Use of Cardiopulmonary Stress Testing for Patients With Unexplained Dyspnea Post–Coronavirus Disease

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Objectives

Approximately 20% of patients with coronavirus disease (COVID) who recover from COVID-19 have described persistent symptoms, such as atypical chest pain, fatigue, palpitations, or dyspnea, months after the initial infection. The etiology of this finding, termed post-acute sequalae of COVID (PASC), is unclear. Some patients with PASC may have normal radio-graphic and spirometric testing. These authors studied 41 patients (18 males, 23 females, average age 45±13 years) with PASC at 8.9 ±3.3 months using noninvasive (n=34) or invasive (n=7) cardiopulmonary exercise testing (CPET).

Study methods

Patients with serologically-proven COVID and persistent dyspnea for ≥3 months were referred for CPET testing, including seven patients with invasive Swan-Ganz monitoring. Subjects were connected to an electrocardiogram, pulse oximeter, and blood pressure cuff and were seated on a bicycle ergometer. They breathed into a metabolic cart. Ramped exercise was continued until exhaustion.

Results

For the cohort, left ventricular ejection fraction was 59%±9%. Peak VO_2 averaged 20.3 mL/kg/min (77% predicted VO_2). VE/VCO_2 slope was 30 (elevated). $P_{et}CO_2$ at rest was 33.5 mm Hg (normal); 58.5% had a peak VO_2 <80% predicted (low). All patients with peak VO2 <80% had a circulatory limitation to exercise. Fifteen of 17 patients with normal peak VO_2 had ventilatory abnormalities including peak respiratory rate >55 (n=3) or dysfunctional breathing (n=12). For the whole co-hort, 88% of patients (n=36) had ventilatory abnormalities with dysfunctional breathing, increased VE/VCO_2, and/or hy-pocapnia $P_{et}CO_2$ <35. In the full cohort, 46% met criteria for the diagnosis of myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS).

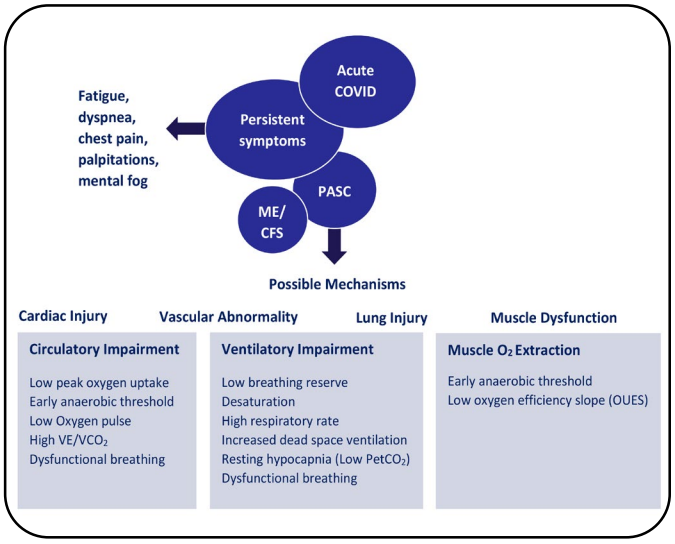

Figure 1 Development of PASC With Possible Causes and How These can be Classified Using CPET

What is CPET?

Cardiopulmonary exercise testing (CPET) provides assessment of pulmonary and cardiovascular system functionality by measuring the response of these systems to both submaximal and peak effort during exercise. Often using either a cycle ergometer or a treadmill, the subject breathes into the CPET device which measures oxygen consumption and carbon dioxide production, along with highly accurate standard spirometric function such as minute ventilation and tidal volume. CPET is frequently used to evaluate unexplained dyspnea and may be valuable in identifying the cause of dyspnea and exercise intolerance in these patients.

Figure 2 Vyntus™ CPX is an example of a CPET measuring device*

Take home message

- CPET is helpful in identifying abnormalities underlying PASC and may aid in identifying targets for treatment.
- Almost all patients (88%) showed ventilatory patterns consistent with disordered breathing, resting hypocapnia, and/or an excessive ventilatory response to exercise.
- Most patients (58%) had evidence of circulatory impairment to peak exercise performance with early anaerobic threshold and hyperventilation.
- Most patients reached anaerobic thresholds early in exercise despite their young age.
- Vyntus™ CPX has the functionality to measure all recognized clinically important ventilatory and gas exchange CPET parameters to identify abnormalities associated with PASC.
- Use of these CPET parameters may be effective in objectively identifying these abnormalities that could be targeted for optimal treatment.

*No endorsement of any specific measuring devices in this paper

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