Tone-Entropy Analysis as a Cardiac Risk Stratification Tool

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Improving risk assessment to provide evidence for preventative intervention has recently become more of a focus in cardiovascular medicine with atherosclerosis as an early manifestation of cardiovascular disease. There are many cardiac risk factors including cholesterol level, gender, age, diabetes and systolic blood pressure as well as coronary calcium screening or scintigraphy usingSPECT for identification of preclinical atherosclerosis. However coronary calcium screening or SPECT are not suitable for population screening purposes. Sudden cardiac deaths or acute myocardial infarctions in previously asymptomatic individuals, are linked to autonomic nervous system dysfunction as a causative factor in the development of atherosclerosis and augmenting arrhythmic events. We propose an algorithm to determine autonomic nervous system dysfunction that calculates the sympathetic-parasympathetic balance and allows stratification of individuals at higher risk of atherosclerosis that would benefit from coronary calcium screening or scintigraphy. Three hundred and seventeen study participants had a 20 minute lead II ECG recording taken and analysed for heart rate variability using the tone-entropy (T-E) algorithm. Tone (T) represents sympatho-vagal balance and entropy (E) the autonomic regularity activity. Of the 317 participants, 274 had TC/HDL ratios of below 5mmol/L indicating normal levels. The mean$\pm$SE of TC/HDL in the control versus elevated risk group were 3.514$\pm$0.047 and 5.809$\pm$0.11 respectively. The results for the tone and entropy analysis were combined using principle component analysis such that the mean$\pm$SE control group and elevated risk group were 1.433$\pm$0.712 and 0.189$\pm$0.236 (95% CI -2.303, 4.791; $p<0/05$). Our results suggest that T-E is a sensitive tool to identify heart rhythm disturbance associated with possible early risk of developing atherosclerosis. T-E does not require multiple tests to determine risk and can be used for patient stratification for coronary calcium screening to identify atherosclerotic plaques and lead to more timely intervention and better treatment outcomes.