Accurate Blood Pressure Measurement

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Key Principles

1. Accurate blood pressure (BP) measurement is essential to guide management decisions in order to avoid over- or under-treatment leading to adverse outcomes.

2. Minimize factors that decrease the accuracy of BP measurements, and be consistent: same arm, same position, and correct cuff size.

3. A severe-range BP obtained with an automated BP device should be validated with a manual measurement for accuracy.

4. Evaluate BP trends vs. isolated values.

Background

Blood pressure (BP) measurement is one of the most important clinical assessments that clinicians perform, yet it is often done inaccurately. For patients with hypertensive disorders of pregnancy (HDP), false BP measurement may lead to delays in diagnosis and treatment. Obtaining accurate BP measurement is critical to guide management decisions in HDP. The oscillatory, or automated BP machine, is the method most used in hospital settings, and it tends to underestimate both systolic and diastolic readings by as much as 10 mm Hg.[1,2] In clinic settings and clinician offices, BP measurement is often performed with the aneroid sphygmomanometer (mechanical type with a dial). For most patients, automated devices are acceptable for clinical practice. However, if there is a potential for deterioration in the patient's condition, a manual cuff should be used when management decisions need to be made.[3]

A severe-range BP obtained with an automated BP device should be validated with a manual measurement for accuracy. The International Standards Organization (ISO) is used by manufacturers of noninvasive BP devices to test against a aneroid sphygmomanometer. The standard allows for a difference of ± 5 mm Hg with a standard deviation of no more than 8mm Hg. Ideally, when severe-range BP values are obtained using an automatic device, the BP should be retaken with a manual device. If the difference is > 8 mm Hg, a manual cuff should be used from this point.[4]

Refer to Table 1 on page 46 for steps in obtaining accurate BP measurement[5] and Figure 1 on page 48 for recommended cuff sizes.

Table 1: Steps for obtaining accurate blood pressure measurements

Steps	Key points for accurate measurement
1. Prepare equipment	a. Aneroid sphygmomanometer is the gold standard for measuring BP; however, in many settings automatic cuffs are used routinely. b. Validated equivalent automated equipment can be used. c. When using automated BP equipment ensure that it has a rigid calibration verification schedule every 6 months. d. Check cuff for any defaults. e. Obtain correct size cuff: width of bladder 40% of circumference and encircle 80% of arm (See Figure 1 on page 48).
2. Prepare the patient	a. Ensure the patient is sitting or in a semi-recumbent position with the back supported and arm at heart level. *If BP must be taken in a recumbent position, place the patient in a left lateral decubitus position with cuff at the level of the right atrium.* b. Patient needs to sit quietly for 5 minutes prior to measurement. c. Free the bare upper arm of any restrictive clothing. d. Patient's feet should be flat, not dangling from examination table or bed, and legs uncrossed. e. Assess recent (within previous 30 minutes) consumption of caffeine or nicotine. If BP is at the level that requires treatment, the patient should be treated. Recent use of nicotine or caffeine should not lead to delays in initiating appropriate antihypertensive therapies.

Steps	Key points for accurate measurement
3. Take measurement	• At time of admission, BP should be taken in both arms; continue BP measurements in arm with higher pressure. • Support patient's arm at heart level. • For auscultatory measurement: use first audible sound (Kortokoff I) as systolic pressure and use disappearance of sound (Kortokoff V) as diastolic pressure. • Read BP level to the nearest 2 mm Hg. • Instruct the patient not to talk. Background noise and talking can affect BP accuracy. • Use the highest reading obtained to determine next steps. • If BP is ≥ 140/90 mm Hg, repeat within 15 minutes and if still elevated, further evaluation for preeclampsia is warranted. • **Do not reposition patient to either side to obtain a lower BP. Repositioning will give you a false reading.**
4. Record Measurement	Document: • Blood pressure measurement. • Patient position (sitting, semi-recumbent). • Location taken (arm, forearm, right or left). • Cuff size used.

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Arm circumference (cm)	Cuff size
22−26	Small Adult: 12x22cm
27−34	Adult: 16x30cm
25−44	Large Adult: 16x36cm
45−52	Adult Thigh: 16x42cm

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Factors that decrease the accuracy of BP measurements and should be avoided:

▸ Using cuffs that are too small, too loose, applied over clothing, or with the arm positioned below heart level and unsupported.

▸ Presence of air in the cuff before it is placed on the arm.

▸ Kinks or loose connections among the tubing.

▸ Any patient arm movement during measurement (passive or active).

▸ Improper positioning such as an unsupported back, crossed legs, as well as the patient talking during the measurement.[6]

Accurate BP measurements in obese women can be quite challenging due to the tronco-conical shape of the upper arm (when circumference near the shoulder is greater than the circumference near the elbow) resulting in a poor cuff fit and an inaccurate reading. Using a too-small cuff can overestimate BP by up to 30 mm Hg, and this practice accounts for 84% of the miscuffing in this patient population. Using a too-large cuff can underestimate BP by 10-30 mm Hg.[7] There have been numerous studies to date comparing traditional cylindrical cuffs with conical-shaped cuffs that provide a better fit and have shown improved accuracy of BP measurements in the obese population.[7,8] In women with an upper-arm circumference of more than 34 cm, large adult cuffs or thigh cuffs can be used to improve BP accuracy. In these potentially sensitive situations, it is important to use nonjudgmental communication. For upper-arm measurements greater than 50 cm, the American Heart Association recommends using a cuff on the forearm and feeling for the appearance of the radial pulse at the wrist to estimate systolic BP. However, the accuracy of forearm measurement is not reliable,[6] because systolic BP and diastolic BP differ in more distal arteries with systolic BP increasing and diastolic BP decreasing due to resistance as the vessels narrow.

Health care practitioners need to be consistent in measuring BP using same arm, same position and cuff size.

Accurate BP measurement is essential to guide management decisions in order to avoid over-or under- treatment. It is therefore imperative that health care providers are consistent in measuring BP using the **same arm, same position,** and correct cuff size for patients. Blood pressure readings can vary by > 10 mm Hg depending on which arm is used, so BP should be measured in both arms initially and the arm with the highest pressure should be used for subsequent readings. If using automated BP monitors, it is extremely important to be present with the patient to confirm that appropriate BP technique and criteria have been met especially if a patient has preeclampsia. Automated BP measurements that are programmed on "auto-cycle" will cycle irrespective of maternal position, contractions, visitor distractions, etc., and the accuracy of BP measurement cannot be relied on unless the clinician is present.

Accuracy of the automated device may be limited if patients are hypertensive, hypotensive, and/or have cardiac dysrhythmias.[6] In these situations, if there is a risk of deterioration in the patient's condition, a manual cuff is recommended to inform management decisions.[3]

Implementing accurate BP measurements

✓ Inventory equipment and make sure it is regularly inspected, calibrated and validated.

✓ Ensure that proper size cuffs are readily available.

✓ Ensure that all staff are trained in standardized BP measurement technique.

✓ Update protocol to reflect current recommendations and guidelines.

EVIDENCE GRADING
LEVEL OF EVIDENCE: B

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