The role of twenty-four-hour ambulatory blood pressure measurement in clinical practice

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Twenty-four-hour ambulatory blood pressure monitoring is passing from research into clinical practice and it is necessary to clarify circumstances for which 24-h ambulatory measurement will be most beneficial. Devices should be accurate and reasonably priced. The operator should be able to interpret 24-h recordings and be familiar with the operation of the equipment. The subject must be capable of complying with the instructions necessary for successful use of the device. In diagnosis, 24-h ambulatory blood pressure measurement is particularly useful in deciding whether subjects with borderline hypertension have a genuinely elevated blood pressure, in identifying white-coat hypertension, in determining dipper status and in diagnosing symptomatic hypotension. In the management of antihypertensive drug treatment, the technique helps the clinician to select the drug best suited to the individual patient in terms of duration of action and suitability for the individual 24-h profile; the technique also identifies any excessive reduction in blood pressure and provides a means of assessing resistant cases of hypertension.

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Introduction

The clinical use of 24-h ambulatory blood pressure measurement is proceeding at a rapid pace. In at least four European countries, ambulatory devices are becoming available in general practice. Often, the impetus for introducing a new technique into clinical practice comes from marketing promotions rather than scientific principles. One fact, however, is clear; as we enter the last decade of this century ambulatory blood pressure measurement is passing from research to clinical practice and we must ensure that it is not misused in this capacity [1,2].

Device and operator requirements

Ambulatory systems must be accurate [3] and reasonably priced, and the recorders should be compact, noiseless, light and comfortable for the patient to wear. In obese subjects a cuff containing an appropriately sized bladder must be used.

The operator must be familiar with the equipment and have an understanding of the normal ranges of blood pressure during the day and the night as well as the factors influencing the diurnal pattern [4,5]. The operator must be familiar with the calibration procedures for the device being used and be prepared to give the necessary time to instruct the subject so that as many measurements as possible are obtained during the recording period. Subjects for ambulatory blood pressure measurement must be capable of coping with and caring for the recorder. The conditions of measurement for the subject should be standardized as far as possible in relation to activity; in particular, the arm should be held still during each measurement [6]; a similar level of activity should be undertaken for comparative repeat measurements; working days should not be compared with recreational days, and likewise, in shift workers, comparative measurements should be made between similar shifts [7]. For clinical use, recordings are usually programmed for every 30 min. The subjects should be asked to keep a diary of activities during the recording period, although motion-logging may soon be available to provide an objective assessment of activity [8].

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Clinical indications for ambulatory measurement

The clinical indications for using 24-h non-invasive ambulatory blood pressure measurement are best considered in relation to the diagnosis of hypertension and the selection and evaluation of antihypertensive drug treatment.

Diagnosis

The use of 24-h ambulatory blood pressure in clinical practice allows a more accurate diagnosis. Normal values over 24 h can be determined, white-coat hypertension can be excluded and non-dippers can be identified.

Normal values

The normal ranges for ambulatory blood pressure for adults have been defined according to gender and age [4,5]; it is now possible to plot 24-h pressures for each patient and determine whether they fall within normal bands, using either 2 standard deviations or the 5th and 95th centiles to define the upper and lower limits of pressure (Fig. 1).

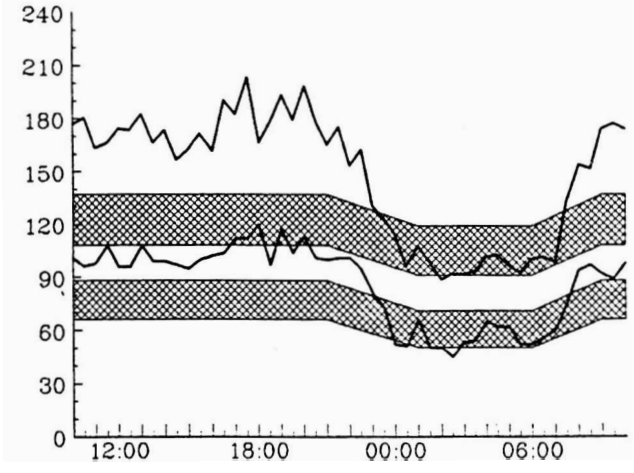

Fig. 1. Twenty-four-hour ambulatory blood pressure (BP, mmHg) for a dipper (patient whose blood pressure falls at night) plotted against time (h); normal systolic (above) and diastolic (below) ambulatory pressures are indicated by the shaded areas (5th and 95th centiles) [4].

Borderline hypertension

Twenty-four-hour ambulatory measurement is particularly helpful in deciding whether subjects with a borderline elevation in office blood pressure, who may be penalized for insurance cover and employment, should be labelled hypertensive. In subjects with borderline hypertension and evidence of target organ involvement, in whom the ambulatory measurement is normal, hypertension may be excluded as a cause of the target organ damage [1].

White-coat and borderline hypertension

Twenty-four-hour ambulatory blood pressure measurement is the most effective method of determining whether a blood pressure elevation is due to the white-coat effect, which occurs in more than 20% of subjects with hypertension diagnosed by conventional measurement [9].

Dipper status

There is some evidence that subjects whose blood pressure does not decline at night (non-dippers) may have a higher risk of cardiovascular disease than those whose pressure does fall at night (dippers) [10,11]. These hypertensive patients may be in need of careful blood pressure control. The only way of determining dipper status is by performing a 24-h ambulatory measurement.

Evaluation of hypotensive symptoms

Twenty-four-hour ambulatory blood pressure measurement is proving useful in diagnosing orthostatic hypotension [12].

Other diagnostic uses

Ambulatory measurement may also be helpful in identifying episodic hypertension in phaeochromocytoma, in characterizing blood pressure behaviour in patients with normal office pressures and evidence of end-organ effects, and in diagnosing hypertension in special subgroups such as blacks, children, the elderly and pregnant women.

Selection and evaluation of antihypertensive drug treatment

Twenty-four-hour ambulatory blood pressure measurement is proving valuable in selecting a drug regimen suitable for the individual patient rather than relying on the stepped-care approach [13].

Selection of drug and dosing regimen

Reference to a plot of 24-h pressures enables the prescribing doctor to select a drug with a duration of action that is appropriate to the rise in pressure for that particular patient. There is some evidence that different groups of drugs may have different effects on the 24-h blood pressure profile. For example, angiotensin converting enzyme inhibitors may accentuate the nocturnal dip and be more suited to treating patients with a sustained elevation of blood pressure over 24 h [14].

Efficacy of treatment

An evaluation of the efficacy of blood pressure control with antihypertensive drugs should be based on the 24-h blood pressure profile rather than on sporadic measurements. The 24-h ambulatory measurement can be particularly helpful in assessing drug efficacy in patients in whom office blood pressures indicate poor control (resistant hypertensives).

Withdrawal of antihypertensive medication

Patients whose blood pressure was initially diagnosed by office measurement and whose blood pressure has been well controlled may merit a drug-free period for reassessment with 24-h ambulatory measurement.

Assessment of symptoms during treatment

An excessive reduction in blood pressure with antihypertensive drugs to below the lower limit of normal [13] may carry a risk in hypertensive patients; this phenomenon, which may occur most often at night in extreme dippers, can be readily detected with 24-h ambulatory measurement.

References

1. NATIONAL HIGH BLOOD PRESSURE EDUCATION PROGRAM (NHBPEP) WORKING GROUP: *Report on Ambulatory Blood Pressure Monitoring.* Bethesda: US Department of Health and Human Services, Public Health Service, US NIH Publication 90-3028, 1990.
2. MEYER-SABELLEK WA, DISTLER A, GOTZEN R, MANCIA G (EDS): International Consensus Conference on Indirect Ambulatory Blood Pressure Monitoring. *J Hypertens* 1990, 8 (suppl 6).
3. O'BRIEN E, MEE F, ATKINS N, O'MALLEY K: Validation requirements for ambulatory blood pressure measuring systems. *J Hypertens* 1991, 9 (suppl 8):S13–S15.
4. O'BRIEN E, MURPHY J, TYNDALL A, *ET AL.*: Twenty-four-hour ambulatory blood pressure in men and women aged 17 to 80 years: the Allied Irish Bank Study. *J Hypertens* 1991, 9:355–360.
5. THIJS L, STAESSEN J, FAGARD R, AMERY A: Reference values for the ambulatory pressure and pressure measured at home: a population study [abstract]. *J Hypertens* 1991, 9 (suppl 8):S82.
6. WHITE WB, LUND-JOHANSEN P, OMVIK P: Assessment of four ambulatory blood pressure monitors and measurements by clinicians versus intraarterial blood pressure at rest and during exercise. *Am J Cardiol* 1990, 65:60–66.
7. PICKERING TG, SCHNALL PL, SCHWARTZ JE, PIEPER CF: Can behavioural factors produce a sustained elevation of blood pressure? Some observations and a hypothesis. *J Hypertens* 1991, 9 (suppl 8):S66–S68.
8. VAN EGEREN LF: Monitoring activity and blood pressure. *J Hypertens* 1991, 9 (suppl 8):S25–S27.
9. PICKERING TG, JAMES JD, BODDIE C, *ET AL.*: How common is white coat hypertension? *JAMA* 1988, 259:225–228.
10. O'BRIEN E, SHERIDAN J, O'MALLEY K: Dippers and non-dippers [letter]. *Lancet* 1988, ii:397.
11. PICKERING TG: The clinical significance of diurnal pressure variations: dippers and nondippers. *Circulation* 1990, 81:700–701.
12. ZACHARIAH P: Orthostatic hypotension and ambulatory blood pressure monitoring. *J Hypertens* 1991, 9 (suppl 8):S78–S80.
13. O'BRIEN E, O'MALLEY K: Ambulatory blood pressure monitoring in the evaluation of drug efficacy. *Am Heart J* 1991, 121:999–1006.
14. STANTON AV, ATKINS N, O'MALLEY K, O'BRIEN E: Circadian blood pressure and antihypertensive drugs [abstract]. *Am J Hypertens* 1990, 3:107A.