FEATURE

Management of elevated BP: ambulatory versus office monitoring

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The management of elevated blood pressure is moving away from a doctor taking a single measurement during a consultation and managing hypertension based solely on this measurement. The increasing availability of oscillometric and ambulatory blood pressure machines and the promotion of an absolute risk-based approach will revolutionise how elevated blood pressure is measured and managed.

Key points

- **Mercury sphygmomanometers are being phased out.**
- **New oscillometric devices allow blood pressure to be more accurately measured within and outside the clinic.**
- **Elevated blood pressure is best diagnosed and managed according to ambulatory measures.**
- **When ambulatory oscillometric devices are unavailable, impractical or unaffordable, home and clinic measures using oscillometric devices or older calibrated devices following strict measurement protocols are valid alternatives.**

CARDIOLOGY TODAY 2012; 2(4): 8-12

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As the first cardiovascular disease risk factor to be recognised and treated with effective therapeutic interventions, hypertension has long been ingrained into general practice. The ritual of a GP measuring a patient's blood pressure with a mercury sphygmomanometer and stethoscope and then prescribing blood pressure-lowering medication if the value is above a cut-off point, indicating hypertension, has contributed to the significant decline in the incidence of heart attack and stroke since the 1960s. However, we can do better by our patients if we recognise that:

- the risk of cardiovascular disease increases as systolic blood pressure increases above 115 mmHg
- the risk of cardiovascular disease is better stratified by including all major risk factors and not just blood pressure alone
- the blood pressure measured by a doctor is subject to a number of biases

- the use of mercury sphygmomanometers is likely to be discontinued because of concerns about the manufacture and disposal of mercury (indeed this has already occurred in Europe)
- blood pressure measured by automated devices allows a better estimate to be made of a patient's everyday blood pressure and correlates better with the adverse cardiovascular events we are trying to prevent.

Measurement of blood pressure in the setting of absolute risk-based management

There has been some controversy about the need for new technologies for blood pressure measurement in the setting of an absolute risk-based approach.[1] The argument is that the increased accuracy of these measurements is not required because it contributes little to the risk classification of an individual and therefore to who receives medication. However, as new guidelines from the National Vascular Disease Prevention Alliance state, although the decision on who to medicate is based on absolute risk, the choice of intervention depends on the individual and his or her individual risk factors.[2,3] Therapy is directed at those risk factors that are considered most significant, with the aim of treating to target and therefore 'normalising' a patient's risk of cardiovascular disease.[4] To do this clinicians need to be able to assess response to therapy.

Measurement of blood pressure in the clinical setting

There is no doubt that blood pressure can be measured accurately using traditional mechanical devices if guideline methods are strictly followed. However, blood pressure measurements recorded in routine clinical practice are often inaccurate for several reasons relating to the doctor, patient and setting. These reasons include patient anxiety, poor measurement technique and the so-called 'white-coat' effect where a measurement made by a doctor is higher than that made by others. These can be addressed somewhat by practice nurses taking measurements, but new technology in the form of semi-automatic and automatic oscillometric devices make it possible to eliminate many of these factors resulting in more accurate clinic blood pressure measurement.

Oscillometric blood pressure devices

Most Australian doctors would have seen the new oscillometric devices as almost 20,000 of these devices were recently distributed by the High Blood Pressure Research Council of Australia. Initial research has indicated that the simple displacement of the old devices leads to superior blood pressure management.[5]

How do these oscillometric devices work? These monitors use cuff oscillometry and detect cuff pressure oscillations. They define the maximal oscillations as mean arterial blood pressure and then use an algorithm to calculate the systolic and diastolic blood pressures from this. However, this method cannot reliably estimate blood pressure when a significant irregular rhythm such as atrial fibrillation is present and the device will display an error message. Under these circumstances, the device is switched to manual and a stethoscope is used to measure blood pressure manually. Although home blood pressure monitoring and 24-hour ambulatory blood pressure monitoring are significantly better at predicting future cardiovascular events than clinic blood pressure measurements, they are not always feasible for diagnosing or following up patients at adverse cardiovascular risk or for routine screening. Therefore, clinic measurements will continue to have a role.

Depending on clinical circumstances the oscillometric devices can be used in the clinic in the following ways:

- by a doctor as a single measure during a consultation; this reduces

Indications for ambulatory blood pressure monitoring*

- Suspected white-coat hypertension (including in pregnancy)
- Suspected masked hypertension
- Suspected nocturnal hypertension or lack of night-time reduction in blood pressure (dipping)
- Hypertension despite appropriate treatment
- Patients with a high risk of future cardiovascular events
- Suspected episodic hypertension

It may also be useful for:

- Titrating antihypertensive therapy
- 'Borderline' hypertension
- Syncope or other symptoms suggesting orthostatic hypotension, where this cannot be demonstrated in the clinic
- Suspected or confirmed sleep apnoea
- Hypertension detected early in pregnancy

*Reproduced with permission from the *J Hypertens* 2012; 30: 253-266.[8]

observer bias – for example, the propensity to round off measures and record blood pressure below treatment thresholds

- by a doctor as a multiple measure during a consultation. The device can measure blood pressure multiple times at various timing settings; this reduces measurement error and promotes regression to the mean – that is, multiple averaged measures are more likely to represent the patient's true blood pressure mean than a single measure
- by a nurse face-to-face; this reduces the white-coat effect
- fitted by a nurse (or doctor) but operated with the patient isolated.

The techniques listed above do not include waiting room self-measures, which are becoming available with rigid cuffs or cuffs that are designed to be operated by an individual in isolation (see the section on Measurement of blood pressure away from the clinic below). The likelihood of measures determined by the above methods representing the true blood pressure increases down the list, so the final method listed of the device being fitted by a nurse or doctor but operated with the patient isolated will be discussed here.

Automated office blood pressure measurement

Automated office blood pressure is a new approach to measurement of blood pressure with three components:

- multiple readings
- taken using an automated oscillometric blood pressure machine
- with the patient resting alone in a quiet room.

Mean automated office blood pressure measures correlate better with home blood pressure and the intermediate measures of target organ damage and mean awake ambulatory blood pressure than do clinic measures, and almost eliminate the white-coat effect.[6]

This technique was pioneered by Professor Myers at the Sunnybrook Health Sciences Centre in Toronto, Canada, using a BpTRU device, but it can be applied in Australia using machines distributed by the High Blood Pressure Research Council of Australia, the OMRON HEM-907, remembering that this machine takes the average of all measures without discarding the first, which must be done manually.

The technique is probably most successful because it is associated with less patient anxiety in the absence of a healthcare professional, there is no opportunity for conversation (which increases blood pressure) and there is less observer error. It is also likely that automated office blood pressure measurement does not increase the prevalence of masked hypertension (the corollary of the white-coat effect where clinic measures are lower than blood pressure measures away from the clinic). It also correlates well with the awake ambulatory blood pressure measurement, which is particularly useful where ambulatory blood pressure devices are unavailable.[7]

How to take an automated office blood pressure measurement

The following instructions are for the OMRON HEM-907 distributed by the High Blood Pressure Research Council of Australia but can be adapted for other automatic devices.

- Sit the patient in a room by themselves; if a separate room is not available an option would be to use a corner of the waiting area that could be partitioned off with a screen.
- Attach an appropriately sized cuff to the patient's upper arm.
- Press the On/Off switch, and set the P-SET to AUTO and the MODE to AVG.
- Set the machine to three measures, the waiting time to five minutes and the measurement interval to three minutes. These are not the factory-set values so refer to the manual on how to change the setting (available online if misplaced).
- Leave the patient alone for 15 minutes; the blood pressure value displayed after this time is the average of all recordings.

Measurement of blood pressure away from the clinic

Twenty four-hour ambulatory blood pressure monitoring is considered to be the gold standard for evaluating an individual's blood pressure status in relation to the risk of experiencing a heart attack or stroke. Currently, it does not attract a Medicare rebate and availability in general practice is limited because of the cost of the units, with most on temporary loan from the pharmaceutical industry with variable maintenance and calibration regimens.

Ambulatory blood pressure monitoring

Ambulatory blood pressure monitoring involves measuring blood pressure at regular intervals (usually every 15 to 30 minutes during awake times and every 30 to 60 minutes when asleep) over a 24-hour period while patients undertake normal daily activities and sleep. Measurements are made by oscillometry as described. The device is portable and is worn on a belt connected to a standard cuff on the upper arm. It has a memory that permits data to be downloaded to a computer to produce a report on the average 24-hour, daytime

and night-time (asleep and awake) systolic and diastolic blood pressures and heart rate.

As with any method, a device is only as good as its operator so a strict regimen should be followed for accurate results. A correct cuff size is needed with a cuff bladder that is at least 80% of the circumference of the upper arm to which it is fitted. To obtain valid results at the time the ambulatory blood pressure monitoring device is fitted, at least three readings should be recorded simultaneously using a calibrated sphygmomanometer connected to the ambulatory blood pressure monitoring device by a Y-connector. These connectors were supplied with the OMRON HEM-907 devices distributed by the High Blood Pressure Research Council of Australia. Average differences between readings should be at most 5 mmHg. Blood pressure should be measured in both arms if this is the first recording. If systolic blood pressure difference between the arms is less than 10 mmHg then the nondominant arm is used, and if it is 10 mmHg or above then the arm with the higher blood pressure reading is used. Ambulatory blood pressure monitoring is indicated in the circumstances listed in the box on page 10.[8]

As for any oscillometric device, ambulatory blood pressure monitoring may not be accurate when there is an irregular heart rate or arrhythmia. Patients would benefit from being given written instructions. Patients should be made aware that the device will automatically inflate the cuff regularly over a 24-hour period and that they should continue with normal daily activities. If possible a work day should be chosen to take measurements rather than a rest day, but patients should avoid vigorous exercise and not interfere with or remove the device. Advise them to shower before the device is fitted and after it has been removed.

When interpreting the results remember that measurements obtained from ambulatory blood pressure monitoring must be interpreted with reference to the 'normal' ambulatory blood pressure values for nonpregnant adults, which are lower than equivalent clinic measures and are as follows:[9]

- 24-hour average less than 115/75 mmHg (hypertension threshold 130/80 mmHg)
- daytime (awake) less than 120/80 mmHg (hypertension threshold 135/85 mmHg)
- night-time (asleep) less than 105/65 mmHg (hypertension threshold 120/75 mmHg).

A patient's guide to measuring blood pressure at home

- Sit quietly for five minutes.
- Measure your blood pressure twice according to the instructions of the machine you have.
- Take the two measurements two minutes apart.
- Record the second measurement on a sheet of paper (if your machine does not have a memory or sufficient memory).
- Repeat measurements at both 8 am and 8 pm (or near to these times according to what is convenient for you).
- Take the measurements wherever you are; it does not have to be done at home, it can be anywhere but the surgery.
- Bring the sheet of paper with your results on or your machine to your next doctor's appointment.

Home blood pressure monitoring

Like ambulatory blood pressure monitoring, home blood pressure monitoring is a validated method for monitoring and managing a patient's blood pressure. With validated and peak body certified machines available to the public and reimbursable on some private insurance schemes, this is an excellent method to empower the patient to take charge of their own management. A simple way of doing this is to instruct your patients to follow the instructions in the box on this page and offer them a copy of the patient handout on page 13.

Home blood pressure monitoring again moves the clinician from interpreting and managing using a single measure to multiple measures that are far more likely to represent the patient's actual blood pressure. As for ambulatory blood pressure monitoring, the cut-off point is lower (135/85 mmHg); however, unlike ambulatory monitoring, home monitoring does not give you an average. A simple method without needing to enter data into a spreadsheet or calculator is to do a 'blood pressure load' – highlight each measurement above the cut-off point and divide by the total number of measurements. If the percentages of entries above the cut-off point is 20% or more then treatment modification needs to be considered.

Conclusion

New oscillometric blood pressure measurement machines allow the management of patients with elevated blood pressure to be improved through superior estimates of usual blood pressure both in the clinic and in the community. **CT**

References

1. Neal B, Irwig L. Not much need for ambulatory blood pressure monitoring. Med J Aust 2011; 195: 634-635.
2. National Vascular Disease Prevention Alliance. Guidelines for the assessment of absolute cardiovascular disease risk. Canberra: National Health and Medical Research Council; 2009. Available online at: http://www.heartfoundation.org.au/SiteCollectionDocuments/guidelines-Absolute-risk.pdf (accessed November 2012).
3. National Vascular Disease Prevention Alliance. Guidelines for the management of absolute cardiovascular disease risk. Canberra; National Health and Medical Research Council: 2012. Available online at: http://www.kidney.org.au/LinkClick.aspx?fileticket=A%2BRjUoFXdMg%3D&tabid=635&mid=1584 (accessed November 2012).
4. Head GA, McGrath BP, Nelson MR, Stowasser M. Importance of ambulatory blood pressure in hypertension management. Med J Aust 2012; 197: 143-144.
5. Nelson MR, Quinn S, Bowers-Ingram L, Nelson JM, Winzenberg T. Cluster randomized controlled trial of oscillometric vs. manual sphygmomanometer for blood pressure management in primary care (CRAB). Am J Hypertens 2009; 22: 598-603.
6. Myers MG, Nelson MR, Head GA. Automated office blood pressure measurement for routine clinical practice. Med J Aust 2012; 197: 372-373.
7. Godwin M, Birtwhistle R, Delva D, et al. Manual and automated office measurements in relation to awake ambulatory blood pressure monitoring. Fam Pract 2011; 28: 110-117.
8. Head GA, McGrath BP, Mihailidou AS, et al. Ambulatory blood pressure monitoring in Australia: 2011 consensus position statement. J Hypertens 2012; 30: 253-266.
9. Head GA, Mihailidou AS, Duggan KA, et al for the Ambulatory Blood Pressure Working Group of the High Blood Pressure Research Council of Australia. Relationship between ambulatory and clinic blood pressure: defining diagnostic points and treatment targets. BMJ 2010; 340: c1104.

COMPETING INTERESTS: None.