

Autonomic nervous system dysregulation in young people with a history of COVID-19

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INTRODUCTION

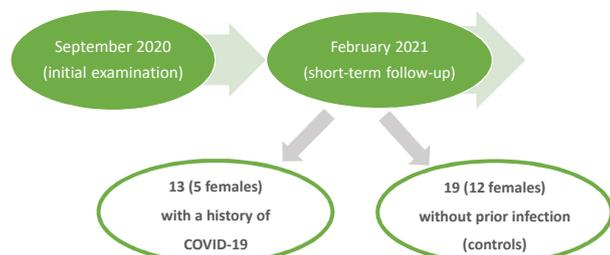
Increasing numbers of COVID-19 patients continue to experience symptoms weeks and months after recovery. 'Long COVID' could be possibly related to a virus- or immune-mediated damage of the autonomic nervous system (ANS) responsible for adaptation as it regulates vital functions such as cardiovascular and respiratory - most commonly affected by COVID-19. However, the involvement of ANS in post-COVID, expressed by dysautonomia, has not been studied well.

OBJECTIVES

- Study the parameters of heart rate variability (HRV) in young people as a marker of ANS activity.
- Evaluate the differences of HRV indices and ANS activity in subjects with and without history of COVID-19.

METHODOLOGY

32 healthy young people (18.4 ± 0.8 years old)



The state of the ANS was assessed by the HRV 5 minute recordings at rest and during the orthostatic test (Varicard 2.6, Russia).

Statistical analysis was performed using software StatTech v.1.2.0 (LLC "StatTech", Russia).

RESULTS AND DISCUSSION

HRV recordings (Fig. 1) in February during orthostatic test in group 1 revealed increased parasympathetic (RMSSD, HF) indices compared to September recordings (0.003 ≤ p ≤ 0.037) and lower HR and LF/HF values (0,019 ≤ p ≤ 0,034).

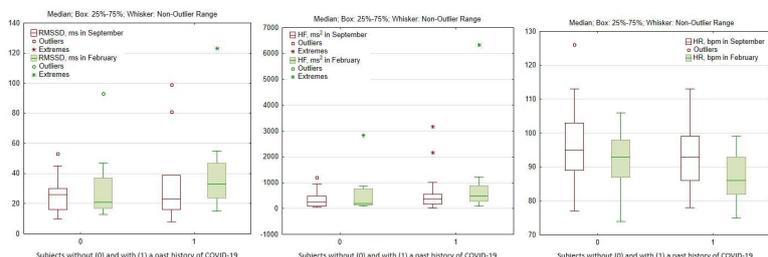


Fig. 1. Dynamics of HRV parameters (RMSSD, HF, HR) in subjects without (0) and with (1) a past history of COVID-19

RESULTS AND DISCUSSION

RMSSD increased from 23 (16 - 39) ms to 33 (24 - 47) ms (p = 0.037), HF from 365 (174 - 549) to 492 (276 - 883) ms² (p = 0.021).

The values of Xmax, MxDMn, MxMn, HF were higher (0.012 ≤ p ≤ 0.033) in subjects with a history of COVID-19, and AMo50% (p = 0.024), SI (p = 0.006) were lower (Fig. 2) compared to the controls suggesting greater activity of the parasympathetic nervous system in group 1 during orthostatic test.

Gender differences revealed that RMSSD, pNNS50, SDNN, TP, HF were 1.3 – 5 times higher in males (0.002 ≤ p ≤ 0.025) than in females during orthostatic test in group 1.

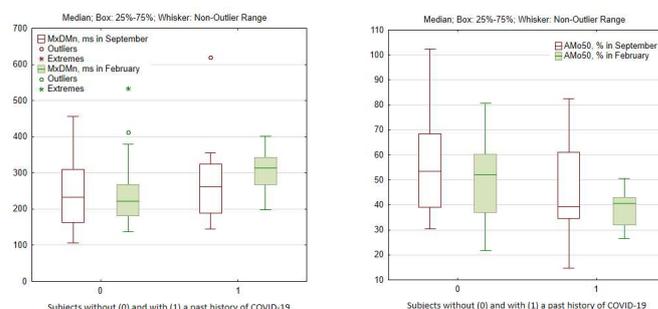


Fig. 2. Dynamics of HRV parameters (MxDMn, AMo) in subjects without (0) and with (1) a past history of COVID-19

These results indicate dysregulation of autonomic cardiac control during orthostatic test in individuals with the history of COVID-19.

Naturally, sympathetic function increases immediately after changing to a standing position. Clinical data suggest that people with COVID show higher sympathetic nervous system tone during the acute infection, and in early days and weeks in the convalescence as well. Later over the course of the disease there might be a reactive 'overshoot' of parasympathetic activity.

CONCLUSIONS

Post-COVID HRV dysregulation may explain some of the persistent symptoms, such as fatigue, dizziness, palpitations and orthostatic intolerance. Prolonged parasympathetic activity might be responsible for these symptoms. HRV is a simple, non-invasive, and validated measure for the assessment of the ANS function. Monitoring the state of ANS via HRV is important for understanding the pathophysiology of "long COVID" and for predicting complications.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.