Blood pressure monitoring

Addressing the controversy about targets and methods

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Accurate blood pressure monitoring is essential to managing hypertension, but moving targets and the choice of different measurement methods complicate this area of care. Recent Australian hypertension guidelines have only added to contention.

Key points

- **Most patients diagnosed with hypertension are started on treatment by their GP.**
- **The main modalities available for diagnosing hypertension and monitoring its control are clinic blood pressure measurement, 24-hour ambulatory blood pressure monitoring and home blood pressure monitoring, each with their own benefits and limitations.**
- **An Australian consensus statement has recommended 24-hour ambulatory blood pressure and/or home blood pressure monitoring as tools for diagnosing hypertension if blood pressure measured in the clinic is more than 140/90 mmHg, as have the British Hypertension Society/NICE guidelines.**
- **Incorporating 24-hour ambulatory blood pressure monitoring and/or home-based blood pressure monitoring in a complementary fashion as dictated by individual situations may improve compliance, help achieve targets and more effectively empower patients.**
- **Target blood pressure levels are contentious and recommendations vary according to international guidelines.**
- **At present the recommendation set out by the National Heart Foundation of Australia is to aim for blood pressure targets of less than 140/90 mmHg for all patients, and even lower (systolic pressure <120 mmHg) in selected high-risk patients, but the authors of this article question the wisdom of this latter recommendation.**

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Hypertension remains a large contributor to cardiovascular disease in the community, hence prompt diagnosis and treatment are important. In recent times there has been much discussion about appropriate blood pressure targets and modes of monitoring, given different modalities with their pros and cons. In this article, we address some of these issues by reviewing recent literature and guidelines.

Hypertension is an important contributor to cardiovascular morbidity and mortality and is one of the leading causes of end-stage renal disease, stroke, atrial fibrillation and heart failure.[1] High blood pressure (systolic pressure ≥140 mmHg and/or diastolic pressure ≥90 mmHg) was the most frequently managed problem in Australian general practice during 2013/14, at a rate of 8.7 per 100 patient encounters.[2]

In 2011–2012, 4.6 million Australians (32%) aged 18 years and over had hypertension (systolic or diastolic blood pressure ≥140/90 mmHg or taking medication). Of these, more than two-thirds (68%) had uncontrolled or unmanaged high blood pressure (not taking medication), representing 3.1 million adult Australians.[3] Most patients diagnosed with hypertension are started on treatment by their GP. The important issues of diagnosing and monitoring hypertension and achieving appropriate blood pressure targets are discussed in this article.

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Diagnosis and monitoring

The main modalities available for diagnosing hypertension and monitoring its control are clinic blood pressure measurement, 24-hour ambulatory blood pressure monitoring (ABPM) and home blood pressure monitoring (HBPM), each with their own benefits, limitations and thresholds for diagnosis (Table 1). Measurement of central blood pressure and assessment of vascular compliance by tonometry has been used in the research setting but is not used in clinical practice as it has not been validated in clinical trials.

Clinic blood pressure measurement

Clinic blood pressure recording is the most common mode of blood pressure measurement, however this is a mere point estimate that fails to take into account day-to-day variation in an individual. This being the case, a patient's blood pressure should be consistently elevated (over more than two or three clinic estimations) before hypertension is diagnosed. Clinic blood pressure recordings can be fairly inconsistent, with varying degrees of interobserver variability making evaluation of a patient's true blood pressure and response to treatment difficult. Despite these limitations, in-clinic blood pressure measurement is cost-effective and readily available, making it the ideal first-line modality in blood pressure assessment. It is also the way blood pressure was measured in the early trials showing the benefits of blood pressure reduction.

White coat hypertension (WCHT) is defined as blood pressure of equal to or greater than 140/90 mmHg at clinic visits on three occasions with a normal blood pressure level in the non-clinic environment on ambulatory blood pressure recording or blood pressure monitoring at home. A meta-analysis has shown that the prevalence of WCHT in population studies averaged 13% (range, 9 to 16%) and was 32% (range, 25 to 46%) among patients with hypertension.[4]

It has also been estimated that 13% (range 10 to 17%) of patients with nonelevated clinic blood pressure readings will have masked hypertension, with elevated readings outside of the medical environment.[4] As WCHT and masked hypertension cannot be diagnosed by clinic readings, it is important to evaluate the patients 'real' blood pressure by other modalities, as the former does not require treatment but the latter does.

24-hour ambulatory blood pressure monitoring

An Australian consensus statement has recommended 24-hour ABPM and/or HBPM as tools for diagnosing hypertension if blood pressure measured in the clinic is more than 140/90 mmHg, as have the British Hypertension Society and NICE guidelines.[5,6] In prospective trials, when compared with levels recorded using conventional clinic blood pressure measurement, blood pressure levels measured using ABPM have been shown to better predict outcomes associated with elevated blood pressure. Ambulatory measurements showed strong correlation with end organ damage, such as left ventricular hypertrophy, as well as surrogate markers of renal and vascular damage, such as microalbuminuria and carotid artery wall thickness.[7]

One of the advantages of this strategy compared with other modalities is being able to measure nocturnal blood pressure to identify 'non dippers'; that is, those patients whose blood pressure does not drop appropriately overnight. This phenomenon is shown to be associated with worse clinical outcomes and greater target organ damage.[7]

As above, ABPM also helps identify white coat hypertension and masked hypertension, which are recognised problems using conventional clinic blood pressure measurement. Response to treatment can be monitored using ABPM, but HBPM is better suited for this.

The major drawback of ABPM is its cost of about $50 to $70 (depending on the provider), which is currently not reimbursed by Medicare. There is, however, some evidence suggesting that if it were used widely the costs of initial testing would be offset by more reliable diagnosis of hypertension and appropriate treatment for those who need it.[7] Owing to the lack of reimbursement, the availability of ABPM is often limited and results can be interpreted inconsistently unless interpreted by experienced physicians.

By definition, 24-hour monitoring assesses blood pressures over a single day and so does not reflect variations over a longer period as does HBPM. Thus ABPM is preferred for confirming the diagnosis of hypertension and home blood pressure measurement is best used to monitor response to treatment over the long term.

Table 1. National Heart Foundation criteria for diagnosis of hypertension using different methods of blood pressure measurement

Method of measurement	Systolic (mmHg)		Diastolic (mmHg)
Clinic blood pressure	≥ 140	and /or	≥ 90
ABPM daytime (awake)	≥ 135	and /or	≥ 85
ABPM night-time (asleep)	≥ 120	and /or	≥ 70
ABPM over 24 hours	≥ 130	and /or	≥ 80
HBPM	≥ 135	and /or	≥ 85

Abbreviations: ABPM = ambulatory blood pressure monitoring; HBPM = home blood pressure monitoring.

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Home blood pressure monitoring

Home-based blood pressure monitoring involves the patient recording his or her own blood pressures using a validated, automated blood pressure device. There are several algorithms for diagnosing and monitoring blood pressure at home, and there is good correlation with clinic and ambulatory blood pressure.[8] In general, home monitoring using a cuff rather than a wrist device is preferred, as there is less artefact and positional blood pressure variability.

This strategy has many attractive features compared with other modalities:

- diagnosis of white coat and masked hypertension

Table 2. Currently recommended target blood pressure levels in adults according to international guidelines

Population	Target blood pressure level (mmHg) by guideline				
	American (JNC 8 2014[9])	European (ESH/ESC 2013[10])	Canadian (CHEP 2015[12])	UK (NICE 2011[6])	Australian (NHF 2016[5])
General	<140/90	<140/90	<140/90	<140/90	<140/90
Diabetes	<140/90	<140/80	<130/80	<140/80	<140/90
Chronic kidney disease	<140/90	<130/80	<140/90	<140/90	<140/90
No proteinuria	<140/90	–	–	–	–
Proteinuria	<130/90	–	–	<130/80	–
Older people					
60 to <80 years	<150/90	<140/90	<140/90	<140/90	60 to 75 years, <140/90
≥80 years	<150/90	<150/90	<150 (systolic)	<150/90	>75 years, high risk without diabetes, <120 (systolic)

Abbreviations: CHEP = Canadian Hypertension Education Program; ESC = European Society of Cardiology; ESH = European Society of Hypertension; JNC = Joint National Committee; NHF = National Heart Foundation; NICE = National Institute for Health and Clinical Excellence.

- measurement of blood pressure variability over a period longer than 24 hours
- assessment of response to treatment and documentation of resistant hypertension
- enhancement of patient education and patients' involvement in understanding and managing blood pressure
- access, ease of use and cost-effectiveness of monitors.

Some of the important limitations of this method are the cost of purchasing a monitor and appropriate training of patients by health-care personnel. As with 24-hour ABPM there is no Medicare reimbursement for home-based monitoring, but monitors are not prohibitively expensive. They cost around $100 to $200 depending on the degree of sophistication and are generally reliable, accurate and durable.

Nocturnal blood pressure cannot be appropriately measured by this method, potentially missing out on 'nocturnal nondippers'; however, new devices are being designed with capabilities for in-home nocturnal blood pressure measuring, although diagnosis of nondipping is not essential because this information does not influence treatment or target recommendations.

An important drawback is patient anxiety due to elevated blood pressure on self-monitoring, which may lead to inappropriate physician contact and patient-initiated changes in the frequency and dose of antihypertensive medication. Education is essential in this respect, but there are some patients in whom HBPM causes more problems than benefits. It is also important to recognise that both 24-hour ABPM and home monitoring devices are less accurate in patients with irregular heart rates, such as atrial fibrillation or frequent ectopic beats.

Moving targets

Target blood pressures in adults as currently recommended by the American, European and Australian guidelines are listed in Table 2.

The latest report from the panel members appointed to the Eighth Joint National Committee (JNC 8) published in 2014 recommended treating to goals as follow:[9]

- age ≥60 years – target systolic pressure <150 mmHg and diastolic pressure <90 mmHg
- age <60 years – target systolic pressure <140 mmHg and diastolic pressure <90 mmHg
- age ≥18 years with a history of chronic kidney disease or diabetes – aim for systolic pressure <140 mmHg and diastolic pressure of <90 mmHg.

The European Society of Hypertension has also released their guidelines recently. They are broadly in agreement with the JNC8 recommendations except for the target blood pressure in patients aged between 60 and 79 years, in whom they suggest the same target blood pressure (<140/90 mmHg) as for those less than 60 years of age, with the more liberal target of less than 150/90 mmHg for patients aged 80 years or more.[10]

The issue of target blood pressure has become even more contentious with the latest iteration of the Australian hypertension guidelines.[5] Recommendations from these guidelines suggest that the target is less than 140/90 mmHg for most patients but in selected high-risk patients a systolic blood pressure less than 120 mmHg is reasonable, if the patient tolerates this blood pressure and is monitored closely for adverse effects. The US National Institutes of Health-sponsored Systolic Blood Pressure Intervention Trial (SPRINT) is the only clinical trial that supports this lower target.[11]

SPRINT examined patients without diabetes or past history of stroke who were more than 50 years of age at increased cardiovascular risk or more than 75 years of age and were allocated at random to either a target blood pressure of less than 120/80 mmHg or a more liberal target of less than 140/90 mmHg. The results showed that the more intensive treatment group had reduced mortality and heart failure. This study seems to differ from previous trials of blood pressure lowering in that the average number of medications needed to lower systolic pressure to less than 120 mmHg was 2.8, which was similar to the number of medications needed in previous trials with higher achieved systolic blood pressure. This raises the important question of whether the lower blood pressure achieved in SPRINT was due to the difference in how blood pressure was measured compared with earlier studies. It is important to recognise that the blood pressure measurements in SPRINT were 'unattended automated clinic measurements'. This is not the way blood pressure is taken in clinical practice or in other clinical trials of hypertension treatment, and may be significantly lower than conventional blood pressure measurements. We thus wonder whether these results are applicable to patients outside a clinical trial environment in Australia, and whether it is premature to recommend less than 120/80 mmHg as the target blood pressure for selected high-risk patients or those aged more than 75 years at the present time, unless the blood pressure is measured in the same way as in the SPRINT study; that is, leaving the patient alone in a room while blood pressure is measured serially by automated device.

Conclusion

Hypertension remains one of the major contributors to acute and chronic cardiovascular disease in Australia. Appropriate diagnosis and treatment is essential to reducing cardiovascular morbidity and mortality by achieving blood pressure targets, which can be facilitated by accurate monitoring. Target blood pressure level recommendations vary for different populations according to international guidelines. At present, the recommendation of the National Heart Foundation of Australia is to aim for blood pressure targets of less than 140/90 mmHg for all adult patients, and even lower (systolic pressure less than 120 mmHg) in selected high-risk patients, although we question the wisdom of this latter recommendation.

Screening and monitoring blood pressure with each clinic visit is important to document the patient's progress and maintain records. It is clear from recent data, however, that incorporating 24-hour ambulatory and/or home-based monitoring of blood pressure in a complementary fashion as dictated by individual situations may improve compliance with antihypertensive treatment, help achieve blood pressure targets and more effectively empower patients. **CT**

References

A list of references is included in the website version of this article (www.cardiologytoday.com.au).

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