

Measurement of blood pressure

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Submitted Dec 11, 2016. Accepted for publication Dec 13, 2016.

doi: [10.21037/atm.2017.01.09](https://doi.org/10.21037/atm.2017.01.09)

View this article at: <http://dx.doi.org/10.21037/atm.2017.01.09>

Hypertension is a major risk factor for cardiovascular events and mortality (1-4). Hypertension occurs in 69% of individuals with first myocardial infarction (5), 77% of individuals with first stroke (5), 74% of individuals with heart failure (5), and 60% of individuals with peripheral arterial disease (6). Hypertension has been diagnosed if the systolic blood pressure is 140 mmHg or higher or if the diastolic blood pressure is 90 mmHg or higher (1-4). However, on the basis of data from the Systolic Blood Pressure Intervention Trial (SPRINT) (7,8) and a meta-analysis of prospective studies showing the impact of baseline prehypertension on cardiovascular events and all-cause mortality in the general population (9), this author considers hypertension to be either a systolic blood pressure of 130 mmHg or higher or a diastolic blood pressure of 80 mmHg or higher.

Pseudohypertension is a falsely increased systolic blood pressure caused by markedly atherosclerotic arteries which do not collapse during inflation of the blood pressure cuff (2,10). Pseudohypertension should be suspected in older persons with refractory hypertension, no target organ damage or cardiovascular disease, and symptoms of overmedication (2). Diagnosis of pseudohypertension should be confirmed by direct intra-arterial measurement of blood pressure (11).

White coat hypertension is diagnosed if a patient not receiving antihypertensive medication has a persistently high office blood pressure with a normal; ambulatory blood pressure or home blood pressure (1-3,12). Masked hypertension is diagnosed if the patient has a normal office blood pressure measurement but increased ambulatory blood pressure monitoring or home blood pressure measurements that are consistently increased (13).

Measurement of blood pressure is very important in the diagnosis and treatment of hypertension. This editorial will

discuss the appropriate measurement of blood pressure.

Hypertension is diagnosed if the blood pressure is elevated on at least three different blood pressure measurements taken on two or more office visits (1,2). The blood pressure should be taken after the patient is sitting comfortably for at least 5 minutes, with the back supported, feet on the floor, arm supported in the horizontal position on a desk or table, with the middle of the blood pressure cuff on the patient's upper arm at the level of the right atrium (the midpoint of the sternum) (2,14). The correct blood pressure cuff size should be used so that the bladder encircles at least 80% of the upper arm circumference (2). The blood pressure device should be validated periodically. If the blood pressure is being taken with a mercury sphygmomanometer, the cuff pressure should be deflated 2 mmHg per second with the systolic blood pressure recorded at the onset of the first Korotkoff sound and the diastolic blood pressure recorded when all Korotkoff sounds disappear. For manual determination of blood pressure, estimate the systolic blood pressure when the radial pulse is obliterated and inflate the cuff 20 to 30 mmHg above this level for an auscultatory measurement of the blood pressure.

The patient must avoid smoking, drinking a caffeine beverage, and exercising for at least 30 minutes before the blood pressure is measured. The patient should empty his or her urinary bladder before the blood pressure is measured. Neither the patient nor the person measuring the blood pressure should talk during the procedure. All clothing covering the location of cuff placement should be removed.

The blood pressure also should be measured with the person standing for 1 to 3 minutes to evaluate for postural hypotension or hypertension (2,15,16). Older patients should also be evaluated for postprandial hypotension,

which is especially common in frail older patients taking multiple antihypertensive and psychotropic drugs (2,17). During the initial blood pressure visit, the blood pressure should be measured in both arms with the arm with the highest blood pressure used for future monitoring of the blood pressure (2,18).

Measurement of blood pressure by use of a mercury sphygmomanometer has given way to use of oscillometric devices which use a sensor to detect oscillations in pulsatile blood volume during cuff inflation and deflation. Blood pressure is indirectly calculated from maximum amplitude algorithms using population-based data. Only automated devices with a validated measurement protocol should be used. The SPRINT trial measured blood pressure during office visits with the patient sitting in a quiet room after 5 minutes of quiet rest with the use of an automated blood pressure measurement system (Model 907, Omron Healthcare) (7,8). No other person was in the room during blood pressure measurement to avoid the white coat effect. Dose adjustment of medications was based on a mean of three blood pressure measurements. This method of blood pressure measurement is the most accurate.

Self-monitoring of blood pressure at home is very helpful in the diagnosis and management of hypertension (2,19,20). At 1-year follow-up of 450 patients with hypertension at high risk of cardiovascular disease, compared with a control group, self-monitoring of blood pressure with self-titration of antihypertensive medication reduced the blood pressure 8.8/3.1 mmHg (19).

Ambulatory blood pressure monitoring is a better predictor of cardiovascular risk than office blood pressure measurements (2,21-23). A meta-analysis of 7,030 persons in four populations showed at a median of 9.5 years of follow-up that 10 to 20 hours of daytime ambulatory blood pressure monitoring predicted cardiovascular events better than conventional blood pressure monitoring (22). Cardiovascular risk increased from a normal blood pressure over white coat and masked hypertension to sustained hypertension (22). A meta-analysis of nine cohorts including 13,844 patients with hypertension showed that 9-time systolic blood pressure independently predicted cardiovascular events better than clinic systolic blood pressure and daytime systolic blood pressure (23).

The 2016 Canadian Hypertension Education Program Guideline from Hypertension Canada recommends the use of unattended automated office blood pressure measurements with a 5-minute rest period as performed in the SPRINT trial (7,8) in addition to home blood

pressure measurement and ambulatory blood pressure measurement (24,25). This author concurs with this recommendation.

Acknowledgements

None.

Footnote

Conflicts of Interest: The author has no conflicts of interest to declare.

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Cite this article as: Aronow WS. Measurement of blood pressure. *Ann Transl Med* 2017;5(3):49. doi: 10.21037/atm.2017.01.09