Cardio-ankle vascular index as an arterial stiffness marker improves on cardiovascular events by adding to framingham risk score

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Background: The cardio-ankle vascular index (CAVI) is a non-invasive measurement that evaluates arterial stiffness using the analysis of oscillometric waveform during cuff-Inflation. Several studies reported that CAVI is associated with cardiovascular risk factors, while the clinical prognostic value of CAVI as a surrogate marker of atherosclerosis has not been fully elucidated. Meanwhile, the Framingham risk score (FRS) is an established marker of cardiovascular outcomes.

Purpose: To investigate whether adding CAVI to Framingham risk score improves the prediction of cardiovascular events.

Methods: This prospective observational study included consecutive 422 patients with cardiovascular risk factors but without known coronary artery disease (69±8 years, 63% men). CAVI was measured by the oscillometric method with VaSera vascular screening system. Patients with atrial fibrillation, left ventricular ejection fraction <50%, both ABI<0.9, severe valvular diseases, or hemodialysis were excluded. Primacy outcomes were cardiovascular death, myocardial infarction, stroke, hospitalization for heart failure and revascularization.

Results: During a median follow-up of 3.1 years, cardiovascular events occurred in 12.8% (3.3%, 15.7%, and 19.1% in the low, intermediate and high-risk group of stratification by FRS, respectively). The ROC curve analysis for discriminating cardiovascular events showed that the AUC of CAVI added to Framingham risk score was the highest compared to Framingham risk score and CAVI alone (CAVI added to Framingham risk score: AUC 66.9, 95% CI 59.6–74.2, Framingham risk score alone: AUC 61.5, 95% CI 53.8–69.1, CAVI alone: AUC 62.3, 95% CI 54.1–70.6). The logistic regression analysis demonstrated that CAVI and Framingham risk score were independent predictors of cardiovascular events (CAVI: OR 1.381, 95% CI 1.164–1.597, p=0.004, Framingham risk score: OR 1.135, 95% CI 1.044–1.225, p=0.007). Next, when logistic regression analysis was performed simultaneously on Framingham risk factor and CAVI, CAVI was an independent predictor of cardiovascular events (OR 1.347, 95% CI 1.124–1.569, p=0.009). Furthermore, in the likelihood ratio test, CAVI added to Framingham risk score significantly improved the cardiovascular event prediction ability than Framingham risk factor alone. Next, when patients with intermediate risk (n=217) were divided into two groups based on CAVI of 9.0, the Kaplan-Meier estimate showed that events occurred more frequently in higher CAVI group (9.3% and 29.1%, log-rank, P=0.009) and the C-statistic was 0.662. Multiple Cox analysis showed that, in the intermediate risk group, CAVI was an independent predictor of primary outcomes (HR 1.387 per 1 index, 95% CI 1.081–1.779, p=0.010).

Conclusion: The measurement of CAVI could be a useful predictor for cardiovascular events. In addition, the combination of CAVI and Framingham risk score could improve the predictability compared to the Framingham risk score alone.