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ELMOCPAP AND HIGH OXYGEN FLOW THERAPY IN PATIENTS WITH HIV/COVID-19 COINFECTION: CASE REPORT

ELMOCPAP E A TERAPIA DE ALTO FLUXO DE OXIGÊNIO EM PACIENTES COM COINFECÇÃO HIV/COVID-19: RELATO DE CASOS

ELMOCPAP Y LA TERAPIA DE ALTO FLUJO DE OXÍGENO EN PACIENTES CON COINFECCIÓN POR VIH/COVID-19: REPORTE DE CASOS

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ABSTRACT

The objective of this study was to report two cases of patients with HIV / COVID-19 coinfection who use ELMOcpap and High Flux Therapy to treat the Severe Acute Respiratory Syndrome (SARS). The reports of cases were performed by review of medical records. Data included were clinical, epidemiological and performance of combined therapy ELMOcpap and TAF. The patients who used non-invasive mechanical ventilation had improved hypoxemia and ventilatory parameters 24h after the beginning of therapy. This is the first study that reported two cases of COVID-19 and HIV coinfection in patients of Brazil who were successful with ELMOCpap and TAF therapy. Thus, combined therapies such as ELMOCpap and TAF are important to manage SARS and can contribute to a shorter hospital stay, as well as prevent complications from the use of invasive mechanical ventilation in these patients.

Descriptors: *COVID-19; HIV; Noninvasive Ventilation*

RESUMO

O objetivo deste estudo foi relatar dois casos de pacientes com coinfecção HIV/COVID-19 que utilizaram o ELMOcpap e a Terapia de Alto Fluxo no tratamento da Síndrome Respiratória Aguda Grave (SRAG). Os relatos de casos ocorreram por meio da coleta de dados em prontuários. Dados clínicos, epidemiológicos e a performance dos efeitos da terapia combinada foram coletados. Os pacientes que utilizaram a terapia de ventilação mecânica não invasiva (VMNI) evoluíram com melhora da hipoxemia e dos parâmetros ventilatórios nas primeiras 24 horas de tratamento. Este é o primeiro relato de dois pacientes coinfectados por COVID-19 e HIV no Brasil, que tiveram êxito no uso da terapia ELMOCpap e TAF. Portanto, terapias combinadas de VMNI são importantes para o manejo da SRAG e podem contribuir para um menor tempo de internação hospitalar, bem como prevenir complicações do uso da ventilação mecânica invasiva nesses pacientes.

Descritores: *COVID-19; HIV; Ventilação Não Invasiva.*

RESUMEN

El objetivo de este estudio fue reportar dos casos de pacientes con coinfección por VIH / COVID-19 que usan ELMOcpap y Terapia de Alto Flujo para tratar el Síndrome Respiratorio Agudo Severo (SARS). Los informes de casos se realizaron mediante revisión de historias clínicas. Los datos incluidos fueron clínicos, epidemiológicos y de rendimiento de la terapia combinada ELMOcpap y TAF. Los pacientes que utilizaron ventilación mecánica no invasiva habían mejorado la hipoxemia y los parámetros ventilatorios a las 24 h del inicio de la terapia. Este es el primer estudio que informó dos casos de coinfección por COVID-19 y VIH en pacientes de Brasil que tuvieron éxito con la terapia con ELMOCpap y TAF. Por lo tanto, las terapias combinadas como ELMOCpap y TAF son importantes para controlar el SARS y pueden contribuir a una estancia hospitalaria más corta, así como a prevenir complicaciones por el uso de ventilación mecánica invasiva en estos pacientes.

Descriptores: *COVID-19; VIH; Ventilación no Invasiva.*

INTRODUCTION

There is growing concern that immunosuppression caused in individuals with human immunodeficiency virus (HIV) infection may make them more susceptible to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection and more likely to develop severe conditions of the disease caused by this new coronavirus 2019 (COVID-19), when infected1. Mounting evidence shows that patients with T lymphocyte counts by differentiation group 4 (CD4+ T lymphocytes) below 200 cells/mm3, as well as those not on antiretroviral therapy, are at the highest risk of contracting severe symptoms of COVID- 19, such as Severe Acute Respiratory Syndrome (SRAG)[2,3].

The management of hypoxemic respiratory failure in COVID-19 is quite challenging. One of the therapies to prevent orotracheal intubation and its complications is the use of non-invasive mechanical ventilation (NIMV). However, the use with traditional interfaces increases the risk of failure, and the patient is often unable to tolerate long periods of treatment[4,5]. Non-invasive therapeutic alternatives have replaced conventional oxygen therapy in recent years[5]. TAF has been used in patients with hypoxemic acute respiratory failure. And now, in the COVID-19 pandemic, a system that generates continuous positive airway pressure (CPAP) through a helmet-type interface was used[6]. These therapeutic systems are able to improve gas exchange, thus reducing respiratory effort. Furthermore, with the use of TAF, it is possible to observe extremely beneficial effects for patients, such as the removal of CO27.

In this context, an assisted breathing helmet-type interface system that offers CPAP, called ELMO6, and high-flow oxygen therapy allow airway handling without intubation, with comfort for patients with mild to severe acute respiratory failure[5-8], reducing the need for advanced life support in the intensive care unit (ICU), as well as unfavorable clinical outcomes with high mortality rates[5,8].

Therefore, the aim of this study was to describe two cases of patients with HIV/COVID-19 co-infection who used ELMOCpap and oxygen TAF in the treatment of acute hypoxemic respiratory failure, in a tertiary hospital of the Unified Health System (SUS), reference for infectious diseases in Northeast Brazil.

METHODS

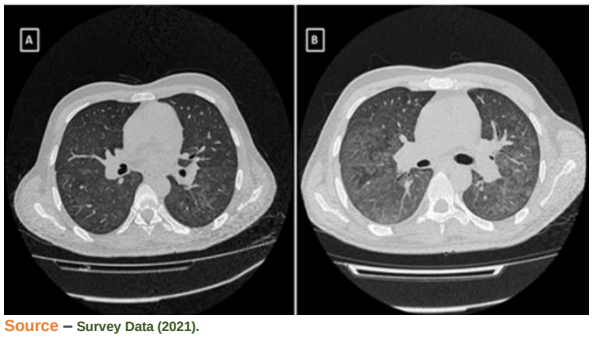
This is a descriptive study, of the case report type. This work is part of the project approved by the Research Ethics Committee of Hospital São José under nº 4.366.829 (CAAE 35017820.1.0000.5044). The case reports were carried out through data collection through the review of medical records, including the clinical and epidemiological characteristics and the performance of the effects of NIMV, through the combined therapy ELMOcpap and TAF, in the period from January to July 2021. The criterion of inclusion of patients established for the research was: patients with HIV/COVID-19 co-infection who evolved with hypoxemic respiratory failure and who had used ELMOCpap Therapy and TAF. After collection, the data were described and the cases studied, analyzing the performance of the therapy. In all cases, non-invasive therapies were used through ELMOcpap and TAF, titrated to maintain SpO2 > 94%. The oxygen flow was determined to reduce the ventilatory demand, being evaluated through the breathing pattern. In ELMOcpap, CPAP was continuous at 10cmH2O. Daily, the performance of NIMV therapies were evaluated through the PaO2/FiO2 ratio (P/F ratio), the pCO2 and the ROX index, obtained through the ratio [(SpO2/FiO2)/Respiratory rate]. This parameter was used to maintain or perform weaning from therapies in order not to delay orotracheal intubation, as well as to avoid complications such as self-inflicted lung injury and mortality. A ROX index value < 3.88 is predictive of non-invasive therapy failure; values above 4.88 are indicative of VMNI's success.

RESULTS

CASE REPORT

CASE 01

Figure 1 – High resolution computed tomography of the chest. (A) Four days before admission: areas outlining mosaic attenuation and mild ground-glass opacities with sparse peribronchovascular distribution, notably in the lower lobes. (B) 1st day of hospitalization: multifocal, rounded and bilateral ground-glass opacities, with peripheral predominance with ~ 75% involvement.



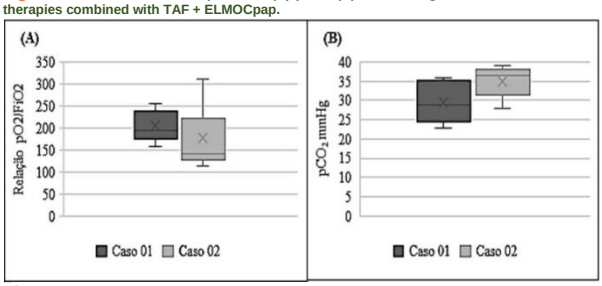
Source – Survey Data (2021).

A 40-year-old Brazilian male was admitted to the COVID-19 Unit of the HSJ on June 29, 2021. Upon arrival at the hospital unit, he complained of coughing for 03 months with white sputum associated with weight loss of approximately 20 kg. , presented with fever (38ºC), tachycardia (HR ~ 130 bpm), persistent cough, respiratory distress (tachydyspnea) with respiratory rate ~28 rpm and peripheral oxygen saturation (SpO2) ~ 80-84%. A rapid test for HIV was performed, being this reagent. Tests for Syphilis and Hepatitis C Virus (Anti-HCV) non-reactive. Search for alcohol-acid resistant

bacillus (BAAR) and rapid molecular test for Mycobacterium tuberculosis (GeneXpert MTB/RIF UltraR) in a sputum sample were negative. The CD4 + T lymphocyte count was 22 cells/mm3 and the HIV viral load was 350,247 copies/ml (July/2021). Real-time polymerase chain reaction (RT-PCR) in a nasopharyngeal swab sample detected SARS-CoV-2. High-Resolution Chest Computed Tomography (HRCT) performed four days before admission revealed mild ground-glass opacities (Figure 1A). Other tests such as research and culture for fungus in buffy coat cream and blood culture for pyogenic germs were negative.

Laboratory tests showed a WBC count of 6300 cells/mm3 (75% neutrophils and 15% lymphocytes) on blood count, C-reactive protein 86 mg/L, lactic dehydrogenase 844 U/L, creatinine 0.8 mg/dL , 3695 ng/ml D-dimer. Arterial blood gases showed a PaO2 of 55mmHg and SpO2 of 92%, performed with the patient using supplemental oxygen through a nasal cannula at 5 L/min. On the day of admission, there was a worsening of the pulmonary tomographic pattern (Figure 01 B). Therapy with ELMOCpap and TAF was started, with significant improvement in the clinical picture and respiratory performance. During hospitalization, the patient used dexamethasone for 10 days, prophylactic enoxaparin, fluconazole for oral candidiasis, sulfamethoxazole-trimethoprim for possible pneumocystosis, and antiretroviral therapy with tenofovir, lamivudine and dolutegravir, started on the 9th day of hospital admission (IDH). After 05 days of ElmoCpap and TAF it evolved to spontaneous breathing in room air.

Figure 3 – Evaluation of the pO2/FiO2 (A) pCO2 (B) ratio during the use of non-invasive therapies combined with TAF + ELMOCpap.



Source – Survey Data (2021).

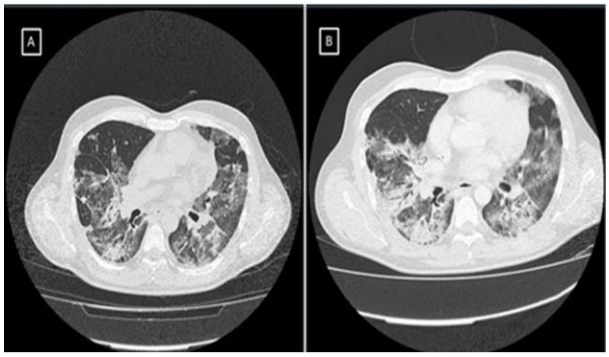
EVALUATION OF THE PERFORMANCE OF THE ELMOCPAP + TAF USE (CASE 01)

After the installation of therapies with TAF and ELMOCpap, an improvement in the P/F ratio was observed in relation to ventilatory oxygen support on admission. The duration of therapy use was five days and the mean P/F ratio 204.2 (195 – 256), during the use of non-invasive combined therapies (Figure 03 A). Regarding pCO2, there was no CO2 retention during the use of non-invasive therapies (Figure 03 B).

When evaluating the ROX index, we observed that the values were above 3.88. We found an average of 9.3 (ranging from 5.1 -14.9), (Figure 04 A). Regarding the oxygen and compressed air flow offered during the use of combined therapies, we observed that the average was 38 L/min (Figure 04 B).

CASE 02

Figura 2 – High resolution computed tomography of the chest. (A) 1st IDH: Ground-glass opacities diffusely distributed throughout the lung parenchyma, with no specific defined pattern, affecting more than 50% of the parenchyma. Mild ectasia of segmental bronchial branches, suggesting inflammatory bronchopathy. (B) 7th IDH: Opacities with ground-glass attenuation sparse throughout the lungs, some with rounded morphology, predominantly peripheral. Bilateral pulmonary alterations with acute inflammatory aspects, affecting more than 50% of the lung parenchyma

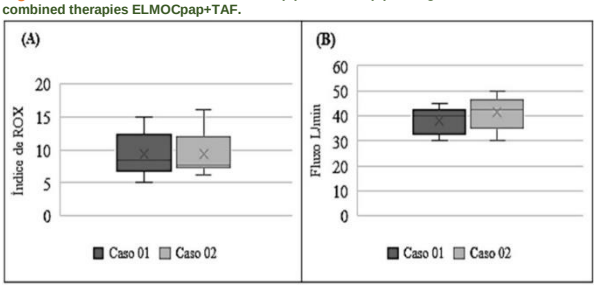


Source – Survey Data (2021).

Brazilian male, 48 years old, known to be HIV positive since 2004. He was being treated for fungal pneumonia suggestive of mucormycosis, after being diagnosed by a pulmonary nodule biopsy performed on October 15, 2020. He had an undetectable HIV viral load (November/ 2020) and CD4+ T lymphocyte count of 604 cells/mm3 (July/2019). She was using itraconazole (400mg/day) and ART with tenofovir, lamivudine and darunavir/ritonavir. Admitted on January 24, 2021 to the COVID-19 Unit of the HSJ for the treatment of SARS-CoV-2 infection. She arrived at the hospital unit complaining of fever, persistent dry cough and dyspnea for 05 days. On examination, he presented fever (38ºC), dyspnea (RR ~25 bpm), which worsened during exertion, and SpO2 ~85-88%. RT-PCR of nasopharyngeal swab was positive for SARS-CoV-2. HRCT showed ground-glass opacities diffusely distributed throughout the lung parenchyma (Figure 02 A). Laboratory tests revealed a WBC count of 11,900 cells/mm3 (93% neutrophils and 3% lymphocytes), C-reactive protein 153 mg/L, lactic dehydrogenase 545 U/L, creatinine 0.7 mg/dL, creatine phosphokinase of 331 IU/L, D-dimer of 618 ng/ml. Research and culture of the leucocyte cream for fungi were negative. Arterial blood gases showed a PaO2 of 71 mmHg and SpO2 of 94%, with the patient using supplemental oxygen through a 10 L/min reservoir mask. A new HRCT scan

of the chest was performed 7 days after admission, showing involvement of more than 50% of the lung parenchyma bilaterally (Figure 2B). Initiated on the 3rd IDH non-invasive therapies combined with improved respiratory pattern and performance. In addition, the patient was treated with dexamethasone for 10 days, prophylactic enoxaparin, and liposomal amphotericin B for 14 days. On the 13th IDH, ELMOcpap and TAF therapy was suspended due to significant clinical improvement. Patient was discharged on the 32nd IHL, on room air.

Figura 4 – Evaluation of the ROX index (A) and Flow (B) during the use of non-invasive combined therapies ELMOCpap+TAF.



Source – Survey Data (2021).

EVALUATION OF THE PERFORMANCE OF THE USE ELMOCPAP + TAF (CASE 02).

The time of use of the combined therapy was 10 days. After the installation of the therapies with FRT and ELMOCpap, an improvement in the P/F ratio and the mean P/F ratio was 177.2 (P/F: 115 - 310), during the use of non-invasive combined therapies (Figure 03 A). Regarding pCO2, there was no CO2 retention during the use of non-invasive therapies (Figure 03 B).

When evaluating the ROX index, we observed that the patient had an average of 9.4 (ranging from 6.2 to -15.8), (Figure 04 A). Regarding the oxygen and compressed air flow offered during the use of combined therapies, we observed that the average was 41.5 L/min (Figure 04 B).

DISCUSSION

Severe Acute Respiratory Syndrome (SARS) is an important complication of COVID-19, occurring mainly in individuals over 60 years of age and in those with comorbidities such as obesity, diabetes and hypertension. Individuals with advanced immunosuppression, such as AIDS or transplant patients, are also likely to develop SARS, which are often fatal9. The cases of individuals with HIV infection reported here presented moderate clinical symptoms of COVID-19, characterized by hypoxemic respiratory failure, altered markers of inflammatory activity, and radiological alterations with significant involvement of the lung parenchyma.

NIMV-based therapies were used after the second epidemic wave of COVID-19, when studies showed a benefit in terms of reduced hospital stay, shorter recovery of hospitalized patients and a minimization of risks for health professionals, when properly dressed with precautionary measures for aerosols. The optimal treatment for COVID-19 pneumonia is still controversial. Some experts believe that providing a moderate level (<10 cmH2O) of PEEP may correspond to the patient's need during the first phase of the disease, although this must be balanced against the potential risk of delayed intubation[10-12].

In the cases reported here, we can observe an improvement in hypoxemia and in the P/F ratio with the use of TAF combined with ELMOcpap. Studies have shown that the increase in the P/F ratio can be explained by the effect of CPAP on the recruitment of swollen and/or collapsed alveoli, with immediate improvement in the ventilation/perfusion (V/Q) ratio[13,14]. In addition, we could verify that there was a reduction in respiratory rate, which led to a reduction in respiratory distress and an improvement in respiratory performance according to the ROX index. Studies have shown that respiratory rate values below 24 bpm in a few hours with a CPAP helmet were associated with greater efficacy in resolving hypoxemic respiratory failure[15,16].

Regarding the flow used, in both cases 30 L/min or more was used. None of the cases in the present study presented CO2 rebreathing when evaluated through arterial blood gases. Similar findings were observed in other studies[17].

Therefore, in the present study, we found that non-invasive mechanical ventilation systems combined with TAF + ELMOCpap, as advanced life support associated with conventional clinical treatment, can be efficient in the treatment of SARS, avoiding invasive mechanical ventilation and all the consequences and complications this procedure over time, as well as the reduction of admissions to the ICU, as demonstrated by other studies [14,19].

FINAL CONSIDERATIONS

As far as we know, these are the first two reported cases of HIV-infected patients who used ELMOCpap combined with TAF who evolved with SARS. Combined NIMV therapy proved to be an important alternative in the treatment of these patients, preventing the progression to orotracheal intubation, the use of mechanical ventilation, the reduction of respiratory work, low levels of oxygen in the blood caused by acute hypoxemic respiratory failure, as well as such as improving peripheral oxygen saturation and

weaning from oxygen support to spontaneous breathing in room air.

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