Self-measurement of blood pressure: a paper for health professionals

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The advantages of self-measurement

Patient self-measured blood pressure levels can complement those measured by the doctor to give a more complete, accurate picture of the patient’s blood pressure, and help doctors to make more informed therapeutic decisions.

Blood pressure levels measured by the patient at home or at work are usually lower than those measured by the doctor in the clinic setting (the ‘white coat effect’), and more closely approximate levels measured by 24-hour ambulatory blood pressure monitoring (ABPM). Evidence from cross-sectional studies suggests that self-measured blood pressure levels correlate more closely than clinic readings with target-organ damage. One longitudinal study has also demonstrated tighter correlation of self-measured blood pressure with regression of left ventricular hypertrophy in response to treatment. Data from prospective outcome trials which are becoming available are confirming that outcome is better predicted by ambulatory blood pressure than by clinic measurements.

Among patients diagnosed with mild hypertension on the basis of clinic readings, approximately one in five exhibit normal blood pressure levels when measured by the patient at home. Such individuals with ‘white coat hypertension’ appear to be at much lower risk of cardiovascular morbidity and mortality than those with sustained hypertension. Most investigators believe that lifestyle modification is sufficient intervention and antihypertensive drug treatment can be safely avoided in these patients so long as home blood pressures remain normal and evidence of target-organ damage (eg. left ventricular hypertrophy) does not develop during close long-term follow-up.

Because of the ‘white coat effect’, and because blood pressure varies markedly from moment to moment, a single clinic measurement is unlikely to be closely representative of the level throughout the day or on other days. When patients measure their own blood pressure at several specific times of the day for a week, many readings can be averaged to give a more complete picture of the blood pressure under conditions of everyday living. Problems such as postural hypotension can be better defined, the effect of changes in antihypertensive medications more fully assessed, and changing trends in blood pressure levels more quickly detected. In addition, self-measurement provides the opportunity to confirm or exclude any suspected relationship between episodic symptoms and periods of high or low blood pressure (eg. light-headedness thought to be caused by medication-induced hypotension).
Self-measurement of blood pressure promotes better patient understanding of the disease and the effects of treatment, and allows the patient to become more involved in the management of their condition, resulting in improved compliance\textsuperscript{9,10}. Most patients are able to take their own blood pressures confidently after adequate instruction\textsuperscript{11} without fear or anxiety\textsuperscript{12}. In fact, the demonstration of well-controlled self-measured blood pressure in the face of elevated clinic readings is a source of reassurance to them.

Self-measurement of blood pressure has been estimated to be the most cost-effective means of assessing hypertension\textsuperscript{13}, and, unlike 24-hour ABPM, is particularly useful in the long-term follow-up of patients with both sustained and ‘white coat’ hypertension. Levels measured by patients living in remote regions, precluding frequent clinic attendances, can be sent to the doctor together with any comments and questions for assessment. By reducing over-treatment consequent on the ‘white coat’ effect, reducing visits to the doctor and improving prognosis, the potential for cost savings are considerable.

**Guidelines for valid blood pressure self-measurement**

A good technique and an accurate device are critical to the value of BP self-measurement. Prior to commencing self-measurement, patients should undergo a practical instruction session by trained personnel, followed by an assessment of their accuracy and competence. They should be provided with written instructions for reference at home. Follow-up sessions are important to ensure that the patient has grasped the procedure and adapted it to his/her home environment, and, in the long term, to prevent ‘bad habits’ in technique from developing.

(i) **Equipment**

Devices used for home BP measurement are usually aneroid or electronic in type. In general, the aneroid machines are very accurate\textsuperscript{14,15} provided they are regularly calibrated (every 6 to 12 months) against a mercury sphygmomanometer\textsuperscript{16}. Calibration can be readily performed using a y-connection and two pieces of blood pressure tubing\textsuperscript{16}. One piece connects to the gauge of the aneroid machine to one arm of the y-connection, and should be the same length as the tubing coming from the mercury column, which is connected to the other arm of the y-piece. The stem of the y-piece is then connected to the inflation bulb of the mercury machine, using the second piece of tubing. The mercury column is then pressurised to 300 millimetres of mercury and slowly reduced, stopping at intervals of no more than 30 mm Hg\textsuperscript{17} to compare the pressures indicated on each sphygmomanometer. Gauges registering greater than 3 millimetres of mercury difference from the mercury sphygmomanometer should be repaired or replaced\textsuperscript{18}. Inability to hold the rate of deflation at 1 mm Hg per second or less when using an aneroid machine may herald the need to repair or replace a faulty exhaust valve screw or leaks in the rubber bladder. Aneroid machines are relatively inexpensive and easier to maintain and repair than
electronic devices. While their use requires more training, most people master
the technique with little difficulty and can retain their skills over time.
Occasionally, patients are unable to use an aneroid machine because of
problems with memory, hearing or vision deficits, or lack of the fine motor control
required to regulate the rate of deflation. In such situations, alternative valves
can be fitted, a friend or relative can be taught to take the patient’s blood
pressure, or a reliable electronic device can be used.

Electronic devices vary widely in cost and reliability. It is essential that all
electronic devices be validated against a mercury sphygmomanometer before
use as well as periodically (6 to 12 monthly) during use as the machine ages.
This is best done using the ‘simultaneous same arm approach’, in which a
mercury column is connected by a y-piece to the cuff tubing and a stethoscope
applied over the brachial artery, allowing an observer to take a mercury reading
at the same time and on the same arm that the electronic device takes its
measurement. The average difference from the mercury reading after several
measurements should be less than 4 mm Hg. It is important that validation be
performed on the patient who uses the device. Also, the deflation rate of the
device should be controlled at 2-3 mm Hg per second all the way down to zero.
An overly rapid deflation rate can result in serious measurement errors and can
impede validation of the device, especially in patients with relatively slow pulse
rates.

Whichever type of machine is used, care should be taken to ensure that the cuff
size is appropriate for the patient. The bladder width should be at least 40%, and
the bladder length at least 80% of the arm circumference at midpoint between
the acromion process and olecranon.

(ii) The technique

Patients should be instructed to take measurements in a warm, comfortable,
quiet place without the distractions of television, loud music or people talking, and
to wait for at least 5 minutes after sitting or lying and at least two minutes after
standing before taking their blood pressure. Measurements should not be taken
within two hours of drinking tea or coffee, or smoking cigarettes if the patient has
not yet given up, as these substances can acutely raise blood pressure.
Whenever possible, the blood pressure should be measured under the same
quiet conditions and in the same manner every time.

For all machines, patients should be shown how to apply the cuff correctly and to
position it so that the pressure-sensing device is placed directly over the brachial
artery with the lower border of the cuff approximately 3-4 cm above the elbow
crease. For aneroid machines, patients should also be taught:

- how to use the stethoscope and identify Korotkoff sounds
• how to use the valve screw and to manipulate it finely during deflation in order to regulate the deflation rate at 2-3 mm Hg per second

• the importance of the ‘systolic gap’ and how to detect this by listening to Korotkoff sounds during the inflation phase and inflating the cuff to 40 mm Hg above the point where the sounds disappear before commencing the deflation phase

• to wait for several seconds before deflating the cuff to allow for any temporary rise in blood pressure which may occur in association with the action of the cuff inflation.

Because blood pressure varies from moment to moment, many readings are required to get an overall picture. For example, patients may be instructed to take lying and standing measurements in the morning before rising, then 2-4 hours after taking their morning medication, and lastly before retiring at night. The average reading for each time and position over the entire week can then be calculated, which is useful for detecting a diurnal pattern or postural effect. Once it has been established that the levels are stable and under control, the frequency of readings can be reduced. However, it is preferable that patients continue to take a full week’s readings at a time and progressively increase the interval between measurement weeks rather than to increase the interval between each measurement time or day. During the weeks when they are not taking a full week’s readings, patients should be advised to take their blood pressure two or three times a week to keep up the skills necessary for accurate measurement.

Blood pressure measurements should ideally be recorded immediately on a chart which indicates the date, time of day and body position when the recorded blood pressure was taken. The chart should provide space to allow the patient to record their medications and dosages, any comments such as symptoms or stressful events that may be relevant when interpreting the recorded readings, and the average systolic and diastolic blood pressures calculated for each week of readings. The blood pressure chart can be taken to the doctor at each clinic visit, or sent if necessary in between visits, and will help the doctor to assess if blood pressure control is adequate, or whether changes to treatment are necessary. The effects of such changes can then be assessed by examining subsequent readings recorded on the chart.

References


September 1999/PP322