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Exacerbation of COPD Treatment Combination Therapy NIV with Thermal Helium- Oxygen Plus Nitric Oxide: A Case Report

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ABSTRACT

Chronic obstructive pulmonary disease (COPD) is a major cause of morbidity and mortality worldwide despite increased health care efforts, financial costs, and research concerning its early diagnosis and proper management [1]. The most relevant event affecting COPD mortality is the acute exacerbation of COPD (AECOPD), a catastrophic event during the clinical course of the disease [2].

In cases of acute respiratory acidosis, noninvasive mechanical ventilation (NIV) is considered. Nevertheless, in 30% of patients with severe exacerbation of COPD, NIV does not lead to the desired results [3]. However, there have been cases of NIV failure in patients with severe respiratory acidosis, and associated pulmonary arterial hypertension. Many studies have shown that thermal helium-oxygen and nitric oxide gas heat treatment has many effects. Here we are reporting a case of severe exacerbation COPD, 67 years old male patient, who came to us with shortness of breath, fever, wheezing and a cough with yellow phlegm. He had a history of smoking 30 pack-year smoker many years. He was given NIV treatment with a combination of helium and nitric oxide heat. And we have had very good results.

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Introduction

Acute exacerbations of chronic obstructive pulmonary disease (AECOPDs) are episodes of symptom worsening1 that have significant adverse consequences for patients [4]. The important causes of exacerbations include airway bacteria, viruses, and pollution; however, the interplay of these triggers must also be considered. It is recognized that defects in immunity and host defense lead to more frequent AECOPDs. Greater frequency of exacerbations is associated with accelerated lung function decline quality-of-life impairment and increased mortality [5-7].

Although half of the patients treated in the community recover to their baseline symptoms by 7 days, a study of the time course found that, despite treatment, 14% had still not fully recovered by 5weeks. Moreover, in a small proportion of exacerbations, symptoms never returned to the baseline level [8]. During acute exacerbation, patients often have respiratory acidosis, hypercapnia. During acute exacerbations with ventilatory failure, NIV is frequently used because it has been shown to improve survival [9].

Helium is an inert gas with the lowest density of any gas other than hydrogen, which is flammable and therefore of limited clinical use. Helium was first isolated from atmospheric air in 1895 by Sir William Ramsey, with the first reports of its clinical application by Alvan L Barach in the 1930s, for treatment of upper-airway obstruction [10,11]. The major benefit of helium mixtures comes from the low density of helium compared with air and oxygen, which favors laminar flow, reduces airway resistance, and improves respiratory mechanics with decreased work of breathing and energy expenditure [12]. Beneficial effects have been observed in patients with asthma, chronic obstructive pulmonary disease (COPD), bronchiolitis, bronchopulmonary dysplasia and upper airways obstruction. In Russia, thermal helium – oxy mixtures have been used in patients with hypoxemia and hypercapnia who reported a good clinical response and no side effects [13].

Nitric oxide is a molecule found in many cells in all mammals that is involved in functions such as in the process of relaxing the blood vessels in the human body. It is a gas and is used for

treating newborns that have a lower than normal amount of oxygen in their bloodstream due to a pulmonary insufficiency associated with high arterial pressure in their lungs. It is also used at any age in patients with pulmonary hypertension related to heart surgery. When a person inhales, they can improve their blood flow by means of their lungs, which can help to increase the amount of oxygen reaching the blood [14-16].

Discussion

67 years old male patient with severe shortness of breath at rest, which increases with a slight load, cough with purulent sputum more than 50 ml per day, Pronounced weakness. Deterioration of the condition during the month - increased cough and shortness of breath. Outpatient therapy with no effect. Anamnesis of life: Since 2012, COPD, The last hospitalization was on 02.03.2019; Pseudomonas aeruginosa was isolated in sputum culture. 107. After discharge, he received: Ultibro, Symbicort.PCR: SARS - CoV-2 negative. IgM:0,013; IgG : 48,58. Status: BMI =32.8 (Height 170 cm; weight 95 kg). On physical examination, the patient was alert with respiration rate 26 cycles per minute, blood pressure 120/80 mmHg, a pulse of 100 beats per minute, axillary temperature 37.5 °C. Thoracic examination showed symmetrical chest movement, sonorous percussion, bronchial sounds with rhonchi on the right side of the chest and bilateral wheezing. Pulse oximetry in air: 88 %, on O2 (4 l / min. through the nasal cannula) 97 %.

COPD Assessment Test (CAT score) 22 points - impact level: hight mMRC Dyspnea Scale: Grade 4-very severe
Blood gas analysis with air were pH= 7.25, PaCO2= 57,8 mmHg, PaO2 =55 mmHg, HCO3− =38.1 mmol/l, BE =-2.2 mmol/L, Lactat =2.5, SaO2= 80,2%, P/F ratio =261
Pre-bronchodilator spirometry results were FVC 0,77 L (21% of predicted), FEV1 0,45 L (16% of predicted), FEV1/FVC 58%.

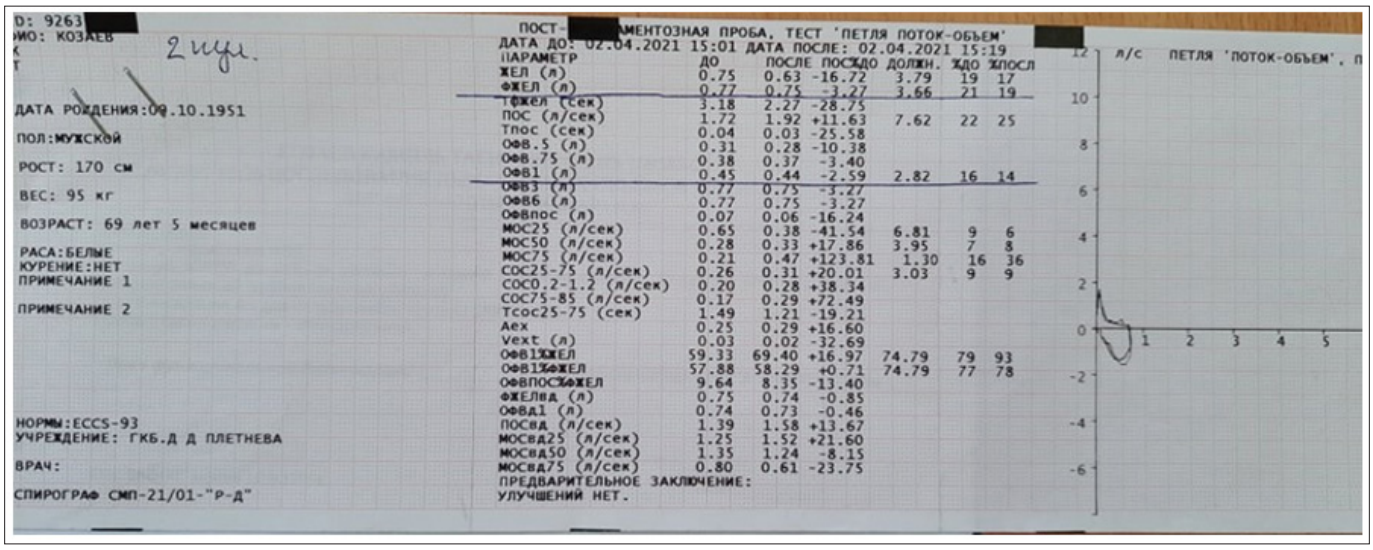

Figure 1: Spirometry: airflow obstruction

Figure 2: CT scanner showing hyperinflation

An echocardiogram: PASP (Pulmonary artery systolic pressure) = 55 mmHg, showed: Pulmonary hypertension:
Oxygenation was given at 2 L/min, medications given were salbutamol + ipratropium bromide nebulizer solution every 6 hours. BiPAP ST 12 h/day: IPAP 20 cm H2O, EPAP 6 cm H2O, Set rate 19 and inhaled T- He/O2: FiO2: 25 %, Temperature 75 oC, 2 times/day, 10 min in 1 time, and NO 20 ppm 6 h/day.

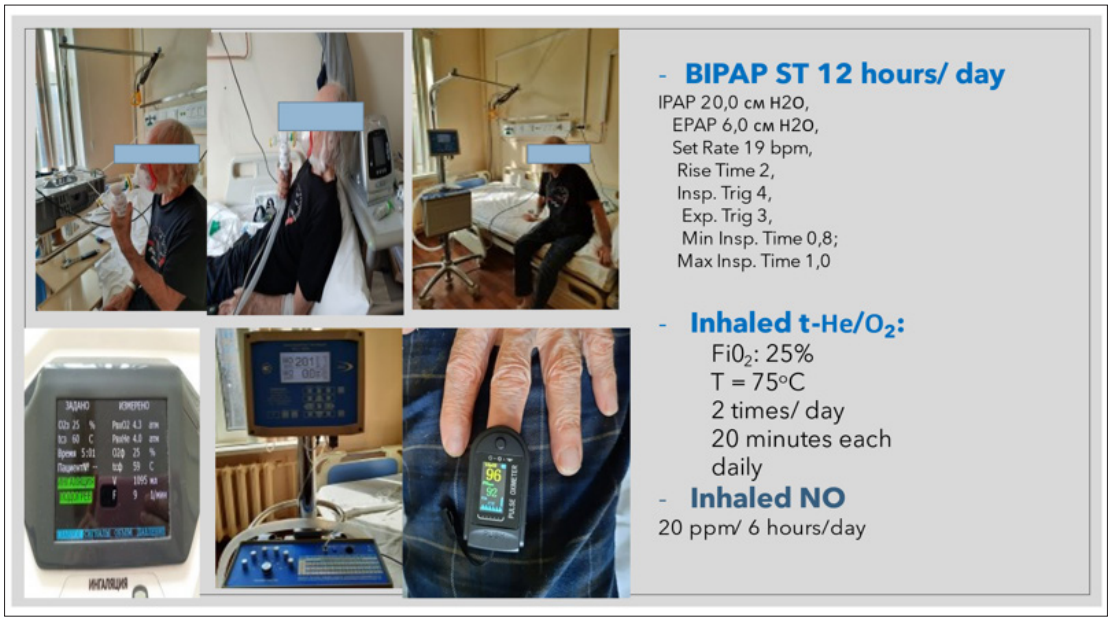

Figure 3: Patient during treatment in hospital

Patient's condition improved after a week of hospitalization.
PH = 7,41; $PaCO_2$ = 46 mmHg; PaO_2 = 75 mmHg; HCO_3- = 26,5 mmHg; Lactat =1,5;
P/F ratio =357
An echocardiogram again: PASP (Pulmonary artery systolic pressure) = 35 mmHg
The 6-minute-walk distance (6MWD) test: 208 m (At the time of admission, the patient could not do it)
Patients feel less shortness of breath, can do personal hygiene, take short walks, eat well and sleep better.

Conclusions

We found a positive effect of combined NIV with thermal helium-oxygen and nitric oxide on patients with COPD exacerbations with hypercapnia. The acidosis status improved rapidly, and the pulmonary artery pressure on echocardiography also decreased significantly. We have and will expand the study to evaluate the effect more accurately and reliably.

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