EUROPEAN RESPIRATORY JOURNAL
ORIGINAL RESEARCH ARTICLE
C.B. INGUL ET AL.

Changes in cardiopulmonary exercise capacity and limitations 3–12 months after COVID-19

Charlotte Björk Ingul[1,2,3], Anne Edvardsen[1,4], Turid Follestad[5], Divna Trebinjac[1], Odd Andre Wathne Ankerstjerne[1], Eivind Brønstad[2,6], Øystein Rasch-Halvorsen[2,6], Bernt Aarli[7,8], Håvard Dalen[2,9,10], Bjarne Martens Nes[2], Tøri Vigeland Lerum[11,12], Gunnar Einvik[4,12], Knut Stavem[4,12,13] and Ingunn Skjørten[1,14]

[1]LHL Hospital Gardermoen, Jessheim, Norway. [2]Department of Circulation and Medical Imaging, Norwegian University of Science and Technology, Trondheim, Norway. [3]Faculty of Nursing and Health Sciences, Nord University, Bodø, Norway. [4]Pulmonary Department, Akershus University Hospital, Lørenskog, Norway. [5]Department of Clinical and Molecular Medicine, Norwegian University of Science and Technology, Trondheim, Norway. [6]Thoracic Department, St Olavs Hospital, Trondheim, Norway. [7]Department of Clinical Science, University of Bergen, Bergen, Norway. [8]Department of Thoracic Medicine, Haukeland University Hospital, Bergen, Norway. [9]Clinic of Cardiology, St Olavs University Hospital, Trondheim, Norway. [10]Department of Medicine, Levanger Hospital, Nord-Trøndelag Hospital Trust, Levanger, Norway. [11]Department of Pulmonary Medicine, Oslo University Hospital Ullevål, Oslo, Norway. [12]Institute for Clinical Medicine, University of Oslo, Oslo, Norway. [13]Health Services Research Unit, Akershus University Hospital, Lørenskog, Norway. [14]Department of Pulmonary Medicine, Oslo University Hospital Rikshospitalet, Oslo, Norway.

Corresponding author: Charlotte Björk Ingul (charlotte.b.ingul@ntnu.no)

Shareable abstract (@ERSpublications)
Exercise capacity improves in COVID-19 patients from 3 to 12 months after hospitalisation, and the majority have normal exercise capacity (77%). Circulatory limitations are more common than ventilatory limitation after COVID-19. Deconditioning is common. https://bit.ly/3DlPxcG

Cite this article as: Ingul CB, Edvardsen A, Follestad T, *et al*. Changes in cardiopulmonary exercise capacity and limitations 3–12 months after COVID-19. *Eur Respir J* 2023; 61: 2200745 [DOI: 10.1183/13993003.00745-2022].

This article has an editorial commentary: https://doi.org/10.1183/13993003.01739-2022

Received: 8 April 2022
Accepted: 27 Aug 2022

Abstract

Rationale To describe cardiopulmonary function during exercise 12 months after hospital discharge for coronavirus disease 2019 (COVID-19), assess the change from 3 to 12 months, and compare the results with matched controls without COVID-19.

Methods In this prospective, longitudinal, multicentre cohort study, hospitalised COVID-19 patients were examined using a cardiopulmonary exercise test (CPET) 3 and 12 months after discharge. At 3 months, 180 performed a successful CPET, and 177 did so at 12 months (mean age 59.3 years, 85 females). The COVID-19 patients were compared with controls without COVID-19 matched for age, sex, body mass index and comorbidity. Main outcome was peak oxygen uptake (V'_{O_2peak}).

Results Exercise intolerance (V'_{O_2peak} <80% predicted) was observed in 23% of patients at 12 months, related to circulatory (28%), ventilatory (17%) and other limitations including deconditioning and dysfunctional breathing (55%). Estimated mean difference between 3 and 12 months showed significant increases in V'_{O_2peak} % pred (5.0 percentage points (pp), 95% CI 3.1–6.9 pp; p<0.001), $V'_{O_2peak}\cdot kg^{-1}$ % pred (3.4 pp, 95% CI 1.6–5.1 pp; p<0.001) and oxygen pulse % pred (4.6 pp, 95% CI 2.5–6.8 pp; p<0.001). V'_{O_2peak} was 2440 mL·min^{-1} in COVID-19 patients compared to 2972 mL·min^{-1} in matched controls.

Conclusions 1 year after hospital discharge for COVID-19, the majority (77%), had normal exercise capacity. Only every fourth had exercise intolerance and in these circulatory limiting factors were more common than ventilator factors. Deconditioning was common. V'_{O_2peak} and oxygen pulse improved significantly from 3 months.