Editorial Comment

Improvement of Arterial Stiffness by Aerobic Exercise in Elderly Subjects

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(*Hypertens Res* 2007; 30: 875–876)

***Key Words*: arterial stiffness, aerobic exercise, augmentation index, elderly subjects**

Arterial stiffness increases with aging (*1*), and is accelerated by common diseases such as hypertension, type 2 diabetes, and metabolic syndrome. Among various indices of arterial stiffness, pulse wave velocity (PWV) and the augmentation index (AI) are commonly used in clinical settings, because these parameters can be easily and noninvasively measured. PWV mainly reflects the vascular stiffness (*2*). On the other hand, AI is calculated based on the analysis of arterial pulse waveform. AI is not simply determined by the wall stiffness of large arteries but influenced by the intensity of wave reflection, which is determined by the diameter and elasticity of small arteries and arterioles (*2*).

PWV (*3*) and AI (*4*) predict cardiovascular events. In addition, arterial stiffness also relates to microvascular diseases in the brain and the kidney (*5*). Increased arterial stiffness may at least partly explain the high incidence of cardiovascular diseases in elderly persons or in patients with hypertension, diabetes, or metabolic syndrome. Thus, a therapeutic regimen to effectively reduce arterial stiffness would exert a beneficial effect in preventing cardiovascular events and progression of microvascular diseases. In fact, the CAFE study, a substudy of the ASCOT, demonstrated that patients receiving an amlodipine regimen exhibited significantly lower values of indices of arterial stiffness, including AI, and better cardiovascular outcomes compared with those receiving an atenolol regimen (*6*). As for the other classes of antihypertensive drugs, the angiotensin receptor blocker valsartan decreased brachial to ankle PWV independent of blood pressure lowering in elderly hypertensive patients (*7*). An angiotensin converting enzyme inhibitor, perindopril, also decreased arterial stiffness in hypertensive patients with type 2 diabetes (*8*).

Lifestyle modification also improves arterial stiffness. Dietary sodium restriction to <100 mmol/day for 3 months significantly decreased aortic PWV and carotid AI in postmenopausal women with systolic blood pressure between 130 and 159 mmHg (*9*). More strict sodium restriction to 54 ± 11 mmol/day improved carotid artery compliance and β-stiffness index in elderly patients with systolic hypertension in 1 to 2 weeks (*10*). More recently, in untreated hypertensive patients, current and ex-smokers showed significantly higher PWV and AI than nonsmokers (*11*). There was a significant linear relationship between smoking status and PWV and AI, and in ex-smokers, longer duration of smoking cessation was associated with lower values of PWV and AI (*11*). Therefore, smoking cessation also seems to reduce the arterial stiffness.

Many cross-sectional observations already have noticed an association between habitual aerobic exercise and lower arterial stiffness. In this issue of *Hypertension Research*, Tabara *et al*. (*12*) report that in sedentary elderly subjects, habitual aerobic exercise of mild to moderate intensity significantly reduced arterial stiffness and blood pressure. Both hypertensive and normotensive subjects aged 50 years or older were included in the study. The authors used radial AI as an index of arterial stiffness. Radial AI can be easily measured in clinical settings and shows a highly significant correlation with directly measured central AI (*13*). The exercise-induced reduction of radial AI was independent of the changes in blood pressure.

Previous studies (*9*, *14*, *15*) failed to prospectively demonstrate the ability of physical exercise to reduce the arterial stiffness in hypertensive patients. Several points may explain the discrepancy between the study of Tabara *et al*. (*12*) and

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Received June 5, 2007.

the previous reports (*9*, *14*, *15*). First, in two of the previous reports the study periods were 8 weeks (*15*) and 3 months (*9*), both of which were shorter than the 6-month aerobic training performed in the study of Tabara *et al*. (*12*). Second, the other previous study (*14*) examined the effects of combined aerobic and resistance training, and resistance training has been reported to have unfavorable effects on arterial stiffness (*16*).

Taking these results together, one may expect that long-term aerobic exercise of mild to moderate intensity reduces arterial stiffness in both hypertensive and normotensive elderly subjects. The results of the study of Tabara *et al*. (*12*) are encouraging. Unfortunately, however, they did not evaluate the effects of long-term exercise in a case-control manner. Well-designed case-control studies will thus be needed to confirm this notion. In addition, it should be examined whether exercise-induced reduction of arterial stiffness leads to a decrease in cardiovascular disease in elderly subjects.

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