

**DIAGNOSIS AND EVALUATION OF HYPERTENSION**

Dr Ng Kheng Siang

**DIAGNOSIS –**

WHO defines a patient as having hypertension when his systolic blood pressure > 140 mm Hg and/or diastolic blood pressure > 90, or when the patient is taking antihypertensive medication.

One would realize that the dividing line between “normotension” and hypertension is nothing more than an artefact. The fact that “normotension” and hypertension cannot be rigidly defined on the basis of a single blood pressure reading has important consequences. It should be borne in mind that it is not even theoretically possible to define a single point at which treatment should commence since blood pressure is only just one of several factors determining the level of risk; the same blood pressure value in two individuals may be associated with different values of risk. Notwithstanding the afore-mentioned difficulties, it is the general consensus that the higher level of blood pressure, the greater the risk of morbidity and mortality.

**Measurement**

Proper measurement and interpretation of the blood pressure (BP) is essential in the diagnosis and management of hypertension.

**TIME OF MEASUREMENT –**

For the diagnosis of hypertension, multiple readings should be taken at various times throughout the waking hours of the patient.

Extraneous variables that can influence the blood pressure should be avoided in the preceding hour prior to evaluation. These include:

- κ Food intake
- κ Strenuous exercise (Strenuous exercise may lower the blood pressure transiently)
- κ The ingestion of caffeine
- κ Smoking. (Smoking can transiently raise the blood pressure; thus, the office blood pressure may underestimate the usual blood pressure in a heavy smoker who has not smoked for more than 30 minutes prior to the measurement.)
- κ Ambient temperature. (Measurements of blood pressure in a cool room (12°C or 54°F) can be raised by as much as 8 to 15 mmHg).

**CUFF TYPE AND SIZE –**

Mercury sphygmomanometers provide the most accurate measurement of blood pressure. Aneroid sphygmomanometers

– which are used in many offices – should be checked against a mercury device since the air gauge may be in error.

Use a proper-sized cuff. The length of the bladder should be at least 75%-80% of the circumference of the upper arm, and the width of the bladder should be more than 50% of the length of the upper arm and approximately 40% of the circumference of the upper arm. Use of a smaller cuff can lead to overestimation of the systolic pressure by 10 to even 50 mmHg in obese patients.

**Pseudohypertension**

A similar problem, in which compression of the brachial artery requires a cuff pressure greater than systolic, can occur in patients with stiff vessels due to marked arterial calcification. This phenomenon is called pseudohypertension. It is characterized by systolic and diastolic pressures (estimated from the sphygmomanometer) that are 10 mmHg or more above the directly measured intra-arterial pressure.

**PATIENT POSITION –**

The blood pressure is usually taken in the sitting position; supine values tend to be slightly different with the systolic pressure rising by two to three mmHg and the diastolic pressure falling by a similar degree. Supine and standing measurements should always be taken in the elderly to detect postural hypotension.

The patient should sit quietly for five minutes before the blood pressure is measured. Even under optimal conditions, many patients are apprehensive when seeing the physician, resulting in an acute rise in blood pressure. 20%-30% of patients with hypertension in the physician's office are normotensive outside of the office.

This phenomenon is called “white coat” or isolated office hypertension. It should be suspected in any patient with marked hypertension in the absence of end-organ damage or with normal ambulatory blood pressures taken at work or at home. The presence of white coat hypertension can be confirmed by 24-hour ambulatory blood pressure monitoring or self-recorded readings. This may be minimized by assigning a nurse or a technician to measure blood pressure.

**TECHNIQUE OF MEASUREMENT –**

When the blood pressure is taken, the cuff should be inflated to a pressure approximately 30 mmHg greater than systolic, as indicated by disappearance of the brachial pulse during palpation. Initial estimation of the systolic pressure by palpation avoids potential problems with an auscultatory gap. The auscultatory gap is said to be associated with increased arterial stiffness and carotid atherosclerosis; it may therefore identify patients at increased risk of cardiovascular disease.

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NG KHENG SIANG, Senior Consultant Cardiologist, The Heart Institute, Tan Tock Seng Hospital

Once the cuff is adequately inflated, the following steps should be followed:

- κ The stethoscope should be placed lightly over the brachial artery. Use of excessive pressure can increase turbulence and delay the disappearance of sound resulting in an artificial reduction of the diastolic pressure reading by up to 10-15 mmHg.
- κ The blood pressure should always be taken with the patient's arm supported at the level of the heart. Allowing the arm to hang down when the patient is sitting or standing will result in the brachial artery being 15 cm below the heart. As a result, the measured BP will be elevated by 10-12 mmHg due to the added hydrostatic pressure induced by gravity. The mercury manometer should be visible but does not have to be at the level of the heart.
- κ The cuff should be deflated slowly at a rate of 2-3 mmHg per heartbeat. The systolic pressure is equal to the pressure at which the brachial pulse can first be palpated as blood flow is restored through the previously compressed vessel; the systolic pressure is also equal to the pressure at which the pulse is first heard by auscultation (Korotkoff phase I).
- κ As the cuff is deflated below the systolic pressure, the pulse continues to be heard until there is abrupt muffling (phase IV). Approximately 8-10 mmHg later, the sound disappears (phase V). The diastolic pressure is generally equal to phase V, although the point of muffling should be used in those patients in whom there is more than a 10 mmHg difference between phases IV and V. This can occur in children and in high-output states such as thyrotoxicosis, anemia, and aortic regurgitation.
- κ The blood pressure should be measured initially in both arms. If there is a disparity due to a unilateral arterial lesion, the arm with higher pressure should be used as reference.
- κ The blood pressure should be taken at least twice on each visit, with the measurements separated by one to two minutes to allow the release of trapped blood. If the second value is more than 5 mmHg different from the first, continued measurements should be made until a stable value is attained. The recorded value on the patient's chart should be the average of the last two measurements.

#### BLOOD PRESSURE MEASUREMENT AT HOME OR WORK –

Several errors can occur when the blood pressure is taken at home or work by the patient or spouse, even if the sphygmomanometer is accurate. With self-measurement, for example, the muscular activity used to inflate the cuff can acutely raise the BP by as much as 12/9 mmHg, an effect that dissipates within 5 to 20 seconds. Thus, inflating the cuff to at least 30 mmHg above systolic and then allowing the sphygmomanometer to fall no more than 2 to 3 mmHg per heartbeat is desirable both for accurate measurement and to permit this exertional effect to disappear. To monitor therapy, the blood pressure should also be taken at roughly the same time each day and the relation to meals and medications noted.

#### MULTIPLE BLOOD PRESSURE MEASUREMENTS –

The above recommendations for blood pressure measurement by the physician apply to a single visit. It is also important to emphasize that, in the absence of end-organ damage, the diagnosis of mild hypertension should not be made until the blood pressure has been measured on at least three visits, spaced over a period of months. Sequential studies have shown that the blood pressure drops by an average of 10-15 mmHg between the first and third visits in newly diagnosed patients, with a stable value not being achieved until more than six visits in some cases. Thus, many patients considered to be hypertensive at the initial visit are in fact normal.

If the blood pressure is taken at home to establish the diagnosis of hypertension, at least two measurements should be taken in the morning and evening over a period of at least three days.

#### White-coat hypertension and ambulatory monitoring –

Approximately 20%-25% of patients with mild office hypertension (diastolic pressure 90-104 mmHg) have what is called "white-coat" or isolated office hypertension in which their blood pressure is repeatedly normal when measured at home, at work, or by ambulatory blood pressure monitoring. This problem is more common in the elderly, but is infrequent (less than 5 percent) in patients with office diastolic pressures  $\geq 105$  mmHg. One way to minimize the white-coat effect is to have the blood pressure in the office taken by a nurse or technician, rather than the physician.

Ambulatory monitoring, which typically involves automated inflation of the BP cuff and recording of the blood pressure at preset intervals (usually every 15 to 20 minutes during the day and every 30 to 60 minutes during sleep), can be used to confirm the presence of white-coat hypertension in patients with persistent office hypertension but normal blood pressure readings in the ambulatory setting. Several studies have suggested that the risk of hypertensive cardiovascular complications (including both the development and regression of left ventricular hypertrophy) correlates more closely with 24-hour or daytime ambulatory monitoring than with the office pressure. Subtle functional abnormalities, however, have been found in white-coat hypertensives, including reduced compliance and increased mass of the left ventricle.

In addition to patients with suspected white coat hypertension (e.g. patients with persistent office hypertension but normal blood pressure readings in the ambulatory setting), ambulatory monitoring should be considered in the following circumstances:

- κ Apparent resistance to increasing medication
- κ Development of hypotensive symptoms (dizziness, weakness) on various medications, suggesting that the patient may be normotensive
- κ Evaluation of episodic hypertension or autonomic dysfunction

There is now a general consensus about the levels of normality by ambulatory monitoring:

- κ Average of daytime readings of <135/85 mmHg is normal
- κ Average of daytime readings of >140/90 mmHg is abnormal

### COMMUNITY RESOURCES

The main community-based resource that the family physician can refer patients to is the Singapore National Heart Association. The Health Promotion Board also has useful educational materials for hypertensive patients. The Singapore Hypertension Society which was formed last year provides continuing medical education updates and resources for family physicians. Useful hypertension resources (as at January 2003) available on the internet are:

<http://www.nhlbi.nih.gov/guidelines/hypertension/jncintro.htm>

The Sixth Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure

<http://www.ash-us.org/>

The American Society of Hypertension

<http://www.bloodpressure.com/>

<http://www.familydoctor.org/>

American Academy of Family Physicians (Patient education handouts)

### Take Home Messages

- For the diagnosis of hypertension, multiple readings should be taken at various times throughout the waking hours of the patient
- For accurate measurement of blood pressure, the correct cuff type and size, timing, position and technique are important
- Be mindful of pseudohypertension and white-coat hypertension
- Consider ambulatory BP measurement to confirm the presence of white-coat hypertension in patients with persistent office hypertension but normal blood pressure readings in the ambulatory setting.

### REFERENCES AND RECOMMENDED READINGS

1. MOH Clinical Practice Guidelines 2000: Management of Hypertension. Available on the MOH website: <http://app.internet.gov.sg/scripts/moh/newmoh/asp/abo/abo0202010301.asph>.
2. Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure. The Sixth Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC VI). *Arch Intern Med.* 1997;157:2413-46.
3. Kaplan NM et al. JNC VI guidelines. *Lancet.* 1998;351:288-90 (Jan. 24).
4. Guidelines Subcommittee. 1999 World Health Organization - International Society of Hypertension. Guidelines for the Management of Hypertension. *J hypertension* 1999;17:151-83.