Automated office blood pressure measurement for routine clinical practice

Good correlation with out-of-office readings, virtual elimination of white-coat effect

Martin G Myers
MD, FRCPC, Cardiologist[1]

Mark R Nelson
MB BS(Hons), PhD, FRACGP, Senior Member, Menzies Research Institute Tasmania, and Chair of General Practice[2]

Geoffrey A Head
BSc(Hons), PhD, NHMRC Principal Research Fellow[3]

1 Schulich Heart Program, Sunnybrook Health Sciences Centre, Toronto, Ontario, Canada.
2 University of Tasmania, Hobart, TAS.
3 Neuropharmacology Laboratory, Baker IDI Heart and Diabetes Institute, Melbourne, VIC.

martin.myers@sunnybrook.ca

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An accurate blood pressure (BP) reading can be obtained if measurement guidelines are followed properly. However, BP readings recorded in routine clinical practice are often inaccurate and much higher than mean awake ambulatory BP values and readings obtained by home measurement. In studies that have included data on office BP readings that were recorded manually in routine clinical practice (ie, not in the context of a research study),[1,2] mean office BP readings are about 10/5 mmHg higher than mean awake ambulatory BP values and home BP readings. Several factors contribute to the poor quality of manually recorded office readings, including the anxiety patients experience in the doctor's office, poor measurement technique and patient–observer interaction. The development of a new class of automated sphygmomanometers has made it possible to eliminate many of these factors, with the result being more accurate office BP measurement that is less subject to white-coat effect (office-induced hypertension).

Automated office BP measurement has three basic principles: multiple BP readings are taken; a fully automated device is used; and measurements are taken while the patient rests quietly alone. Several independently validated, oscillometric devices are available for automated office BP measurement, including the BpTRU (BpTRU Medical Devices), Omron HEM-907 (OMRON) and WatchBP Office (Microlife). These sphygmomanometers can record an initial test reading followed by several readings over a period of 5 minutes or less. After being displayed, the test reading is discarded (automatically by the BpTRU and manually with the other devices); subsequent readings are then taken automatically, and the mean of the subsequent readings is shown as the result.

Advantages of automated office BP measurement

The main advantage of automated office BP measurement over manual measurement in routine clinical practice is that the white-coat effect is virtually eliminated. In studies that have compared automated office readings with mean awake ambulatory values, differences in mean systolic and diastolic BP have been in the range of 1–2 mmHg.[1,2] So the same cut-point for defining hypertension (135/85 mmHg) can be used for automated office, awake ambulatory and home BP readings.

Differences between systolic BP readings that are recorded manually and those that are recorded by automated office devices are generally in the range of 10–20 mmHg, depending on the setting and patient population.[1,2] Manual readings of BP in these studies were recorded by physicians and nurses in routine clinical practice. As a result, it was not possible to perform a separate analysis on the difference between manual and automated readings recorded by physicians versus nurses.

Treated and untreated patients who are suspected of having white-coat effect generally have a lower BP when measurements are taken according to the principles of automated office BP measurement.[1-4] The reasons appear to be simple: less patient anxiety in the absence of a health professional, no opportunity for conversation (which increases BP) and less observer error with the use of a validated, fully automated sphygmomanometer. Most studies of automated office BP measurement have taken BP readings while the patient is resting in an examining room, but preliminary data suggest that these measurements could be taken in areas such as waiting rooms, provided that the patient is kept apart from others.[5]

Automated office BP measurement has other advantages over routine manual measurement of BP.[1,2] It correlates significantly better with the awake ambulatory BP, which is a superior standard for defining a patient's BP status. Automated office BP also correlates better with target organ damage such as left ventricular mass and intima-media thickness of the carotid artery. Automated office readings tend to be consistent from visit to visit and are not affected by changes in the setting in which the BP is recorded, provided that the principles of automated office BP measurement are followed. Also, automated readings do not increase the prevalence of masked hypertension (ie, normal BP in the office and hypertension outside the office).

The benefits of automated office BP measurement in routine primary care practice were evaluated in a randomised controlled trial involving 555 patients in 67 practices.[6] Automated readings of BP were significantly lower than routine manual readings, and were more strongly correlated with awake ambulatory values than with routine manual readings. Automated measurement also reduced digit preference (rounding off BP readings to the nearest zero value) and improved the overall accuracy of office BP readings in routine primary care practice.

Automated office BP measurement and hypertension guidelines

In 2005, the Canadian Hypertension Society adopted an algorithm for the diagnosis of hypertension that included home BP readings and 24-hour ambulatory BP monitoring (ABPM). Five years later, automated office BP measurement was added to the guidelines and recommended as an alternative to manual office BP measurement.[7] In a recent study of 254 untreated patients who had ABPM for diagnosis of hypertension, overdiagnosis of hypertension

using routine manual BP measurement was reduced from 22% to 7% by automated office systolic BP measurement;[2] another study showed a similar reduction in 654 treated patients.[3] Based on these findings, a proposal has been made to add automated office BP measurement to the algorithm for diagnosing hypertension that is used in Canada, with automated office readings being complementary to home readings, and ABPM as the gold standard to be used when available. All three of these automated methods of BP measurement now have the same cut-point for defining hypertension, 135/85 mmHg.[1,2]

This approach should simplify the diagnosis of hypertension in contrast to manual BP measurement, which has a cut-point of 140/90 mmHg. As recommended in the Canadian guidelines,[7] a recent National Institute for Health and Clinical Excellence monograph on the management of hypertension[8] and a recent Australian consensus statement,[9] 24-hour ABPM is considered to be the gold standard for evaluating an individual's BP status in relation to the risk of experiencing a future cardiovascular event. Otherwise, automated office BP readings, home BP readings and ABPM can be considered complementary in the management of hypertension. If automated office and home BP readings are elevated, patients have a high likelihood of being hypertensive, whereas an optimum reading (< 130/80 mmHg) is likely to be associated with a normal awake ambulatory BP.[3] Readings on the border of normal and hypertensive values (120–139/80–89 mmHg) require further assessment with a combination of automated office and home BP readings or, if feasible, with 24-hour ABPM. Regardless of the method used to measure BP, global cardiovascular risk should be the basis for deciding on the need for antihypertensive therapy as it includes other factors such as age, sex, smoking status, dyslipidaemia, presence of target organ damage and coexisting diabetes mellitus. Indeed, lower targets for ABPM have recently been proposed for individuals who are at higher risk.[9]

Routine use of automated office BP measurement

The adoption of automated office BP measurement into routine clinical practice may raise concerns that extra time and additional facilities are required. In reality, there is no difference in the time taken for a manual BP reading and an automated office BP reading, because proper manual BP readings are recorded in duplicate and involve a 5-minute period of rest and several minutes to obtain the actual BP measurements. Given the time constraints associated with having only one examining room, physicians are more likely to record a single manual BP reading without any antecedent period of rest, which can result in overdiagnosis of hypertension. A better option would be to create a quiet space for automated office BP measurement where the patient can rest alone, such as a corner of a waiting area that can be partitioned off with a screen.

Over 10 000 BpTRU units are currently in use in clinical practice in Canada. In Australia, about 20 000 Omron HEM-907 automated sphygmomanometers were distributed by the High Blood Pressure Research Council of Australia (HBPRCA), mostly to physicians in general practice. The distribution was accompanied by an education program on the importance of measuring BP accurately. At the time, the Cluster Randomised Controlled Trial of an Automated Versus Manual Device for Blood Pressure Management, sponsored by the HBPRCA, was initiated to investigate the effect that use of these machines would have on BP management compared with the use of conventional mercury sphygmomanometers.[10] This study demonstrated improved BP management using the Omron HEM-907, although the measurement technique differed from the concept of automated office BP measurement in that the BP readings were not taken with the patient resting alone.

> "preliminary data suggest that these measurements could be taken in areas such as waiting rooms"

Conclusion

Automated office BP measurement reduces the effect of human and environmental factors on BP readings by recording multiple BP readings using a fully automated device with the patient resting alone, preferably in a quiet room. Although most research studies on the treatment of hypertension have used manual BP measurements, current guidelines favour ABPM and home BP readings over manual readings for the diagnosis and management of hypertension.[7-9] Automated office BP readings should provide a better assessment of a patient's BP status than manual office readings, with automated office readings being similar to the awake ambulatory BP values and home BP readings. More research on automated office BP measurement is required in different patient populations and under a variety of clinical conditions. In addition, cut-points for defining hypertension based on automated office BP need to be confirmed by long-term, clinical outcome studies.

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