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Ultrasound-based stroke/cardiovascular risk stratification using Framingham Risk Score and ASCVD Risk Score based on "Integrated Vascular Age" instead of "Chronological Age": a multi-ethnic study of Asian Indian, Caucasian, and Japanese cohorts

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Abstract

Background: Vascular age (VA) has recently emerged for CVD risk assessment and can either be computed using conventional risk factors (CRF) or by using carotid intima-media thickness (cIMT) derived from carotid ultrasound (CUS). This study investigates a novel method of integrating both CRF and cIMT for estimating VA [so-called integrated VA (IVA)]. Further, the study analyzes and compares CVD/stroke risk using the Framingham Risk Score (FRS)-based risk calculator when adapting IVA against VA.

Methods: The system follows a four-step process: (I) VA using cIMT based using linear-regression (LR) model and its coefficients; (II) VA prediction using ten CRF using a multivariate linear regression (MLR)-based model with gender adjustment; (III) coefficients from the LR-based model and MLR-based model are combined using a linear model to predict the final IVA; (IV) the final step consists of FRS-based risk stratification with IVA as inputs and benchmarked against FRS using conventional method of CA. Area-under-the-curve (AUC) is computed using IVA and benchmarked against CA while taking the response variable as a standardized combination of cIMT and glycated hemoglobin.

Results: The study recruited 648 patients, 202 were Japanese, 314 were Asian Indian, and 132 were Caucasians. Both left and right common carotid arteries (CCA) of all the population were scanned, thus a total of 1,287 ultrasound scans. The 10-year FRS using IVA reported higher AUC (AUC =0.78) compared with 10-year FRS using CA (AUC =0.66) by ~18%.

Conclusions: IVA is an efficient biomarker for risk stratifications for patients in routine practice.

Keywords: Cardiovascular disease (CVD); carotid intima-media thickness; chronological age (CA); conventional cardiovascular risk factors (CCVRFs); integrated vascular age (IVA); risk assessment; stroke; vascular age (VA).

Figures

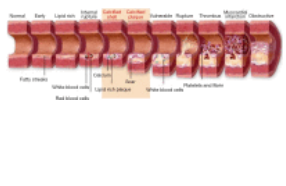

Figure 1 The vascular aging process (Courtesy…

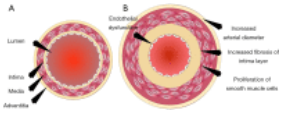

Figure 2 The cross-sectional view of the…

Figure 3 Two-stage system for IVA design…

Figure 4 The internal architecture of the…

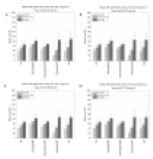

Figure 5 Comparison between the average values…

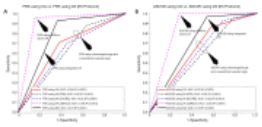

Figure 6 Receiver operating characteristics curve indicating…

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