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## **Response to Correlating Ambulatory Blood Pressure Measurements With Arterial Stiffness: A Conceptual Inconsistency**

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# Letter to the Editor

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## **Response to Correlating Ambulatory Blood Pressure Measurements With Arterial Stiffness: A Conceptual Inconsistency**

We defined the ambulatory arterial stiffness index (AASI) as unity minus the regression slope of diastolic on systolic blood pressure, as measured at the brachial artery by ambulatory monitoring.<sup>1,2</sup> AASI reflects the dynamic relation between diastolic and systolic blood pressure during the day. Conceptually consistent with a hypothesis put forward in 1914,<sup>3</sup> the stiffer the arterial tree, the closer the regression slope and AASI are to 0 and unity, respectively. We concede that AASI is an indirect measure of arterial stiffness and must be influenced by other hemodynamic factors, such as wave reflections originating from peripheral sites, stroke volume, and peripheral resistance. The range of systolic and diastolic blood pressure values, which itself depends on the duration of the awake and asleep periods and on the intensity of physical activity during daytime, might additionally influence AASI. Nevertheless, in collaboration with the Ohasama investigators,<sup>4</sup> we demonstrated recently that random exclusion of readings from ambulatory recordings with measurements programmed at 30-minute intervals did not significantly change the average value of AASI until  $\geq 7$  readings were omitted.

We validated AASI in terms of established indexes of arterial stiffness. Among 166 healthy volunteers, the correlation between AASI and aortic pulse wave velocity was 0.51 ( $P < 0.001$ ).<sup>1</sup> As illustrated in Figure 1 of the Irish study, the slope of diastolic on systolic blood pressure can be similar in individual recordings with differences in 24-hour systolic pressure or 24-hour pulse pressure as large as 40 or 25 mm Hg, respectively. However, across individual subjects, as other measures of arterial stiffness, AASI increased with age and mean arterial pressure.<sup>1</sup> Furthermore, both before and after adjustment for arterial wave reflections by considering height and heart rate as covariates and for mean arterial pressure, AASI correlated more closely with the central and peripheral systolic augmentation indexes than 24-hour pulse pressure did.<sup>1</sup>

The discussion on what AASI means exactly in terms of arterial regulation<sup>5</sup> might continue for some time until appropriate experimental studies in animals or human volunteers have been completed. However, as of to date,  $\geq 1$  cross-sectional analysis<sup>6</sup> and 3 prospective cohort studies<sup>2,4,7</sup> demonstrated significant association of AASI either with signs of target organ damage in never-treated hypertensive patients<sup>6</sup> or with the incidence of cardiovascular mortality and morbidity<sup>2,4,6</sup> in representative population samples randomly recruited in Western Europe<sup>2,7</sup> or Japan.<sup>4</sup> AASI seems to be especially predictive of stroke,<sup>2,4,7</sup> even at levels of blood pressure within the normotensive range.<sup>2,7</sup> AASI retains its prognostic significance, over and beyond 24-hour pulse pressure, a static surrogate measure of arterial stiffness throughout the day.<sup>2,4,6</sup> Additional adjustment for any component of clinic or 24-hour blood pressure did not remove the prognostic significance of AASI.<sup>4,7</sup> Abstraction made of the physiological interpretation of the novel index, AASI,

allows noninvasive risk stratification beyond anthropometric characteristics, classic cardiovascular risk factors, lifestyle, and other measures derived from blood pressure measurement in the clinic environment or under ambulatory conditions. In our opinion, this represents the ultimate validation and added value of AASI.

## **Disclosures**

None.

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