Correlating Ambulatory Blood Pressure Measurements With Arterial Stiffness: A Conceptual Inconsistency?

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Letter to the Editor

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To the Editor:

There is a growing interest in characterizing arterial properties using noninvasive measurements. A new parameter, called the "Ambulatory Arterial Stiffness Index" (AASI), was derived recently from the linear relationship between systolic and diastolic blood pressure (BP) observed using 24-hour ambulatory measurements.[1,2] AASI has been hypothesized to be an index of arterial stiffness and shown to predict cardiovascular mortality. The purpose of this letter is to suggest that AASI is unlikely to reflect arterial stiffness and to propose an alternative view.

A plot of repeatedly measured diastolic versus systolic BP data shows a fairly linear relationship. The diastolic versus systolic, called hereafter "slope," can be derived using regression analysis. AASI is defined as l-slope.[1] Stating that AASI is an index of arterial stiffness is conceptually inconsistent, because the same slope may correspond with different values of arterial stiffness. By definition, a slope is determined by different BP levels and is independent of the distribution of data along the regression line. In contrast, arterial stiffness is known to increase for higher BP levels, which makes it sensitive to the distribution of BP data. For example, consider 24-hour ambulatory BP data of an individual. Excluding from the calculations a few high BP data points that occur along the regression line would not change the slope but would clearly shift 24-hour mean arterial stiffness to a lower value. This is true also for other pressure-dependent measures related to arterial stiffness as pulse wave velocity or augmentation index. Because this discrepancy cannot be eliminated by averaging, we may conclude that finding positive correlations between AASI and stiffness-related variables cannot justify an association between AASI and arterial stiffness.

On the other hand, mechanical properties of the arterial wall, including stiffness and related measures, are known to depend on parameters like elastin/collagen ratio, that are altered with age and diseases[3–5] but are unlikely to vary over 24 hours. This is by no means an explanation for the linearity between systolic and diastolic BP but a possibility that deserves consideration. Using a model approach, systolic-on-diastolic slope was shown to be equal to the relative increase of arterial stiffness during the systole.[6] This expression is compatible with the above view, as the elastin/collagen ratio is an important determinant of the increased arterial stiffness in elevated pressure.

Disclosures

None.

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