Dysregulation of the Autonomic Nervous System in ME/CFS and Post-COVID Syndrome: Insights from 48-Hours Heart Rate Variability Monitoring.

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ABSTRACT

- Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS) and Post-COVID Syndrome (PCS) represent post-viral syndromes characterized by shared symptoms and pathophysiological mechanisms. Dysregulation of the autonomic nervous system (ANS) and the presence of postural orthostatic tachycardia syndrome (POTS) are implicated in both conditions.
- This study utilizes continuous 48-hour monitoring to investigate potential ANS dysregulation and heart rate variability (HRV) in individuals with ME/CFS, Post-COVID Syndrome and a Healthy Control subject.
- Through this case study, we explore the intricate relationship between viral infections and the autonomic nervous system, specifically focusing on interactions involving the dorsal vagus nerve, sympathetic overstimulation, and the ventral vagus nerve across day and night cycles.
- Our findings contribute to a deeper understanding of the shared pathophysiological mechanisms between ME/CFS and Post-COVID Syndrome, offering insights into the role of ANS dysregulation and HRV

METHODS

Participants:

- The study included four individuals diagnosed with Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS) and four individuals diagnosed with Post-COVID Syndrome. Participants were recruited based on clinical diagnosis, self-report measures, adherence to the Canadian Consensus Criteria for CFS, and ICD-10 coding.

Data Collection:

- All participants underwent continuous monitoring for a duration of 48 hours, employing the Faros 180-degree sensor. During daytime hours, heart rate variability (HRV) analysis of 3D vectors was performed using the Nerv Express HRV program. Subsequently, the collected data were integrated and processed using MATLAB.

Control Group:

- To facilitate comparative analysis, a control group consisting of a single healthy subject, age-matched to the patient group, was included. All eight patients and the healthy control subject had an average age of 35 years, with a standard deviation of ±6 years.

RESULTS

Autonomic Nervous System (ANS) Dysregulation:

- All patients exhibited markedly low parasympathetic activity, accompanied by an absence of deep sleep phases, and a lack of discernible differentiation between sympathetic and parasympathetic ANS activation.
- Power spectrum analyses unveiled a near-total loss of heart rate variability (HRV) during upright posture, indicating profound autonomic dysregulation.

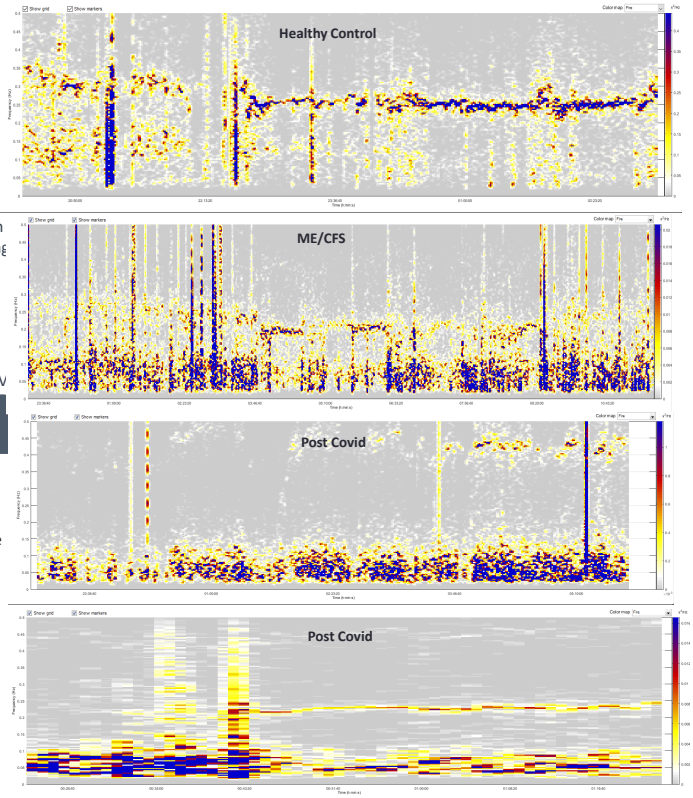
Classification of Post-COVID Patients:

- Among post-COVID patients, two-night measurements demonstrated an above-average pulse range of 70 bpm - 95 bpm.
- A day-night reversal pattern was observed, characterized by nocturnal sympathetic nervous system overactivity and partial daytime parasympathetic nervous system overactivity.
- A four-stage classification system for post-COVID patients emerged:
- 1. Constant daytime sympathetic dominance with minimal parasympathetic activity.
- 2. Dual nervous system activity observed.
- 3. Daytime overactivity of the dorsal vagus nerve, influencing daily functioning.
- 4. Inefficiency in both sympathetic and parasympathetic nervous systems.

CONCLUSIONS

The findings from this study suggest that long-term HRV/ECG measurements could serve as a valuable diagnostic pre-screening tool. Additionally, these measurements have the potential to effectively guide and adjust pacing and exercise intensities.

RESULTS



- Fig. 4 In Figure 4, the dark blue line represents HRV frequency ranges, with its position indicating either high or low frequency related to the parasympathetic or sympathetic nervous system. The blue line at the bottom of the X-Axis signifies sympathetic nervous system activity.

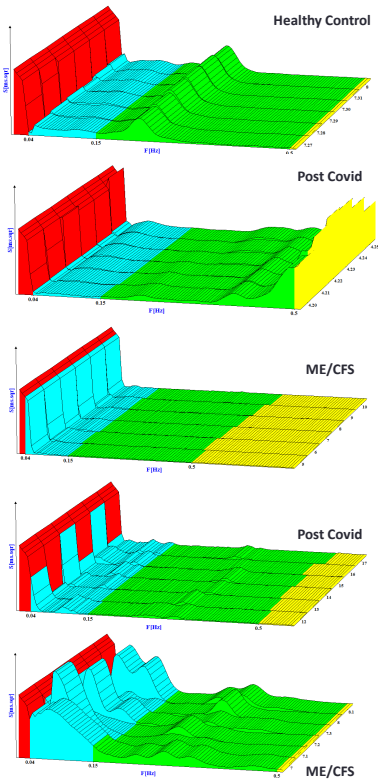
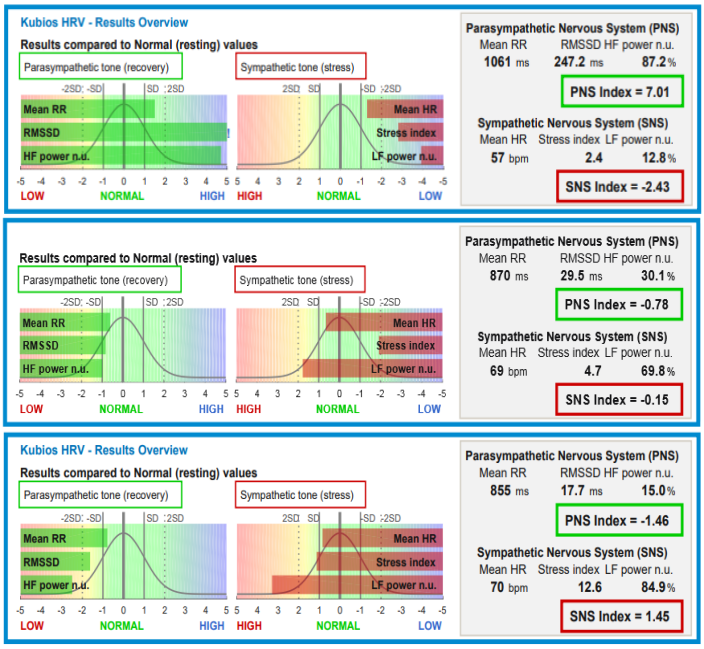


Fig. 3 Shows the daily activity of the healthy control patient and the Post Covid Patients differentiation into four different VNS patterns measured over the day.



- Fig. 2 In Figure 2, a clear progression is observed from the top to the bottom, representing the healthy control group, individuals with ME/CFS, and those with Long COVID. The Stress Index increases significantly from the healthy control group to Long COVID patients, with a notable difference in heart rate values and averages over two nights.

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