Sex Differences in Blood Pressure—A Measured Relook at Measures

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During the past few years, emerging data have refocused our attention on sex differences in blood pressure (BP). While confirming the findings from historical physiologic and experimental studies demonstrating how measures of BP are intrinsically lower in women than men, longitudinal epidemiologic data have also revealed that BP elevation begins earlier in life and increases faster with aging in women. Furthermore, outcomes data from almost a dozen national and international large cohort studies have found that for the same degree of increased BP, women have a greater risk than men of myocardial infarction and stroke. The pressing question now is why. What accounts for the lower BP levels and yet higher BP-associated risks in women? At least part of the answer could lie in how we measure BP.

In JAMA Network Open, Abbaoui et al have taken on the important task of clarifying how observed sex differences in peripherally measured systolic BP (SBP) and related outcomes may, in fact, be related to a discordance in how well the brachial cuff pressure reflects central BP. In a cohort of 500 patients with a mean (SD) age of 66 (10) years who were referred for coronary angiography, including 145 women (29%), postprocedural, catheter-based measurements of ascending aortic and intrabrachial pressures were recorded in sync with noninvasive central and brachial pressures assessed using an automatic BP monitor (Mobil-O-Graph; I.E.M.). In cross-sectional analyses, invasive central aortic SBP was higher in women than in men even though there was no difference in noninvasive brachial or central SBP measures. The difference between invasive central and noninvasive brachial SBP measures was significantly but only partially (55%) mediated by height, and, notably, the difference was not mediated by age. Although analyses were not adjusted for other covariates that could have contributed to sex differences in this setting, such as arm circumference and variables related to the catheterization procedure, the findings are intriguing. Leveraging the key methodologic strength of being able to simultaneously compare direct invasive measures of central BP with noninvasive measures, the study results underscore the importance of considering how the most commonly used noninvasive method for measuring BP could be sex biased.

Although the study premise and findings are compelling, there is still more work to be done. Additional investigations examining potential differences between noninvasive brachial and invasive central measures of BP in healthy women and men, without any cardiovascular risk traits, are needed. Future studies are also needed to determine whether the main findings are generalizable to more diverse populations, including individuals across the age spectrum with and without cardiovascular risk factors. Furthermore, if there truly is a sex difference in the concordance between noninvasive brachial cuff and invasive central measures of BP, there could also be a sex difference in the association between invasive BP and outcomes—even when accounting for variations in height as well as age. The downstream implications are numerous, including the potential need to consider sex-specific algorithms for oscillometric brachial BP devices or develop more accurate noninvasive measures of central aortic pressure to guide the diagnosis and treatment of hypertension.

The importance of this study extends beyond the results alone. Perhaps foremost is the conceptual innovation of reconsidering the accuracy of a physiologic measure commonly used in practice, particularly in the context of potential sex differences. We have long taken for granted that women and men need to have separate reference growth curves for height and weight and that, even into adulthood, sex differences persist for anatomical measures, such as cardiac size and shoe size. However, we are only in the beginning stages of understanding how physiologic measures, such as brachial BP, may also benefit from sex-specific considerations. In this study, Abbaoui et al...
press us to question even further the method of a physiologic measurement and its potentially limited generalizability across sexes. In effect, we are now challenged to ask whether we have been using the correct device, the correct device settings, or the correct units or reference ranges when performing a particular physiologic measure given what we know about fundamental sex differences in anatomy and the interdependence between anatomy and physiology. This concept was previously demonstrated by still-overlooked evidence of sex divergence in the physiologic response to exercise stress across the age span.5,6 Ironically, but aptly, perhaps one of the most accepted and illustrative examples is offered by brachial BP. We know that a one-size cuff does not fit all, or even most, when it comes to arm circumference and the accurate measurement of BP, and now we may need to consider more than just arm circumference.7 Given that ample evidence has demonstrated that women are not just smaller versions of men, ongoing endeavors to optimize cardiovascular health in both women and men would do well to increasingly consider the possibility of intrinsic sex differences. Notwithstanding the need for more work in the field, the current study serves to deepen our appreciation for the potential value of reexamining biomedical measures through the lens of sex diversity as we work to achieve more appropriately tailored and, in turn, more effective approaches to evaluating, managing, and mitigating cardiovascular disease risk for all.

ARTICLE INFORMATION
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REFERENCES