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COMMENTARY

What is important for aging-induced arterial stiffening, autonomic dysfunction, vascular characteristics or both?

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Aging decreases arterial distensibility via changes in arterial impedance, arterial pressure, and flow wave contours; these aging-induced pathological changes in large arterial walls are qualitatively similar to those observed in hypertensive patients.[1–4] Therefore, hypertension is often considered as an accelerated form of aging.[5]

Isnard's study[6] is the first to report that both the aortic arch diameter and the elastic modulus are increased in hypertensive patients. However, in this study, the elastic modulus and age were positively correlated in hypertensive patients but not in normal subjects. On the other hand, Laurent *et al.*[5] reported that common carotid artery distensibility was not attenuated in hypertensive patients compared with that in age-and sex-matched normotensive subjects. Interestingly, the large cross-sectional data[7] indicates that hypertension-induced arterial stiffness is due to changes in distending pressure rather than structural changes in the artery. It has been clarified that the interaction between aging and hypertension affects arterial stiffening, but these previous findings suggest that the contribution of aging to the arterial wall alteration is different from that of chronic hypertension. However, the physiological mechanism underlying the different effects of aging and hypertension remains unknown.

In this issue of *Hypertension Research*, Tanaka *et al.*[8] report some novel findings regarding central arterial compliance and sympathetic tone of the vasculature measured in healthy young and elderly subjects. The authors found that carotid arterial compliance in elderly subjects was 45% lower than that in young subjects. More interestingly, they demonstrated, for the first time, a significant inverse relationship between carotid arterial compliance and muscle sympathetic nerve activity, indicating that individuals with low central arterial compliance have a high sympathetic tone of the vasculature. On the basis of these findings, the authors suggest that the mechanistic role of sympathetic tone of the arterial vasculature on arterial compliance and the reduction in the compliance of large elastic arteries occurring with advancing age are due to the increase in sympathetic activity. This conclusion is reasonable because previous studies[9,10] have reported that acute increases in sympathetic adrenergic tone decrease arterial compliance. Thus, it could be expected that chronic high sympathetic tone of the arterial vasculature increases arterial compliance.

In addition, this study provides us with important information for research on hypertensive patients. The findings of this study demonstrate the possibility that high sympathetic nerve activity in hypertensive patients accelerates aging-induced arterial stiffening, thereby supporting the finding of previous studies that arterial distensibility or compliance decreases more rapidly with aging in hypertensive patients than in normotensive subjects.[6,11–13] In other words, this study provides the evidence on the contribution of the interaction between aging and chronic hypertension to arterial stiffening.

However, a drawback of this study is the lack of evidence that aging-induced high sympathetic nerve activity causes low arterial compliance because aging is a chronic condition. In other words, it is unknown as to which physiological factor occurs first: compliance or sympathetic nerve activity. It is possible that a decrease in arterial compliance attenuates the transition from sympathetic nerve activity to peripheral vasomotion because arterial stiffening causes attenuation in peripheral vasomotion. This downregulation of sympathetic nerve activity on vasomotion may consequently lead to increase in resting sympathetic nerve activity to maintain adequate blood pressure.[14,15]

Importantly, another study by the author's research group[16] suggested that this vascular characteristic (arterial stiffening) causes autonomic dysfunction. Aging-induced attenuation in the arterial baroreflex is caused by arterial stiffening, which decreases conformational changes in carotid baroreceptors. This conclusion is likely contradictory to the study's suggestion that high sympathetic nerve activity causes arterial stiffening. However, whether autonomic dysfunction or vascular characteristics are important in determining arterial stiffening remains unknown. To resolve this important question, other studies, for example, those that examine the effect of adrenergic blockade on vascular compliance in both young and elderly subjects, while maintaining arterial blood pressure (for example, using phenylephrine infusion), are required. Both factors appear important, but the contribution of each factor to arterial compliance in the elderly may be different from that in young individuals.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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