Altered heart rate variability is related to the number of metabolic syndrome factors and manifest diabetes: the Tromsø study

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Abstract

Background: Diabetes mellitus (DM) and the metabolic syndrome (MetS) are associated with autonomic neuropathy, which predisposes to cardiac events and death. Measures of heart rate variability (HRV) can be used to monitor the activity of the autonomic nervous system (ANS), and there are strong indications that they can be used to study the progression of ANS-related diabetes complications. This study aims to investigate differences in HRV in healthy, MetS and diabetic populations.
Methods: We use data from the sixth survey of the population study in Tromsø (Tromsø 6, 2007-2008), in particular the variables related to DM and MetS. HRV estimated from short term pulse wave signals (PRV) was calculated from non-invasive continuous blood pressure recordings from 8142 participants. The data was used in an ANOVA model to study the non-specific total effect of having a varying number of MetS factors on PRV in the general population. In addition, we modeled the contribution from specific factors and their interactions on the alteration of PRV, and the association between PRV and HbA1c.
Results: Mean PRV (SDNN) was 49.3, 43.2, 38.6, 36.6, 34.3, 33.6 for increasing number of MetS factors, and 32.3 for manifest diabetes. The ANOVA model showed a significant negative association between the number of MetS factors and measured PRV, with a significantly higher SDNN in the healthy group compared to those with MetS (p-value<0.001) or DM (p-value<0.001). This relationship did not appear to be linear, but with a decreasing PRV for the first two factors before leveling off after the third factor. There was no significant difference between the MetS and DM populations.

When looking at the specific contribution of metabolic syndrome factors, high triglycerides and blood pressure was the strongest explanatory variables, while low HDL cholesterol was the only non-significant MetS factor. No two- or three-way interactions were significant. There was a significant negative association between HbA1c and SDNN.
Conclusion: The MetS and DM populations are different from healthy controls with respect to HRV, but we could not find a stronger alteration in the DM versus the MetS population. This study does however confirm that both the MetS factors and manifest diabetes affect ANS in this population. With further research, this might be used to predict cardiovascular events in patients with DM or MetS.