Controlling blood pressure over 24 hours: a review of the evidence

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Key words

ambulatory blood pressure monitoring, hypertension, long duration of action treatments, 24-hour blood pressure control,

Br J Cardiol 2008;**15**:31–4

Despite huge advances in hypertension care in recent times, some important aspects of treatment are not routinely considered in practice, in particular the need for good 24-hour blood pressure (BP) control. Insufficient access to ambulatory blood pressure monitors (ABPM) in primary care and a lack of clear guidance limits routine use in BP management.

ABPM, which measures BP over a full 24-hour period and captures BP fluctuations, may provide a more accurate reflection of patients' 'true' BP than traditional office readings. Since uncontrolled 24-hour BP is linked to increased incidence of cardiovascular (CV) events and target organ damage, the panel believed the use of ABPM is beneficial to both patient and doctor. ABPM can aid compliance and guide treatment choices, given that there are marked differences in the duration of action of many commonly used BP treatments. A treatment with a long duration of action may be important in managing BP over 24 hours.

Introduction

A panel of physicians and general practitioners (GPs) with a specialist interest in cardiology was convened on 9th February 2007 in London to discuss and debate the role of 24-hour blood pressure (BP) control and ambulatory blood pressure monitoring (ABPM) in the management of hypertension. The panel agreed that while the UK has made huge advances in hypertension care in recent years, some important aspects of treatment are not being routinely considered in practice, in particular the need for good 24-hour BP control. Furthermore, the panel believed the use of ABPM is beneficial to both patient and doctor in aiding compliance and guiding treatment choices, but that a lack of guidance and resources currently restricts its use in the UK.

The need to treat BP consistently over 24 hours

The diagnosis of hypertension and subsequent treatment decisions tend to be made on the basis of a small number of office BP measurements taken at certain times of day. Yet hypertension is a 'lifetime load', affecting the body 24 hours a day, seven days a week, 365 days a year.

During the course of 24 hours, it is normal for BP to fluctuate dramatically, starting with a rapid rise in the morning between 6 am and 10 am and falling at night (see **figure 1**)[1]. The rise in BP accompanying waking and the onset of physical activity is also associated with a rise in heart rate.

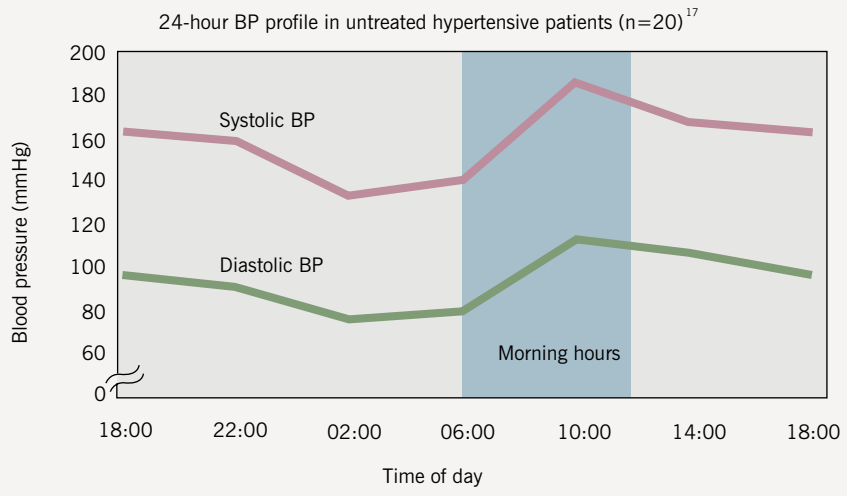
The link between the early morning BP surge and an increase in cardiovascular (CV) events is well established. Acute myocardial infarction has been shown to be three times more common at 9 am than at 11 pm[2] and 44% of ischaemic strokes occur in the morning period (see **Figure 2**).[3] BP value on rising in the morning is correlated with left ventricular mass[4] and is more discriminating for association with CV events than three office readings.[5]

Twenty-four hour BP variability is also associated with increased target organ damage. For any given value of mean 24-hour BP, low 24-hour variability is associated with less target organ damage.[8] Just as uncontrolled hypertension over a period of years will determine the extent of CV target organ damage, so it is true that BP load over 24 hours is more likely than isolated clinic measurements to predict CV disease.[9]

Morning BP is not the only variable that affects CV outcomes. Those patients with a night-time BP dip of less than 10%, known as non-dippers, are also at significantly increased cardiovascular risk and have an increased risk of developing left ventricular hypertrophy, target organ damage, a decline in renal function and CV events.[8]

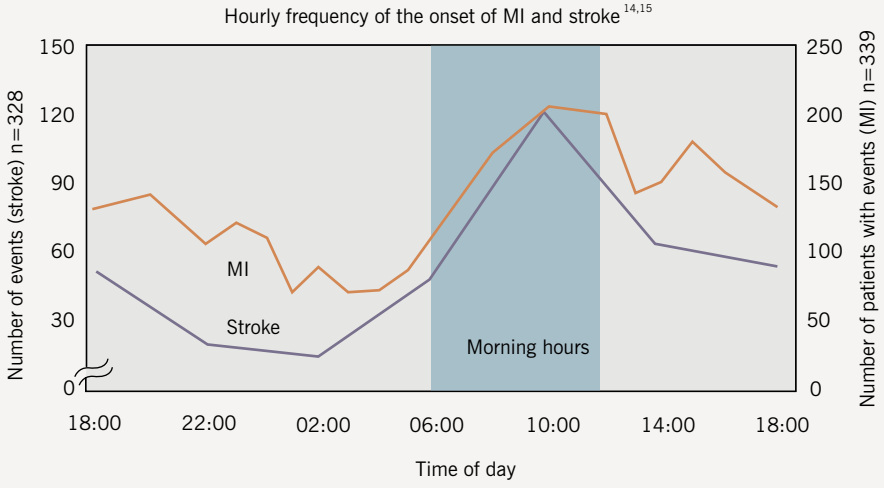
There are significant challenges involved in managing early morning BP. The majority of office BP readings are taken after the early morning BP surge and therefore do not take account of the peak in BP earlier in the day. Even though office BP is controlled, many patients may still have uncontrolled early morning BP.

Figure 1. The circadian rhythm of blood pressure[1]



Key: BP= blood pressure

Figure 2. Increases in 24-hour BP values associated with higher cardiovascular risk[6,7]



Key: BP= blood pressure; MI= myocardial infarction

24-hour BP monitoring

ABPM has the advantage of measuring BP over a full 24-hour period, obtaining automatic measurements of BP at intervals throughout the day and night.[10] In doing so, ABPM captures BP fluctuations, including the early morning BP surge.

ABPM is not currently recommended in the UK for diagnosing hypertension. While use of ABPM may not be appropriate in all instances, and should be used alongside office and home BP monitoring, the panel believed that 24-hour BP assessment should be used in line with the European Society of Hypertension (ESH) guidelines on measurement of blood pressure: [10]

- Borderline or variable BP (>10–20 mmHg between observations or between office readings or between home/hospital/surgery readings or between repeated readings at the same sitting)
- Hypertension not responding to treatment (not at target despite a rational combination of three drugs in appropriate doses)
- Symptoms suggestive of hypotension in those on antihypertensive therapy
- Patients in whom tight control is required e.g. renal failure, diabetes
- Patients reticent to contemplate pharmacotherapy – in order to confirm risk.

Clinical practice has shown that ABPM readings are, on average, 12 mmHg systolic and 7 mmHg diastolic lower than equivalent office readings (usually rounded to 10/5 mmHg for convenience). Using machines validated by the British Hypertension Society (BHS), with correct size and fitting cuffs, the goals of treatment using ABPM suggested by the panel are a daytime mean of <130/85 mmHg, or <120/80 mmHg for patients with diabetes or renal disease or target organ damage such as left ventricular hypertrophy. A night-time mean of <120/75 mmHg was also suggested, on the basis that night-time BP may be an even better indicator of long-term prognosis than other readings.[10] A key advantage of ABPM is that it is more reproducible than office BP and has been shown to be a stronger predictor of CV mortality and morbidity than office BP.[10]

Increasingly, patients are checking their own BP with monitors at home. If used correctly, they provide an opportunity to check BP earlier in the day. Giving free home BP monitors to patients may also be helpful in improving compliance. Asking patients to take three BP readings a day, including an early morning reading, means that a good estimation of a patient's BP can be obtained on which to decide treatment. This can then be compared to the reading obtained in the surgery, adding 10/5 mmHg (in keeping with advice from the 2004 BHS guidelines)[11] to compare the home readings with the office BP. Monitoring BP in this way also helps patients to understand that treatment is actually necessary – particularly those patients who are unwilling to start treatment. This avoids both under-treatment, and also over-treatment of patients with white-coat hypertension.

Controlling BP over 24 hours

The first approach to managing hypertension should be non-pharmacological means. Patients should be advised to lower their salt intake, reduce their alcohol consumption, lose weight and increase their exercise. For example, a >5 kg weight loss has been shown to reduce systolic BP on average by 6.63 mmHg.[12]

For those in whom treatment is required, using drugs in the right combination (since the majority

of patients will require more than one drug) and at correct dosages was felt to be the key to successful treatment. In this respect, the National Institute for Health and Clinical Excellence (NICE)/BHS ACD algorithm, now widely adopted, has given doctors helpful guidance.[13]

It was agreed that use of a once-daily treatment, which controls BP over 24 hours, is needed to protect against the early morning BP surge and in order to reduce 24-hour BP variability. Additionally, given that hypertension is an asymptomatic condition, once-daily treatment may encourage patient compliance. However, there is a great deal of confusion in primary care about which treatments are for once-daily administration; even among the panel there was disagreement as to which agents were truly suitable for once-daily administration in order to deliver 24-hour control.

Nevertheless, it is clear that the commonly used antihypertensive therapies have different durations of action. This should be a consideration when deciding on therapy. For example, evidence from the PRISMA I study (comparing the efficacy and safety of once-daily telmisartan 80 mg and ramipril 10 mg on BP reductions over 24 hours), demonstrated that telmisartan, a long-acting angiotensin receptor blocker, is significantly more effective than ramipril at reducing BP in the early morning hours[14] – the time when patients are at greatest risk of CV and cerebrovascular events.

Over 24 hours, telmisartan 80 mg produced significantly greater reductions in BP than ramipril 10 mg (a mean systolic blood pressure [SBP] reduction of 14.5 mmHg compared to 11.6 mmHg and a mean diastolic blood pressure [DBP] reduction of 9.8 mmHg compared to 7.7 mmHg, respectively) (see **figure 3**).[14]

These results are likely to have significant clinical implications given that even a small decrease in BP can produce a significant reduction in CV mortality – a 2 mmHg reduction in SBP has been shown to be associated with a 7% reduction in death from ischaemic heart disease and a 10% reduction in death from stroke.[15]

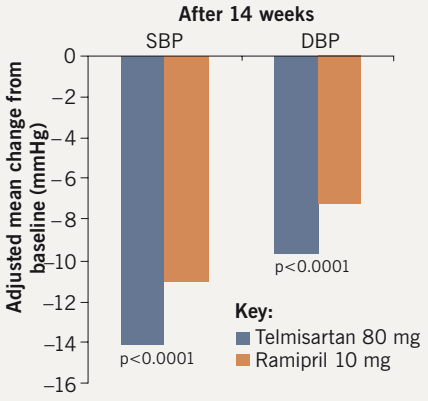
Guidance and policy: where are we now?

Many different guidelines exist for BP management (**table 1**), but much of primary care is driven by the Quality and Outcomes Framework (QOF) agenda.[16] The current QOF BP target of 150/90 mmHg for patients without diabetes or chronic kidney disease does not recognise the true risk of hypertension.[16] This target is in line with the BHS audit standard for those without diabetes, chronic kidney disease (CKD) or cardiovascular disease, and reflects the minimum recommended levels of BP control – the optimal treatment targets are lower.[11]

While targets are necessary, a consensus is needed on consistent, achievable targets. There is currently no target for 24-hour control and NICE does not currently recommend the routine use of ABPM in primary care.[13]

Targeting patients with CKD is a new clinical area in primary care. Poor control of hypertension is significantly associated with deterioration in renal function; hypertension management should be a priority in this patient population

Figure 3. PRISMA I: comparing the effects of telmisartan 80 mg and ramipril 10 mg on mean change in baseline SBP and DBP over 24 hours.[14]



Key: SBP=systolic blood pressure; DBP=diastolic blood pressure

Table 1. Blood pressure targets

BHS IV BP targets 2004[11]

- For patients with no CVD < 140/85 mmHg (audit standard 150/90 mmHg)
- For patients with diabetes, CVD or renal impairment <130/80 mmHg
- For patients with renal disease and proteinuria >1g/24 hr – <125/75 mmHg, even though there is no clinical evidence and most trials failed to achieve it

NICE target BP 2006[13,17]

- For hypertensive patients without diabetes <140/90 mmHg
- For patients with diabetes but no/low microalbuminuria <140/80 mmHg
- NICE target BP for patients with diabetes and microalbuminuria/proteinuria <135/75 mmHg

Current (2006) QOF BP target[16]

- For patients with hypertension, coronary heart disease, stroke or TIA <150/90 mmHg
- For patients with diabetes <145/85 mmHg
- For patients with chronic kidney disease <140/85 mmHg

Key: BHS=British Hypertension Society; BP=blood pressure; CVD=cardiovascular disease; NICE=National Institute for health and Clinical Excellence; QOF=Quality Outcomes Framework; TIA=transient ischaemic attack

Conflict of interest

MM, JA, KG, GK, EK, PL and JV received honoraria for attending a consensus meeting sponsored by Boehringer Ingelheim leading to the compilation of this report.

Key messages

- There is strong evidence demonstrating the importance of controlling blood pressure (BP) over 24 hours, yet this is not routinely considered when diagnosing and treating hypertension
- Uncontrolled 24-hour BP is linked to increased incidence of cardiovascular events and target organ damage
- Ambulatory blood pressure monitoring (ABPM) has the advantage of measuring BP over a full 24-hour period, capturing BP fluctuations which may provide a more accurate reflection of patient's 'true' BP than traditional office readings
- Insufficient access to ABPM monitors in primary care and a lack of clear guidance limits the routine use of ABPM in BP management
- There are marked differences in the duration of action of many commonly used BP treatments
- Selection of a treatment with a long duration of action may be important in managing BP over 24 hours

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Diary

2008

9th–12th March
The Society for Cardiothoracic Surgery in Great Britain and Ireland 2008 Annual Meeting, Edinburgh
Contact: sctsadmin@scts.org
Website: www.scts.org

10th–13th March
Cardiovascular Risk Course (optional accreditation at Master's level), University of Warwick
Contact: Dr Steve Hicks
Tel: 02476 523540
Email: s.j.hicks@warwick.ac.uk
Website: www2.warwick.ac.uk

29th March–1st April
57th Annual Scientific Sessions of the American College of Cardiology, Chicago, USA
Website: www.acc.org

3rd–4th April
British Atherosclerosis Society Spring Meeting, Oxford
Contact: Ms Natasha Dougall
Tel: 01922 457 984
Email: wheldonevents@btconnect.com
Website: www.britathsoc.org

17th-18th April:
2nd joint Scientific Meeting of the Anticoagulation in Practice 2008, Birmingham.
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fax: 0121 414 3759
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website: www.anticoagulation.org.uk

26th-29th April
77th Congress of the European Atherosclerosis Society (EAS)
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13th – 16th May
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