Seismocardiography-based Score for Estimating the Likelihood of Coronary Artery Disease

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Aim- The purpose of this study is to develop a score for estimating the likelihood of coronary artery disease (CAD) defined as more than 50% stenosis in at least one coronary artery. This score is based on the analysis of linear acceleration (seismocardiogram, SCG) of the heart recorded from an accelerometer sensor mounted on the sternum.
Dataset- The database was collected from 672 individuals through a multicenter study conducted from 2021 to 2022 in Uzbekistan. It included patients with CAD (n = 419) who underwent invasive coronary angiography, and a healthy control cohort (n = 253). The dataset was randomly divided into training (80%) and test (20%) datasets.
Method- A zero-phase high-pass Butterworth filter with an order of 5 and a cut-off frequency of 0.5 Hz removed baseline wander from the SCG signals. Next, a synchrosqueezing transform (SST) was applied to determine the frequency components of the signals at each time instant. SST is a method that combines wavelet analysis and reallocation to sharpen the time-frequency representation of a signal. The resulting planes were divided into matrices that represented the time-frequency components of each cycle. These matrices were then converted to intensity images. Finally, the images were flattened and used to train a one-dimensional Convolutional Neural Network (1D CNN) classifier. The performance of the CAD risk score was assessed by evaluating the area under ROC curve (AUC), sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV), which were determined based on the predictions made by the trained 1D CNN.
Result and Conclusion- In the test dataset, AUC was 0.92. At the cut-off of 20%, sensitivity, specificity, PPV, and NPV were 95%, 65%, 75%, and 95% respectively. A CAD risk score based on SCG with an NPV of 95% is effective in ruling out the coronary artery disease.