

Blood Pressure Measurement Challenges in Severely Obese Patients

M. Siddiqui¹ and D.A. Calhoun¹

The recent 2017 American College of Cardiology/American Heart Association blood pressure (BP) guidelines emphasized the importance of utilizing good technique when measuring BP, including use of a properly sized arm cuff. Specific recommendations in this regard require that the cuff bladder encircle 80% of the upper arm. In most adults, selection of a properly fitting cuff from routinely available cuff sizes is not a problem, but for extremely obese patients, it often is, such that accurately measuring BP in extremely obese patients is a common clinical problem because of the extremely large arm sizes.¹⁻⁴ In severely obese patients, BP measurement is challenging because the BP cuff is simply too small and/or fits poorly around the large, conically shaped upper arm. This cuff/arm mismatch can result in so-called hidden under-cuffing, i.e., use of a cuff bladder that is too small and/or too narrow for the patient's arm size, resulting in falsely elevated BP values.⁵⁻⁸

Possible solutions to overcome this mismatch in order to obtain accurate BP readings may include use of extra-large cuffs, such as thigh or conical cuffs; or the use of wrist BP monitors; or the use of regular-sized cuffs but placed around the forearm as opposed to the normal upper arm position. However, because of the absence of rigorous testing of the various methods, use of these alternative strategies has been done presumptively or based on anecdotal experience.

Extra-large cuffs like conical-shaped cuffs or thigh cuffs can be used for BP measurement in severely obese patients in upper arm. Conical cuffs better fit the natural contour of the upper arm in severely obese patients who have often have a pronounced conical upper arm shape. Studies done in severely obese patients have shown that standard cylindrical cuffs overestimate systolic and diastolic BP compared with measurements done with conical cuffs.^{5,7} Around 15% of individuals found to be hypertensive with the cylindrical cuff were actually normotensive when assessed with the conical cuff.⁷ Use of extra-large thigh cuffs at the level of upper arm are recommended in the 2017 ACC/AHA BP guidelines for BP measurement in severely obese patients.¹ These extra-large

conical or thigh cuffs may provide a reasonable means of BP measurement in severely obese patients as it does not deviate from the standard recommendations of measuring BP in upper arm. However, these extra-large cuffs may not be routinely available in most clinics, and in the case of the latter, may be difficult to use, such that their use is not widespread.

The 2018 Canadian hypertension guidelines recommend use of validated wrist BP monitors for use in severely obese patients (BMI >35 kg/m²) in whom an overly large arm circumference precludes use of standard-sized BP cuffs.⁸⁻¹⁰ Importantly, the wrist monitor should be supported on the chest at heart level during use. In addition, concordance of wrist and upper arm measurements should be confirmed prior to relying on wrist BP measurements.^{8,9} Use of fingertip BP monitors is not recommended as their accuracy has not been confirmed.^{11,12}

An alternative to extra-large cuffs and wrist monitors is use of standard cuffs for measurement of BP in the forearm. Forearm BP measurement has been validated in severely obese patients when in the supine position.¹³ The 2016 National Heart Foundation of Australia guidelines recommend using an appropriate-sized cuff on the forearm during auscultation of the radial artery if the upper arm is too large for oversized cuffs.¹⁴

In the current issue of *American Journal of Hypertension*, Leblanc et al. compared forearm BP measurements during varying body and arm positions to directly obtained intra-arterial assessments in severely obese patients (BMI ≥40 or ≥35 kg/m² with associated comorbidities) and a comparator group of nonseverely obese subjects (BMI < 35 kg/m²).¹⁵ The study compares forearm and upper-arm BP measurements in supine and semi-fowler (i.e., semi-upright with head of bed elevated at 45°) positions done preoperatively in patients undergoing elective surgeries. In the semi-fowler position, BP measurements were taken while the arm was supported at heart level resting on a pillow, in a downward position, or with the arm raised overhead, positioned at 45° also resting on a pillow. These forearm and upper-arm

Correspondence: M. Siddiqui (msiddiqui@uabmc.edu, siddiquimohd@gmail.com).

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¹Vascular Biology and Hypertension Program, Division of Cardiovascular Disease, University of Alabama at Birmingham, Birmingham, Alabama, USA.

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BP measurements were compared with gold standard inter-arterial measurements¹⁵. The investigators found that forearm systolic BP measurements agreed with intra-arterial assessments in the supine position and in semi-fowler with the arm in a downward position in severely obese patients. In addition, forearm systolic BP measurements agreed with intra-arterial assessments in the supine position and semi-fowler position with forearm resting at heart level in the comparator group. In conclusion, forearm systolic BP measurement consistently agreed with intra-arterial assessments in the supine position with the arm and forearm resting at heart level in both severely obese and nonseverely obese subjects¹⁵.

The advantages of forearm BP measurement is that it can be done easily and inexpensively with existing BP monitors that are already routinely used both in clinics and at home. The disadvantage of supine or semi-fowler forearm BP measurement is that it does deviate from current recommendations of obtaining BP measurements with the patient seated upright with the arm resting at heart level. Reconciling forearm BP measurements when done supine or in the semi-fowler position with assessments when done in the more routine sitting position would be of value for a future study. Such a comparison would serve to standardize BP measurement in regards to patient position, such that it can be more easily incorporated into outpatient clinic and home settings.

DISCLOSURE

The authors declared no conflict of interest.

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