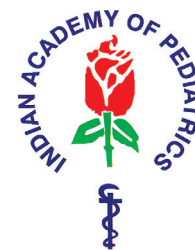


Indian Academy of Pediatrics (IAP)



GUIDELINES FOR PARENTS

Importance of Checking Blood Pressure in Children



Convener: Arvind Bagga

Members: Aditi Sinha, Bhawan Deep Garg,
Saroj Patnaik

Reviewer: Madhuri Kanitkar

10 FAQs on IMPORTANCE OF CHECKING BLOOD PRESSURE IN CHILDREN

1. What is blood pressure and how is it measured?
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9. Does my child require medications to control blood pressure? Why and for how long?
10. What are the long-term complications of high blood pressure?

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Importance of Checking Blood Pressure in Children

Q1

What is blood pressure and how is it measured?

Blood pressure is the pressure exerted by blood on the walls of the vessels (called “*arteries*”) which carry it from the heart to various body parts (**Fig. 1**). This pressure peaks with each heartbeat, when the heart pumps blood into the vessels, termed “*systolic*” blood pressure.

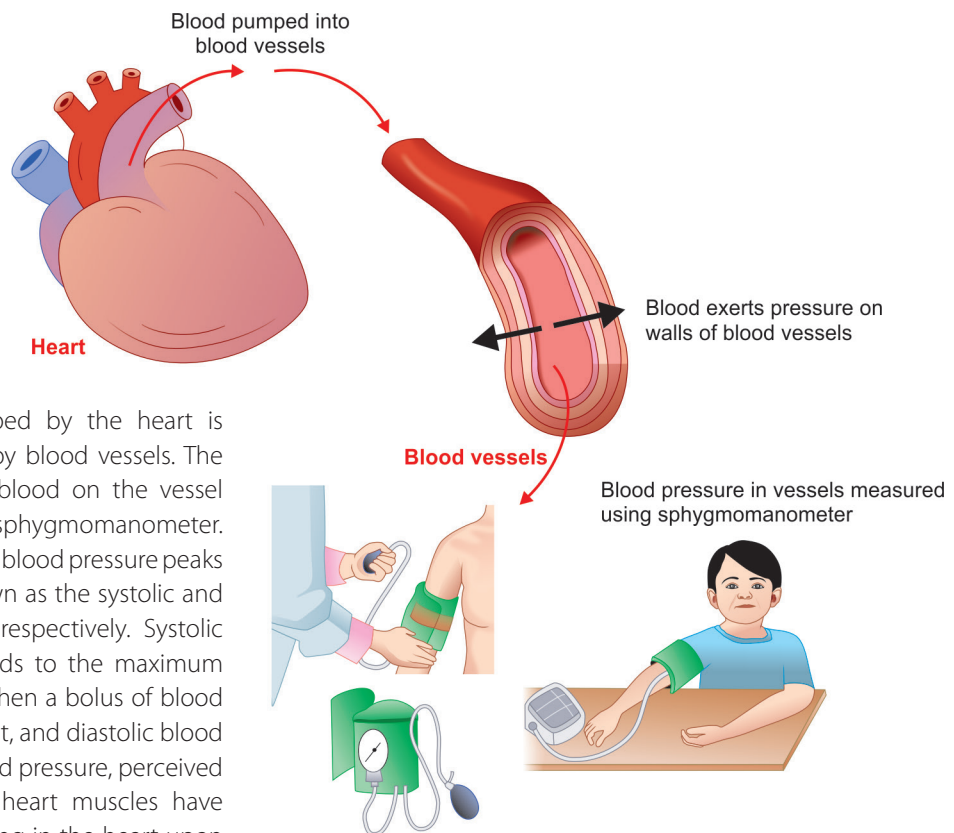


Fig. 1: The blood pumped by the heart is carried to all body parts by blood vessels. The pressure exerted by the blood on the vessel walls is measured using a sphygmomanometer. During each heartbeat, the blood pressure peaks and falls to what are known as the systolic and diastolic blood pressure, respectively. Systolic blood pressure corresponds to the maximum blood pressure, exerted when a bolus of blood is pumped out by the heart, and diastolic blood pressure is the lowest blood pressure, perceived in the phase when the heart muscles have relaxed and blood is pooling in the heart upon its return from the body.

The blood pressure falls to a low value between two heart beats, termed “diastolic” blood pressure. Normally, the blood pressure increases with age and height. Blood pressure varies with the contracting ability of the heart and the tone of blood vessels that are affected by hormones, emotional state, and exercise.

Similar to the pressure of any liquid, blood pressure is measured in millimeters of mercury (mm Hg). Normal systolic and diastolic blood pressure in adults are 100–120 mm Hg and 70–80 mm Hg, respectively.

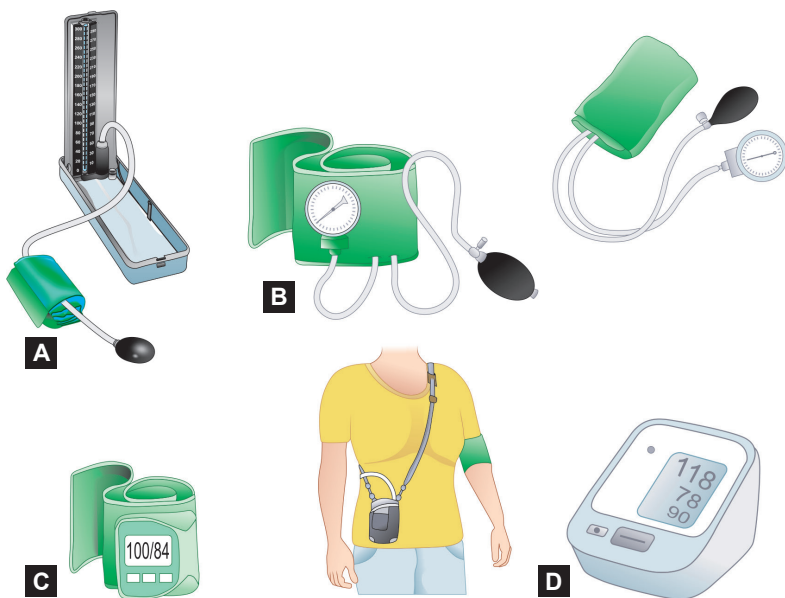
Blood pressure is measured by hearing the flow of blood into blood vessels at the inner aspect of the elbow, using a stethoscope. A cuff wrapped around the upper arm is inflated with air, and the stethoscope is used to listen for sounds when the cuff is slowly deflated. The cuff is connected to an instrument called sphygmomanometer, which measures the pressure, using either a column of mercury or an aneroid gauge (**Figs. 2A and B**). Since mercury is an environmental hazard, mercury sphygmomanometers are no longer recommended for use. The aneroid (dial) sphygmomanometers that are widely used are reasonably accurate but need to be calibrated intermittently.

Digital (automated) blood pressure instruments are based on oscillations of pressure in the blood pressure cuff. These instruments do not require a stethoscope and can be used to monitor blood pressure at home (**Fig. 2C**). The blood pressure measured in the upper arm (and in some cases, wrist or finger) is displayed digitally. These instruments are convenient to use but less accurate than sphygmomanometers and need to be calibrated frequently.

Ambulatory blood pressure monitoring (ABPM) instruments are increasingly used to estimate blood pressure through the day and night while the child carries on his daily activities (**Fig. 2D**). A large number of values provide a realistic estimate of blood pressure pattern that is not influenced by anxiety and stress.

It is important to note that accurate measurement of blood pressure requires the use of an appropriately sized cuff, which varies with the size of the child. Your doctor can advise you on the correct cuff size for your child.

Figs. 2A to D: Types of sphygmomanometers (blood pressure measuring instruments). Blood pressure can be measured using a stethoscope (manually) and a (A) mercury sphygmomanometer, which is largely replaced by a variety of (B) aneroid instruments. Various types of (C) automatic blood pressure monitors are available that display blood pressure digitally, but require frequent calibration. (D) Ambulatory blood pressure monitors provide blood pressure values over 24-h period.



Q2

What is high blood pressure (hypertension)?

As discussed above, blood pressure refers to two separate measurements, the systolic and diastolic pressures. If either or both measurements are above the upper limit of their range in healthy children of the same age, sex and height, this is termed “hypertension”. Values that are high should be confirmed on repeat measurements, on at least three occasions.

Detailed tables are available that display the range of blood pressure for boys and girls of different height across ages. Your doctor will refer to these tables in order to inform you whether your child’s blood pressure is normal or high. **Table 1** gives a summary of blood pressure values, higher than which are considered abnormal and requires evaluation.

TABLE 1: Limits of normal blood pressure, higher than which requires further evaluation.

Age, years	Boys		Girls	
	Systolic (mm Hg)	Diastolic (mm Hg)	Systolic (mm Hg)	Diastolic (mm Hg)
1	98	52	98	54
2	100	55	101	58
3	101	58	102	60
4	102	60	103	62
5	103	63	104	64
6	105	66	105	67
7	106	68	106	68
8	107	69	107	69
9	107	70	108	71
10	108	72	109	72
11	110	74	111	74
12	113	75	114	75
≥13	120	80	120	80

The table assumes that the height is appropriate for the age. Threshold values will increase or decrease by 2–3 mm Hg if the height is higher or lower than normal, respectively.

Q3

Does my child have mild or severe hypertension?

Blood pressure values that are slightly higher than that of 90% normal children are termed as “*elevated blood pressure*”. If the blood pressure is higher than levels found in 95% healthy children of the same sex and age, on three different occasions, the patient is considered to have “*hypertension*”. Based on the level of blood pressure compared to normal, hypertension is staged as stage 1 (mild) or stage II (severe). Children with stage II hypertension are at a higher risk of complications associated with high blood pressure. These children require urgent evaluation and management.

Q4

What are the symptoms of high blood pressure?

Children with stage 1 (mild) hypertension have few symptoms. Patients with severe hypertension may occasionally have headache, nausea, vomiting, blurred vision, dizziness, nosebleed, and fast heartbeat. Persistently high levels of blood pressure may rarely result in fits (seizures), altered consciousness, breathlessness or rapid breathing. Since symptoms are unusual in most children, periodic measurement of blood pressure is the only reliable way to detect hypertension.

Q5

What are the reasons for high blood pressure in children?

Hypertension in older children and adolescents, as in adults, may not have a precise cause and is termed “*essential*”. Essential hypertension is usually seen in older children, especially whose parent(s) also has/have high blood pressure. It may be associated with being overweight or obese, a sedentary lifestyle with reduced physical exercise, and excessive dietary intake of salt and carbohydrates.

In contrast, an underlying secondary cause is more likely in young children with high blood pressure. The younger the child, the more likely it is that high blood pressure is not “*essential*” but “*secondary*” to an underlying condition. The most common cause is in the kidneys; many forms of chronic and acute kidney diseases may present with hypertension. Other causes of secondary hypertension include narrowing of the aorta (coarctation) or of blood vessels supplying the kidneys (renovascular hypertension), diseases affecting the adrenal glands or the thyroid, and some medications (**Box 1**).

BOX 1: Conditions in which blood pressure should be measured in children younger than 3 years of age and frequently in older children.

- Complications at birth (prematurity, small for date, very low birth weight, intensive care stay)
- Known heart disease
- Known kidney disease; urinary tract infections, urinary loss of red blood cells (hematuria) or protein (proteinuria)
- Solid organ or bone marrow transplant
- Brain disease associated with increased intracranial pressure
- Malignancy
- Illness associated with hypertension (e.g., neurofibromatosis, tuberous sclerosis, sickle-cell disease)
- Therapy with drugs known to raise blood pressure (e.g., corticosteroids, oral contraceptives, stimulants used to treat attention deficit and hyperactivity disorders)

Q6

Is my child at risk of hypertension? How often should blood pressure be checked?

We usually assume that high blood pressure is a problem that affects adults, and not children. However, essential hypertension is quite common, and affects 2–3% of otherwise normal children. As most children do not show symptoms of hypertension, doctors recommend that blood pressure should be measured once a year in every child older than 3-years of age. In addition, screening of children younger than 3-yr-old is advised in certain high-risk settings, listed in **Box 1**.

Children who are obese, have obstructive sleep apnea (snoring, frequent night-time awakening, mouth breathing) or whose parent(s) has/have hypertension, are at increased risk of essential hypertension and should definitely be screened for high blood pressure. Children with conditions associated with secondary hypertension, such as diseases affecting the kidneys, blood vessels, endocrine glands, heart or brain, or taking medications that might increase blood pressure, require regular screening.

Q7

Does my child require evaluation for high blood pressure?

If hypertension is confirmed, your child must be evaluated for the cause and consequences of high blood pressure. Certain tests are necessary to look at the effect of high blood pressure on the kidneys, heart, and eyes. An echocardiogram, detailed examination of the eyes, and blood tests are required.

Even if essential hypertension is suspected, certain investigations are necessary to rule out secondary causes. Based on clues from history and physical examination, your physician will advise specific blood and urine tests. Your child would undergo an ultrasound of the abdomen to evaluate the kidneys and its vessels, and screen for other abnormalities.

The management of hypertension is guided by this evaluation, as the choice of drugs may vary by the cause. Specific and definitive management of the underlying disease may be possible in few instances.

Q8

Do I need to alter my child's diet if the blood pressure is elevated? What other measures can I take to keep the blood pressure in control?

Fortunately, there is a lot that you can do to help your child control his/her blood pressure. Overweight children should be encouraged to reduce weight to the normal level for age, using changes in lifestyle that lead to increase in physical activity and reduce intake of unhealthy foods. Weight reduction in these children leads to significant decline in blood pressure, often obviating the need of medications. Weight reduction also decreases cardiovascular risk factors such as elevated levels of lipids and blood sugar. Lifestyle diseases often affect the family and hence changes in lifestyle that are undertaken by the whole family, are expected to have better outcomes compared to nagging the child alone to eat less or exercise more.

Children with hypertension may benefit from a dietary approach to stop hypertension (DASH) diet (**Fig. 3**). A DASH diet focuses on increasing the daily intake of fresh fruits and vegetables, foods rich in dietary fiber, nonfat dairy products, and whole grains, while restricting the intake of sugar and salt. Foods rich in salt include processed cheese, sauces, cornflakes, potato chips, salted nuts, *papad*, pickles, and preserved foods (canned vegetables, soups, salted fish, and meat). Salt restriction should not be so excessive that food is not palatable. The recommended daily intake of salt for 4–8-year-old children is upto 1.2 g, and 1.5 g for older children.

Children should be encouraged to limit sedentary activity to <2-hours/day, by limiting screen time and increasing walking, sports or running. They should spend about 30–60 minutes on aerobic exercises on at least 3–5 days each week.

Monitoring blood pressure at home, at bed-time on 2–3 days each week, helps to understand, if your child's blood pressure is controlled. These records should be maintained in a notebook to help your physician plan your child's management. Home blood pressure monitoring is particularly valuable, since records taken in the doctor's office are rather infrequent and may be influenced by anxiety.

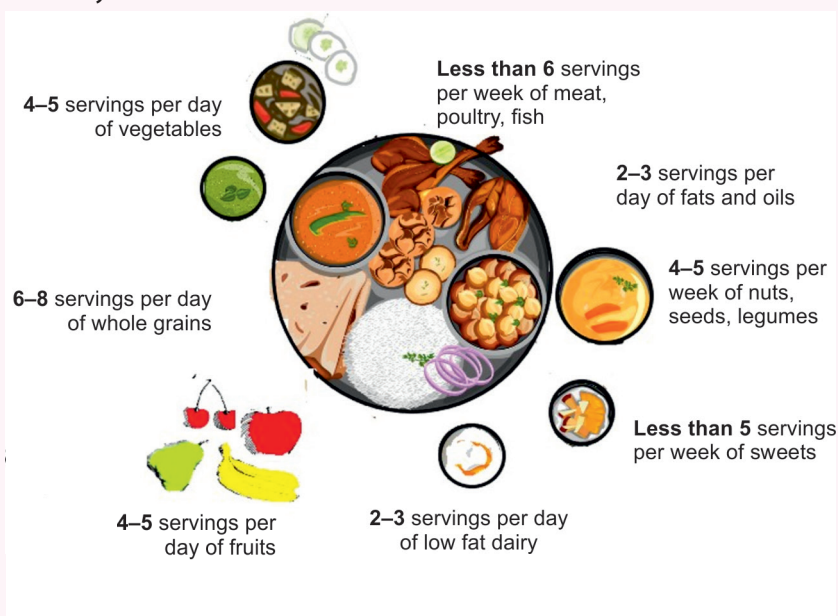


Fig. 3: Distribution of food items in a dietary approach to stop hypertension (DASH) diet. Examples of serving sizes for a 2,000-calorie diet are in parentheses as follows: whole grains (half-cup of cooked rice), vegetables (one cup raw salad or half-cup cooked vegetables), fruits (half-cup of fruit juice or half an apple or pear), dairy (one cup fat-free curd or yoghurt), lean protein (one egg, 30 g lean meat or 110 g tofu), nuts, seeds, and legumes (10 peanuts, 6 almonds or cashewnuts or 16 pistachios), sweets (one small cupcake or cola drink of 350 mL) and fats and oils (1 tablespoon peanut butter or 1 teaspoon olive oil).

Q9

Does my child require medications to control blood pressure? Why and for how long?

Children with mild (stage I) hypertension, particularly those with essential hypertension, are first managed by lifestyle measures, described above. If blood pressure is not controlled despite these measures, medications are necessary. Occasionally, patients may present with very severe hypertension with complications, including convulsions or breathing difficulty, and require admission for urgent control of blood pressure.

Patients with severe (stage II) hypertension, symptoms due to hypertension, and adverse effects on heart, kidneys, or the eyes require therapy with antihypertensive medications. Most patients with secondary hypertension also require antihypertensive medications. Several medications are approved for management of hypertension in children and are effective and safe. Agents include angiotensin-converting enzyme inhibitors (enalapril and ramipril), angiotensin-receptor blockers (telmisartan), beta-blockers (metoprolol), calcium-channel blockers (amlodipine, nifedipine), and diuretics (hydrochlorothiazide).

When prescribing treatment, your physician will also advise regarding the precautions and possible side effects of these medications. Therapy with these agents may require to be reduced or withheld during illnesses when oral intake is limited (e.g., diarrhea, vomiting, and fever).

Lifestyle interventions should be continued in children who are receiving anti-hypertensive agents. These measures might help to reduce the dose of medications used. In most cases, these medications need to be taken for several months or years, unless the cause of high blood pressure is temporary, such as acute conditions affecting the kidneys (acute glomerulonephritis).

Q10

What are the long-term complications of high blood pressure?

Hypertension is known to injure organs 'silently' on the long term. High blood pressure imposes a constant extra load on the heart, leading it to work harder and become 'hypertrophic' or enlarged. Such a hypertrophied heart is at risk of myocardial infarction ('heart attack') in adulthood. High pressure in blood vessels in various organ systems can lead to other complications, such as loss of blood supply to deep tissues in the brain and thickening and injury of blood vessels in the eyes (termed 'hypertensive retinopathy'). Small blood vessels in the filtering units of the kidneys (glomeruli) bear the brunt of high blood pressure and leak protein into the urine which, along with injury to larger vessels, might injure the kidneys severely (hypertensive kidney disease) on the long term.