

Rehabilitation Challenges on Platypnea-Orthodeoxia Syndrome in COVID-19: A Case Report

Desafios da Reabilitação na Síndrome de Platipneia-Ortodeoxia na COVID-19: Caso Clínico

Lurdes Rovisco Branquinho⁽¹⁾ | Alexandra Coelho⁽¹⁾ | João Nuno Malta⁽¹⁾
| Joana Santos Costa⁽¹⁾

Abstract

Platypnea-orthodeoxia syndrome (POS) is characterized by dyspnea and arterial desaturation in the standing or sitting position which is relieved in the supine position. It is a rare post-acute condition in severe coronavirus disease 2019 (COVID-19) survivors, posing additional challenges in the rehabilitation of these patients.

A 62-year-old male, recovering from critical COVID-19, presented with worsening dyspnea and positional arterial desaturation while upright on the 36th day of hospital admission, which was significantly impairing early mobilization and functional recovery. Retailored inpatient rehabilitation program included adapted breathing exercises, monitored slowly progressive orthostatism reconditioning, supplemental oxygen therapy and low intensity functional training. After 43 days the patient was discharged, and the rehabilitation program continued without any complication. Dyspnea, strength and functionality scales were used to monitor each phase of the rehabilitation program: Modified Medical Research Council Dyspnea Scale (mMRC) graded 4 in the first assessment, 2 at discharge and 0 after the outpatient intervention, 1 Minute Sit-to-Stand Test scored 25 repetitions in the first outpatient evaluation and 36 at the end of the program and Post-COVID-19 Functional Status Scale graded 4 on the first assessment, 3 at discharge and 1 at the end of the outpatient program.

Rehabilitation tailoring is essential and, in patients with severe COVID-19, one of the situations that can interfere with the implementation and progression of the rehabilitation

program is POS, which must be considered whenever there is positional dyspnea or arterial desaturation after an initial period of clinical improvement.

Keywords: COVID-19; Dyspnea/rehabilitation; Hypoxia/rehabilitation

Resumo

A síndrome de platipneia-ortodeoxia (SPO) é caracterizada por dispneia e dessaturação arterial periférica durante o levante ou sedestação, que melhora em decúbito. É uma condição pós-aguda rara nos sobreviventes da doença provocada pelo novo coronavírus 2019 (COVID-19), colocando desafios na reabilitação destes doentes.

Um homem de 62 anos, ao 36^o dia de internamento e em fase de recuperação de COVID-19 crítica, apresentou agravamento da dispneia e dessaturação arterial em posição vertical, que melhorava significativamente com o decúbito. O programa de reabilitação foi adaptado e incluiu exercícios respiratórios, recondicionamento ao ortostatismo lento, progressivo e monitorizado, oxigenoterapia suplementar e treino funcional de baixa intensidade. Após a alta, ao 43^o dia de internamento, progrediu no programa de reabilitação em regime de ambulatório sem intercorrências. Foram utilizadas escalas de dispneia, força e funcionalidade para monitorizar a evolução ao longo do programa de reabilitação: na Escala de Dispneia Modificada do Medical Research Council (mMRC) registou-se grau 4 na primeira avaliação, grau 2 à data da alta e grau 0 no final da

(1) Serviço de Medicina Física e de Reabilitação do Centro Hospitalar e Universitário de Coimbra.

© Autor(es) (ou seu(s) empregador(es)) e Revista SPMFR 2022. Reutilização permitida de acordo com CC BY-NC. Nenhuma reutilização comercial.

© Author(s) (or their employer(s)) and SPMFR Journal 2022. Re-use permitted under CC BY-NC. No commercial re-use.

Autor correspondente: Lurdes Rovisco Branquinho. email: lurdes.rovisco.branquinho@gmail.com. Serviço de Medicina Física e de Reabilitação do Centro Hospitalar e Universitário de Coimbra. Praceta Professor Mota Pinto, 3004-561 Coimbra

Data de submissão: dezembro 2022

Data de aceitação: janeiro 2023

Data de publicação: março 2023

intervenção ambulatoria; no Teste 1 Minuto Sentar-Levantar contaram-se 25 repetições na primeira avaliação ambulatoria e 36 no final do programa e na *Post-COVID-19 Functional Status scale* o doente pontuou grau 4 na primeira avaliação, grau 3 à data da alta e grau 1 no final da intervenção ambulatoria.

A individualização do programa de reabilitação é essencial e indispensável e, nos doentes com COVID-19 uma das situações que pode influenciar a tolerância e a progressão no programa é a SPO, que deve ser considerada sempre que surja dessaturação ou dispneia posicional após um período de melhoria clínica inicial.

Palavras-chave: COVID-19; Dispneia/reabilitação; Hipoxia/reabilitação

Introduction

The coronavirus disease 2019 (COVID-19) is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), and respiratory failure is one of its main complications.¹

Platypnea-orthodeoxia syndrome (POS) is a rare clinical entity characterized by dyspnea and arterial desaturation in the standing or sitting position (arterial oxygen saturation or partial pressure of oxygen drop higher than 5% and 4 mmHg, respectively),² which is relieved in the supine position.³ It is a rare post-acute condition in severe COVID-19 survivors, with only a few cases described in the literature.^{2,4-7}

Although rare and poorly described, it poses a significant challenge to the rehabilitation of these patients.

Case Report

The authors present the case of a 62-year-old male with a body mass index (BMI) of 25.8 kg/m² and no personal history of respiratory diseases, admitted in an Intensive Care Unit with critical COVID-19. After an initial improvement period, 36 days following admission, he presented with worsening dyspnea and arterial desaturation while upright (oxygen desaturation of 8% to 10%), with significant relief by lying down. The patient had normocytic normochromic anemia (hemoglobin 11.9 g/dL). The chest radiograph showed peripheral ground-glass opacities in the lower zone of the right lung. The chest computed tomography (CT) scan showed ground-glass with tree in bud foci, air bronchogram, air entrapment areas and bronchiectasis at full height of both lungs (Fig. 1). The ventilation-perfusion scintigraphy manifested functional impairment of about 11% of global lung perfusion, especially in the right lung, but there were no signs of pulmonary hypertension. Transthoracic

echocardiogram revealed good left and right ventricle function, without dilation of either ventricle or of the inferior vena cava; there was no pericardial effusion. There were no signs of intracardiac shunt, but confirmation with transesophageal echocardiogram was not performed due to the COVID-19 pandemic restrictions.

This orthostatism intolerance was interfering with tolerance and progression of the standard implemented respiratory and neuromotor rehabilitation program.

Hence, the rehabilitation program was adapted, including energy conservation techniques to reduce energy consumption per session, breathing exercises (ventilatory rhythm control and ventilation/perfusion optimization techniques, pulmonary volumes recruiting maneuvers, respiratory muscles strengthening and airway clearance techniques), supplemental oxygen therapy and slowly progressive orthostatism reconditioning, twice a day, 7 days a week, with close monitoring of symptoms, blood pressure, heart rate and peripheral oxygen arterial saturation.

Early implementation of this tailored rehabilitation program resulted in clinical improvement, specifically a subjective perception of progressive improvement of dyspnea and less arterial oxygen saturation drops with positional changes, with improving orthostatism tolerance, which allowed functional training progression, and the patient was discharged after 7 days.

The patient was reassessed 1 week after discharge in the Physical and Rehabilitation Medicine Department and continued the treatments in an outpatient setting. A post-COVID-19 rehabilitation program was conducted 3 times per week for eight weeks, including breathing exercises, aerobic training with an intensity from 40% to 60% of maximal heart rate (started from 40% and incremented according to patient tolerance), strength and endurance training (resistance exercises for the major muscle groups of the upper and lower extremities, with increased repetitions and weights weekly according to performance, from 50% to 70% of ten repetition maximum), limited by Borg Scales of Perceived Exertion and Dyspnea and SpO₂, supervised, and flexibility exercises. The goals were to improve symptoms of dyspnea, relieve anxiety, reduce complications, minimize disability, preserve function and improve quality of life. After completing the protocol for two months, the patient was able to return to work, and maintained a moderate intensity home-based aerobic physical exercise program, with the goal of reaching 150 minutes per week.

Dyspnea, strength and functionality scales were used to monitor the patient's evolution from the early diagnosis of POS, until two months after the end of the outpatient rehabilitation program. Dyspnea was assessed using the Modified Medical Research Council Dyspnea Scale⁸: the patient initially had a grade 4 (too breathless to leave the

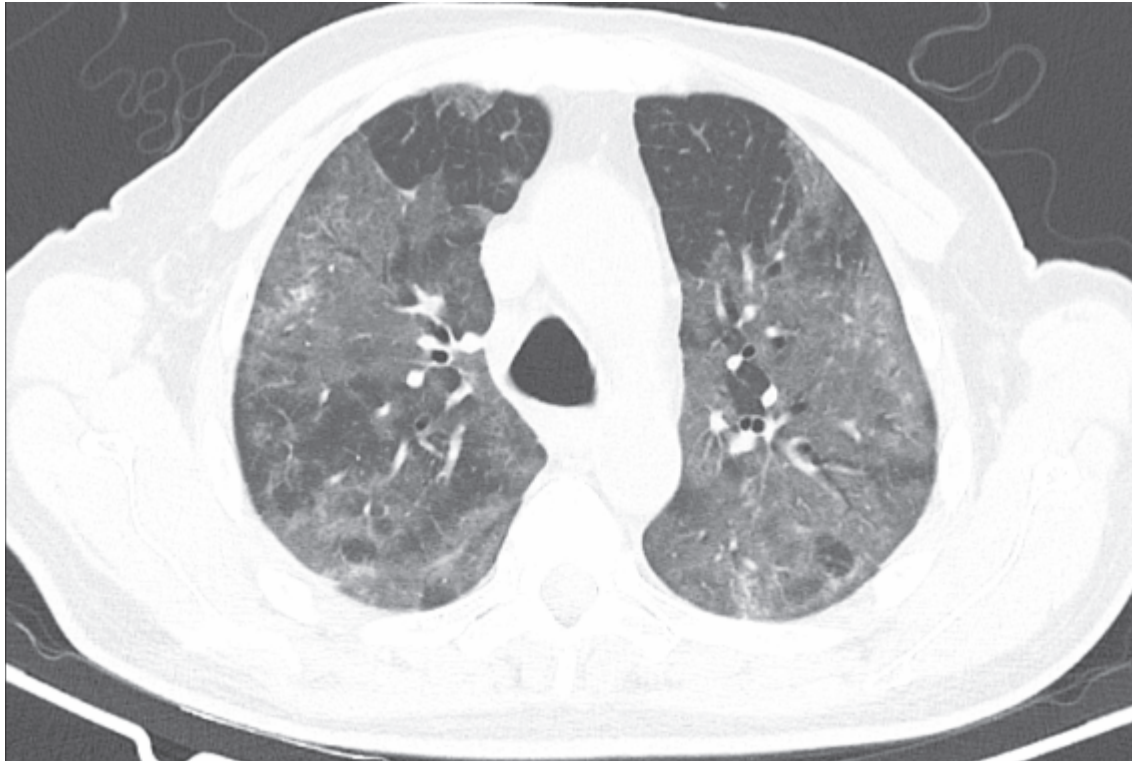


Figure 1 - Chest CT scan.

house or breathless when dressing or undressing), that improved to grade 2 (walks slower than contemporaries on the level because of breathlessness or has to stop for breath when walking at own pace) at hospital discharge, and evolved to grade 0 (not troubled by breathlessness except on strenuous exercise) at the end of the 2 month ambulatory intervention. To evaluate the performance (strength, mobility and endurance) the patient was instructed to perform the 1 Minute Sit-to-Stand Test: initially the patient was not able to perform it due to orthostatic intolerance but in the first outpatient evaluation he scored 25 repetitions and at the end of the ambulatory program was able to perform 36 repetitions.

The Post-COVID-19 Functional Status Scale⁹ was used to grade functionality, according to the norm 002/2022 of Direção Geral da Saúde (DGS)¹⁰: on the first assessment the patient had severe functional limitations (grade 4), which improved to moderate limitations (grade 3) while at the hospital, and grade 1 (negligible functional limitations) when the ambulatory rehabilitation program was completed.

Discussion

Rehabilitation is essential and indispensable in patients with COVID-19, particularly after severe disease, as it can reduce hospital length of stay and improve patient status and quality of life,¹⁰ but effective rehabilitation programs need tailoring and monitoring.

POS is a rare clinical entity that can influence the tolerance and progression of the standard inpatient rehabilitation programs in patients recovering of severe COVID-19, and that must be considered whenever there is positional dyspnea or arterial desaturation after an initial period of clinical improvement.

The pathophysiology of POS in patients recovering from severe COVID-19 appears to be related to a gravitational increase in ventilation-perfusion mismatch either for the involvement of the lower segments, microthrombosis and vasculopathy and/or reduced cardiac output.⁵ The majority of case reports of POS associated with COVID-19 report

complete resolution of POS symptoms and orthostatic tolerance after intervention, ranging from 6 to 65 days.^{2,4-7}

Additionally, rehabilitation is also crucial for the management and recovery of this entity, and for that to happen is essential to have a more conservative approach, adapting and personalizing the progression criteria by close monitoring.

Hemoglobin levels optimization, supplemental oxygen therapy, strategies of energy conservation to diminish oxygen consumption and effort readaptation are useful while the patient is recovering from POS.

The patient's age and BMI were in line with other study,² in which the patients recovering from COVID-19 that developed POS were older (median 64 years) and had lower body mass index (median 24.7 kg/m²); the duration of POS, however, was lower than the median in that study, but the duration was highly variable between those 5 patients (ranging from 6 to 39 days).

Conflitos de Interesse: Os autores declaram a inexistência de conflitos de interesse na realização do presente trabalho. **Fontes de Financiamento:** Não existiram fontes externas de financiamento para a realização deste artigo. **Confidencialidade dos Dados:** Os autores declaram ter seguido os protocolos da sua instituição acerca da publicação dos dados de doentes. **Consentimento:** Consentimento do doente para publicação obtido. **Proveniência e Revisão por Pares:** Não comissionado; revisão externa por pares.

Conflicts of Interest: The authors have no conflicts of interest to declare. **Financing Support:** This work has not received any contribution, grant or scholarship. **Confidentiality of Data:** The authors declare that they have followed the protocols of their work center on the publication of data from patients. **Patient Consent:** Consent for publication was obtained. **Provenance and Peer Review:** Not commissioned; externally peer reviewed.

Referências / References

1. Chams N, Chams S, Badran R, Shams A, Araj A, Raad M, et al. COVID-19: A Multidisciplinary Review. *Front Public Health*. 2020;8:383. doi: 10.3389/fpubh.2020.00383.
2. Tan GP, Ho S, Fan BE, Chotirmall SH, Tan CH, Lew SJ, et al. Reversible platypnea-orthodeoxia in COVID-19 acute respiratory distress syndrome survivors. *Respir Physiol Neurobiol*. 2020;282:103515. doi: 10.1016/j.resp.2020.103515.
3. Agrawal A, Palkar A, Talwar A. The multiple dimensions of Platypnea-Orthodeoxia syndrome: A review. *Respir Med*. 2017;129:31-38.
4. Tham S, Ong P, Lee A, Tay M. Rehabilitation of patients with platypnea-orthodeoxia syndrome in COVID-19 pneumonia: Two case reports. *J Rehabil Med – Clin Commun*. 2020;3:jrmcc00042.
5. Aayilliath AK, Singh K, Ray A, Wig N. Platypnoea-orthodeoxia syndrome in COVID-19. *BMJ Case Rep*. 2021;14::e243016. doi: 10.1136/bcr-2021-243016.
6. Singh K, Kadnur H, Ray A, Khanna P, Singh A, Wig N, Trikha A. Platypnea-orthodeoxia in a patient with severe COVID-19 pneumonia. *Monaldi Arch Chest Dis*. 2020;90. doi: 10.4081/monaldi.2020.1609.
7. Longo C, Ruffini L, Zaroni N, Longo F, Accogli R, Graziani T, et al. Platypnea-orthodeoxia after fibrotic evolution of SARS-CoV-2 interstitial pneumonia. A case report. *Acta Biomed*. 2020;91. doi: 10.23750/abm.v91i3.10386.
8. Salepçi B, Eren A, Çağlayan B, Fidan A, Torun E, Kiral N. The effect of body mass index on functional parameters and quality of life in COPD patients. *Tuberk Toraks*. 2007;55:342-9.
9. Klok FA, Boon GJ, Barco S, Endres M, Geelhoed JJ, Knauss S, et al. The Post-COVID-19 Functional Status scale: a tool to measure functional status over time after COVID-19. *Eur Respir J*. 2020;56:2001494. doi: 10.1183/13993003.01494-2020.
10. Direção Geral da Saúde. Norma 002/2022 de 17/03/2022. COVID-19: Situação pós-COVID-19. Lisboa: DGS;2022.
11. Sun T, Guo L, Tian F, Dai T, Xing X, Zhao J, et al. Rehabilitation of patients with COVID-19. *Expert Rev Respir Med*. 2020;14:1249-56. doi: 10.1080/17476348.2020.1811687.