

Review Article

HIGH BLOOD PRESSURE – “A SILENT KILLER”: IT’S PREVENTION AND THERAPY

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ABSTRACT

Hypertension or high blood pressure (HBP) is a chronic medical condition in which the blood pressure in the arteries is elevated. It is a major risk factor for cardiovascular disease and is present in 69% of patients with a first myocardial infarction, in 77% of patients with a first stroke, in 74% of patients with chronic heart failure, and in 60% of patients with peripheral arterial disease. Blood pressure is summarised by two measurements, systolic and diastolic. This equals the maximum and minimum pressure, respectively. High blood pressure is said to be present if it is often at or above 140/90 mmHg. Hypertension puts strain on the heart, leading to hypertensive heart disease, coronary artery disease, stroke, and is a cause of chronic kidney disease if not treated. Angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, beta blockers, calcium channel blockers and diuretics have all reduced cardiovascular events in randomized trials. Dietary and lifestyle changes can improve blood pressure control and decrease the risk of health complications.

Key words: Hypertension, Systolic, Diastolic, Beta blockers

INTRODUCTION:

Hypertension is a major health problem throughout the world because of its high prevalence and its association with increased risk of cardiovascular disease. About one third of adults in most communities in the developed and developing world have hypertension. Most patients with hypertension have other risk factors as well, including lipid abnormalities, glucose intolerance, or diabetes; a family history of early cardiovascular events; obesity; and cigarette smoking. Recent data suggest that individuals who are normotensive at age 55 years have a 90% lifetime risk for developing hypertension. Advances in the diagnosis and treatment of hypertension have played a major role in recent dramatic declines in coronary heart disease and stroke mortality in industrialized countries. However, in many of these countries, the control rates for high blood pressure have actually slowed in the last few years. It is estimated that by 2010, 1.2 billion people will be suffering hypertension worldwide. ^[1]

What is Blood Pressure?

Hypertension (HT), also known as high blood pressure (HBP), is a long term medical condition in which the blood pressure in the arteries is persistently elevated.^[1] When your heart

pumps blood through the blood vessels, the blood pushes against the walls of your blood vessels. This creates blood pressure. Your body needs blood pressure to move the blood throughout your body, so every part of your body can get the oxygen it needs. Healthy arteries (the blood vessels that carry oxygen-rich blood from the heart to the rest of the body) are elastic. They can stretch to allow more blood to push through them. How much they stretch depends on how hard the blood pushes against the artery walls. For your arteries to stay healthy, it's important that your blood pressure be within a healthy range. Fortunately, there are things you can do to help keep your blood pressure in that range.

High blood pressure usually does not cause symptoms. ^[2] Long term high blood pressure, however, is a major risk factor for coronary artery disease, stroke, failure, peripheral, vision loss, and chronic kidney disease. ^[3,4]

ETIOLOGY: ^[5,6]

Hypertension etiology includes the following points:

- Family history of hypertension
- Obesity, particularly excess abdominal fat
- Insulin resistance
- High dietary sodium intakes, low dietary intakes of calcium, potassium and magnesium
- High alcohol intakes
- Cigarette smoking

RISK FACTORS ^[5,6]

1. **Family history:** Just as hair and eye color can run in families, so can high blood pressure. If the parents or other close blood relatives have high blood pressure, there's an increased chance that children will get it, too. This is why it's important to get the blood pressure checked on a regular basis. The American Heart Association recommends checking blood pressure is in a normal range (Table-1).
2. **Age:** The older you are, the more likely you are to get high blood pressure. As we age, our blood pressures gradually lose some of the elastic quality, which increases blood pressure.
3. **Gender:** Until age 54, men are more likely to get high blood pressure than women are. But that changes as we age. From age 55 to 64, men and women get high blood pressure at similar rates. And at 65 and older, women are more likely to get high blood pressure than men are.
4. **Race:** African Americans tend to develop high blood pressure more often than Caucasians. For African Americans, high blood pressure also tends to occur at younger ages and to be more severe.
5. **Lack of physical activity:** Not getting enough physical activity as part of your lifestyle increases your risk of getting high blood pressure. Physical activity is great for your heart and circulatory system in general, and blood pressure is no exception.
6. **An unhealthy diet:** Especially one high in sodium. Good nutrition from a variety of sources is critical for your health. A diet that is too high in salt consumption, as well as calories, saturated fat, and sugar, carries an additional risk of high blood pressure. On the other hand, making healthy food choices can actually help lower blood pressure.

7. **Overweight and obesity:** Carrying too much weight puts an extra strain on your heart and circulatory system, and can cause serious health problems. Being overweight increases your risk of cardiovascular disease and diabetes. It also increases your risk of getting high blood pressure.
8. **Drinking too much alcohol:** Regular, heavy use of alcohol can cause many health problems, including heart failure, stroke, and irregular heartbeats. Drinking too much alcohol can increase your risk of cancer, obesity, alcoholism, suicide, and accidents. It can also cause your blood pressure to increase dramatically.
9. **Smoking and tobacco use:** Using tobacco can cause your blood pressure to temporarily increase and can contribute to damage arteries, which can make high blood pressure worse.
10. **Stress:** Stress is not necessarily a bad thing in and of itself. But too much stress may contribute to increased blood pressure. Also, too much stress can encourage behaviours that increase blood pressure, such as poor diet, physical inactivity
11. **Sleep apnea:** This is a condition in which some of the tissues in the throat collapse during sleep and blocks the breathing passageway. In response to that, the brain awakens the sleeper, who then gulps for air in order to open the trachea again. This cycle often repeats many times a night, leading to severe fatigue the following day from a lack of good sleep. Sleep apnea can be a contributing factor to high blood pressure.

Table-1: Blood pressure ranges as recognized by the American Heart Association

Blood Pressure Category	Systolic (mm Hg)	Diastolic (mm Hg)
Optimal	< 120	< 80
Normal	120-130	80- 85
High Normal	130-139	85-89
High Blood Pressure	> 139	> 89

SIGNS AND SYMPTOMS:

There are usually no symptoms or signs of hypertension, and thus it is called the “silent killer”. Since humans are completely unaware of excessive blood pressure, it is only through measurements that it becomes detected. The exception is malignant hypertension, which can cause headache, congestive heart failure, stroke, seizure, papilledema, renal failure and anuria. Hypertension is rarely accompanied by symptoms, and its identification is usually through screening, or when seeking healthcare for an unrelated problem. Some with high blood pressure report headaches (particularly at the head and in the morning), as well as light-headedness, vertigo, tinnitus (buzzing or hissing in the ears), altered vision or fainting episodes.^[7] These symptoms, however, might be related to associated anxiety rather than the high blood pressure itself.^[8]

On physical examination, hypertension may be associated with the presence of changes in the optic fundus seen by ophthalmoscopy.[9] The severity of the changes typical of hypertensive

retinopathy is graded from I–IV; grades I and II may be difficult to differentiate.^[9] The severity of the retinopathy correlates roughly with the duration and/or the severity of the hypertension.^[7]

CAUSES OF HYPERTENSION

Primary Hypertension

About 95% of adults with high blood pressure have primary hypertension (sometimes called essential hypertension). The cause of primary hypertension is not known, although genetic and environmental factors that affect blood pressure regulation are now being studied. Environmental factors include excess intake of salt, obesity.

Blood pressure rises with aging and the risk of becoming hypertensive in later life is considerable.^[10] Several environmental factors influence blood pressure. High salt intake raises the blood pressure in salt sensitive individuals; lack of exercise, obesity, and depression^[11] can play a role in individual cases. The possible role of other factors such as caffeine consumption and vitamin D deficiency are less clear. Insulin resistance, which is common in obesity and is a component of syndrome X (or the metabolic syndrome), is also thought to contribute to hypertension.^[12] Events in early life, such as low birth weight, maternal smoking, and lack of breast feeding may be risk factors for adult essential hypertension, although the mechanisms linking these exposures to adult hypertension remain unclear.^[13] An increased rate of high blood urea has been found in untreated people with hypertensive in comparison with people with normal blood pressure, although it is uncertain whether the former plays a causal role or is subsidiary to poor kidney function.^[14]

Secondary hypertension

The main types of secondary hypertension are chronic kidney disease, renal artery stenosis, excessive aldosterone secretion, pheochromocytoma, and sleep apnea. Hypertension can also be caused by endocrine conditions, such as Cushing's syndrome, hypothyroidism, hyperaldosteronism and pheochromocytoma. Other causes of secondary hypertension include obesity, sleep apnea, pregnancy, coarctation of the aorta, excessive eating of liquorice, excessive drinking of alcohol, and certain prescription medicines.^[15]

COMPLICATIONS OF HYPERTENSION

Over time, uncontrolled hypertension can damage some of your blood vessels and organs. The longer it gets uncontrolled, the greater the damage. Uncontrolled hypertension can result (Fig.1):

- Atherosclerosis. Narrowing of the arteries.
- Heart attack or stroke. Atherosclerosis can lead to a heart attack, stroke or other complications.
- Cerebral stroke.
- Aneurysm. Dangerous weakening and bulging of the main artery either in the chest or the abdomen which can rupture.
- Heart failure. Decreased ability to pump blood.
- Thickened or ruptured blood vessels in the eyes. This can lead to vision loss.

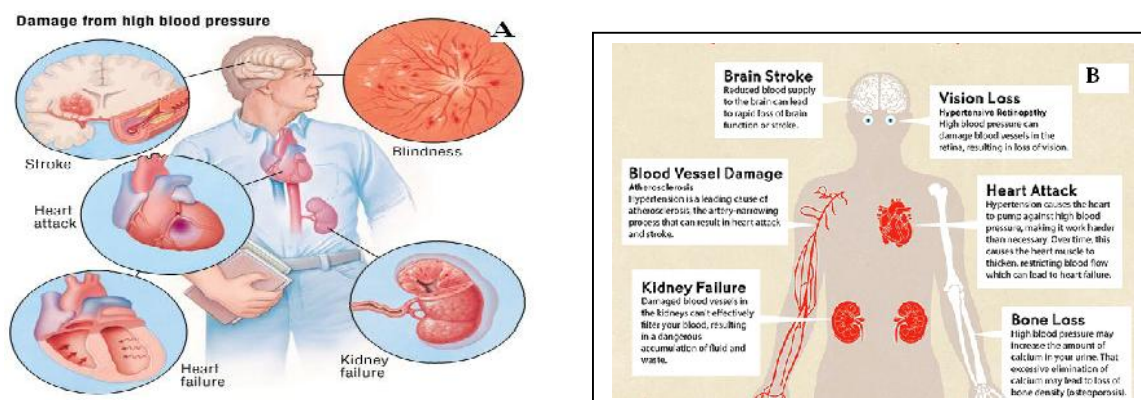


Fig.1 (A, B): Complications occur during of hypertension.

I. DIAGNOSIS

Blood pressure can be measured by either a conventional sphygmomanometer (Fig.2B) using a stethoscope or by an automated electronic device (Fig.2A). The electronic device is preferred because it provides more reproducible results than the older method and is not influenced by variations in technique or by the bias of the observer's diastolic blood pressures.

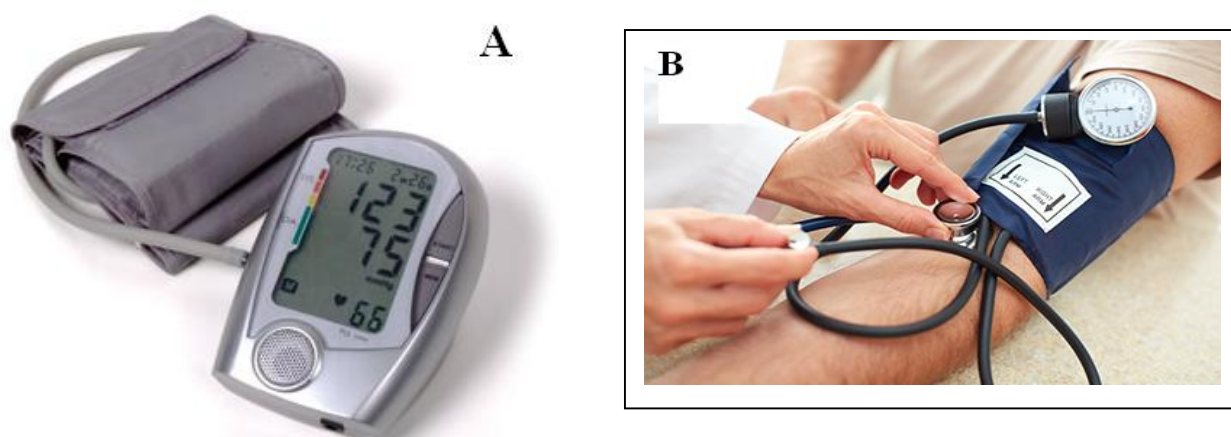


Fig.2: Blood pressure measurement device (A)-Automated electronic device (B)-Sphygmomanometer.

The diagnosis of hypertension depends on blood pressure readings. Therefore, it's essential that blood pressure be measured carefully. To obtain an accurate blood pressure measurement:

- Avoid the following for at least one hour before you have your blood pressure taken:
- Strenuous exercise
- Smoking
- Eating

- Be seated for at least five minutes before the reading is taken.
- Do not talk while your blood pressure is being measured.
- Two readings should be recorded and averaged.

If the blood pressure is high, the doctor should examine patient's eyes, heart and nervous system, to look for evidence of damage from hypertension. If there is no such evidence, the patient should return for at least two more blood pressure measurements. Only then should the doctor diagnose the patient with hypertension. That is because a single high reading can happen to anyone. If the patient is diagnosed with hypertension, other tests will check for organ damage. These tests can include:

- Blood tests to check kidney function
- An electrocardiogram (EKG) to look for:
 - Thickening of the heart muscle
 - Irregular heart rhythms
- A chest x-ray to look for:
 - Enlargement of the heart
 - Fluid buildup in the lungs due to heart failure



PREVENTION [16, 17]

Lifestyle changes are recommended to lower blood pressure, before starting drug therapy. The 2004 British Hypertension Society guidelines^[8] proposed lifestyle changes consistent with those outlined by the US National High BP Education Program in 2002^[9] for the primary prevention of hypertension:

- Maintain normal body weight for adults (e.g. body mass index 20–25 kg/m²)
- Reduce dietary sodium intake to <100 mmol/ day (<6 g of sodium chloride or <2.4 g of sodium per day)

- Engage in regular aerobic physical activity such as brisk walking (30 min per day, most days of the week)
- Limit alcohol consumption to no more than 3 units/day in men and no more than 2 units/day in women.
- Consume a diet rich in fruit and vegetables (e.g. at least five portions per day)

Effective lifestyle modification may lower blood pressure as much as an individual antihypertensive drug. Combinations of two or more lifestyle modifications can achieve even better results. There is considerable evidence that reducing dietary salt intake lowers blood pressure, but whether this translates into a reduction in mortality and cardiovascular disease remains uncertain. The DASH (Dietary Approaches to Stop Hypertension) plan emphasizes eating plenty of fruits and vegetables (Fig.3), as well as low-fat protein sources (such as skinless poultry, fish, and legumes), low fat dairy products, and whole grains. It is also low in sugars and red meat, and offers many other nutritional benefits.

TREATMENT

Major Antihypertensive Drug Therapy (Fig.4):



1. Diuretics (thiazide, loop, and potassium-sparing diuretics).

- **Thiazide diuretics** such as hydrochlorothiazide and chlorthalidone are among the most commonly used drugs for treating hypertension. They inhibit reabsorption of Na and Cl in the distal tubule and lose effectiveness when GFR (glomerular filtration rate) is low. Their initial effects are said to be mediated by decreasing intravascular volume, however (as mentioned above) most untreated hypertensives have contracted intravascular volume. Diuretics cause peripheral vascular resistance to fall through an unknown mechanism. Unfortunately thiazide diuretics have a number of undesirable metabolic effects such as hypercalcemia, hypokalemia, hyponatremia, hyperglycemia, hyperlipidemia, and hyperuricemia. These side effects often dictate which drugs to use. When thiazide diuretics are used in low doses, their side effects seem to be minimized.

- **Loop diuretics** such as furosemide inhibit the Na/K/Cl co-transporter in the ascending limb of the loop of Henle. They cause a very brisk diuresis, but their anti-hypertensive effects are actually not that strong. Acute intravenous administration of furosemide can cause venodilation by an unknown mechanism. Loop diuretics are often part of treatment for malignant hypertension and hypertension with hypervolemia (e.g., renal insufficiency). The metabolic derangements produced by these drugs (particularly hypokalemia, and hypocalcaemia) can be profound. This class is not recommended as initial monotherapy for hypertension.

- **Potassium-sparing diuretics** such as spironolactone, amiloride, and triamterene are not as efficacious as thiazides or loop diuretics in reducing blood pressure, however, they do correct the potassium loss associated with thiazide and loop diuretics. Amiloride and triamterene inhibit the Na/proton exchanger in the distal and collecting tubules. Spironolactone inhibits the Na/K exchanger affected by aldosterone, and it is particularly effective in the face of hyperaldosteronism. If potassium-sparing diuretics are given to patients on ACE (Angiotensin converting enzyme) inhibitors, particular care must be taken since both classes cause elevations in serum potassium.

2. Sympatholytics (beta-blockers, mixed alpha and beta-blockers, alpha-blockers and central sympatholytics).

- **Beta adrenergic blockers** such as propranolol, metoprolol or atenolol are typical first-line agents for treating hypertension. They have negative chronotropic and negative inotropic effects. However the chronic administration can decrease peripheral resistance, probably by decreasing plasma renin and angiotensin II. Unfortunately beta-blockers can elevate triglycerides and reduce HDL (high density lipoprotein). In addition, they can produce glucose intolerance, impotence, and depression. In patients prone to bronchospasm (i.e., asthmatics), non-selective beta-blockers can theoretically worsen the problem, although the risks are somewhat overplayed. These side effects often dictate drug choices for the hypertensive patient.

- **Alpha-1 adrenergic blockers** such as prazosin, terazosin and doxazosin are effective at reducing sympathetic vasoconstriction and thereby reducing vascular resistance. These drugs are also useful for men who have benign prostatic hypertrophy because they can reduce bladder outlet obstruction. Unlike the beta blockers and thiazide diuretics, the alpha blockers have not been shown to decrease mortality.

- **Central sympatholytics** such as clonidine stimulate central alpha-2 receptors and thereby reduce sympathetic outflow. These drugs are effective in decreasing heart rate, contractility and vasomotor tone; however, they cause sedation and are usually not first line therapies.

- **Mixed alpha and beta antagonists** such as labetalol and carvedilol block both alpha receptors and beta receptors, so the reduction in blood pressure is usually not associated with reflex tachycardia. Labetalol is a very effective intravenous antihypertensive, but it is less frequently used chronically in its oral form. Carvedilol has had its primary use in the treatment of chronic congestive heart failure.

3. Vasodilators (calcium-channel blockers, direct arterial vasodilators, and sodium nitroprusside)

- **Calcium channel blockers** such as verapamil, diltiazem, nifedipine and amlodipine block L-type calcium channels and are effective arterial vasodilators. The dihydropyridine agents nifedipine and amlodipine act primarily as vasodilators and have minimal direct effects on the heart. In contrast, verapamil and diltiazem act principally as negative inotropes and negative chronotropes, and thus decrease heart rate, contractility and cardiac conduction speed. In addition, they reduce vascular resistance. There is controversy over

the use of short-acting dihydropyridines in patients with angina because they can cause reflex sympathetic activation and worsen ischemia. When using verapamil or diltiazem one has to expect a reduction in LV (left ventricular) systolic function as well as a reduction in cardiac conduction. Thus, in patients with congestive heart failure of the systolic type or in those with a significant conduction defect, these drugs should be avoided. Verapamil and diltiazem are synergistic with beta-blockers and the combination can cause severe bradycardia, heart block or pump dysfunction.

- **Direct arterial vasodilators** such as minoxidil and hydralazine have relatively limited use. Neither has much effect on venous tone. The mechanism of action of hydralazine is not known. Minoxidil appears to increase potassium conductance in vascular smooth muscle, and the resultant hyperpolarization reduces calcium entry. Both drugs can cause reflex tachycardia (particularly minoxidil) and fluid retention. These side effects can be managed with the addition of a beta-blocker and/or a diuretic. Neither drug is effective for sustained periods. They are usually reserved for the short-term treatment of refractory hypertension, especially in patients with renal failure. Each of these drugs has a unique side effect: hydralazine can cause a lupus-like syndrome (cf. Drug Allergy case), and minoxidil can produce hair growth (and is sold for the purpose!).

- **Sodium nitroprusside** breaks down non-enzymatically to form nitric oxide. It is an extremely potent arteriolar and venous dilator that is used intravenously for rapid control of hypertensive crises and for blood pressure control during operations. Reflex increases in heart rate and contractility usually require treatment with beta blockers.

4. **Renin-angiotensin system (RAS) blockers:** It comprises two broad categories- Angiotensin converting enzyme inhibitors (ACE inhibitors) and angiotensin type 1 receptor blockers (ARB's).

ACE inhibitors like captopril, enalapril, and lisinopril decrease the conversion of angiotensin I to angiotensin II (ATII). This reduces peripheral vascular resistance and promotes both natriuresis and hyperkalemia, since a reduction in ATII leads to a reduction in aldosterone. These medications work by expanding blood vessels and reducing resistance inside them. By doing this, ACE inhibitors allow blood to flow more easily and reduce the workload on the heart. ACE also breaks down bradykinin, so inhibiting this enzyme can increase bradykinin levels and cause more vasodilatation.

- **Angiotensin receptor blockers (ARB's)** like losartan and valsartan cause arteriolar vasodilation by blocking the effects of angiotensin II at the angiotensin Type I receptor. Since the mechanism is essentially the same as for the ACE inhibitors, the indications and contraindications are the same. The blockade is downstream, so bradykinin is not elevated, and this class of drugs is not associated with a cough.

CONCLUSION:

High blood pressure is a lifelong condition. Making healthy changes can help control blood pressure, and you should consider eating healthy and getting more physical activity to be lifelong habits. The same is true of taking medication. Dealing with side effects can be a difficult matter, but it's worth working with your healthcare provider to manage side effects because taking medication can make a huge difference in how well you manage your blood pressure. Controlling your blood pressure means you're lowering your risk for heart disease, heart attack, diabetes, stroke, and kidney disease. Most people who control their high blood pressure are able

to live full, healthy lives. There is no cure, high blood pressure is manageable. Maintaining a healthy life style is necessary.

CONFLICT OF INTREST: The authors declared that there is no conflict of interest.

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They don't call high blood pressure a "silent killer" for nothing. Turns out, about half of Americans have this condition, which, left unaddressed, can cause hardening of the arteries, stroke, kidney damage, and even early cognitive decline and dementia. Yet most people with high blood pressure (also called hypertension) have no idea they're affected. For most people, it's multifactorial, meaning a bunch of factors work in tandem to spike your levels into unsafe territory. According to the Centers for Disease Control and Prevention (CDC), Americans are consuming an average of 3,400 mg of sodium per day, which is well beyond the recommended cap of 2,300 mg per day. It is called a silent killer. It is a warning sign from your body that something is not OK. Although people may live with high blood pressure for years without even knowing it, it is important to check your blood pressure regularly and take the necessary steps. The WHO says that you can reduce your blood pressure by changing your living habits. Eating a balanced diet, exercising regularly, avoiding alcohol and nicotine are some things that you can do without consulting a doctor. High blood pressure tends to run in families and is more likely to affect men than women. Age and race also play a role. In the United States, blacks are twice as likely as whites to have high blood pressure, although the gap begins to narrow around age 44. After age 65, black women have the highest incidence of high blood pressure. Continued. Essential hypertension is also greatly influenced by diet and lifestyle. The link between salt and high blood pressure is especially compelling. People living on the northern islands of Japan eat more salt per capita than anyone else in the world and hav