

First things first: Accurate blood pressure (BP) measurement for hypertension diagnosis and management

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Conventional office BP measurement

In the last 100 years the evolution of clinical hypertension has been an excellent model for evidence-based medicine. Sixty-one prospective observational outcome studies including one million adults with 12.7 million person-years at risk and 56,000 cardiovascular deaths during follow-up have shown that BP is strongly and directly related to cardiovascular and total mortality. More importantly, 122 interventional randomized outcome trials, in which 350,000 subjects participated, demonstrated the benefits of drug-induced BP lowering in reducing the risk of fatal and nonfatal cardiovascular events. This enormous database of mega-trials, on which the current management of hypertension is based, has been almost exclusively derived from conventional upper-arm cuff-based office BP measurements, initially using manual auscultatory devices and more recently using automated oscillometric ones.

Despite the indisputable value of the conventional office BP measurement in defining and managing hypertension worldwide, this method has major deficiencies which seriously undermine the accurate BP measurement and the reliable diagnosis of hypertension. These shortcomings are mainly related to (i) unstandardized methodology (rest period, posture, talking, number of measurements) resulting in poor reproducibility of office BP, (ii) observer error and bias with the auscultatory method, and (iv) the white-coat and masked hypertension phenomena which are common in both untreated and treated individuals.

Out-of-office BP measurement

Out-of-office BP evaluation using 24-hour ambulatory or self-home BP monitoring (i) provides multiple measurements in the usual environment of each individual, (ii) avoids the white-coat and masked hypertension phenomena, (iii) is more reproducible and (iv) more closely related to cardiovascular risk than the office measurements. Current guidelines on both sides of the Atlantic recommend treatment decisions in hypertension to be based on out-of-office BP measurements in most untreated and treated hypertensives.

Automated attended and unattended office BP

The development of automated oscillometric BP monitors has been essential for ambulatory and home BP monitoring and is being increasingly used for office measurement. Automated office BP avoids the observer-related issues and requires less training than the auscultatory measurement. Unattended automated office BP (several measurements taken automatically while the patient remains alone in the examination room) is the most standardized office BP measurement method, as it avoids the observer issues and talking during measurements and ensures triplicate (usually) measurements. However, a special device and additional space and time is required, and the BP threshold for diagnosing hypertension is rather uncertain and lower than with the conventional office measurement.

Accuracy of automated BP monitors

The accuracy of automated BP monitors (for office, ambulatory or home use) needs to be verified using an established validation protocol. Moreover, an automated device which is accurate in adults may not be accurate in special populations (e.g. children and pregnancy). Unfortunately, only one in five of the BP monitors available on the market has proven accuracy. There are several on-going initiatives by scientific societies to inform doctors and patients by listing properly validated devices. The American Medical Association and the American Heart Association, as well as an international group of BP measurement experts (STRIDE-BP organization) are currently developing internet resources with accurate devices lists.

Conclusions

The accurate measurement of BP is essential for the diagnosis and management of hypertension. With recent hypertension guidelines recommending lower BP targets with treatment, the need for accurate BP evaluation has become even more important. The hierarchy of using the currently available BP measurement methods is presented in the table. Out-of-office BP measurement (ambulatory or home) should be the basis for hypertension diagnosis and management. Office BP measurement should be used as a screening test in most cases. International initiatives are urgently needed to optimize office, home and ambulatory BP measurement in clinical practice.

References

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	Method	Advantages	Limitations	Threshold (mmHg)	Clinical Utility
1	24-hour ambulatory BP	<ul style="list-style-type: none"> • Prognostic ability superior to office BP • More reproducible than office BP • Night-time BP sleep evaluation 	<ul style="list-style-type: none"> • Limited availability in primary care • High cost of devices • Intolerable by some patients particularly for repeated use 	130/80	<ul style="list-style-type: none"> • Recommended method for treatment decisions (preferred for diagnosis) [#]
2	Self-home BP	<ul style="list-style-type: none"> • Prognostic ability superior to office BP • More reproducible than office BP • Wide availability • Preferred by patients • Improves compliance with treatment - hypertension control 	<ul style="list-style-type: none"> • Many devices not validated for accuracy • Possible misreporting of BP readings by patients (avoided with automated memory, or mobile/PC link) • Some patients self-modify treatment 	135/85	<ul style="list-style-type: none"> • Recommended method for treatment decisions (preferred for long-term follow-up) [#]
3	Automated unattended office BP	<ul style="list-style-type: none"> • Most standardized office BP • Avoids several issues of office BP 	<ul style="list-style-type: none"> • Requires special device and additional space and time • Uncertain BP threshold 	135/85 (?)	<ul style="list-style-type: none"> • Probably the best screening method [*]
4	Automated attended office BP	<ul style="list-style-type: none"> • Strong prognostic data • Avoids most observer-related issues 	<ul style="list-style-type: none"> • Usually inadequately standardized 	140/90	<ul style="list-style-type: none"> • Most applicable screening method for wide use [*]
5	Auscultatory office BP	<ul style="list-style-type: none"> • Strong prognostic data • Wide availability • Low-cost devices 	<ul style="list-style-type: none"> • Poorly standardized and subject to observer error and bias 	Higher than 140/90	<ul style="list-style-type: none"> • Screening method when automated devices are not available or have questionable accuracy [*]
6	Pharmacy BP	<ul style="list-style-type: none"> • Access to treated and undiagnosed hypertensives. • Useful in collaborative approaches aiming to improve BP control 	<ul style="list-style-type: none"> • Poorly standardized • Limited evidence on threshold values, reproducibility and clinical relevance 	135/85 (?)	<ul style="list-style-type: none"> • Low cost screening method • Monitoring of BP control in treated hypertensives [*]
7	Public space kiosk BP	<ul style="list-style-type: none"> • Access to undiagnosed hypertensives 	<ul style="list-style-type: none"> • No evidence on threshold values, reproducibility and clinical relevance 	?	<ul style="list-style-type: none"> • Low cost massive screening in general population [*]

[#] Ideally perform both home and ambulatory BP monitoring as these methods are complementary and their reproducibility is imperfect.

^{*} Requires confirmation by out-of-office BP measurement (ambulatory or home).