

Hypertension

What is hypertension?

Hypertension, also known as high blood pressure, is a persistent elevation in blood pressure that taxes the heart and can, over time, cause damage to organs such as the kidneys, brain, eyes, and heart. Blood pressure (BP) is the amount of force blood exerts on the walls of the arteries and veins. BP depends on the force and rate of the contraction of the heart as it pumps oxygenated blood from the left ventricle (compartment) of the heart into the arteries and the resistance to that flow. The amount of resistance depends on the elasticity and diameter of the blood vessels and how much blood is flowing through them.

Blood pressure is dynamic; it rises and falls depending on a person's level of activity, time of day, and physical and emotional stresses. In healthy people, it is largely controlled by the autonomic nervous system but is also regulated by **hormones**, including:

- Angiotensin II — produced by the kidneys, it causes increased resistance in blood vessels.
- Aldosterone — produced by the **adrenal glands** in response to angiotensin II, it affects the amount of sodium, potassium, and fluids excreted by the kidneys.
- Catecholamines — such as epinephrine, also called adrenaline, produced by the adrenal glands in response to stress and increases heart rate and resistance in blood vessels.

When one or more of the regulating factors is not able to respond appropriately to the demands of the body, then the pressure of the blood may become persistently increased.

Two pressures are measured when blood pressure is evaluated. They are systolic pressure – the peak amount of force exerted on the blood vessel walls when the heart is contracting – and diastolic pressure – the amount of pressure present when the heart is relaxing between beats. Both are measured in millimeters of mercury (mm Hg) and are expressed as systolic over diastolic pressure. For instance, a blood pressure of 120/80 mm Hg corresponds to a systolic pressure of 120 and a diastolic pressure of 80 and would be reported as 120 over 80. The National Heart, Lung and Blood Institute (NHLBI) **web site** has a table that lists the categories of blood pressure levels in adults.

Usually, diastolic pressures will mirror systolic pressures, but as people age, the diastolic pressure tends to level out and hypertension that involves primarily the systolic pressure (called isolated systolic hypertension) becomes more common. In general, the greater the blood pressure for extended periods of time, the greater the potential for damage.

Signs and Symptoms

In most people, high blood pressure rarely causes any kind of **signs or symptoms**. Many times you will not know you have high blood pressure until it is discovered during a routine health checkup. Rarely, even when levels are life-threatening, high blood pressure may cause a few symptoms such as headaches, dizziness, and more frequent nosebleeds. That is why it is important to have your level checked on a regular basis.

What causes hypertension?

In most cases, the cause of hypertension is **idiopathic**. This form of high blood pressure is called essential or primary hypertension. It can affect anyone but is found more frequently in men, especially those of African descent, and it becomes very common in all Americans as they age. The National Heart, Lung, and Blood Institute estimates that as many as 1 in 3 Americans will develop high blood pressure, but about one-third of those affected do not know that they have it. In most cases, high blood pressure does not cause symptoms until it begins to damage body organs. For this reason, hypertension is sometimes referred to as the “silent killer,” quietly increasing the risk of developing **stroke, heart disease, heart attack, kidney damage**, and blindness. Because it is both a quiet and a common condition, blood pressure is usually evaluated each time a patient sees their doctor.

Although it may not be possible to identify the cause, there are several things that are known to increase the risk of developing hypertension and that are known to exacerbate it when it is present. These include:

- Obesity
- Sedentary lifestyle
- Smoking
- Excessive use of alcohol
- Excessive dietary sodium
- Use of oral contraceptives
- Use of drugs such as steroids, cocaine, and amphetamines

Hypertension may also be due to an identifiable underlying condition. This form of high blood pressure is called secondary hypertension. It is important to identify the underlying conditions as they may be able to be resolved and/or controlled, allowing a person's blood pressure to return to normal or near normal levels. These conditions include:

- Kidney disease or damage – decreases the removal of salts and fluids from the body, increasing blood volume and pressure. Since hypertension can also cause kidney damage, this can be a progressive problem if left untreated.
- Heart disease – this may affect the force and rate of the heart's contraction. This can also be progressive.

- **Diabetes** – this condition can damage the kidneys and affect the integrity of the blood vessels over time.
- Arteriosclerosis – a hardening of the arteries that limits their ability to dilate and constrict
- **Cushing's syndrome** – a disorder that involves increased production of the hormone cortisol by the adrenal gland
- Hyperaldosteronism (**Conn's syndrome**) – a condition characterized by an overproduction of aldosterone, a hormone that helps regulate the retention and excretion of sodium by the kidneys; it may be due to an adrenal gland tumor (usually **benign**)
- **Pheochromocytoma** – a tumor of the adrenal gland (rare and usually benign) that produces excessive amounts of epinephrine, a hormone that the body uses to help it respond to stress; affected patients often have severe episodes of hypertension
- **Thyroid disease** – both excessive and deficient amounts of thyroid hormone production can cause increases in blood pressure
- **Pregnancy** – hypertension may develop at any time during a woman's pregnancy but is most common during the last trimester, when it can cause **preeclampsia (toxemia)**, a condition characterized by increased blood pressure and retention of fluids.

Tests

The goals with testing are to detect high blood pressure, confirm that it is persistent over time, determine whether it is being caused by an underlying medical condition that may be able to be resolved or controlled, evaluate the status of body organs, get a baseline of organ health prior to the start of drug therapies, and to monitor hypertension control and organ status over time.

Laboratory Tests

Laboratory testing is not diagnostic for hypertension, but tests are frequently ordered to detect conditions that may be causing and/or exacerbating high blood pressure and to evaluate and monitor organ function over time.

General tests that may be ordered include:

- **Urinalysis** - ordered to help assess kidney function
- **Hematocrit** – may be ordered as part of the **Complete Blood Count (CBC)** to evaluate the ratio of fluid to solids in the blood
- **BUN (Blood Urea Nitrogen)** and/or **Creatinine** – to detect and monitor kidney dysfunction or to monitor the effect of medications on the kidneys

- **Potassium** – may be ordered as part of the **Electrolyte panel**, which also includes sodium, chloride, and carbon dioxide (CO₂); used to evaluate and monitor the balance of the body's electrolytes; some high blood pressure medications can upset the balance by causing excessive sodium and potassium loss
- **Fasting Glucose** – ordered to determine if blood glucose levels are within healthy ranges
- **Calcium** – may be ordered to determine how much total calcium or ionized calcium is circulating in the blood; increased activity of the parathyroid glands, which produces an increase in serum calcium, is associated with hypertension
- **TSH (Thyroid Stimulating Hormone)** and **T4** – may be ordered to detect and monitor thyroid dysfunction
- **Lipid Profile** – may be ordered to evaluate levels of total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides

The **Basic Metabolic Panel (BMP)** includes several of the tests listed above, so it may be ordered instead of the individual tests.

Specific tests that may be ordered based on the patient's medical history, physical findings, and routine laboratory test results to help detect, diagnose, and monitor conditions causing secondary hypertension include:

- **Aldosterone and Renin** – to help detect the overproduction of aldosterone by the adrenal glands (which may be due to a **tumor**)
- **Cortisol** – to detect an overproduction of cortisol that may be due to **Cushing's syndrome**
- **Catecholamines** and **Metanephrines** – to measure epinephrine, norepinephrine, and their **metabolites** primarily to help detect the presence of a **pheochromocytoma** that can cause episodes of severe hypertension

Non-Laboratory Tests

Blood pressure measurement

This is the primary tool for detecting and monitoring hypertension. Although it can now be evaluated with a variety of electronic devices, blood pressure is traditionally and most accurately measured with a stethoscope and a blood pressure cuff (a sphygmomanometer – which includes a cuff, a bulb, and a pressure dial that reads the pressure in millimeters of mercury (mm Hg)). The doctor may have the patient wear a device that monitors and records the blood pressure at regular intervals during the day to evaluate their blood pressure over time. This is especially helpful during the diagnostic process and can help rule out the high measurements that are sometimes present only when the patient is in the doctor's office. All of these forms of blood pressure measurement are considered indirect. Very rarely, a direct measurement of blood pressure may be required. This can be obtained by inserting a **catheter** into an artery to measure the pressure inside the blood vessel.

As part of the diagnostic process and to help evaluate the status of vital organs, the doctor may order or perform one or more of the following:

- **ECG (Electrocardiography)** – to evaluate the heart rate and rhythm and look for evidence of heart damage
- Eye Exam – to look at the **retina** for changes in the blood vessels (retinopathy)
- Physical Exam – to help evaluate the kidneys, to look for abdominal tenderness, to listen for bruits (the sound of blood flowing through a narrowed artery), to examine the thyroid gland in the throat for any enlargement or signs of dysfunction, and to detect any other clinical signs as they present
- Imaging scans, such as X-ray or ultrasound of the kidneys or X-ray of the chest

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