Errors in Estimating Propagation Distances in Pulse Wave Velocity

To the Editor:

Recent correspondence over the report by Lantelme et al exposes a more serious problem with the use of the automated pulse wave velocity (PWV) measuring instrument (Complior®). The aortic PWV reported by Lantelme et al (~14 m/s) was approximately 50% higher than the aortic PWVs obtained by others for similarly aged human subjects, 8.7 m/s. In fact, a literature search revealed that other investigators using this instrument have also measured unreasonably high aortic PWVs.

It appears the problem lies with the error in estimation of the propagation distance of the traveling pulse. The manufacturer recommends the use of the absolute distance between the 2 transducers as the propagation distance. This approach is not only inconsistent with published data but also introduces a body size bias into the PWV measurements. Using the typical distances between the aortic arch and the carotid/femoral arterial sites (12 cm/50 cm), one can estimate the order of magnitude of the introduced error by this recommendation. In this instance the distance between transducers is 62 cm (=50+12 cm) but the actual propagation distance is 38 cm (=50–12 cm), because the pulse in the carotid and femoral sites are traveling in opposite directions. It is interesting to note that the ratio of 62 to 38 is approximately 14/8.7. More importantly, this ratio is dependent on the body size.

PWV measurements are becoming more widely used because it is a simple and quite straightforward method of assessing arterial stiffness in health and disease. Unfortunately a seemingly innocuous error like this can make PWV measurements completely inaccurate.

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Response

In our recent report, we used an automatic device for pulse wave velocity (PWV) measurement that is commercially available (Complior, Colson). The Complior device has been validated in comparison with the manual method in more than 50 men and women, of various age, blood pressure, and heart rate level. It is a widely accepted device and has been recently used in an international study to assess the effect of different antihypertensive treatments on arterial stiffness. As indicated by Karamanoglu, we followed the manufacturer’s recommendations for the measurement of PWV. Taking into account the fact that our patients were older, their PWV values were consistent with those observed in REASON (Preterax in Regression of Arterial Stiffness in a Controlled Double-Blind Study). Notwithstanding these considerations, the measurement of PWV remains a challenging task that may explain differences of PWV. Regarding the distance traveled by the 2 pulse waves, it is true that (1) it is difficult to measure and it can only be an approximation, and (2) it greatly affects the calculation of PWV. The approximation of this distance may be even less accurate in elderly subjects whose aorta is made sinuous by atherosclerosis. In his letter Karamanoglu not only contends that we overestimate PWV by the Complior method but also that we introduce a body size bias. It may very well be that we overestimate the real PWV because of the method used. As to the body size bias, we are ready to accept that the distances, aortic arch–carotid and aortic arch–femoral, do not vary proportionately when body size varies, although we are not aware of data supporting this contention.

Be that as it may, going back to the goal of our study, we sought to test the effect of heart rate variations on PWV within an individual. Therefore, the only source of PWV variation is a change in the transit time (when evidently the 2 transducers are positioned in the same place). Thus, to our eyes, the concern raised by Karamanoglu does not apply to our results.

We agree however that, not only because of the way the distance is measured but also because of the effect of heart rate and blood pressure variations on PWV values, it is difficult to implement this method in a routine clinical set-up. Future improvements should probably concern standardization of the methods, which would deserve the development of practice guidelines by an appropriate task force.

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