Reduced Vagally Mediated Heart Rate Variability Predicts Hypertension

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Objectives: Autonomic dysregulation has been linked to hypertension. However, previous research has been cross-sectional and overlooks the effect of stress on vagal activity. We hypothesize that vagally mediated heart rate variability is decreased in individuals at high risk of developing hypertension.

Method: There were 388 healthy participants aged 20 to 26 years who were examined during two visits 6.5 years (median: 5.7-7.1) apart. Each visit consisted of resting and exposure to a videogame challenge. Resting and reactive blood pressure (BP) were recorded at 2 visits while the root of mean squared differences of successive RR intervals (RMSSD) was determined at rest and stress during baseline visit. Results: At follow-up, the means of systolic and diastolic BP were 116.4±14.2 and 68.9±9.1 mmHg, respectively. Participants under stress had lower RMSSD and shorter R-R interval when compared with resting condition. Multiple linear regression adjusting for age, race, gender, body mass index, baseline systolic BP, heart rate and total peripheral resistance, revealed that RMSSD at rest (\(\beta=-0.0442, P=0.023\)) and under stress (\(\beta=-0.0815, P=0.001\)) were significant predictor of systolic BP, and RMSSD under stress (\(\beta=-0.0488, P=0.004\)) was significant predictor to diastolic BP. Namely, 12.3 units increase of RMSSD predicted 1 mmHg decrease of systolic BP, and 20.5 units increase of RMSSD predicted 1 mmHg decrease of diastolic BP. A total of 31 (8%) participants developed hypertension during the follow-up period. The participants with lower RMSSD had significant higher incidence of hypertension than those with higher RMSSD (15/113, 11.7% for Tertile 1; 10/118, 7.8% for Tertile 2; and 6/121, 4.7% for Tertile 3). After adjustment of other covariates, Logistic regression model showed that RMSSD at rest in tertile 1 (OR: 3.47, 95%CI: 1.00-12.09, \(P=0.050\)) had a significantly higher risk of incident of hypertension compared with tertile 3. Similar result was found for RMSSD under stress (OR: 4.84, 95%CI: 1.23-19.07, \(P=0.024\)).

Conclusion: We demonstrate that lower vagally-mediated heart rate variability at rest and under stress predicts BP elevation overtime suggesting that interventions that enhance vagal activity may prevent hypertension.