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Case Report

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Early non-invasive ventilatory treatment for elderly patients with severe SARS-CoV-2 infection, applied by a hospital in the Brazilian Amazon.

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Abstract

Novel coronavirus also known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), generated a high worldwide demand for intensive care units and mechanical ventilation equipment, due to the severity of cases of respiratory failure. In the Brazilian state of Amazonas, the infection reached 50% of the national incidence coefficient. In this scenario, we describe the case of a 71-year-old male Amazon's capital citizen with a history of hypertension and obesity who presented a transfer to a hospital facility with worsening fevers, cough, and respiratory distress. Images showed bilateral ground-glass opacities consistent with COVID-19, with more than 50% of involvement. The RT-PCR and IgM / IgG were positive. The patient was treated in intensive care unit (ICU), using medications from the institutional protocol for COVID-19 and, from the beginning until discharge from the ICU, he used non-invasive oxygen therapy with capsule equipment protection for aerosol retention in the hospital environment. After 11 days, the patient was discharged with $SatO_2$> 95%, without signs of changes in physiological functions. Early NIV can be considered an alternative for the management of critically ill patients, avoiding complications from hospitalization for longer and the risk of using mechanical ventilation.

Keywords: Non-invasive mechanical ventilation, SARS-CoV-2, COVID-19, aerossol generating procedures, Polymerase chain reaction.

Introduction

Novel Coronavirus (SARS-CoV-2) is a public health emergency of international concern [1]. On March 13th, 2020, the first case was diagnosed in Manaus city, capital of Amazonas State – Brazil, reaching on April 17th an incidence coefficient of 668/1 million people, 50% above the national coefficient [2].

The most important complication of SARS-CoV-2 infection is acute hypoxemic respiratory failure requiring invasive mechanical ventilation (IMV)[1]. Arguments for and against early intubation are not yet resolved [3]. Non-invasive ventilation (NIV) use in general wards maybe an alternative for some patients but has seldom been described and is not used worldwide [4]. However, WHO guidelines for the management of respiratory failure in COVID-19 shows that is possible to use CPAP or NIV, provided that appropriate personal protective equipment (PPE) is worn, in mild to moderate cases [3, 5].

In one small retrospective case series from Wuhan, 72% of COVID-19 patients given NIPPV died, although death rates were also high for patients intubated from the outset [6].

The purpose of this report is to demonstrate the favorable outcome of an elderly patient with comorbidity who was treated with NIV associated with the use of an aerosol protection capsule.

Case

A 71-year-old man

JFSM, male, hypertensive patient on regular use of Losartana (50mg 1x / day) and obese (BMI 40.1), reported vaccination for H1N1 on April 7, 2020, evolving in 24 hours with malaise and unmeasured fever, which persisted for a week, with no other symptoms. On April 23, he developed respiratory distress, showing SpO_2 93% under oxygen catheter 3L / min. He was admitted to the Campaign hospital in Manaus, where he remained on NIV, under a capsule to protect against aerosol dispersion. Computed tomography images of the chest indicated pulmonary involvement > 50%, suggestive of viral infection, probably COVID-19 (Figure 1).

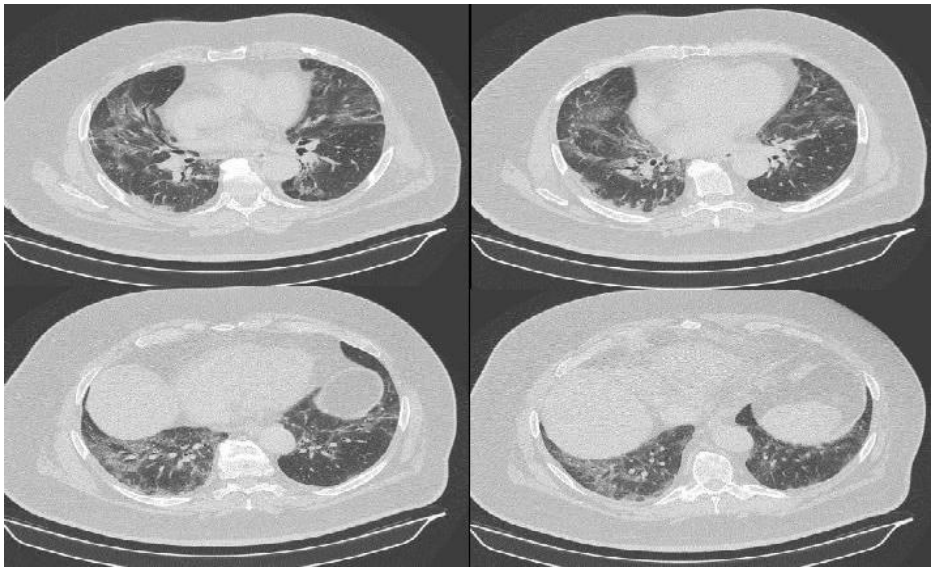

Figure 1. Chest tomography in the pulmonary window, showing multiple areas of parenchymal opacities, ground-glass pattern, diffuse and thickening of interlobular and intralobular septum. Typical changes in COVID-19 infection, confirmed by RT-PCR.

During the period from hospitalization to discharge, the patient received drug treatment consisting of antibiotics, corticosteroids, anticoagulants (Table 1), as well as symptomatic at losartan for arterial hypertension.

Table 1 - Medications used during hospitalization in the case reported during the hospitalization period.

Drugs	Prescribed dose	Period of use
Ceftriaxone	1g IV 12/12h	April 23th to 25th/2020
Clarithromycin	500mg IV 12/12h	April 23th to 25th/2020
Methylprednisolone	125mg IV 8/8h 31,25mg IV 1x/day	April 23th to 25th/2020 April 26th to 30th/2020
Zinc Gluconate	20mg PO 1x/day	April 26th to 30th/2020
Cholecalciferol	10.000 IU PO 1x/day	April 23th to May 02th/2020
Enoxaparin Sodium	80mg SC 12/12h 40mg SC 12/12h	April 23th to 25th/2020 April 26th to May 02th/2020
Hydroxychloroquine Sulfate	400mg PO 12/12h 400mg PO 1x/day	April 26th/2020 April 27th to 30th/2020
Oseltamivir Phosphate	75mg PO 12/12h	April 23th to 27th/2020

IV = intravenous route; PO = orally route; SC = subcutaneous route; IU= International Unit
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On April 25, the patient was transferred to the ICU and was in regular general condition, lucid, oriented in time and space, collaborative, hemodynamically stable, flushed and hydrated, afebrile, acyanotic, and anicteric. The initial treatment was maintained, alternating with the application of NIV and 50% Venturi mask, under a protective capsule (Table 2).

Short Laboratory and Physical exam findings:

Lymphopenia, C-Reactive Protein (CRP) of 25.2, Reference Value (RV) = 6, lactate 1.8mmoL / dL, without changes in muscle injury enzymes, without use of vasoactive drugs. Lung auscultation with bilateral vesicular murmur preserved, with crackles in the left lung base. At this time, SpO_2 was 88%, with no cardiac auscultation changes, with a HR of 78 beats per minute and blood pressure of 154 x 87 mmHg. There were no changes in the extremities or in the physical examination of the abdomen.

Table 2 – Description of the modalities of oxygen therapy used in the case report during the hospital stay.

Date	Oxygen Delivery	Parameters	SpO_2	$SatO_2/FiO_2$ or PaO_2/FiO_2	FiO_2	Comments
04/26/2020	Venturi mask 50% interspersed with NIV	NIV assisted-controlled mode-face mask, IT 1.2s	88%	176	50%	Tachypneic
04/27/2020	Venturi Mask 50%	None	94%	188	50%	Patient with high RR
	Continuous NIV	CP 16 cmH_2O, PEEP 8 cmH_2O, RR espontaneous 20 IRPM, IT 1,2s	94%	188	50%	None
04/28/2020	Continuous NIV	CP 15 cmH_2O, PEEP 8 cmH_2O, RR espontaneous 25 IRPM	94%	94	99%	After agitation and desaturation episode was increased FiO_2
	Continuous NIV	CP 15 cmH_2O, PEEP 8 cmH_2O, RR espontaneous 25 IRPM	94%	156	60%	After stabilizing SpO_2 and using precedex was reduced FiO_2
	Venturi Mask 50%	**	94%	188	50%	None
04/29/2020	Continuous NIV	Assisted-controlled, PEEP 8 cmH_2O, RR spontaneous 25 IRPM, IT 1,2s	96%	189 (PaO_2/FiO_2)	65%	Arterial blood gas collected
04/30/2020	Continuous NIV	CP 15 cmH_2O, PEEP 10 cmH_2O, RR spontaneous 20 IRPM, IT 1,2s	96%	147	65%	None

	Venturi Mask 50%	**	96%	192	50%	After removal of NIV
05/01/2020	Oxygen NC	3L/min	95-96%	**	**	Patient spent most of the day on oxygen NC
	NIV (1 cycle)	CP 10 cmH_2O, PEEP 5 cmH_2O, RR spontaneous 20 IRPM, IT 1,2s	100%	222	45%	Received only 1 NIV cycle (1 hour) - reported mild dyspnoea
05/02/2020	Catheter removed and kept in room air	None	96%	457	21%	None
05/03/2020	Room air	None	96%	457	21%	None

NIV = Non-invasive ventilation; NC = nasal catheter; IT = Inspiratory time; PEEP = Positive pressure at the end of expiration; RR = respiratory rate; IRPM = respiratory incursions per minute; CP = controlled pressure.
Electronic Record of Samel Hospital. Tasy® System

On April 26, positivity for the specific IgM and IgG antibodies for SARS-CoV-2 was confirmed and a positive RT-PCR result for the virus, collected at admission.

On April 28, the patient presented bradycardia of 50 bpm, needing to make brief use of dobutamine, which was removed after control of the condition. At that time, SpO_2 was 93% and PaO_2 / FiO_2 was 156.

He evolved with a gradual improvement in the ICU, with a PaO_2 / FiO_2 189 ratio on April 29, being discharged to the ward the next day. Then the NIV was removed, with Spo_2 96%, PaO_2/ FiO_2 182 ratio and maintained using only 50% Venturi mask.

In the ward, the breathing pattern improved, maintaining 100% oxygen saturation in a low flow nasal catheter at 6L / min. On May 3, he was discharged from the hospital, as he was in room air, with $SatO_2$> 95%, without alarm signs or changes in physiological functions.

Discussion

In the fight against infection by SARS-CoV-2, the Amazon region faced difficulties in acquiring respirators and PPE, coupled with the lack of hospital structure for the demand of patients. In view of this scenario, a NIV protocol was proposed by the multidisciplinary team to treat patients in Manaus and in remote locations in the state of Amazonas, where there are no ICU beds available. In addition, a complementary protection device for the use of PPE was developed, in partnership with a local research institute, to prevent the contagion of health professionals by aerosol dispersion.

The report shows the favorable outcome of an elderly patient with severe SARS-CoV-2 infection where the use of NIV, associated with the protection capsule, provided a short hospital stay (11 days). Studies have shown an increase in the period of hospital stay ranging from 4.3 to 13 days, especially when related to the use of mechanical ventilation[7]. In elderly patients, the prolonged hospital stay is directly proportional to greater loss of functionality, with a greater risk of unsatisfactory results and increased morbidity and mortality in this age group[8,9].

Another study showed that there was a good response to the use of NIV (oxygen concentration around 0.6 and continuous positive pressure of 10 cmH20) in 62 patients who had SaO_2 <94% on admission. Despite the limitations regarding the small sample size (age = 56 years ± 6), in addition to the lack of a control group and the short duration of the prone position, the data indicate that the technique can be implemented, especially in mild and moderate cases[10].

According to Dietrich et al (2020), a great loss of functional capacity was observed in elderly patients who were admitted to the ICU over 6 months compared to their previous state, with no differences between the age groups presented. The results showed that about half of elderly patients who were admitted to the ICU became functionally dependent[11].

Another concern among elderly hospitalized and intubated patients is pneumonia associated with mechanical ventilation (MV), which in the United States is responsible for about 30-42% of all infections and 46% of mortality that occur in the ICU[12].

Data analysis of 5,700 patients admitted by COVID-19 in New York showed that the average age among them was 67 years, with 94% having at least one comorbidity. Among these, the most common were: systemic arterial hypertension, obesity and diabetes, which were considered risk factors for the unfavorable evolution of COVID-19. In addition to these changes, it was identified that chronic lung diseases and renal failure can also contribute to the worsening of the condition [13,14].

The association of advanced age with obesity (BMI > 35 kg / m²), as observed in the reported case, increases the risk of metabolic changes due to the accumulation of localized fat, especially in the central region of the body, with impairment of its mobility and ventilatory mechanics. These aspects are intensified during hospitalization,

leading to a reduced capacity to resist stressors[15]. Thus, the patient described had a potentially serious condition since admission, including the need for ICU management.

Despite the little clinical evidence regarding the use of NIV in cases of viral infections[4], especially in critically ill patients, the reported case indicates that it is possible to perform NIV associated with the use of an aerosol dispersion protection device, which has become an item that contributed to implementing the use of NIV in an elderly patient with COVID-19.

It is concluded that in view of the difficulties encountered, early NIV presents itself as an alternative in places with limited resources, provided that it is properly handled by the team, given the high transmissibility of SARS-CoV-2. Since the good response to early NIV reduced the length of hospital stay and did not have any consequences for respiratory mechanics. The patient is without sequelae and under home monitoring by the medical and physiotherapy team.

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Conflicts of interest

The authors declare no conflicts of interest.

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