

How To Measure Blood Pressure

Blood pressure represents the force (pressure) exerted by blood against the arterial walls during a cardiac cycle. Systolic pressure, the higher of the two blood pressure measurements, occurs during ventricular contraction (systole) as the heart propels 70 to 100 mL of blood into the aorta. After systole, the ventricles relax (diastole), the arteries recoil, and arterial pressure continually declines as blood flows into the periphery and the heart refills with blood. The lowest pressure reached during ventricular relaxation represents diastolic pressure. Normal systolic blood pressure in an adult varies between 110 and 140 mm Hg; normal diastolic pressure varies between 60 and 90 mm Hg. Elevated systolic or diastolic blood pressure (termed hypertension) is defined as a resting systolic blood pressure that exceeds 140 mm Hg and a diastolic pressure that exceeds 90 mm Hg. Pulse pressure reflects the difference between systolic and diastolic pressures.

Measurement Procedures

Blood pressure, measured indirectly by auscultation (listening to sounds; described in 1902 by Russian physician N.S. Korotkoff; 1874-1920), uses a stethoscope and sphygmomanometer. The latter includes a blood pressure cuff and aneroid or mercury column pressure gauge.

1. Subject, seated in a quiet room, exposes upper arm.
2. Subject bends left arm (closest to heart) to bring the elbow to heart level, palm facing up.
3. Locate the brachial artery at the inner side of the upper arm, approximately 1 inch above the bend in the elbow.
4. Take the free end of the cuff and gently slide it through the metal loop (or wrap over exposed Velcro) and flap it back over so the cuff wraps around the upper arm at heart level. Align the arrows on the cuff with the brachial artery. Secure the Velcro parts of the cuff. The sphygmomanometer cuff should fit snugly (but not tight) to obtain accurate readings. Use appropriate sized cuffs for children and the overfat.
5. Place the stethoscope bell below the antecubital space over the brachial artery.

6. The cuff should now have the connecting tube (from the sphygmomanometer bulb and gauge) exiting the cuff towards the arm.
7. Before inflating the cuff, close the air release switch (turn the knob clockwise).
8. Inflate the cuff with quick, even pumps to about 180 mm Hg.
9. Gradually release the cuff pressure (about 3 mm per s) by slowly opening the air release knob (counter-clockwise turn), noting the first sound. This sound results from turbulence from the rush of blood as the artery briefly opens during the highest pressure in the cardiac cycle. This represents systolic blood pressure.
10. Continue to reduce pressure, noting when the sound becomes muffled (4th phase diastolic pressure) and when the sound disappears (5th phase diastolic pressure). Sometimes the 4th sound is used as an indicator of exercise diastolic pressure and the 5th sound as the resting diastolic pressure.
11. If the measured pressure exceeds 140/90 mm Hg, allow a 10-minute rest and repeat the procedure.

Keywords and Concepts

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| 1. Blood pressure | 8. Auscultation |
| 2. Systolic pressure | 9. Korotkoff sounds |
| 3. Diastolic pressure | 10. Sphygmomanometer |
| 4. 110 and 140 mm Hg | 11. Brachial artery |
| 5. 60 and 90 mm Hg | 12. 4th phase diastolic pressure |
| 6. Hypertension | 13. 5th phase diastolic pressure |
| 7. Pulse pressure | |

References

1. National Institutes of Health. The Sixth Report of the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure. NIH Pub. NO. 98-4080, 1997.
2. McArdle, WD., Katch FI., and Katch VL. 2001 Exercise Physiology: Energy Nutrition and Human Performance. Fifth Edition. Lippincott Williams & Wilkins, Baltimore, MD.
3. World Hypertension League. <<http://www.mco.edu/org/whl/>>

Table 1. Blood pressure classifications and recommended follow-up of initial screening blood pressure in adults*.			
Systolic (mm Hg)	Diastolic (mm Hg)	Category	Follow-up
<120	<80	Optimal	None
<130	<85	Normal	Recheck in 2 y
130-139	85-89	High normal	Recheck in 1 y
140-159	90-99	Mild (Stage 1) hypertension	Confirm within 2 mo
160-179	100-109	Moderate (Stage 2) hypertension	Begin treatment within 1 mo if BP is consistently high
180-209	110-119	Severe (Stage 3) hypertension	Begin treatment within 1 wk
>210	120	Very severe (Stage 4) hypertension	Treat immediately

* Not taking antihypertensive drugs and not acutely ill. When systolic and diastolic BP categories vary, the higher reading determines the BP classification; For example, a reading of 152/85 mm Hg is classified as Stage I Hypertension.
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