

What can tone and entropy tell us about risk of cardiovascular diseases?

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. The total cholesterol to high-density lipoprotein (TC/HDL) ratio is often used as an atherogenic index to measure the extent of atherosclerosis. High levels of the TC/HDL ratio also affect nervous system function. Causes of rhythm disturbance include both intrinsic and extrinsic factors. QT interval dispersion (QTd) indicates ventricular repolarisation. The autonomic nervous system (ANS) can be viewed as a modulator that regulates interbeat interval variation. Tone and entropy are measures of the mean sympathovagal balance and the total autonomic nervous system activity influencing heart rate. We measured tone, entropy, QTd and TC/HDL in 313 participants attending a diabetes research project. Both tone and entropy were significantly related to QTd length in control but not in people with diabetes ($37 < \text{QTd} < 83 \text{ msec}$, $p < 0.05$ and $88 < \text{QTd} < 184 \text{ msec}$, $p = 0.054$ respectively). In the diabetes group the association between tone and entropy to QTd was decreased ($111 < \text{QTd} < 117 \text{ msec}$, $p = 0.086$; $118 < \text{QTd} < \text{QTd} < 122 \text{ msec}$, $p = 0.93$ respectively). The level of TC/HDL played a significant role in ANS function when analysed using tone and entropy. Tone was significantly associated with TC/HDL for the control but reduced in the diabetes group ($3.8 < \text{TC/HDL} < 4.9$, $p < 0.05$; $4.8 < \text{TC/HDL} < 4.9$, $p < 0.07$ respectively). For entropy no significant association was noted for either control or diabetes group. For the control group the optimum association was at TC/HDL of 6.5 and $p = 0.0824$. For the diabetes group the best association was for TC/HDL of 5 at $p = 0.183$. Our findings suggest that tone has an influence on ventricular repolarisation and is in turn modulated by the level of TC/HDL providing a link between these systems. The relationship seen for tone and TC/HDL suggests that tone can be used as an initial risk indicator for further invasive cardiac function testing.