Selection of an arm cuff of the right size is necessary for accurate measurement of blood pressure (BP). Incorrect measurement can result either in unnecessary investigations, treatment, and follow-up for the mistaken diagnosis of hypertension, or no treatment for hypertension in individuals mistakenly thought to have normal BP. This is of particular importance in children, who have age-dependent variations in body size and BP. Studies have revealed that health care providers often do not follow published guidelines concerning cuff selection for children. Perceptions about cuff selection and published recommendations are frequently discrepant. Our studies have revealed that larger BP cuffs are required if upper arm length is used as a criterion for cuff selection. In contrast, smaller cuffs are required if 40% of the upper mid-arm circumference is used as a criterion for cuff selection. No single cuff, when used in accordance with current recommendations, yields accurate systolic as well as diastolic BP. The century-old issue of how to select a right size arm cuff for an accurate measurement of BP remains unresolved. Am J Hypertens 2002;15:67S–68S © 2002 American Journal of Hypertension, Ltd.

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Blood pressure (BP) measurement is an integral part of the clinical examination. A number of factors affect the accuracy of its measurement. These include the subject’s mental status and level of anxiety, position of the arm, and the size of the arm cuff, as well as observer bias and the instrumentation used. In 1901 Von Recklinghausen was the first to observe that a smaller BP cuff gives a falsely high BP reading. Many subsequent studies have shown that a cuff larger than appropriate size can give falsely low measurements (large cuff effect), whereas a smaller one gives falsely high readings (small cuff effect). This issue is of particular importance in children, because of significant differences in arm sizes at various ages.

Nearly 100 years have passed since Nicholai Korotkoff, a Russian army surgeon, defined the auscultatory measurement of systolic and diastolic BP. Yet a century later, we still have not perfected the art of indirect BP measurement. Selection of the appropriate cuff size for a particular subject is made difficult by ever-changing recommendations for cuff selection. In 1987 the Task Force on Blood Pressure Control in Children recommended that the cuff bladder should be wide enough to cover three-quarters of the upper arm length (UAL), measured from the acromion to the olecranon process. In its update, the working group recommended that the width of the bladder cuff should equal 40% of the mid-upper arm circumference (UAC).

Despite various recommendations, perceptions on cuff selection among the health care providers do not match the Task Force recommendations. We surveyed attending pediatricians, resident physicians, and nurses at our hospital. The survey revealed that 60% of attending pediatricians use two-thirds UAL as a criterion for cuff selection. A similar percentage of resident physicians and nurses used these criteria—60% and 56%, respectively. Of 201 attending pediatricians, residents, and nurses, 157 (78%) incorrectly defined UAL as the distance between axilla and the cubital fossa. A similar apparent lack of interest in published guidelines was also highlighted in a study from the United Kingdom by Wingfield et al who reported that of 831 practitioners, only 27% of doctors and 32% of nurses correctly estimated the appropriate coverage of arm with BP cuff bladder. Alpert recently wrote an editorial in Blood Pressure Monitoring, in which he stated, “from practical experience, I would estimate that improper cuffs are used at least 30% to 50% of the time.”

The evident confusion concerning cuff selection may be due, in part, to conflicting recommendations in textbooks, a major source of reference for practitioners and those in training. Both Nelson’s Textbook of Pediatrics and Rudolph’s Pediatrics recommend that the cuff should cover approximately two-thirds of the UAL, yet neither defines UAL. In a chapter on childhood hypertension in the textbook Hypertension, the author recommends that the cuff should be wide enough to cover at least 75% to 80% of the arm between the antecubital fossa and axilla. According to another popular textbook, Primary Pediatric Care, the optimal cuff size is described as one that covers...
two-thirds of the distance between the antecubital fossa and the shoulder. A different chapter in the same book recommends that the cuff should cover approximately 75% of the upper arm.

A previous study from our group revealed that by using the criterion of three-quarters UAL, a large adult-size cuff should be appropriate for a 6-year-old child but by two-thirds UAL criterion, the same cuff should be appropriate for an average-sized 7- to 8-year-old child. In contrast, by using 40% UAC criterion, a small adult cuff should be appropriate for an average 16-year-old male and a 25-year-old female; and a 14-cm wide adult cuff should be large for any average-sized pediatric patient. In fact, the ideal arm circumference as defined by Report of the Special Task Force Appointed by the Steering Committee by American Heart Association, is 30 cm for a 12-cm cuff, 37.5 for a 15-cm cuff and 45 cm for an 18-cm cuff. Accordingly, a 14-cm regular adult cuff would need an ideal UAC of 35 cm, which is more than the average UAC for adult males and females, 32.6 cm and 30.3 cm, respectively. Such a cuff should, therefore, be of no use for any average-sized pediatric or adult subject.

In a study involving 31 pediatric subjects (mean age, 9.5 years), we compared directly measured intra-arterial pressure with that measured by sphygmomanometer by using two-thirds UAL, three-quarters UAL, and 40% UAC criteria for arm cuff selection. Mean cuff width as used by two-thirds UAL and three-quarters UAL criteria were 16.3 cm and 16.5 cm (large adult or thigh size, respectively). By using 40% UAC criterion, the mean cuff width used was 8.5 cm (“pediatric”). This confirms our previous observation that for UAL criteria, we should be using larger BP cuffs, whereas for 40% UAC criterion, we should be using smaller BP cuffs. A statistically significant difference was seen between the selected and the ideal cuff sizes when UAL criteria were used. A limited choice exists among larger cuffs, and health care practitioners have a tendency to use larger cuffs when the right-sized cuff is not available. However, for 40% UAC criterion, the difference between selected and ideal cuff size was not significant because of a larger variety of pediatric cuff sizes. The study also revealed that, of the three modes of cuff selection, the one with 40% UAC shows the closest agreement with systolic (but not diastolic) BP.

We conclude that larger BP cuffs are required for indirect measurement by using the two-thirds and the three-quarters UAL criteria, whereas smaller cuffs are required for measurement by applying 40% UAC criterion. However, when intra-arterial measurements are compared to those obtained by cuffs, no readings were accurate, irrespective of the selection method used. Thus, the issue of the appropriate cuff size for indirect measurement of both systolic and diastolic BP remains unresolved.

References