HYPERTENSION

4.0 Contact Hours

Presented by:

CEU Professor®

www.CEUProfessorOnline.com

HYPERTENSION

By Dr. Ratnakar P. Kini

ABSTRACT

Hypertension is a condition characterized by an increase in blood pressure. Though it is usually a disease of old age, it can affect also children and adolescents. Hypertension, over a period of time, can affect various organs in the body. It can cause arteriosclerosis, left ventricular hypertrophy, heart failure, stroke, renal damage, retinal damage and cognitive decline.

Hypertension is basically classified in to Primary and Secondary Hypertension. Primary hypertension is usually diagnosed in persons of old age as their arteries become less elastic and thus increasing blood pressure. On the other hand, secondary hypertension can affect even children and is due to various causes. There are also other types of hypertension, like pregnancy induced hypertension, which is diagnosed in pregnant women. Irrespective of the type of hypertension, the treatment includes salt and fluid restriction and taking appropriate medication.

OBJECTIVES

Upon completion of this course, the learner will be able to:

1. Define hypertension.
2. Explain what are systolic and diastolic blood pressures and their normal values.
3. Discuss the classification of hypertension.
4. Discuss in detail the various causes of hypertension.
5. Explain how to investigate the cause of hypertension.
6. Explain the different complications of hypertension.
7. Discuss in detail the various treatment options.
8. Discuss recent medical developments.

DEFINITIONS

Blood pressure is the force of the blood that is pumped by the heart pushing against the walls of the arteries. Blood pressure is produced by the flow of blood in the arteries

Hypertension, or high blood pressure, is the chronic state of elevated pressure in the arteries.

Blood pressure readings are expressed as two numbers, such as 140/90 mm Hg. The top number, 140, refers to systolic blood pressure and 90 refers to diastolic blood pressure.

Systolic pressure is measured while the heart contracts and pumps blood into the arteries. **Diastolic pressure** is measured while the heart fills with blood. A person with systolic and/or diastolic blood pressures consistently above the normal range (120/80 mm Hg) is said to have hypertension, or high blood pressure. The term pre-hypertension is used when blood pressure ranges between 120 and139 for systolic and 80-89 for diastolic pressure.

RANGE OF BLOOD PRESSURE

Level	**Systolic**	**Diastolic**
High blood pressure	**140 or above**	**90 or above**
Prehypertension	**120 to 139**	**80 to 89**
Normal adult (age 18 or older) blood pressure	**119 or below**	**79 or below**

Blood pressure is measured with a device called a sphygmomanometer. (Sphygmo in Greek means pulse, and a manometer measures pressure.) It consists of an inflatable arm cuff, a hand pump, a valve to let the pressure out of the cuff, and a gauge to read the pressure.[37]High blood pressure is a lifelong disease.[69]Although it usually

cannot be cured, it can be controlled. Keeping blood pressure within normal limits lowers the risk of many complications produced by high blood pressure.

CLASSIFICATION

Hypertension is mainly classified into

1. Primary hypertension
2. Secondary hypertension.

Primary/ Essential Hypertension

Most people have essential hypertension, which has no identifiable cause. It is considered in part to be a genetic predisposition. The probability of developing this condition increases with age. Essential hypertension affects approximately 75 million Americans, yet its basic causes or underlying defects are not always known. Nevertheless, certain associations have been recognized in people with essential hypertension.

Essential hypertension develops only in groups or societies that have a fairly high intake of salt, exceeding 5.8 grams daily. In fact, salt intake may be a particularly important factor in relation to essential hypertension in several situations. Thus, excess salt may be involved in the hypertension that is associated with advancing age, obesity, hereditary susceptibility and renal insufficiency. Approximately 30% of the cases of essential hypertension are attributable to genetic factors

The vast majority of patients with essential hypertension have in common a particular abnormality of the arteries. That is, they have an increased resistance (stiffness or lack of elasticity) in the tiny arteries that are most distant from the heart.

Secondary hypertension

In approximately 5% of patients, a secondary cause exists. Secondary causes include certain types of diseases like kidney disease, or chronic intake of certain substances and medications (e.g., alcohol, steroids), and the presence of a rare tumor.

1. Kidney disease

In renal hypertension, narrowing of the renal artery (such as in coarctation of aorta – see below) impairs the circulation of blood to the affected kidney. This deprivation of blood then stimulates the kidney to produce the hormones renin and angiotensin. These hormones, along with aldosterone from the adrenal gland, cause a constriction and increased stiffness in the peripheral arteries throughout the body, which finally, results in high blood pressure.

It is usually first suspected when high blood pressure is found in a young individual, or a new onset of high blood pressure is discovered in an older person. Diagnosis is by radioactive imaging, ultrasonographic imaging, or magnetic resonance imaging (MRI) of the renal arteries. It can be corrected by widening of the renal arteries by angioplasty or balloon angioplasty. Any of the other types of chronic kidney disease that reduces the function of the kidneys can also cause hypertension due to hormonal disturbances and/or retention of salt.

2. Adrenal gland tumors

Adrenal glands are the endocrine glands located exactly above the kidney. A tumor of this gland is called, primary hyperaldosteronism, causes hypertension because the tumor produces excessive amounts of the hormone aldosterone. This hormone has the property of excessive water and sodium retention in the blood and also causes constriction and increased stiffness in the peripheral arteries throughout the body resulting in hypertension. In addition to the hypertension, this condition causes the loss of excessive amounts of potassium from the body into the urine, which results in a low level of potassium in the blood. Accordingly, hyperaldosteronism is generally first suspected in a person with hypertension when low potassium is also found in the blood. These tumors can be diagnosed from blood tests, urine tests, and imaging studies of the adrenal glands.

The other type of adrenal tumor that can cause secondary hypertension is called a pheochromocytoma. This tumor produces excessive catecholamines, which include several adrenalin-related hormones. The diagnosis of a pheochromocytoma is suspected in individuals who have sudden and recurrent episodes of hypertension that are associated

with flushing of the skin, rapid heart beating and sweating in addition to the symptoms associated with high blood pressure.

3. Coarctation of the aorta

Coarctation of the aorta is a rare hereditary disorder that is one of the most common causes of hypertension in children. This condition is characterized by a narrowing of a segment of the aorta, the main large artery coming from the heart. The aorta delivers blood to the arteries that supply all of the body's organs, including the kidneys.

The narrowed segment (coarctation) of the aorta generally occurs above the renal arteries, which causes a reduced blood flow to the kidneys. This lack of blood to the kidneys prompts the renin-angiotensin-aldosterone hormonal system to elevate the blood pressure as mentioned previously. Treatment of the coarctation is usually the surgical correction of the narrowed segment of the aorta. Sometimes, balloon angioplasty can be used to widen the coarctation of the aorta.

OTHER COMMON TYPES OF HYPERTENSION

1. Primary Pulmonary Hypertension

When pressure in the pulmonary circulation becomes abnormally elevated, it is referred to as pulmonary hypertension. Pulmonary hypertension results from constriction, or tightening, of the blood vessels that supply blood to the lungs. Consequently, it becomes difficult for blood to pass through the lungs, making it harder for the heart to pump blood forward. This stress on the heart leads to enlargement of the heart, and eventually fluid can build up in the liver and tissues, such as the in the legs. Affected patients can sometimes notice increasing shortness of breath and dizziness. Pulmonary hypertension can be secondary to many diseases of the heart and lung such as chronic obstructive pulmonary disease, left ventricular failure, recurrent pulmonary embolism, and constrictive disease like scleroderma. This kind is known as secondary pulmonary hypertension.

When pulmonary hypertension occurs without underlying heart and lung disease or other illnesses, it is called primary pulmonary hypertension. Primary pulmonary hypertension is more common in young females. Primary pulmonary hypertension has no identifiable underlying cause, and is also referred to as idiopathic pulmonary hypertension.

Treatment of pulmonary hypertension involves treating the underlying causes, using supplemental oxygen to increase blood oxygen levels, diuretics, blood thinning medications, and medications that dilate blood vessels such as calcium channel blockers (see below). Despite advances in various treatments, there is no cure for pulmonary hypertension.

2. Hypertension during pregnancy

Hypertension in pregnancy can occur in

a) Preeclamsia or eclampsia of pregnancy, also known as Toxemia of pregnancy.
b) Gestational hypertension.

Pre-eclampsia or toxemia of pregnancy- These conditions usually develop during the last three months (trimester) of pregnancy. In preeclampsia, which can occur with or without pre-existing hypertension, affected women have hypertension, protein loss in the urine (proteinuria), and edema. In eclampsia, otherwise called toxemia, convulsions also occur and the hypertension may require prompt treatment. The foremost goal of treating high blood pressure in toxemia is to keep the diastolic pressure below 105 mm Hg in order to prevent a brain hemorrhage in the mother.

Gestational hypertension- Hypertension that develops before the 20th week of pregnancy almost always is due to pre-existing hypertension and not toxemia. High blood pressure that occurs only during pregnancy, called gestational hypertension, may start late in the pregnancy. These women, however, do not have proteinuria, edema, or convulsions. Furthermore, gestational hypertension appears to have no ill effects on the mother or the fetus. This form of hypertension resolves shortly after delivery, although it may recur with subsequent pregnancies.

3. Isolated systolic high blood pressure

A systolic blood pressure that is persistently higher than 140 mm Hg is usually considered elevated, especially when associated with an elevated diastolic pressure (over 90). Isolated systolic hypertension, however, is defined as a systolic pressure that is above 140 mm Hg with a diastolic pressure that is still below 90. This disorder primarily affects older people and is characterized by an increased (wide) pulse pressure. The pulse pressure is defined as the difference between the systolic and diastolic blood pressures. An elevation of the systolic pressure without an elevation of the diastolic pressure, as occurs in isolated systolic hypertension, therefore, increases the pulse pressure. Stiffening of the arteries contributes to this widening of the pulse pressure. Isolated systolic hypertension is associated with a 2 to 4 time increased future risk of an enlarged heart called left ventricular hypertrophy, a heart attack (myocardial infarction), a stroke (due to hemorrhage in brain and damage), and death from heart disease or a stroke. Clinical studies in patients with isolated systolic hypertension have indicated that a reduction in systolic blood pressure by at least 20 mm to a level below 160 mm Hg reduces these increased risks.

4. Borderline high blood pressure

Borderline hypertension is defined as mildly elevated blood pressure that is found to be higher than 140/90 mm Hg at some times and lower than that at other times. Patients with borderline hypertension need to have their blood pressure taken on several different occasions and their end-organ damage assessed in order to establish whether their hypertension is significant.

5. Malignant hypertension

About one out of every 100 (1%) of people with hypertension is diagnosed with severe high blood pressure called accelerated or malignant hypertension at their first visit to the doctor. In these patients, the diastolic blood pressure exceeds 140 mm Hg. Affected persons often experience severe headache, nausea, visual symptoms, dizziness, and

sometimes kidney failure. Malignant hypertension is a medical emergency and requires urgent treatment to prevent a stroke.

SYMPTOMS

High blood pressure is called "the silent killer" because it usually causes no symptoms for many years, even decades, until it finally damages certain critical organs. Some people with uncomplicated hypertension, however, may experience symptoms such as headache, dizziness, shortness of breath, and blurred vision. The majority of the patients, however, do not have any warning signs or symptoms of high blood pressure, and the problem is detected usually when a health professional takes a blood pressure reading.

DIAGNOSIS

Hypertension is diagnosed by measuring the blood pressure using a device called a sphygmomanometer. The ideal way of measuring the blood pressure is by inserting a cannula to the arteries and measuring the blood pressure directly. However, since it is not possible, pressure of flow of the blood in the artery is measured indirectly by auscultating over the narrowed artery using the sphygmomanometer. It consists of an inflatable arm cuff, a hand pump, a valve to let the pressure out of the cuff, and a gauge to read the pressure.[37]

First, the cuff is placed around the upper arm and inflated with the hand pump. When the cuff is fully inflated, it pushes against the large artery in the arm, stopping the blood flow momentarily. Then the cuff is gradually deflated to allow blood to flow again. As the air is released, the person measuring the blood pressure listens to the artery with a stethoscope. When the blood starts to pulse through the artery, it makes a sound until the cuff is almost deflated.[38]While the person listens and looks at the gauge, he or she records two important measurements.

Systolic Blood Pressure is the pressure reading on the gauge when the first sound of the blood flowing through the artery is heard. This is the pressure in the artery as the blood is being pushed through just after a heart beat.

Diastolic Blood Pressure is the pressure reading on the gauge when the last sound is heard. This is the pressure on the artery between heartbeats.

High blood pressure should never be diagnosed on one set of readings on a patient, because there are many factors that can artificially raise a patient's blood pressure. A patient may have rushed to the doctor's office and may still have high adrenaline levels. Seeing a new health care provider for the first time can make a patient nervous and raise blood pressure.

"***White coat hypertension***" is experienced by some patients whose blood pressure is higher when measured by the doctor than when measured by another health care provider.

If the blood pressure is not measured correctly, the readings obtained may be artificially high. Several steps ensure that the measured blood pressure truly represents the patient’s blood pressure:

1. Patients should sit with their arms supported at heart level.
2. Patients should not smoke or ingest caffeine for 30 minutes prior to blood pressure measurement.
3. Patients should sit down for at least 5 minutes before blood pressure is measured.
4. The bladder (inflatable part) of the blood pressure cuff should encircle at least 80% of the arm. A large cuff should be used for patients with thick arms.

Blood pressure is considered to be high if the person has consistent high readings of systolic/ diastolic above 140/90 on at least 3 settings. Two or more readings should be taken at least 2 minutes apart. After the diagnosis, certain points to be noted and examined are: to check for complications of undetected long standing hypertension; a

focused history including if high blood pressure runs in the family; and a detailed physical examination should be performed.

INVESTIGATIONS

Some of the investigations, like blood tests and imaging, should be done to know he cause and assess the damage to organs like

Renal Function Test. Blood and urine tests may be helpful in detecting kidney abnormalities in people with high blood pressure. Measuring the serum creatinine in a blood test can assess how well the kidneys are functioning. An elevated level of serum creatinine indicates damage to the kidney. In addition, the presence of protein in the urine (proteinuria) may reflect chronic kidney damage from hypertension, even if the kidney function is normal. Even small amounts of protein referred to as microalbuminuria may be a signal of impending kidney failure and other vascular complications from uncontrolled hypertension. In addition, chest x-ray, electrocardiogram and echocardiography retinal examination by ophthalmoscope should be done to assess the end organ damage by hypertension.

Heightened public awareness and screening of the population are necessary to detect hypertension early enough so that it can be treated before damage has occurred to the critical organs

COMPLICATIONS OF HYPERTENSION

Long standing hypertension causes damage to multiple organs of the body and results in what is known as end organ damage. Some of the common complications of hypertension are listed below.

1 Arteriosclerosis. Hypertensive individuals have a greater stiffness (resistance) in their peripheral arteries throughout the body

2. Left ventricular hypertrophy. People with high blood pressure have an increased stiffness, or resistance, in the peripheral arteries throughout the tissues of the body. This increased resistance causes the heart muscle to work harder to pump the blood through these blood vessels. The increased workload can put a strain on the heart, which can lead to heart abnormalities that are usually first seen as enlarged heart muscle mainly in the left ventricle.

3. **Heart failure.** An enlarged heart, as in left ventricular hypertrophy, has to pump harder against increased resistance in the peripheral arteries. Increased strain on the heart over a long time causes the heart muscle to become weak and unable to pump efficiently, leading to heart failure.

4. **Stroke.** Strokes are usually due to a hemorrhage or a blood clot like thrombosis of the blood vessels that supply blood to the brain. The patient's symptoms and signs are evaluated to assess the neurological damage. A stroke can cause weakness, tingling, or paralysis of the arms or legs and difficulties with speech or vision. Multiple small strokes can lead to dementia (impaired intellectual capacity).

5 Renal damage. Kidney damage can be the cause or the result of hypertension as described previously. Renal damage in hypertension further leads to a cascade of events of increased secretion of hormones like renin and angiotensin, which constrict the peripheral blood vessels, and thus by increasing peripheral resistance leads to more hypertension.

6 Retinal damage. Examination of the eyes in patients with severe hypertension may reveal damage--narrowing of the small arteries, small hemorrhages in the retina and swelling of the retinal nerve

7 Cognitive decline. People with long standing hypertension may have slow cognitive decline of mental function over long periods of time

TREATMENT OF HYPERTENSION

Goal of treatment

The goal of treatment for most patients is to lower the systolic blood pressure below 140 mm Hg and the diastolic blood pressure below 90 mm Hg. The goal for patients with combined systolic and diastolic hypertension is to attain a blood pressure of 140/85 mm Hg. Bringing the blood pressure down even lower in patients with diabetes or chronic kidney disease may be desirable. In pre-hypertensive patients, life style changes may be adequate, as it is not well established that treatment with medications of patients with pre-hypertension is beneficial.

The main modes of treatment are 1) Pharmacological 2) Non-Pharmacological

1. Non Pharmacological

Lifestyle modifications are a critical and indispensable part of managing high blood pressure and should be part of any blood-pressure-control program. Some of the changes suggested are:[71]Some of the

Restriction of consumption of salt

The content of sodium in the common salt used for routine cooking leads to retention of water and increases blood pressure. The American Heart Association recommends the consumption of dietary salt be less than 6 grams of salt per day in the general population and a lower level (for example, less than 4 grams) for people with hypertension. The diet for hypertensives should instead consist of less saturated fat in the diet and more of fruits and vegetables.

Exercise

A regular exercise program may help lower blood pressure over the long term. For example, activities such as jogging, bicycle riding, or swimming for 30 to 45 minutes daily may ultimately lower blood pressure by as much as 5 to15 mm Hg.

Restricting alcohol consumption

People who drink alcohol excessively (over two drinks per day) have a 1½ to 2 times increase in the prevalence of hypertension. The more alcohol that is consumed, the stronger the link with hypertension. It is advisable to limit alcohol consumption to no more than two drinks a day for men and one drink a day for women.

Avoiding smoking

Nicotine is known to produce an immediate, temporary rise in blood pressure of 5 to10 mm Hg

Reducing weight

Obesity is common among hypertensive patients, and its prevalence increases with age. In fact, obesity may be what determines the increased incidence of high blood pressure with age. Obesity can contribute to hypertension in several possible ways. Obesity leads to a greater output of blood because the heart has to pump out more blood to supply the excess tissue. The increased cardiac output then can raise blood pressure. Obese hypertensive individuals have a greater stiffness (resistance) in their peripheral arteries throughout the body. In addition, insulin resistance and the metabolic syndrome occur more frequently in the obese. Finally, obesity may be associated with a tendency for the kidneys to retain salt. Weight loss may help reverse problems related to obesity while also lowering blood pressure. It has been estimated that blood pressure can be decreased 0.32 mm Hg for every 1 kg (2.2 pounds) of weight lost down to ideal body weight for the individual.

2. Pharmacological

Starting the treatment

Blood pressure that is persistently higher than 140/ 90 mm Hg usually is treated with lifestyle modifications (as described above) and medication. However, if the diastolic pressure remains at a borderline level (usually under 90 mm Hg, yet persistently above 85) more aggressive treatment also may be started in certain circumstances. There

are a variety of medications used to treat high blood pressure called anti-hypertensive agents. Which agent a patient is started on depends on numerous factors, including ease of use, side effects and coexisting medical conditions that might dictate preferential use of one agent over another.

Generally, an anti-hypertensive agent is started at a relatively low dose, and the response to it is assessed over the course of several weeks. If the blood pressure remains elevated, the dose of the medication is gradually increased.

When treatment with relatively high doses of an anti-hypertensive medication fails to lower blood pressure to target levels, two options are possible: (1) that particular medication may be discontinued and a different class of anti-hypertensive medication begun, or (2) a second class of medication may be added to the first agent. The second approach is often used because different classes of anti-hypertensive agents work in different ways to lower blood pressure, and the actions of one agent may complement the actions of the second agent. In some patients, it may be necessary to add a third agent.

Most of the newer medications are taken once or twice a day. They all have side effects, but most are well tolerated by patients. The mainly used drugs in therapy are:

- Diuretics,
- Beta-blockers
- Calcium channel blockers
- ACE inhibitors
- Angiotensin-receptor blockers (ARBs)
- Direct-acting vasodilators
- Centrally acting agents.

1. Diuretics:

These are the drugs that rid the body of excess fluids and sodium, and thus relax the walls of the blood vessels[53] Diuretics increase the kidneys' excretion of sodium and water, decreasing the volume of fluid in the bloodstream and the pressure in the arteries.

Diuretics are the oldest and most studied anti-hypertensive agents. One of the most commonly used diuretic agents is hydrochlorothiazide. Other diuretics used to treat hypertension include the following: Acetazolamide, Indapamide, Metolazone, Spironolactone, Torsemide and Triamterene.

The main **side effect** of these agents is increased frequency of urination. Another side effect is increased urinary excretion of potassium. Because of this, doctors monitor blood potassium levels when initiating therapy and periodically thereafter. Patients who have low potassium levels are encouraged to eat foods rich in potassium, such as bananas, or may be prescribed a potassium supplement.

2. Beta-blockers.

This class of medications decreases the vigor of the heart's contractions. By decreasing the force used to pump blood into the arteries, the medications decrease blood pressure. In addition to lowering blood pressure, beta-blockers have multiple beneficial effects including prolonged life in patients with coronary artery disease, patients who have had myocardial infarction, and many patients with congestive heart failure (CHF). Commonly used beta-blockers include the following: Atenolol, Bisoprolol, Carvedilol, Metoprolol and Timolol. Another beta-blocker, labetolol, also has alpha-blocker properties that dilate the arteries and lower blood pressure.

Potential **side effects** of the beta blockers are slowing the heart rate excessively, worsening heart failure (careful long-term use has been shown to frequently provide beneficial effects in patients with CHF), and, rarely, contributing to confusion, depression, and impotence by erectile dysfunction.

3. Calcium channel blockers.

This class of agents lowers blood pressure in several ways. Two of these agents, diltiazem and verapamil, act in part like the beta-blockers, decreasing the vigor of the heart's contractions. They decrease blood pressure by decreasing the force with which blood is pumped into the arteries. These agents also dilate arteries, decreasing resistance

to blood flow, thereby decreasing blood pressure. The newer calcium channel blockers primarily dilate the arteries and have little effect on the forcefulness of the heart's contractions. These include: Amlodipine, Felodipine, Idradipine Nicardipine, and Nisoldipine

Calcium channel blockers may have serious **side effects** and should be used with caution in patients with **pulmonary arterial hypertension (PAH)**. PAH, which is life-threatening, is high blood pressure in the arteries that supply blood to the lungs

In some cases, diltiazem and verapamil, which decrease the force of the heart's contractions, worsen congestive heart failure symptoms. Verapamil may occasionally cause constipation, especially in elderly patients. Many of the calcium channel blockers cause headache and edema (swelling) in the ankles and feet.

4. ACE inhibitors.

These medications help dilate the arteries, thereby decreasing resistance to blood flow and consequently decreasing blood pressure. They interfere with the body’s production of angiotensin, a chemical that constricts and narrows the blood vessels. They have many other beneficial effects and are used to treat patients with congestive heart failure. Many studies have shown that treatment of heart failure patients with ACE inhibitors improves heart failure symptoms, decreases the chance of future hospitalizations, decreases the risk for future heart attack, and decreases the risk of death from heart failure.

There are many ACE inhibitors available, including the following: Benazepril, Captopril, Enalapril, Fosinopril, Lisinopril, Quinapril, Ramipril, Trandolapril.

Side effects. Approximately 10% of patients develop a chronic nonproductive cough. Rarely, ACE inhibitors produce a sudden swelling of the lips, face, and cheek areas in an allergic reaction that can occur at any time during therapy. If an allergic reaction occurs, medical attention should be sought immediately. Because ACE inhibitors can affect

kidney function and raise the potassium level, doctors monitor these during the first several weeks of therapy and periodically thereafter.

5. Angiotensin-receptor blockers (ARBs).

This is a new class of medications, which are similar in some respects to ACE inhibitors. Like ACE inhibitors, they help dilate arteries, lowering blood pressure and making it easier for the heart to pump blood throughout the body. Also, like ACE inhibitors, they can improve congestive heart failure symptoms, decrease the chances of future hospitalizations for heart failure, and prolong life. Ongoing studies are comparing the effects of ARBs with the ACE inhibitors and are investigating the use of both in patients with heart failure. Currently available ARBs include: Candesartan, Irbesartin, Losartan, Telmisartin and Valsartan. **Side effects** include interference in kidney function.

6. Direct-acting vasodilators. The medication hydralazine more or less directly dilates the arteries in the body, lowering blood pressure. Hydralazine is sometimes used in combination with isosorbide dinitrate to treat patients with congestive heart failure.

7. Centrally acting agents. These anti-hypertensive agents affect the central nervous system to decrease blood pressure. Such medications include clonidine and methyldopa. Because these drugs act directly on the brain, they occasionally cause drowsiness, depression, and other symptoms

COMBINATION THERAPY

The use of combination drug therapy for hypertension is not uncommon. At times, using smaller amounts of one or more agents in combination can minimize side effects while maximizing the anti-hypertensive effect. For example, diuretics, which also can be used alone, are more often used in a low dose in combination with another class of anti-hypertensive medications. In this way, the diuretic has fewer side effects while it improves the blood pressure-lowering effect of the other drug. Diuretics also are added to

other anti-hypertensive medications when a patient with hypertension also has fluid retention and swelling edema.

The ACE inhibitors or angiotensin receptor blockers may be useful in combination with most other anti-hypertensive medications. ACE inhibitors and angiotensin receptor blockers have additive effects in treating patients with cardiomyopathies and proteinuria. Another useful combination is that of a beta-blocker with an alpha-blocker in patients with high blood pressure and enlargement of the prostate gland in order to treat both conditions simultaneously. Caution is necessary, however, when combining two drugs that both lower the heart rate. For example, adding a beta-blocker to a non-dihydropyridine calcium channel blocker warrants caution. Patients receiving a combination of these two classes of drugs need to be monitored carefully to avoid an excessively slow heart rate. Combining alpha and beta-blockers may be beneficial for cardiomyopathies and hypertension.

EMERGENCY TREATMENT OF HIGH BLOOD PRESSURE

Emergency medical therapy may be needed for patients with severe (malignant) hypertension. In addition, emergency treatment of hypertension may be necessary in patients with acute congestive heart failure, dissecting aneurysm (dilation or widening) of the aorta, stroke, and toxemia of pregnancy. The most commonly used agents in this situation are sodium nitroprusside and labetalol.

TREATMENT DURING PREGNANCY

Mild or moderate hypertension during pregnancy needs to be treated with medication. If it is treated, however, the blood pressure should be reduced slowly and not to very low levels, not below 140/80. The anti-hypertensive agents used during pregnancy need to be safe for normal fetal development. The beta-blockers, hydralazine, labetalol, alpha methyldopa, and more recently, the calcium channel blockers, have been advocated as suitable medications for hypertension during pregnancy. Certain other anti-

hypertensive medications, however, are not recommended during pregnancy. These include the ACE inhibitors, the ARB drugs, and probably the diuretics. ACE inhibitors may aggravate a diminished blood supply to the uterus and cause kidney dysfunction in the fetus. The ARB drugs may even lead to death of the fetus. Diuretics can cause depletion of the blood volume and so impair placental blood flow and fetal growth.

ALTERNATIVE MEDICINE IN TREATMENT OF HYPERTENSION

Many forms of alternative medicine like yoga, meditation and acupuncture are suggested for reducing the blood pressure**.** These techniques can be effective in lowering the blood pressure, at least temporarily. However, they need to be practiced daily for sustained effects and therefore are more suited as life style modifications. Certain herbal remedies have blood pressure-lowering components that may well be effective in treating hypertension. Most herbal remedies are available as food supplements, however the Food and Drug Administration (FDA) does not approve them as drugs. Therefore, herbal treatments for hypertension have not yet been adequately evaluated in scientifically controlled clinical trials for effectiveness and safety. In particular, their long-term side effects are unknown. Furthermore, a major problem with most herbal treatments is that their contents are not standardized. Moreover, the ways in which herbal treatments work to lower blood pressure are not known

RECENT DEVELOPMENTS

A new class of anti-hypertensive drug, called a vasopeptidase inhibitor, has been developed. Uniquely, it works on two different systems at the same time. It blocks that part of the renin-angiotensin-aldosterone hormonal system that narrows (constricts) the peripheral arteries. It also blocks that part of the body's salt regulating system that conserves salt. Accordingly, this class of drug decreases blood pressure by simultaneously dilating the peripheral arteries and increasing the body's loss of salt

One such drug that is currently being studied is called omapatrilat. In laboratory animals with high blood pressure, this drug reduces the blood pressure and appears to protect the end-organs (heart, kidney, and brain) from damage by high blood pressure. Moreover, the drug dilates the peripheral arteries, which increases blood flow to all tissues, and improves cardiac function in hypertensive patients with heart failure. Not yet approved by the FDA, omapatrilat is undergoing further testing to evaluate its effectiveness and safety.