

Measurement of Blood Pressure

Clinic Measurement

- Blood pressure (BP) is characterized by large spontaneous variations, therefore the diagnosis of hypertension should be based on multiple BP measurements taken on several separate occasions.
- With increasing awareness about the hazardous effects of mercury on health, the standard mercury sphygmomanometer should be used less frequently, with caution and primarily for calibration of the aneroid and digital sphygmomanometers (to be used in conjunction with stethoscope) which should be used as routine equipments.
- Use a standard cuff with a bladder that is 12 cm X 35 cm. Use a large bladder for fat arms and a small bladder for children. The bladder should encircle and cover 80% of the length of the upper arm. Proper maintenance and calibration of the sphygmomanometer should be ensured. Whenever aneroid sphygmomanometer is used, its accuracy should be checked against standard mercury sphygmomanometer at regular intervals.
- For measurement, inflate the bladder quickly to a pressure 20 mm Hg higher than the point of disappearance of the radial pulse. Deflate the bladder slowly by 2 mm Hg every second.
- The first appearance of the sound (Phase I Korotkoff) is the systolic BP. The disappearance of the sound (Phase V Korotkoff) is the diastolic BP. For children and in those with high output states, muffling of the sound (Phase IV Korotkoff) is taken as diastolic pressure.

Precautions

The following precautions are required for correct measurement of blood pressure:

- At the initial visit, an average of three readings, taken at intervals of 2-3 minutes should be recorded.
- For confirmation of diagnosis of hypertension, record at least 3 sets of readings on different occasions, except in Stage III hypertension.
- Patients should be asked to refrain from smoking or drinking tea/coffee, exercise for at least 30 minutes before measuring the BP.
- Allow the patient to sit for at least five minutes in a quiet room before beginning blood pressure measurement.
- Measurement should be done preferably in a sitting or supine position. Patient's arm should be fully bared and supported at the level of the heart.
- Measure the blood pressure in both arms at the first visit and use higher of the two readings.
- In older persons aged 60 years and above, in diabetic subjects

Table 5 : Blood pressure thresholds (mm Hg) for definition of hypertension with different types of measurement^{23,24}

	SBP (mm Hg)	DBP (mm Hg)
Office or Clinic	140	90
Home (self)	135	85
ABPM (daytime average)	135	85

SBP: Systolic Blood Pressure; **DBP:** Diastolic Blood Pressure

and patients on antihypertensive therapy, the BP should be measured in both, supine/sitting and in standing positions to detect postural hypotension.

- If atrial fibrillation is present, additional readings may be required to estimate the average SBP and DBP.
- Occasionally, thigh BP (popliteal) has to be measured with appropriately large cuff, in prone position especially in younger persons with hypertension. Normally thigh SBP is higher and DBP a little lower than the arm BP because of the reflected pulse wave. This is important for suspected coarctation and nonspecific aortoarteritis, where BP is lower in the lower limb as compared to the upper limb.

Mercury Manometer as per Recent Guidelines on Environment

In hospitals, mercury sphygmomanometers are usually the equipment that contain largest amount of mercury (70 to 90 grams of mercury).²⁸ Mercury is a potent neurotoxin, a global priority pollutant and a persistent bio-accumulative. Humans are exposed to methylmercury almost entirely by eating contaminated fish, seafood and wildlife that are at the top of the aquatic food chain.

Health Care Without Harm (HCWH) and the WHO are together leading a global partnership to achieve virtual elimination of mercury-based thermometers and sphygmomanometers over the next decade and their substitution with accurate, economically viable alternatives. This will entail availability of accurate meters for widespread use. This initiative is based on the 2005 WHO Policy Paper, which has set the objective to phase out the demand for mercury-containing fever thermometers and sphygmomanometers by at least 70% by year 2017.

It is recommended that Physicians should gradually look at phasing out the mercury sphygmomanometers and replace these with aneroid and digital meters to be used with stethoscope. Some mercury sphygmomanometers can be kept only for the purpose of calibration.

The other modalities of home BP measurement and ambulatory BP measurement are being recommended by some bodies (NICE guidelines 2011)²⁹ for diagnosis and definition of hypertension. We feel that with the availability of better automatic home BP monitoring devices, these should be now used increasingly for follow-up of therapy. We may not yet use this for the diagnosis of hypertension.

Home Blood Pressure Measurement

Measurement of blood pressure outside the clinic may provide valuable information for the initial evaluation of patients with hypertension and for monitoring the response to treatment. Home measurement has the advantage that it distinguishes sustained hypertension from "white-coat hypertension", a condition noted in patients whose blood pressure is elevated in the physician's clinic but normal at other times. For home blood pressure, readings of more than 135/85 mm Hg should be considered elevated.

As a change from our second guidelines, we recognize newer data that has emerged indicating that home monitoring of blood pressure (BP) improves compliance and ensures better BP control. We now recommend the use of this modality after proper

patient education regarding its usage and with good quality electronic sphygmomanometers which are periodically checked.

Finger and wrist monitors are inaccurate and are not recommended. The patient should be educated not to change medication without consulting their physician.

Ambulatory Blood Pressure Monitoring

It has been found that at least 20-25% of patients diagnosed with stage I-II hypertension (DBP 90-104 mm Hg) are normotensive outside the physician's clinic. Ambulatory blood pressure monitoring (ABPM) has been found to be clinically useful only in the following settings: to identify non-dippers and white-coat hypertension, evaluate drug resistant hypertension, episodic hypertension, evaluate antihypertensive drugs and in individuals with hypotensive episodes while on antihypertensive medication. However, this procedure should not be used indiscriminately in the routine work-up of a hypertensive patient because of its high cost.

When using ABPM to confirm a diagnosis of hypertension, ensure that at least two measurements per hour are taken during the person's usual waking hours (for example, between 08:00 and 22:00). Use the average value of at least 14 measurements taken during the person's usual waking hours to confirm a diagnosis of hypertension.²⁹

BP has a reproducible circadian profile with higher values while awake and mentally and physically active, whereas, much

lower values during rest and sleep. Different values have been suggested for definition of hypertension with ABPM for day time average BP (>140/90 mm Hg) and the night-time average (>125/75 mm Hg). Early morning surge in BP for 3 or more hours during transition from sleep to wakefulness, can be an independent risk factor and needs to be managed effectively²² by addition of a second dose in the evening or a dose of a second class of antihypertensive agent in the evening or a drug with a long half-life.

Pulse Pressure³⁰

The Pulse Pressure (SBP-DBP) depends upon factors like arterial stiffness (the cushioning capacity of arteries) and wave reflections - speed of the forward wave (pulse wave velocity of PWV).

MBP is the pressure for the steady flow of blood to peripheral tissues. PP is the consequence of intermittent ventricular ejection from the heart and is influenced by left ventricular ejection fraction and large conduit arteries, mainly the aorta. Factors like arterial stiffness (the cushioning capacity of arteries) and wave reflections - speed of the forward wave (pulse wave velocity or PWV) are also major determinants of PP. In subjects >50 years of age the arterial stiffness and wave reflections become the main determinants of increased SBP and PP.

Novel methods of monitoring central aortic pressure are being developed. Novel therapeutic approaches available to reduce PP and arterial stiffness with age are ACEI or ARBs in association with diuretics.