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Editorial

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Noninvasive Assessment of Arterial Stiffness Using Oscillometric Methods: baPWV, CAVI, API, and AVI

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Pulse wave velocity (PWV) has been used as a noninvasive index of arterial stiffness and atherosclerosis and is useful as a predictor or surrogate end-point marker for cardiovascular diseases. Carotid–femoral PWV (cfPWV) measurement is a conventional technique for measuring PWV. However, in the measurement of cfPWV, a femoral artery transducer should be carefully adjusted to obtain an accurate pulse wave, which increases the psychological stress in patients. Such sophisticated and complex techniques are inconvenient, particularly in large clinical trials.

A simple, noninvasive, automatic method of measuring brachial–ankle PWV (baPWV) has been developed and used in clinical practice and large cohort studies. baPWV is correlated with aortic PWV and has been shown to be a predictor for morbidity and mortality of cardiovascular diseases. We investigated the association between carotid intima–media thickness (IMT) and baPWV or cardiovascular risk factors in 1583 Japanese male subjects undergoing routine health checkup. We found that high baPWV was a stronger predictor for early carotid atherosclerosis with carotid IMT ≥1.0 mm than high blood pressure (BP) in the general male population[1]. If baPWV is >1600 cm/s in males, we recommend further examinations, including carotid ultrasonography. Recently, in the *Journal of Atherosclerosis and Thrombosis*, baPWV evaluation was reported to have an additional value to single-photon emission computed tomography (SPECT) for the detection of obstructive coronary artery disease, especially in patients with mild ischemia on SPECT[2]. In addition, high baPWV was associated with poor outcomes in 861 patients with noncardioembolic stroke[3] and with composite coronary and carotid atherosclerotic burden in 773 community-based asymptomatic Korean subjects[4].

After the development of baPWV, the cardio–ankle vascular index (CAVI) with PWV and BP measurements has also been developed. CAVI is adjusted for BP based on the stiffness parameter β and is expressed as arterial stiffness independent of BP. We have previously reported that CAVI showed a weaker correlation with systolic BP than with baPWV and was not affected by changes in BP during measurement[5]. Many evidences have suggested that CAVI is associated with arteriosclerotic diseases, such as coronary artery diseases, cerebral infarction, and chronic kidney diseases, as well as with various coronary risk factors[6]. An improvement in these risk factors decreased CAVI. In the *Journal of Atherosclerosis and Thrombosis*, CAVI was reported to be a predictor for cardiovascular events, independent of traditional coronary risk factors in 1562 outpatients with metabolic disorders[7] and to be associated with the executive function assessing letter word fluency test in140 community-dwelling elderly individuals[8].

Recently, novel, noninvasive indices of arterial stiffness using oscillometric BP, arterial pressure–volume index (API), and arterial velocity–pulse index (AVI) evaluation have been developed. API was reported to correlate with baPWV, cfPWV, and carotid arterial compliance, suggesting that it may be used for evaluating arterial stiffness. Moreover, AVI was suggested to indicate the enhancement of reflected waves and to be associated with arterial stiffness. These two indices were correlated with the known risk factors of cardiovascular disease, carotid IMT, and CAVI in 7248 healthy Japanese adults[9].

In this issue of the *Journal of Atherosclerosis and Thrombosis*, Yamanashi, *et al.* demonstrated that API and AVI maintained positive associations with the mean carotid IMT in 2809 participants aged ≥40 years who underwent Japanese national medical checkups. Fur-

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thermore, they proposed that the cutoff values of API and AVI for the detection of carotid IMT ≥ 1.0 mm were 31 for API and 29 for AVI[10]. These two indices may detect preclinical carotid atherosclerosis. However, the clinical evidences on API and AVI are scarce, and the validity of these two indices has not been fully established. Therefore, large cohort studies are needed to clarify the clinical significance and advantages of these indices.

The measurement of arterial stiffness in routine medical practice is important to assess the progression of arteriosclerosis. The measurement of baPWV, CAVI, API, and AVI using oscillometric methods is simple and noninvasive for the evaluation of arterial stiffness; additionally, BP is also measured in these equipment. The characteristics of these indices, such as dependency on BP during the measurement, should be understood. For these indices, an adequate cutoff value of surrogate maker or predictor for cardiovascular diseases should be established in the near future.

Conflict of Interests

The author declares no conflicts of interest.

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