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Diagnosing hypertension

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Abstract: As the most common long-term condition in most developed health-care systems and a major risk factor for premature death and major cardiovascular disease events, hypertension remains one of the world's most important risk factors for preventable disease. Its early and accurate diagnosis is therefore important. Recent guideline updates have reinforced the importance of repeated blood pressure readings to accurately diagnose hypertension, upgrading recommendations that ambulatory or repeated home-based blood pressure assessments are more reliable in diagnosing hypertension (and correlate better with clinical outcomes). European guidelines have maintained the diagnostic threshold for Stage 1 hypertension at levels above 140 systolic and 100 diastolic, but this differs from US guidelines that consider this threshold as Stage 2 hypertension. There is no reliable evidence, however, that patients would benefit from current therapies with these lower US thresholds. ■ *Heart Metab*. 2019;79:10-14

Keywords: ABPM; blood pressure threshold; diagnosis; HBP; hypertension

Background

Hypertension is the commonest long-term condition in most global adult populations, affecting up to 13% of the population,[1] and is a major preventable cause of cardiovascular disease (CVD), all-cause death, and premature death. According to WHO Global Burden of disease estimates, hypertension is far and away the most important of all known global disease risk factors in terms of death and morbidity secondary to vascular events such as stroke and heart attack.[2] Hypertension is therefore a major preventable cause of cardiovascular disease (CVD) and premature death on a global scale.

There is a long-standing and considerable evidence base showing that lowering blood pressure (BP) can substantially reduce premature morbidity and mortality.[3,4] However, despite these important outcome data, BP control rates are poor worldwide. Only about 40% of patients with hypertension are treated, and of these only about 35% achieve BP <140/90 mm Hg.[5] This poor treatment rate may be partly related to inadequate or delayed recognition of hypertension. Accurate and early diagnosis of hypertension is therefore a priority for health care internationally.

Specialist guideline recommendations for the diagnosis of hypertension

International hypertension guidelines, such as the joint ones from the European Society of Hypertension and European Society of Cardiology (ESH/ESC), have in the past advised that screening and diagnosis of hypertension was predominantly based on office blood pressure (BP), measured at least twice and on at least two visits. The process for conducting office BP measurement is shown in *Table I*. The recommendations are more conservative than the main US Hypertension Guidelines,[6] which use lower BP thresholds to diagnose hypertension and recommend more intensive treatment regimes.

Since 2013,[7] the ESC guidelines have added that out-of-office BP measurement is also considered useful, to confirm diagnosis or identify the type of

Patients should be seated comfortably in a quiet environment for 5 minutes before beginning BP measurements.
Take at least three BP measurements, 1–2 minutes apart, and take additional measurements if the first two readings differ by >10 mm Hg. BP is recorded as the average of the last two BP readings
Measurements of BP should be repeated in patients with arrhythmias, such as AF
Use a standard bladder cuff (12–13 cm wide and 35 cm long) for most patients, but have larger and smaller cuffs available for larger (arm circumference >32 cm) and thinner arms, respectively
The cuff should be positioned level with the heart
When using auscultatory methods, use phase I and V (disappearance) Korotkoff sounds to identify systolic and DBP, respectively
Measure BP in both arms at the first visit to detect possible between-arm differences. Use the arm with the higher value as the reference
Measure BP 1 minute and 3 minutes after standing in all patients at the first measurement, and in all subsequent visits in the elderly, patients with diabetes, and in those with other conditions in which orthostatic hypotension may frequently occur
Record heart rate and use pulse palpation to exclude arrhythmia

Table I *Processes for office BP measurement.*
AF, atrial fibrillation; BP, blood pressure; DBP, diastolic blood pressure

hypertension, detect hypotensive episodes, and to maximize prediction of CV risk.[6] Importantly, some types of elevated blood pressure, such as white-coat hypertension, can only be identified if out-of-office BP is measured.

In the 2018 ESH/ESC hypertension guideline,[2] whilst diagnosis for many health settings can remain based on office BP, recommendations include a wider use of out-of-office BP measurement, performed with ambulatory blood pressure measurement (ABPM) or repeated home blood pressure measurement (HBPM) to confirm the diagnosis, detect white-coat or masked hypertension, and monitor BP control.

Challenges in accurate BP measurement

The upgraded guideline recommendations regarding out-of-office measurements has stemmed from better recognition that routine BP measurement is often unreliable. BP varies throughout the day and between seasons.[8] Other factors affecting BP measurement[9] are common and include: talking, which can increase SBP by 17 mm Hg and DBP by 6 mm Hg; exposure to acute cold, which can induce increases of about 11 and 8 mm Hg, respectively; and acute ingestion of alcohol, which can result in 8 and 7 mm Hg higher SBP and DBP, respectively, lasting for about 3 hours.

Using the wrong cuff size has a similar magnitude of effect, and other suboptimal techniques affect the BP readout to a lesser extent. An expectation bias of the measurer has also been documented, where BP values are rounded to the nearest 5 or 10 mm Hg value.[9] Blood pressure is also lower when a nurse measures it, as opposed to a doctor. While this difference has been described to be 7 mm Hg on average,[10] there aren't different BP targets depending on who performs the BP measurement.

BP measurement methods also vary substantially in clinical practice. A UK-based study, testing how BP was measured in routine practice via an online survey among UK charities and patient groups,[11] showed that initial BP was significantly lower in respondents in whom BP was measured once, as compared with two or three measurements. This may suggest that where the BP is measured as normal on the first reading, GPs may accept this without remeasurement and record the initial reading in the health record. When more measurements are done, BP tends to come down with subsequent readings.[11] It is probable that the last or lowest reading is recorded. It may be that routinely collected BP data that are used for development of risk calculators are on the low side.

White-coat and masked hypertension

White-coat hypertension is diagnosed when BP is normal on ABPM and high on clinic measurements. Cardiovascular risk in individuals with white-coat hypertension is similar to that of normotensive patients, even though those with white-coat hypertension may have between 5 and 10 mm Hg higher SBP on office readings than a normotensive population. While individuals with white-coat hypertension may still be in the normal range, they should be followed up, because they are more likely to develop hypertension over time. When a person with previous white-coat hypertension goes on to develop hypertension, it is important to treat them based on home readings to avoid overtreatment.

When BP is normal in the clinic but elevated on ABPM, people are considered to have masked hypertension. Masked hypertension is associated with a doubled CV risk compared with normotensive patients.[12]

Heart Metab. 2019;79:10-14

Category	Systolic (mm Hg)		Diastolic (mm Hg)
Optimal	<120	and	<80
Normal	120–129	and/or	80–84
High normal	130–139	and/or	85–89
Grade 1 hypertension	140–159	and/or	90–99
Grade 2 hypertension	160–179	and/or	100–109
Grade 3 hypertension	≥180	and/or	≥110
Isolated systolic hypertension[2]	≥140	and	<90

Table II *Classification of office BP1 and definitions for hypertension grading. [1]BP category defined on seated clinic BP and by highest level of BP, whether systolic or diastolic. Isolated systolic hypertension is graded 1-3 according to SBP values in the ranges indicated.*
BP, blood pressure; SBP, systolic blood pressure

Blood pressure thresholds for diagnosing hypertension

When using office measurement (*Table I*), the blood pressures that determine whether hypertension is present, and its staging, are shown in *Table II*.

ABPM is usually programmed to record BP at 20- to 30-minute intervals, and average BP values are usually provided for daytime, night-time, and 24 hours. ABPM offers additional information over HPBM, for instance night vs daytime blood pressure (to detect "nondipping" blood pressure at night, which has a particularly poor prognosis), and it correlates best with long-term outcomes such as end-organ damage[12] and stroke,[13] compared with other methods.

ABPM also allows identification of white-coat hypertension and masked hypertension. ABPM BP values are usually lower than office BP values, and the diagnostic threshold for hypertension is ≥130/80 mm Hg over 24 hours, or 135/85 mm Hg for the daytime average (both equivalent to office BP ≥140/90 mm Hg), *Table III*.

Category	Systolic BP (mm Hg)		Diastolic BP (mm Hg)
Office BP	≥140	and/or	≥90
Ambulatory BP			
Daytime (or awake)	≥135	and/or	≥85
Night-time (or asleep)	≥120	and/or	≥70
24-hour	≥130	and/or	≥80
Home BP	≥135	and/or	≥85

Table III *Hypertension diagnostic thresholds for office, ambulatory, and home BP levels.*
BP, blood pressure

A systematic review and meta-analysis that compared the relative accuracy of clinic measurements and HBPM, with ABPM as a reference standard, concluded that neither clinic nor home measurement had sufficient sensitivity or specificity to be recommended as a single diagnostic test. About 25% of patients are misdiagnosed if only clinic measurement is used. Treatment decisions based on clinic or home BP alone might result in substantial overdiagnosis, if ABPM is considered a reference standard.

Performing ABPM before the start of lifelong drug treatment might therefore lead to more appropriate targeting of treatment.[14] A modeling study, assessing cost-effectiveness of further measurement in the clinic, HBPM and ABPM after an initial raised reading in the clinic in a primary care population aged 40 years or older, showed that ABPM is the most cost-effective diagnostic strategy for hypertension in men and women of all ages. Savings from better-targeted therapy counterbalanced the additional costs associated with ABPM. [15]

Finally, in relation to diagnosis, there is a strong argument that health systems need to screen populations for hypertension since it is common, important, and usually asymptomatic. Indeed, when structured population screening programmes have been undertaken, a majority of people (>50%) were unaware of their hypertension.[16,17] However, the best method of screening is not determined, and when to start and repeat case-finding varies by country. Most guidelines therefore simply recommend opportunistic case-finding or screening from age 35 or 40 onwards.

Clinical evaluation after diagnosing hypertension and assessment of target-organ damage

Once hypertension is diagnosed a number of tests and examinations should be performed to: establish hypertension grading; screen for potential secondary causes of hypertension: identify contributing factors to the development of hypertension (lifestyle, concomitant medications, or family history); identify additional cardiovascular risk factors (including lifestyle and family history); identify comorbidities; and establish target end-organ damage (TOD) and any existing cardiovascular, cerebrovascular, or renal disease.

Medical history

A medical history should address in particular: time of the first diagnosis of hypertension, including records of any previous medical screening; hospitalization; records of current and past BP values; records of antihypertensive and other medications; family history of hypertension, cardiovascular disease, stroke, or renal disease; a lifestyle evaluation, including exercise levels, body weight changes, diet history, smoking history, alcohol; and history of any other cardiovascular risk factors.

Clinical examination

Physical examination may establish potential secondary causes of hypertension, signs of comorbidities, and TOD. Patients should undergo auscultation of the heart, carotid and renal arteries, and vascular system to detect murmurs or bruits which need further investigation. Peripheral arteries should be palpated. Height and body weight should be measured and body mass index (BMI) calculated. Funduscopy should be performed to detect hypertensive retinopathy. Urine should be tested for hematuria and proteinuria. The routine blood tests and clinical investigations are listed in *Table IV*. The main investigation is the electrocardiograph, particularly to exclude left ventricular hypertrophy, past myocardial infarction or arrhythmias.

Summary

Hypertension is the world's most common long-term condition and one of the most important risk factors for coronary heart disease, stroke, and renal failure.

Routine clinical assessments
Hemoglobin and/or hematocrit
Blood glucose and glycated HbA_{1c}
Blood lipids: total cholesterol, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, triglycerides
Liver function tests
Blood potassium, sodium, creatinine, and eGFR
Blood uric acid
Urine analysis: microscopic examination; urinary protein by dipstick test and albumin:creatinine ratio if dipstick positive
12-lead ECG

Table IV *Routine clinical assessments for evaluation of hypertensive patients.*
ECG, electrocardiogram; eGFR, estimated glomerular filtration rate; HbA_{1c}, hemoglobin A_{1c}

There is a huge evidence base to guide therapy but early and accurate diagnosis of hypertension is needed first. Guidelines are now more consistent on the blood pressure cutoff criteria to determine hypertension and principally recommend out-of-office measurement before confirming a diagnosis. ■

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