation of vessels and lowers blood pressure. Alpha blockers inhibit the effects of norepinephrine, one of the adrenal hormones that raise blood pressure as part of the fight-or-flight response. Thus, alpha blockers may be a first-choice drug in treating patients with pheochromocytoma, the tumor that produces excessive amounts of adrenaline-like products.

Alpha blockers are usually prescribed along with other antihypertensive drugs, such as a beta blocker and/or a diuretic. One of their major side effects is orthostatic hypotension, a drop in blood pressure when a person abruptly stands up; this can result in fainting, especially in the elderly. Thus, care is needed to avoid sudden movements when taking this medication, especially when first starting the drug. In general, alpha blockers are not as effective for initial therapy as some of the other blood-pressure-lowering medications. Several medications are now available that combine the effects of blocking both the beta and alpha receptors. (See Chapter 23.)

VASODILATORS

As their name indicates, these drugs lower blood pressure by dilating, or opening up, arteries, thereby facilitating blood flow through them. Vasodilators are usually prescribed along with other drugs such as a beta blocker and a diuretic. Some produce a very rapid reduction in blood pressure, especially when administered by injection. Thus they may be useful in treating a hypertensive crisis. For chronic use, several office visits may be needed to fine-tune the dosage. Side effects may be annoying, and blood-pressure-lowering effects may be less when these

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drugs are used as initial treatment. One drug in this category, minoxidil, has gained considerable media attention because of one of its side effects, promotion of hair growth. It has been formulated into a topical preparation that is now marketed as a remedy for baldness. (See Chapter 23.)

PERIPHERAL ADRENERGIC ANTAGONISTS

These drugs, which are among the older antihypertensive agents, lower blood pressure by inhibiting the release of norepinephrine or by blocking its activities. Reserpine, the oldest drug in this category, is derived from rauwolfia plants and has been used in India and other Asian countries for many years as a sedative. This effect remains a major drawback to the continuing use of the drug to treat high blood pressure. Some patients complain that it dulls mental acuity and makes them feel lethargic. This can be at least partly overcome by giving it in small doses with other antihypertensive drugs, such as a diuretic. In any event, medications in this class should not be prescribed for patients who have suffered episodes of mental depression. This is the least expensive of all the antihypertensive medications and, in combination with a diuretic, is effective in lowering blood pressure.

CENTRALLY ACTING DRUGS

Drugs in this category reduce nerve impulses from the brain to the sympathetic nervous system. They

lower blood pressure by opening up (dilating) peripheral arteries; they may also cause the heart to beat more slowly.

Centrally acting drugs are not widely used in the initial treatment of high blood pressure; instead, they are given along with a diuretic or other antihypertensive drugs when these drugs alone do not produce an adequate reduction in blood pressure. They may cause a number of side effects, including muscle weakness, fatigue, drowsiness, depression, dry mouth, and constipation. One drug in this category, clonidine, has an added use in some people, namely, minimizing withdrawal symptoms during smoking cessation or in an alcohol detoxification program. (See Chapter 23 for specific details about antihypertensive drugs.)

SUMMARY

There is little doubt that the next few years will see the development of newer and more effective blood-pressure-lowering drugs. In the meantime, however, we can continue to utilize the available treatments with the expectation that the majority of hypertensive patients can have their pressures normalized. We can also expect that as more people are treated there will be a further reduction in cardiovascular disease rates.