

Heart Rate Variability and Maximum Oxygen Uptake in adolescent and adult Patients with different Types of congenital Heart Disease

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Introduction

The heart rate variability (HRV) is a measure to quantify the autonomous nervous system (ANS) pathways' activities. According to current research there is an indication of an impaired vagal activity considering the Root Mean Square of Successive Differences (RMSSD) in patients with congenital heart disease (CHD). This study evaluates the vagal activity of patients with CHD and their association to exercise capacity.

Methods

In the period from July 2016 until December 2017 a total of 199 patients with different types of CHD (43% female; 29.3 ± 10.6 years) received a breath controlled HRV measurement subsequent to a 3 minutes resting phase in supine position. Based on 130 adjacent heartbeats the RMSSD, a measurement of vagal activity, was assessed. RMSSD values are displayed in median and interquartile [IQR 25; 75]. Additionally all patients underwent a cardiopulmonary exercise test until exhaustion on the bicycle ergometer. For comparison a control group (CG) of 44 (59% female; 36.9 ± 13.4 years) healthy volunteers was recruited.

Results

Patients with CHD have impaired vagal activity by means of a reduced RMSSD in comparison to healthy controls (CHD: $33.9 [19.8; 60.8]$ ms versus CG: $42.4 [29.8; 85.4]$ ms; $p=0.008$). Especially patients who underwent palliative Fontan operation (FP; $n=39$) showed impaired vagal activity (FP: $23.9 [11.7; 38.2]$ ms; $p=0.003$).

Peak oxygen uptake (VO_{2peak}) of the patients was on average $75.6 \pm 19.8\%$ of the predicted reference value. In patients with CHD lower vagal activity was associated with a reduction in peak oxygen uptake ($r=0.200$; $p=0.005$).

Conclusion

The impaired vagal activity and the association with a reduced peak oxygen uptake in patients with CHD suggest a dysfunction of the ANS in this cohort. For improved medical care advanced studies should investigate these impairments in diagnostic subgroups.