## 1. Equipment for recording blood pressure

1.1 Sphygmomanometer

i. Mercury sphygmomanometer – the most reliable type of instrument for recording blood pressure. However, mercury is being gradually phased out due to health and environmental hazard[1]. WHO recommends that mercury sphygmomanometers be retained for calibration purposes in designated laboratories[2].

ii. Electronic devices – can also be used, but periodic calibration should be done to ensure its accuracy.

iii. Electronic devices that record the pressure in the fingers or the wrist should be avoided.

1.2 Checking of mercury sphygmomanometer

i. The column of the manometer is in the intended position (vertical).

ii. Mercury level is at zero when cuff is deflated.

iii. No blockage of the air venting system at the top of the manometer

iv. A sluggish response or bouncing of the mercury column during inflation and deflation usually indicates a blocked vent.

v. No leakage from rubber tubing, hand pump and control valve:

   a. Roll a cloth cuff into its own tail.

   b. Pump up to 200 mmHg and wait for 10 seconds.

   c. Mercury should fall < 2 mmHg in 10 seconds.

   d. If fall > 2 mmHg, clamp circuit in sections to locate the leakage or replace the control valve.

1.3 Checking of electronic devices

i. Routine checks - compare the reading with mercury sphygmomanometer.

ii. Periodic calibration is needed.

iii. If consistent discrepancies of more than 5 mmHg persist, refer to service manual or send the monitor to a trained technician for calibration.

## 2. Blood pressure measurement and recording techniques

i. The client should be advised to be seated for at least 5 minutes before the recording is taken.
ii. Arrange client in sitting position.
iii. Remove any constrictive clothing from the arm.
iv. Support client's arm with the antecubital fossa at heart level.
v. Use an appropriate sized blood pressure cuff. The cuff should be wide enough to cover two thirds of the upper arm and its length should be long enough to encircle the whole arm.
vi. Advise client to relax and not to talk during blood pressure recording.
vii. Check blood pressure initially by palpation prior to auscultation.
    a. palpate the radial artery with your fingertips.
    b. inflate the cuff while simultaneously palpating the artery.
    c. note the point on the manometer at which the radial artery pulsation is no longer palpable. (This is the estimated systolic pressure.)
    d. deflate the cuff.
viii. Wait 30-60 seconds before reinflating.
ix. Place the stethoscope gently over the brachial artery and steadily inflate the cuff to the level of 30 mmHg above the estimated level of systolic pressure checked by palpation.
x. Deflate the blood pressure cuff by 2 mmHg per second.
xi. Record the first Korotkoff sound (the regular appearance of sound) as the systolic pressure.
xii. Record the last (5th) Korotkoff sound (the disappearance of sound) as the diastolic pressure. If sounds persist to zero, or close to zero, use the muffling sounds (4th Korotkoff sound) to indicate diastolic pressure.
xiii. Allow 1-2 minutes between blood pressure recordings.[3]
xiv. Three BP measurements should be recorded and additional measurements only if the first two readings differ by >10 mmHg. BP is recorded as the average of the last two BP readings.[3]
xv. In older people, people with diabetes, or people with other causes of orthostatic hypotension, BP should also be measured 1 minute and 3 minutes after standing. Orthostatic hypotension is defined as a reduction in SBP of ≥ 20 mmHg or in DBP of ≥ 10 mmHg within 3 min of standing.[3]
xvi. Before using an electronic device, check for pulse irregularity. If pulse irregularity is present, measure blood pressure manually using direct auscultation over the brachial artery[4].

xvii. The diagnosis of hypertension is confirmed if BP is substantially increased (e.g. grade 3 hypertension) and there is clear evidence of hypertension-mediated organ damage (e.g. hypertensive retinopathy with exudates and haemorrhages, LVH, or vascular or renal damage), or repeat office visits confirm a persistent elevation in BP. The number of visits and the time interval between visits varies according to the severity of the hypertension, and is inversely related to the severity of hypertension.[3]

## 3. Precautions about blood pressure recording

3.1 Recorder's precautions

i. Read at eye level.
ii. Avoid digital preference. The blood pressure reading should be corrected to the nearest 2 mmHg.
iii. Choose the correct cuff size (see 2 v).
iv. Consistent use of the 4th or 5th Korotkoff sounds for recording (see 2 xii).
v. Correct arm positioning
    a. blood pressure changes 8-10 mmHg for every 10 cm that the antecubital fossa is above or below the heart level.
    b. arm well supported (diastolic pressure may be raised by as much as 10%).
vi. Deflate the cuff not too rapidly or too slowly (see 2 x).
vii. Avoid venous congestion due to repeated measurement.
viii. Adopt a unified standard in recording routinely to avoid variation among recorders.

3.2 Patient's factors

i. Emotional factors including white coat hypertension: 24-hour ambulatory blood pressure monitoring and self BP monitoring at home can be used to address the white coat effect.
ii. Physical exertion: blood pressure will increase during exertion.
iii. After exercise, decrease in blood pressure may persist for more than one hour.
iv. After meals: blood pressure may decrease following meals; recording is not recommended within half an hour of eating.
v. Smoking and caffeine: should be avoided within 30 minutes prior to BP recording[5].
vi. Alcohol.
vii. Temperature extremes.
viii. Bladder and bowel distension.
ix. Pain.

## 4. Home/ self BP monitoring

4.1 Potential advantages and disadvantages of home monitoring

| *Advantages* | *Disadvantages* |
|---|---|
| ➢ Providing information on response to antihypertensive medication<br>➢ Improving patient adherence with therapy[6]<br>➢ Can identify white-coat and masked hypertension | ➢ Reporting bias<br>➢ Unsupervised alteration of medication |

4.2 Self-measurement of BP

- Persons with an average BP 135/85 mmHg measured at home are generally considered to be hypertensive[3,7].
- Two consecutive measurements are taken, at least 1-2 minutes apart and with the person seated and blood pressure is recorded twice daily[4].
- Initial assessment or the assessment of treatment effects should be for a 7-day period, with recordings performed in the morning and evening[3]. The average of the readings is taken as the home BP level.
- Home measurement devices should be checked regularly.

## 5. Ambulatory blood pressure

i. ABPM provides the average of BP readings over a defined period, usually 24 hours.
ii. It is typically programmed to record BP at 15 - 30 min intervals, and average BP values are usually provided for daytime, night-time, and 24 hours.[3]
iii. It can identify BP patterns (i.e. sustained, white-coat, masked, and nocturnal hypertension, and non-dipping or reverse-dipping BP).[8]
iv. For each period (daytime, nighttime, and 24 h), the average of all readings should be calculated to determine mean daytime BP, mean nighttime BP, and mean 24-h BP, respectively, and other BP measures (e.g. dipping).[8]
v. The values are, on average, lower than office BP values, and the diagnostic threshold for hypertension is ≥ 130/80 mmHg over 24 h, ≥ 135/85 mmHg for the daytime average, and ≥ 120/70 for the night time average (all equivalent to office BP ≥ 140/90 mmHg).[3,7]
vi. BP normally decreases during sleep. An arbitrary cut-off has been proposed to define patients as ‘dippers’ if their nocturnal BP falls by >10% of the daytime average BP value.

vii. Recognised causes for an absence of nocturnal BP dipping are sleep disturbance, obstructive sleep apnoea, obesity, high salt intake in salt-sensitive subjects, orthostatic hypotension, autonomic dysfunction, chronic kidney disease, diabetic neuropathy, and old age.[3]

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