Post-coronavirus disease-19: the impact of cardiopulmonary rehabilitation on arterial stiffness, left ventricular deformation, and ventricular-arterial coupling

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Introduction: Although coronavirus disease-19 (COVID-19) is a primarily a respiratory disease, impairment of cardiovascular function has been documented, even in the post-acute phase. Cardiopulmonary rehabilitation could represent an appealing approach in the management of cardiovascular sequelae of post-COVID-19, which may affect arterial and left ventricular function, ultimately influencing ventricular-arterial coupling (VAC).

Purpose: In this study, we assess the impact of a post-acute COVID-19 rehabilitation program on arterial stiffness, left ventricular deformation, and VAC.

Methods: We enrolled 60 convalescent patients from COVID-19 and one-month post-acute disease were randomized at 1:1 ratio in a 3-month cardiopulmonary rehabilitation program (study group) or not (control group). The levels of pro-inflammatory interleukin-1β (IL-1β) were determined. Arterial stiffness was evaluated by carotid-femoral Pulse wave velocity (cf-PWV) at 1 month and at 4 months post-acute disease. Transthoracic echocardiography was performed, and left ventricular global longitudinal strain (LV-GLS) was estimated. Finally, the ratio of cf-PWV/LV-GLS was calculated as an index of VAC.

Results: There were no significant differences in major risk factors across the studied groups (age, sex, body mass index, smoking, hypertension, diabetes mellitus, dyslipidemia). Moreover, patients across the study groups did not differ regarding the levels of IL-1β. Although cf-PWV was similar in the study and the control group at baseline, it was improved only in the study group (8.2±1.3m/sec vs. 6.6±1.0m/sec, p<0.001) but not in the control group (8.9±1.8m/sec vs. 8.8±1.9m/sec, p=0.74). Similarly, for GLS, no differences were noted at baseline. However, the study group exhibited a significant improvement during the study (-19.6±2.0% vs. -21.3±1.9%, p<0.001), while no changes were observed in the control group (-18.7±2.9% vs. -18.3±2.1%, p=0.15). Finally, VAC was significantly ameliorated only in patients receiving cardiopulmonary rehabilitation (-0.43±0.11m/s% vs. -0.31±0.06m/s%, p<0.001). When individuals undergoing cardiopulmonary rehabilitation were stratified according to median baseline IL-1β levels, those presenting with lower concentrations experienced a significant benefit in ΔVAC (IL-1β<8.4pg/ml: 0.14±0.08m/s% vs. IL-1β≥8.4pg/ml: 0.09±0.05m/s%, p=0.04).

Conclusion: A 3-month cardiopulmonary rehabilitation program following the acute phase of COVID-19 accelerates the recovering of arterial and ventricular function, especially in individuals with a lower baseline inflammatory burden.