

High Blood Pressure and Diabetes

Control Them
and Live Longer



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Contents

Hypertension	1
Diabetes and Hypertension —A Special Problem	1
What Is Hypertension?	2
What Is Normal Blood Pressure?	7
What Causes Hypertension?	8
How Do You Find Out if You Need Treatment for High Blood Pressure?	9
What Can You Do to Reduce the Risk of a Heart Attack or Stroke?	13
Hypertension and Other Risk Factors for Heart Disease	17
Diabetes: A Major Risk Factor for Heart Disease	27
Summary	34
Facts to Remember About High Blood Pressure and Diabetes	35
Final Advice for People With High Blood Pressure and Diabetes	37
Glossary	38



Hypertension

Hypertension, or high blood pressure, affects about 50 million Americans and more than 600 million people worldwide. It is the most common reason that adult Americans visit doctors. More than 50% of all people over the age of 60 have it. Unlike many conditions, such as bursitis, other painful conditions, or an infection with a high fever, high blood pressure causes few symptoms. This fact may explain why many people with high blood pressure are unaware of it or, if they have it, are not actively seeking medical care.

Diabetes and Hypertension— A Special Problem

Many people with high blood pressure also have diabetes. Approximately 15–20 million Americans and about 200 million people worldwide have diabetes. They have lost their ability to burn up sugar that is taken in the diet and turned into fuel for energy. Blood sugar (glucose) builds up in the blood stream rather than being used or stored in the muscles and liver. Some of this spills

over into the urine and is wasted and not converted to energy. When glucose levels are high in the blood stream or sugar is washed out in the urine, the patient is considered to have diabetes. Diabetes increases the risk of heart, kidney, and brain disease. If someone has hypertension and diabetes, his/her risk is greatly increased.

What Is Hypertension?

Hypertension is just a medical term for elevated or high blood pressure. Hypertension does not mean that a person is overly tense or nervous. An elevated blood pressure increases the risk of strokes, heart failure, kidney failure, and heart attacks; if it is treated and controlled, complications that used to occur frequently can be prevented in a majority of cases. Unfortunately, in the United States only about one third of all people with elevated blood pressure are treated effectively. In many parts of the world fewer than 10%–15% are under treatment. This is a major reason why people should become educated about this disease, what it can do, and how it can be treated.

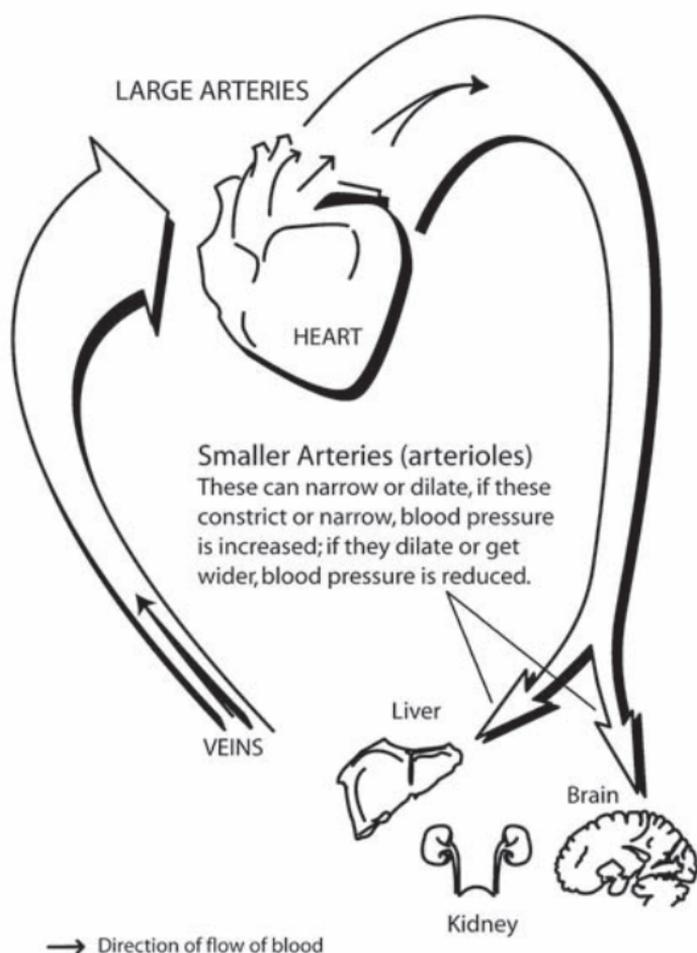
What Used to Happen to People With High Blood Pressure? At the age of 57, Franklin Delano Roosevelt (FDR), the 32nd President of the United States, was found to have an elevated blood pressure of 170/90 mm Hg. (A normal pressure varies between 120–130/75–80 mm Hg). He had no symptoms of heart disease or blood vessel damage. Over the next few years, a slow rise in blood pressure occurred with levels in 1941 and 1942 of 180–190/105 mm Hg. In 1943 and 1944, his blood pressure rose to levels above 200/110 mm Hg. He felt short of breath and had other symptoms of heart failure. His heart

had enlarged, there was evidence that his kidneys were no longer working properly and he possibly had had small strokes. The President died of a massive brain hemorrhage (stroke) on April 12, 1945, at the young age of 63 years. Other US presidents, Woodrow Wilson and Warren Harding, and numerous world leaders also have had severe hypertension and its complications.

FDR's treatment was to rest as much as possible, a low-fat, low-salt diet, and mild sedatives. In the 1930s and 1940s, there were no effective and safe treatments available. Since that time, many medications have been introduced and have been used successfully to prevent problems. Had the President lived 15–20 years later, he most certainly would have lived longer. His story would have ended differently.

What Is Blood Pressure and What Is a Normal Blood Pressure? Blood pressure is the force exerted by the blood stream against the walls of arteries that carry blood to various parts of the body. Everyone has to have some pressure in their blood vessels to get blood to vital organs and muscles. Normally, each time our heart beats (about 60–80 times a minute at rest) it pushes blood out into the larger arteries, which carry blood from the heart. Blood then flows into smaller arteries or arterioles to various parts of the body, such as the liver, kidney, or brain. These can open wide (dilate) or close (constrict). If they are open, blood pressure remains low; if they constrict, it gets high. Blood then returns to the heart through the veins (see diagram).

The beating action of the heart may be compared to a faucet that is intermittently opened



and closed. The arteries may be compared to the tubing of a hose. The small blood vessels or the arterioles act like a nozzle. If the nozzle is kept open, water flows freely through the hose, and not too much pressure is built up on the walls of the hose. If, however, the nozzle is almost closed and the faucet remains open, increased pressure is built up on the sides of the hose. In the same way, if the arterioles or small blood vessels remain open as the heart beats, blood pressure in the arteries remains fairly low or normal. If they narrow or constrict, higher blood pressure results. Of course, the circulation in our bodies is a closed system,

and blood is not leaking out anywhere but is being pushed through in surges every time the heart muscle contracts or “pumps.”

Blood pressure varies widely. When you exercise or are excited or nervous, it can rise; during sleep, it is lower. It may vary during the course of the day by as many as 20–30 points.

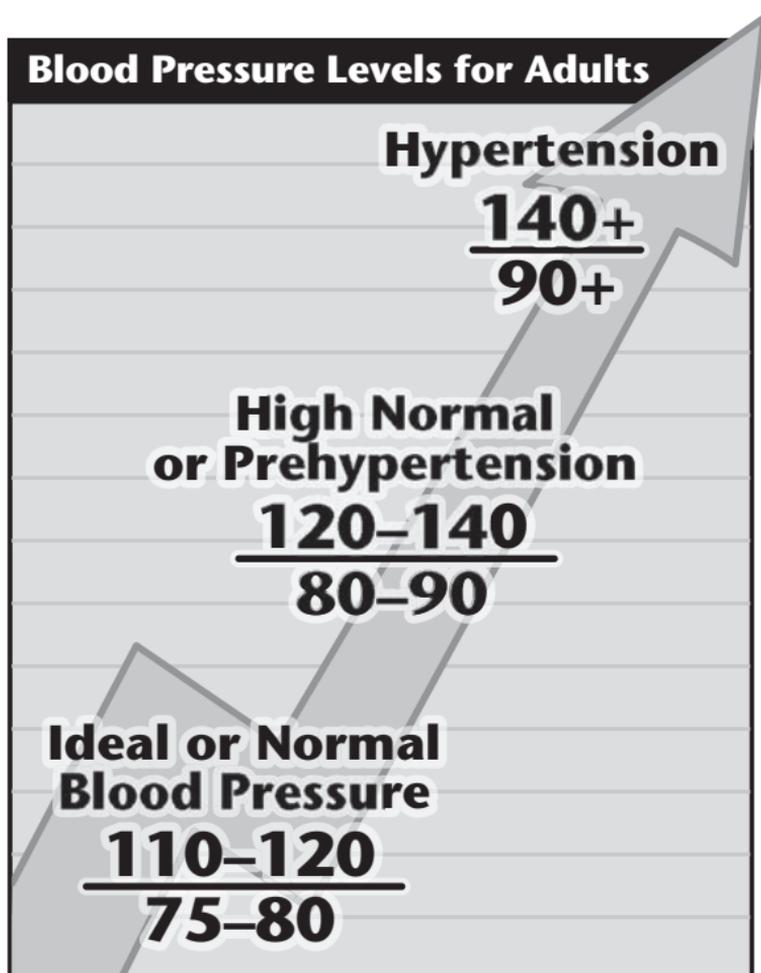
How Is It Measured? The amount of pressure in the arteries is measured by the level of air or mercury in a tube. This is a part of a blood pressure instrument called a sphygmomanometer (sfig-mo-mah-nom-eter). Blood pressure should be taken when you are relaxed with your arm at the level of your mid chest area. A cuff is placed around the upper arm and inflated with air until the circulation in the artery is temporarily cut off. A valve in this instrument is opened and air is gradually released from the cuff. The person who is measuring the blood pressure places a stethoscope over the artery on the inner side of the elbow to listen for the first sound of blood rushing through the artery as the pressure in the cuff is lowered. The number on the gauge at the moment that this occurs represents the pumping or systolic (sis-tal-ik) pressure. This is the pressure produced in the artery when the blood is pumped from the heart into the large blood vessels. Additional air is gradually released from the cuff. When all beating sounds stop, the number on the pressure gauge represents the resting or diastolic (di-ah-stal-ik) pressure. This is the pressure that remains in the arteries when the heart is relaxing between beats.

Thus, blood pressure is recorded in two numbers as millimeters of mercury (mm Hg). For example:

120 mm Hg systolic (pumping pressure)

80 mm Hg diastolic (resting pressure)

The measurement above would be spoken of as “120 over 80,” with the systolic (higher) number always given first, followed by the diastolic number. Many blood pressure cuffs that employ electronic devices or digital-readout technology do not require the use of a stethoscope to listen for sounds. Blood pressure is taken automatically and displayed on a small screen or signaled by a beeping sound. These machines are easy to use and are generally accurate.



What Is Normal Blood Pressure?

Normal blood pressure may be as low as 70/50 mm Hg in infants or as high as about 130/80 mm Hg in adults. Normal pressure for people under 18 is usually below 120/80 mm Hg. Over the age of 18 a reading of up to about 130/80 mm Hg is considered within the normal range. A diastolic (lower number) reading between 85–90 mm Hg and a systolic (upper number) reading of 135–139 mm Hg is considered “high-normal” or prehypertension. If an adult’s blood pressure is consistently 140/90 mm Hg or higher, he or she has high blood pressure or hypertension.

As blood pressure rises above 135–140/85–90 mm Hg, the risk of heart, kidney, and blood vessel disease increases regardless of age. Some physicians used to believe that a normal systolic blood pressure was 100 mm Hg plus age, i.e., a 70-year-old person was once considered “normal” with a systolic blood pressure of 170 mm Hg. However, abundant data now show that blood pressures above 140 mm Hg at any age should not be ignored and should be treated.

Which Reading Is More Important, the Upper Reading (Systolic) or the Lower Reading (Diastolic)? Recent studies have shown that the upper reading (systolic) is more accurate in determining the risk of high blood pressure than the lower reading (diastolic). It is, therefore, most important to keep the systolic pressure below 140 mm Hg. Many older people just have an elevation of the upper reading (170/80 for example). This is called isolated systolic hypertension. Lowering these levels has been shown to reduce cardiovascular events, such as strokes and heart failure, even in people over the age of 80.

White Coat Hypertension—“I’m Just Nervous.”

There are many people whose blood pressure is elevated in a doctor’s office and normal when taken at home—so-called “white coat” hypertension. Some physicians believe that white-coat hypertension is nothing to be concerned about. Yet, studies have shown that individuals with these kinds of blood pressures already have some changes in their blood vessels. They should not be ignored. It does not mean that they should immediately be put on medication but it does mean they should be followed and treated with medication if non-drug treatment does not lower blood pressure to normal levels *in* and *out* of a doctor’s office.

What Causes Hypertension?

In more than 90% of cases a specific cause is not found. However, despite the fact that we cannot pinpoint the exact cause of high blood pressure in most people, we can treat it effectively and prevent progression to more severe disease, heart attacks, strokes, and heart and kidney failure. We do know *some* of the causes. A few patients have abnormalities of the adrenal glands, the glands that sit on top of the kidneys; others have a narrowing of the arteries to the kidneys; there are a very few women whose blood pressure is elevated by birth control pills.

Role of Heredity and Environment. *Heredity Plays a Role in Hypertension.* Persons with one parent with high blood pressure have an increased risk of having hypertension; persons with two parents with hypertension stand a greater chance of having it. This does not mean, however, that all children with parents who are hypertensive will develop an elevated blood pressure. It suggests that they are more likely to become hypertensive

and that certain measures should be taken at an early age to prevent this if possible. Most importantly, weight should be kept as close to normal as possible and a low-salt diet and exercise should be encouraged.

Environmental Factors Play a Role. Although many people can eat lots of salt without worrying about changes in blood pressure, there are “salt-sensitive” people whose blood pressures go up with an increase in salt intake. The average intake of salt in the United States is about two teaspoonfuls (10–12 g/day) although in some parts of the United States, the Caribbean, and Europe it is considerably higher. Sodium, which makes up about 40% of salt, is the part of salt that is important. We only need less than one half a teaspoonful/day of salt (2 g) and less than 1 g or 1000 mg/day of sodium regardless of our occupation or daily activities. Nothing is to be lost by getting used to a low-salt diet whether or not you have a family history of hypertension. Salt is an acquired taste—if you don’t get used to salty foods, you can get along without them, and if you have hypertension, being on a low-salt diet may help to lower your blood pressure. A list of foods to be avoided or eaten sparingly is noted in Table I.

Once you have high blood pressure reducing the amount of salt or sodium that you take in may be helpful but it may not be effective in lowering your blood pressure to acceptable goal levels of below 140/90 mm Hg.

How Do You Find Out if You Need Treatment for High Blood Pressure?

Measuring blood pressure involves a simple test. Blood pressure should be taken when

TABLE I

Some Foods With a High Salt or Sodium Content	
These should be limited or avoided if you have high blood pressure	
"Fast Foods"	Commercially prepared soups
Potato chips	Bouillon
Pretzels	Ham
Salted crackers	Sausages
Biscuits	Frankfurters
Pancakes	Smoked meats or fish
Most commercial pastries & cakes	Sardines
Pickles	Tomato juice
Sauerkraut	Many canned vegetables
Soy sauce	Many kinds of cheese
Ketchup	
Olives	
NOTE: LOOK AT LABELS!	
<i>Avoid or limit foods with more than 150 mg sodium in each serving.</i>	

you are sitting quietly with your arm at mid chest level. It should be taken several times at each sitting. A careful medical history is taken to determine whether or not there are any clues to a specific cause of the disease. A urine or blood test will rule out the presence of significant kidney disease as a cause of high blood pressure. A blood test for a mineral called potassium may help to rule out the presence of too much of a certain hormone

from the adrenal gland. *Expensive, complicated, or painful tests are not necessary and one or two visits to a doctor's office or clinic will complete the work-up.* It is rarely necessary to be hospitalized for studies for high blood pressure.

What Does High Blood Pressure Do If Left Untreated? *The Heart.* Just as a person's biceps or arm muscles get bigger after weight lifting over a period of time, the heart muscle enlarges if it has to work harder than usual to push blood into vital organs of the body. This does not happen overnight. The heart may become enlarged over time but function normally for many years. However, if high blood pressure remains untreated, the heart muscle eventually may not be powerful enough to push blood forward into the body. Blood is backed up into the lungs. Heart failure occurs. Just as pressure in a hose can be reduced by opening up the nozzle and letting water flow freely through it, a person's blood pressure can be lowered by dilating or opening up the small blood vessels between the arteries and veins. If this is done, the heart doesn't have to pump as hard each time it beats. After treatment has lowered blood pressure and it has remained controlled for several months to a year, there is a good possibility the heart will return to its normal size. Heart failure is rare in people whose blood pressure is controlled.

The Brain. Uncontrolled elevated blood pressure can cause a stroke. If blood pressure remains high, damage occurs to the lining of blood vessels in the brain and little blisters may form. These may rupture with hemorrhaging or bleeding into the brain causing weakness on one side of the body or loss of speech. Strokes can also be caused by narrowing or closure of

some of the vessels in the brain. Hypertension and diabetes speed up this process. Lowering elevated blood pressure and controlling blood sugar levels prevent strokes.

The Kidney. The kidney may fail to function if high blood pressure is left untreated. This is especially true if diabetes is also present. Over time, damage occurs to the small arteries in the kidney. The kidney is then unable to wash out waste products; these build up in the body. Certain chemical changes, which become life threatening, may occur. Dialysis or transplantation of the kidney may become necessary. Early treatment of hypertension and effective management of diabetes may prevent this serious complication.

Hardening of the Arteries. More rapid progression of “hardening of the arteries” or atherosclerosis (like rust on the inside of a pipe) is definitely noted in patients with elevated blood pressure—and even more commonly

Summary

High Blood Pressure may cause:

- The heart to enlarge
- Little blisters (aneurysms) in the blood vessels in the brain
- Progressive narrowing of kidney blood vessels
- Increased rate of “hardening of the arteries” all over the body especially in the heart, brain, and kidneys.

Many of these effects can be prevented by treatment.

in people with diabetes and hypertension. If one of the coronary arteries that supply blood to the heart muscle develops a “plaque” and becomes plugged with fatty material, the blood supply to a portion of the heart is cut off. A heart attack occurs. Many heart attacks can be prevented by treatment of hypertension.

What Can You Do to Reduce the Risk of a Heart Attack or Stroke?

Lower Blood Pressure—Keep Your Weight Down! Lose weight if you are heavy and maintain normal weight as long as you can. The heavier you are the greater your chance of developing diabetes, having an elevated fat (cholesterol) level in your blood stream, and developing high blood pressure. These all contribute to increasing your risk for heart attacks or strokes. Losing weight, if appropriate, is probably the single most important non-drug treatment for high blood pressure. There is no easy way to lose weight. Recent publicity regarding the benefits of a high fat, high protein, or low carbohydrate diets have served to confuse; weight reduction results from taking in fewer calories than you burn up. A balanced diet still is the healthiest diet. Increasing activity or reducing caloric intake are the two ways to lose weight. There is nothing magic about this. Most people are unaware of what their ideal weight should be, how many calories they require to maintain weight and how many calories are necessary to lose weight. Simple formulas help to determine this (see pages 14, 15).

Reducing your salt or sodium intake is also important. Here are some clues to help you reduce your salt intake.

- Cut down on the amount of salt used at the table.
- Reduce salt used in cooking a little bit each day until you no longer use any.
- Read food labels to find the amount of sodium in foods. *Avoid or limit foods with more than 150 mg in each serving.*
- Choose foods that do not list salt as one of the first three ingredients.
- Look for foods with the words “sodium free,” “low sodium,” “very low sodium,” or “unsalted” on the label.
- Use fresh or frozen fruits and vegetables whenever possible. (Many contain large amounts of potassium, a mineral that may

How to Measure Ideal or Desirable Weight in Adults

Men

106 lb for the 1st 5 feet
6 lb for each additional inch

Women

100 lb for the 1st 5 feet
5 lb for each additional inch

Example:

A 5 foot 10 inch man
should ideally weigh 166 lb
 $106 + (10 \times 6 = 60)$

A woman who is 5 feet 5 inches
should ideally weigh 125 lb
 $100 + (5 \times 5 = 25)$

These weights are approximate. A variation of 5–10 lb is acceptable.

be beneficial to some people with high blood pressure.)

- Limit intake of smoked, cured, or processed meats.
- Use fewer sauces, mixes, and “instant” products.
- Use mostly low-salt ingredients in recipes.
- Rinse canned foods to remove some of the salt.
- If you crave the taste of salt, try one of the

How to Estimate the Number of Daily Calories You Need to Maintain Your Weight

If you are sedentary

Ideal weight \times 13

If you are moderately active

Ideal weight \times 15

If you are very active

Ideal weight \times 17

Example:

Wt. 166 (5'10" man) \times 15
(moderately active) = 2490 calories/day

Wt. 125 (5'5" woman) \times 13
(sedentary) = 1625 calories/day

(These are approximate numbers.)

Remember, if you take in 500 calories/day less than you need, or take in 300 fewer calories and burn up 200 calories with exercise you will lose 1 lb/wk.

People over 60 years of age require fewer calories to maintain body weight.

lower salt substitutes, especially ones with added potassium.

- Unfortunately, more than 50% of the salt we eat comes from processed food. It is difficult to limit sodium intake if eating in a restaurant or eating a lot of processed foods is part of your lifestyle. Remember, if you are being treated for heart failure, try to keep your sodium intake considerably below 2000 mg (2 g) per day.
- Blood pressure responses to limiting sodium intake vary. In some “salt-sensitive” people, pressures will decrease; in those who are not “salt sensitive” they may not change. There is no certain way to prove whether or not you are “salt sensitive.” But, in general there is no down side or harm in limiting salt intake.

Smoking Is a Major Risk Factor for Heart Disease. Obviously if you smoke, you should stop and if you do not smoke, don’t start. It is interesting to note that the risk of a heart attack in a person who once smoked but has stopped is almost the same as a person who has never smoked.

Exercise. Exercise is one of the more important things that you can do to maintain your weight, keep your blood fat or cholesterol level as close to normal as possible, and perhaps lower your blood pressure. Exercise need not include jogging or running or going to a health club and doing high impact aerobics. It has been shown that moderate exercise, for example, walking briskly 30–40 minutes 3–4 times a week, is adequate to reduce your cardiovascular risk.

Tension and Anxiety. Although reducing tension or anxiety may make you feel better,

there is little evidence that depending on relaxation techniques, vacations, or getting away from it all will lower your blood pressure over time.

Alcohol. Numerous studies have shown that having one or two drinks a day will not only *not* increase your risk of heart attack or stroke, but may actually decrease it. However, people who drink more than four or five drinks a day are at increased risk for cardiovascular disease. You should set a limit of one to two glasses of beer, two glasses of wine or about one or one and a half drinks of 80 proof whiskey or scotch, etc. per day. *Remember, if you have a family history of alcoholism or sensitivity to alcohol, you should not drink at all.*

All of these lifestyle modifications may help but medication is necessary if blood pressure remains higher than 140/90 mm Hg. Cutting out smoking, losing weight, exercising, relaxing more, and most especially reducing salt and fatty intake are all good for you but they don't work in a majority of patients.

Hypertension and Other Risk Factors for Heart Disease

People with high blood pressure often are overweight and have other risk factors for heart disease, such as elevated cholesterol levels in the blood or a high blood sugar level that may indicate diabetes. It is important to also correct these factors in addition to treating the blood pressure. Regulating fat intake and cholesterol levels should, therefore, be an important part of a treatment program in people with hypertension. A great deal of meat and dairy products are still consumed in the United States although the amount is considerably less than

10–15 years ago. People in Eastern Europe, where heart disease risk is even greater than in the United States, eat a great deal of fatty foods. Animal fats tend to raise blood cholesterol levels and, as noted, together with high blood pressure, greatly increase the chance for a heart attack. Keeping cholesterol at desired levels may not be possible with a diet alone, but certain dietary adjustments may be helpful. Avoiding fatty foods, such as processed pork and bacon, using 1% or skim milk instead of whole milk, and reducing the amount of cheese, butter and eggs, will help but may not be successful in keeping cholesterol levels within a normal range in a majority of patients.

Most people with elevated cholesterol levels will need medication to reduce these and the harmful “low-density lipoproteins” (LDLs) to desirable levels.

There are many medications available to do this but the most effective and best tolerated are medications called statins. Examples of these are Crestor[®], Lipitor[®], Pravachol[®], and Zocor[®]. Studies have demonstrated that correcting high levels of cholesterol and LDL will reduce cardiovascular events, especially in patients at high risk, i.e., those with heart disease. Other medications, such as nicotinic acid, are effective but may not be as well tolerated. The fibric acid derivatives (Lopid[®] or Tricor[®]) are also effective in raising the good cholesterol (high-density lipoprotein [HDL]). Controlling blood fat levels is especially important in people with high blood pressure and diabetes.

Many hypertensive patients, especially diabetics, will need both antihypertensive and

lipid-lowering treatment. In addition, once blood pressure is controlled, a baby aspirin (81 mg) should be taken once daily to possibly prevent a heart attack.

Facts About Cholesterol

Cholesterol—a fatty substance necessary for production of hormones, healthy cell growth, etc.

- Elevated levels in the blood → increase risk of heart disease
- High blood pressure plus elevated cholesterol → greater risk

In people without heart disease:
Normal → up to about 240 mg/dL
Elevated → above 240 mg/dL

In people with heart disease or diabetes
a desirable level is below 200 mg/dL

Components of total cholesterol

*LDL (low-density lipoproteins)—
so-called “bad cholesterol”*

- In healthy people—should be below 160
- In people with high blood pressure—should be below 130
- In people with heart disease or diabetes—should be below 100

*HDL (high-density lipoproteins)—
the good cholesterol*

- Normal range—above 45–50
- If this level is higher than 60 (as it is in many younger women), risk of a heart attack is actually reduced.

How Long Do You Try Non-Drug Treatment For Your High Blood Pressure? This depends on how many other risk factors are present. If you are a 45-year-old woman, for example, with blood pressures of 145/90–95 mm Hg, you need treatment; but if you have no other risk factors, i.e., your cholesterol is below 240, you are a nonsmoker, you are thin, exercise regularly, and don't have diabetes, you might be tried on non-drug treatment for as long as 3–6 months. On the other hand, if you are a 45-year-old man with the same blood pressure, but also have diabetes, *you should be started with medication as well as non-drug treatment at the same time.*

One of the mistakes in treatment is to depend totally and for too long a period of time on lifestyle changes to control blood pressure. If, after a reasonable period of time that depends on how many other risk factors you have, your pressure is not below 140/90 mm Hg, your physician will probably decide to give you medication. Don't feel that you have failed if you end up taking medication. Remember, studies have demonstrated that the reduction of blood pressure will prevent progression from less severe to more severe high blood pressure, will prevent enlargement of the heart and heart failure, and will dramatically reduce strokes, stroke deaths, heart attack deaths, and kidney failure. Benefit has been noted in both young and old persons, even those over 80 years of age. Getting blood pressure down to below 140/90 mm Hg if at all possible is a good idea for all ages—and worth the effort.

Medications For High Blood Pressure. There are many types of blood pressure-lowering

drugs available and your doctor should be able to find one or a combination of several that will work in your case. Although blood pressure may not be reduced to below 140 in everyone, about 80% of people can have their pressure reduced to normal and maintained at those levels. Some medications include:

Diuretics wash out extra salt or sodium from the body and from blood vessel walls and allow the blood vessels to dilate, thereby reducing blood pressure. They are highly effective and well tolerated. Most people are able to continue their use for many years. When diuretics are used and blood pressure lowered, data show a reduction in heart attacks, strokes, heart failure, etc. Some commonly used diuretics include hydrochlorothiazide and chlorthalidone. A diuretic should be the first drug of choice in most patients, or if another medicine is used first and blood pressure is not controlled, a diuretic should be added. A diuretic is often combined with another medication to prevent the loss of potassium, an important mineral. Examples of these combinations include Dyazide[®] or Moduretic[®].

Beta-Blockers have also been in use for many years. These drugs reduce the effect of adrenalin in various parts of the body, slow down the heart rate, and reduce its force every time it contracts. This reduces the work of the heart and lowers blood pressure. In addition, these drugs reduce the production of a substance called renin. This enzyme is involved in a series of reactions that result in the production of a chemical (angiotensin II) that narrows blood vessels and elevates blood pressure. Blocking the production of renin is an effective way to lower blood pres-

sure. Commonly used beta-blockers include Tenormin[®] and Toprol XL[®].

ACE Inhibitors are a class of drugs that is widely used. These medications prevent the production of the chemical (angiotensin II) that causes blood vessels to constrict. Vessels open up and blood pressures are lowered. These drugs are especially effective in people with heart failure when used along with a diuretic, and in most cases, digitalis. They are also especially effective in patients with diabetes, kidney disease, and hypertension. Commonly used ACE inhibitors include Accupril[®], Altace[®], Monopril[®], Vasotec[®], and Zestril[®]. These are most effective when given with a diuretic.

Angiotensin II Receptor Blockers (ARBs), medications related to ACE inhibitors, act on the same chemicals as the ACE inhibitors but at a different location. Blood pressure is reduced. These agents are also highly effective in patients with diabetes and kidney disease. Commonly used ARBs include Atacand[®], Avapro[®], Cozaar[®], and Diovan[®].

There are numerous combinations of medications available that contain a diuretic, i.e., beta-blockers and diuretics, ACE inhibitors and diuretics, and ARBs and diuretics. In the majority of cases, especially in diabetics or people with kidney disease, more than one medication will be necessary to control blood pressure at goal levels. The available combinations are highly effective in approximately 70%–75% of patients. Commonly used combinations that include a diuretic are Tenoretic[®], Ziac[®], Vasoretic[®], Zestoretic[®], Hyzaar[®], Avalide[®], Benicar HCT[®], Diovan HCT[®], and Atacand HCT[®].

Calcium Channel Blockers (CCBs) have been in use for more than 20 years. They act by preventing calcium from entering blood vessel walls or heart muscle. There are different types of CCBs. Some, like Norvasc[®] and DynaCirc[®], primarily act to dilate blood vessels. Some, like Cardizem CD[®] or Calan SR[®], may dilate blood vessels but also slow down the heart rate. CCBs are available in combination with other medications such as the ACE inhibitors. Examples include Lexxel[®], Lotrel[®], and Tarka[®].

Alpha-Blockers, which also act as vasodilators, are also available. These are generally not used as initial treatment but are effective in patients with prostate disease. A patient with hypertension and prostate disease might be put on one of these drugs in addition to other medications. Examples of alpha-blockers are Cardura[®] and Hytrin[®].

There are many other medications available but the classes of drugs listed in Table II are used in the majority of patients.

Only about 40%–50% of people will have their blood pressure decreased to normal levels with any one of the medications when given alone regardless of the drug chosen for initial therapy. It may be a nuisance and expensive to be on two or three different pills at one time, but it is well worth it if your blood pressure is brought down to normal and future illnesses and disability are prevented. Taking one pill containing two different medications may help to simplify treatment. It is important to emphasize that diabetic patients and people with kidney disease most often require multiple medications to reduce their pressures to normal levels.

TABLE II

Some Commonly Used Antihypertensive Drugs

Diuretics: Hydrochlorothiazide

ACE Inhibitors: Accupril®
 Altace®
 Monopril®
 Vasotec®
 Zestril®

Alpha-Blockers: Cardura®
 Hytrin®
 Prazosin®

ARBs: Atacand®
 Avapro®
 Benicar®
 Cozaar®
 Diovan®
 Micardis®

Beta-Blockers: InnoPran™ XL
 Tenormin®
 Toprol XL®

Combinations With Diuretics: Atacand® HCT
 Avalide®
 Diovan® HCT
 Hyzaar®
 Micardis® HCT
 Teveten® HCT
 Vaseretic
 Ziac®

Calcium Channel Blockers: Calan® SR
 Cardizem® LA
 DynaCirc® CR
 Procardia-XL®
 Norvasc®

Combinations of ACE inhibitors and calcium channel blockers: Lexxel®, Lotrel®, Tarka®

Possible Side Effects From Medications That Lower Blood Pressure. Side effects may occur when any drug is taken. In some instances, even simple aspirin may cause stomach trouble. Some people are allergic to drugs like penicillin, and the same is true for medications that lower blood pressure. For example, a few people taking diuretics may experience weakness and muscle cramps because, in addition to salt (sodium), another important mineral, potassium, may be washed out of the body. This is not common when low doses are used. (Some combination medications, like Dyazide® or Maxzide®, prevent this from happening.) A chronic cough may result from an ACE inhibitor. Most people taking medication for high blood pressure do not experience side reactions. In fact, recent studies indicate that many people feel better on medication because their blood pressures are lower.

If you have high blood pressure, are on medication, and experience a symptom that bothers you, do not stop medication; this could lead to trouble. Instead, call your doctor to see what can be done about it, or ask if the dosage of the drug should be reduced or the prescription changed to another drug. Your physician knows about possible medication effects. He or she should be able to correct them in most instances. Often, a pharmacist or other health care professional will be able to help you get over the “rough spots” and stay on therapy.

In some cases, after blood pressure has been normal for a year or more, it may be possible to reduce medication, or, in rare cases (especially if a weight loss of more than 10–15 pounds has occurred), to eliminate it

completely. Careful follow-up is important in these instances.

Treatment or Cure? Modern drug treatment does not cure hypertension. It keeps blood pressure at normal levels, but usually only as long as medication is continued. If treatment is stopped, blood pressure usually goes back to where it was before, although in some instances this may not happen for several to as long as 6–9 months. If doctors do not explain this or patients fail to realize how important it is to continue treatment, complications may occur.

Diabetes: A Major Risk Factor for Heart Disease

There are two types of diabetes, commonly referred to as type 1 or type 2. Type 1 diabetes occurs mostly in younger people. In these cases, the pancreas, an organ near the intestinal tract and liver, which normally secretes a hormone called insulin, isn't working properly. Without adequate insulin the carbohydrates and other foods that we take into our body are not processed appropriately. Insulin is necessary to help store glucose (sugar) in the body cells providing them with energy. It is also involved in the storage of reserve supplies of glucose in the muscles and liver. Type 2 diabetes is common in patients with high blood pressure and usually occurs in adults. This accounts for more than 90% of all cases. The incidence of type 2 diabetes is increasing rapidly worldwide with extremely high rates in Southeast Asia and Eastern Europe. As more people become obese, diabetes becomes more common. In people with type 2 diabetes, the pancreas may have secreted adequate amounts of insulin through the years but for some reason the body is resistant to the usual amounts; more insulin is required to break down carbohydrates that we take in our diet. These patients have "insulin resistance," a common finding in patients with high

Diabetes

- **Too much sugar in the blood**
- **Less sugar stored in muscles and tissues**
- **High sugar levels may cause damage to the eyes, kidneys, nerves, or blood vessels**

blood pressure. Over the years the pancreas must work harder to produce more insulin to metabolize the sugar taken in. Eventually, the pancreas becomes exhausted and blood sugar levels rise.

When someone has diabetes and hypertension together, they are at greater risk for a heart attack, stroke, and kidney failure than with either disease alone. In addition, many people with diabetes and hypertension also have abnormal amounts of fatty material in their blood stream. Many of the changes in lifestyle that are recommended for people with hypertension are also appropriate in diabetics.

How to Diagnose. Diabetes is diagnosed by a test that measures the amount of blood sugar or glucose in the blood. If a fasting blood sugar of more than 126 mg/dL is recorded on at least two occasions, the diagnosis is justified. The diagnosis is also justified if the level is above 200 mg/dL in a specimen taken after meals. Blood sugars are routinely determined when a doctor takes a screening blood chemistry in hypertensive patients.

What to Do About Diabetes and High Blood Pressure? A person with diabetes can be considered to be at almost as great a risk for vascular disease as a person with a previous coronary event, angina pectoris, or other symptoms of heart disease. Anyone with hypertension who also has diabetes must be treated vigorously. Medical therapy to lower blood pressure should be started at the same time as lifestyle interventions, without a 2–3 month trial period, and blood pressure should be lowered if at all possible to levels lower than in the general public. In other

words, elevated blood pressure should be lowered to *below 130/80–85 mm Hg*. Treatment of hypertension in diabetics will markedly reduce strokes, heart attacks, heart failure, and kidney failure.

The drugs of choice in the treatment of diabetic hypertensives probably are the ACE inhibitors or the angiotensin II receptor blockers. Almost all of the time these agents should be used with a diuretic to reduce blood pressures to goal levels. These combinations have been shown to prevent many of the complications that used to occur in untreated diabetics. In diabetic hypertensives there are multiple abnormalities of metabolism. The use of these medications, by virtue of their effects on one of the enzyme-hormone systems in the body, may be able to correct many of these. Some of the other antihypertensive drugs, such as beta-blockers, have also been shown to reduce complications when used along with diuretics.

Complications in diabetics are similar to those noted in nondiabetic hypertensives—heart attacks, strokes, and kidney failure. However, kidney failure is more common and occurs

Things to Do if You Have Diabetes

- **Keep weight as close to normal as possible**
- **Exercise regularly**
- **Keep the sugar content in the blood as close to normal as possible**
- **Monitor blood pressure and cholesterol levels and reduce them if they are high**

TABLE III

A Reasonable Diet for a Diabetic Patient

- About 50%–55% as carbohydrates (cereals, fresh fruits, vegetables)—not refined sugar or “sweets.”

Example:

*2000 calories would include about 1000 cal/day or 250 g a day of carbohydrates**

- About 15%–20% as protein (400 cal/day or 100 g/day)
- About 20%–25% of fat (400–500 cal/day or approximately 50g/day)* (i.e., low-fat dairy products; limited intake of fatty meats, bacon, etc.)

** 1 g of carbohydrates = 4 calories; 1 g of fat = 9 calories*

Read food labels!

The aim of a diabetic diet is to decrease the need for insulin and to allow the available insulin to work better.

more readily in diabetic hypertensives than in people with high blood pressure and normal blood glucose levels. In addition, diabetics are more susceptible to problems with blood vessels in the legs, and to changes in the eyes, which may lead to blindness. These complications can also be reduced by lowering blood pressure and maintaining normal levels of sugar in the blood.

What About Controlling Glucose (Blood Sugar) Levels? It has been shown that controlling levels of glucose in the blood is effective

in improving the tone of the linings of blood vessels and, along with blood pressure control, will help to delay “hardening of the arteries.” Numerous diets are available, which suggest a carbohydrate intake of approximately 50%, a protein intake of about 25%–30%, and a fat intake of about 20%–25% of total calories (Table III). Diet alone is not going to work in a majority of diabetic patients unless it is accompanied by weight loss. Since many diabetics are obese, a weight reduction program may help to regulate blood sugar. A majority of patients with diabetes will, in addition to their blood pressure-lowering drugs and medications used to control abnormal fats in the blood stream, require certain medications that will help control their diabetes. Most patients with adult onset diabetes will not require insulin since they already have some insulin available but it is not being utilized properly.

Exercise. To re-emphasize: Exercise should be part of any treatment program in diabetes as well as in hypertension. This need not be vigorous or involve jogging or running but

In Diabetes

- **If blood sugar is not maintained at levels below 125 mg/dL or HbA_{1C} below 6.5, medication may be necessary**
- **There are many safe and effective medications available**
- **If blood pressure and cholesterol levels are not reduced to normal levels by lifestyle changes there are many safe and effective medications that will help**

should include walking, biking, swimming, etc. Exercise helps burn up calories, may reduce blood pressure and the fat content in the blood, and may reduce the amount of medicine that has to be taken to control blood sugar.

TABLE IV
Examples of Currently Available Oral Medications for Diabetes*

<i>Generic Name (Trade Name)</i>	<i>Recommended Starting Dose (mg)</i>
Chlorpropamide (Diabinese®)	250 q.d.
Tolazamide (Tolinase®)	100 q.d.
Tolbutamide (Orinase®)	250 b.i.d.
Glipizide (extended release) (Glucotrol XL®)	5 q.d.
Glyburide (DiaBeta®, Micronase®)	2.5–5 q.d.
Repaglinide (Prandin®)	0.5 b.i.d.–q.i.d. with meals
Rosiglitazone (Avandia®)	4 q.d.
Metformin (Glucophage®)	500 q.d. with dinner
Glyburide/metformin (Glucoavance®)	1.25/250 q.d. with meals
Acarbose (Precose®)	25 t.i.d. with meals
Miglitol (Glyset®)	25 t.i.d. with meals

**Not all medications are listed*

Antidiabetic Medications. There are many different types of antidiabetic agents. Examples of these are listed in Table IV. Some of them, like repaglinide (Prandin[®]), tolbutamide (Orinase[®]), or chlorpropamide (Diabinese[®]) increase insulin secretion. These drugs may cause a decrease in blood sugar to low levels because of their effect on insulin. Glipizide (Glucotrol XL[®]) lowers glucose by decreasing the production of glucose in the liver and by enhancing insulin secretion. Metformin (Glucophage[®]) suppresses the production of glucose in the liver and increases the burning up of glucose in tissues. This medication, as well as the others listed, such as glyburide, are useful in regulating blood sugar levels in obese patients with type 2 diabetes who are unresponsive to diet alone. Other agents like Avandia[®] may decrease insulin resistance. Some of these medications may cause a weight gain or increase in water retention. Finally, there are drugs like Precose[®] which delay the absorption of carbohydrates and thereby limit the increase in blood glucose after meals. All of these drugs have certain side effects and dosage must be adjusted carefully. It is occasionally necessary to use two of these medications together in order to control blood sugar levels. If oral medication is not effective, insulin injections may have to be given. There are several different types of insulin available with different durations of action. Careful monitoring of blood sugar levels is necessary if insulin is used. Physicians knowledgeable in the management of diabetes should be involved in the care of the diabetic patient, especially if insulin is being given.

What Does Treatment Accomplish? In the diabetic hypertensive patient, lowering of blood pressure and controlling blood sugar levels

to below 120 mg/dL will decrease many of the complications that might have occurred. This includes changes in the eyes and the kidneys. It is important that patients with diabetes and high blood pressure be treated vigorously to prevent cardiovascular as well as kidney complications. The lifespan of the diabetic patient with hypertension has been dramatically prolonged by these efforts.

Summary

Hypertension and diabetes are major health problems that result in much family tragedy, many thousands of lost workdays, and a great deal of human grief. These might be prevented if more people watched their salt intake and their weight. Modern treatment can save lives.

Adequate treatment of high blood pressure has reduced the incidence of strokes and stroke deaths as well as heart attacks. It has dramatically decreased the occurrence of heart failure resulting from hypertension and has prevented many cases from progressing from less severe to severe hypertension or kidney failure.

Studies have established the benefits of treating high blood pressure even in people over 60 years of age even if just the upper reading (systolic pressure) is elevated, e.g., a blood pressure of 160–170/80 mm Hg.

A patient with diabetes is at high risk for a heart attack or stroke to begin with and at higher risk if he or she has hypertension. Control of blood sugar, blood cholesterol, and blood pressure will prevent complications and prolong life. It is important to keep fasting

blood sugar levels close to or lower than 120 mg/dL and to reduce the HbA_{1c} level, which is a measure of the blood sugar levels over a several months period of time, to 6.5 or below. (HbA_{1c} measures the amount of glucose that has attached itself to the hemoglobin component of red blood cells. The level is not useful to make a day-to-day change in treatment since it reflects the average amount of glucose in the blood over a 2–3 month period of time.)

Facts to Remember About High Blood Pressure and Diabetes

- High blood pressure may not cause symptoms. Usually the only way to find out if you have it is to have your blood pressure measured.
- Tests to evaluate elevated blood pressure and diabetes are usually simple, and hospitalization is rarely necessary.
- The outlook for people with high blood pressure and/or diabetes is excellent. In most cases, their habits need not be changed a great deal. They can look forward to a long life, free of many of the fears that used to accompany this diagnosis, as long as they continue treatment.
- Being heavy or obese may go along with having high blood pressure and diabetes, but losing weight alone may not control blood pressure in many people.
- Smoking is bad for you, and you should stop it (or never start) to prevent heart disease as well as lung damage.
- If you are very anxious, relaxing or taking tranquilizers or sedatives may help to lower blood pressure in some less severe cases, but these treatments will not work in the majority of patients.



- A low-salt diet may help to lower blood pressure in some people with less severe hypertension, but most people cannot stay on a rigid enough salt-restricted diet to lower blood pressure adequately without specific medication.
- If modifying your eating habits and lifestyle do not lower your blood pressure or blood sugar levels, there are excellent medications available to control them in a large majority of patients.
- Although side effects or annoying symptoms may occur with some of the blood pressure lowering drugs, these usually can be controlled or eliminated by changing dosages or switching to another medication.
- Above all, remember that just *being on treatment* does not mean that your blood pressure or blood sugar levels are controlled. If your blood pressure is not below 140/90 mm Hg, or your fasting blood sugar level is not below 120 mg/dL despite lifestyle changes and medication, *ask your doctor why*. Some aspect of your treatment may have to be changed.

- Remember that controlling the upper blood pressure reading to below 140 mm Hg may be more important than controlling the lower reading. Normal blood pressure cannot be achieved in everyone, but about 80%–85% of people with high blood pressure can be successfully treated regardless of the severity of their disease.
- If you have diabetes or kidney disease, efforts should be made to get your pressure to about 130/80–85 mm Hg.

Final Advice for People With High Blood Pressure and Diabetes

- 1) It is up to you to have your blood pressure and blood sugar checked.
- 2) If your blood pressure is elevated, it is the responsibility of your physician to prescribe the right combination of medications and other treatment to bring your blood pressure back to normal levels.
- 3) If your blood sugar level is high or you have sugar in the urine, you should be following a specific diet, exercising regularly, and taking medication if necessary to reduce your blood sugar level to normal.

In the final analysis, it is up to both you and your doctor to recognize how important treatment is and to follow a program that keeps your blood pressure and blood sugar levels under control.

Glossary

Aneurysms: Small blister-like expansions of blood vessels. They represent weak spots in the artery. They may rupture and cause bleeding or a hemorrhage.

Angiotensin-Converting Enzyme Inhibitors (ACE Inhibitors): Medications that block the formation of a substance that constricts blood vessels.

Antidiabetic Medications: Drugs that help to regulate blood sugar levels

Atherosclerosis: “Hardening” of the arteries. Fatty material is deposited in the walls of arteries, which are thereby narrowed.

Angiotensin or A-II Receptor Blockers (ARBs): Medications that block the effects of substances that cause blood vessels to narrow.

Blood Pressure: Pressure exerted against the walls of the arteries.

Systolic (upper reading): pressure recorded at the time when the heart is pumping.

Diastolic (lower reading): pressure recorded when the heart is resting, in between beats.

Normal Blood Pressure (over age 18): up to 135/85 mm Hg. A blood pressure reading of 135–139/85–89 mm Hg is considered “high-normal.”

Isolated Systolic Hypertension (ISH): A systolic blood pressure above 140 mm Hg and a diastolic blood pressure below 90 mm Hg

indicates ISH (common in persons 60 years of age or older).

Calcium Channel Blockers: Medications that interfere with the movement of calcium in and out of the blood vessel walls. Dilation of blood vessels and a lowering of blood pressure result from their use.

Cardiovascular: Refers to heart and blood vessels, e.g., diseases of the cardiovascular system.

Cholesterol: A fatty substance in our bodies that is necessary for producing certain hormones, etc. It is found in many foods (milk, eggs, and meat, etc.). Vegetables, grains, and fruits do not contain any cholesterol. If too much cholesterol is present in the blood, the process of “hardening of the arteries” may be hastened.

Coronary: Refers to the heart, e.g., coronary arteries are those arteries that supply blood to the heart muscle.

Diabetes: A disease in which blood sugar levels are high and where some sugar is spilled in the urine. Untreated, it may lead to serious complications.

Diuretics: Medications that wash out salt (sodium) from the body and help to reduce elevated levels of blood pressure.

Hemoglobin A_{1c}: A measure of the amount of glucose that has attached itself to hemoglobin in red blood cells. A good index of average blood sugar levels over the previous 2–3 months; not to be used for day-to-day regulation of blood sugar.

Hypertension: High blood pressure. A consistent blood pressure recording of more than 140/90 mm Hg.

mm Hg: Millimeters of mercury. The blood pressure numbers in this booklet refer to the height to which your blood pressure would push a column of mercury.

Potassium: A mineral in the cells of the body that may be washed out by diuretics, especially in high doses. Can be found in foods such as bananas and orange juice. “Salt substitutes” usually contain potassium.

Salt: Common table salt is sodium chloride. Potassium chloride is a salt substitute.

Sodium: A component of salt (about 40% of salt is sodium). This is a mineral that may contribute to high blood pressure if taken in large amounts by certain people.

Sphygmomanometer: A device that measures blood pressure.

Statins: A class of medications that is highly effective in reducing elevated cholesterol and LDL cholesterol.

Stroke: Sudden loss of function of a part of the brain due to interference with its blood supply. May be caused by a clot (thrombosis) or rupture of a blood vessel (hemorrhage).

Sympathetic Nerves: Nerves that, when stimulated, constrict or narrow blood vessels and cause blood pressure to rise.

Uremia: The result of kidney failure. Waste products accumulate in the body when the kidney fails to excrete enough of them in the urine.

Vascular: Refers to blood vessels.

Questions for my Doctor:

Notes:

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About the Author

Marvin Moser, MD, is a Clinical Professor of Medicine at the Yale University School of Medicine and was Senior Medical Consultant to the National High Blood Pressure Education Program of the National Heart, Lung, and Blood Institute from 1974 to 2002. He was Chairman of the first Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure and a participant in the six subsequent committees. He is Emeritus Chief of the Cardiology Section at the White Plains, NY, Hospital Medical Center, a Fellow of the Council for High Blood Pressure Research of the American Heart Association, and the author of eleven books, including *Lower Your Blood Pressure and Live Longer*, *Week by Week to a Strong Heart*, and *Heart Healthy Cooking For All Seasons*. He was a Co-Editor and contributor to the *Yale University School of Medicine Heart Book*. He has published more than 500 scientific papers in the field of hypertension and cardiology. He is Editor in Chief of *The Journal of Clinical Hypertension*, President of the Hypertension Education Foundation, and has received numerous awards for research and treatment of high blood pressure, including the 2004 Clinical Award of the International Society of Hypertension. He is an honorary fellow of the Royal College of Physicians and Surgeons.

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