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The Efficacy of High Flow Nasal Cannula (HFNC) in Chronic Obstructive Pulmonary Disease (COPD): a Case Report

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ABSTRACT

Introduction: Chronic Obstructive Pulmonary Disease (COPD) is a heterogeneous lung condition characterized by chronic respiratory symptoms due to abnormalities of the airways and/or alveoli (that cause persistent, often progressive, airflow obstruction. The main environmental exposures leading to COPD are tobacco smoking and the inhalation of toxic particles and gases from household and outdoor air pollution. COPD could lead to worse outcomes from COVID-19. Oxygen therapy is the main treatment method for patients with COPD and hypoxemia. Compared with NIV, HFNC can significantly reduce the incidence of pressure injuries such as facial and nasal bridge rupture. And also HFNC could be a valuable and feasible treatment option for patients with COVID-19 pneumonia, with remarkable clinical advantages.

Method: This was a retrospective case report, after analysis of patient clinical data. The patient provided written informed consent to publish their case details and any accompanying images.

Results: A 63-year-old man was presented with a complaint of shortness of breath that had been felt for two days before entering the hospital. The first day of treatment, the patient complained of increasing severe shortness of breath accompanied by fever. Later on, the patient was diagnosed with an acute exacerbation of COPD accompanied by COVID-19. During 4 days of hospitalization, the patient was admitted to the ICU because of worsening breathing and was given oxygen therapy with HFNC and other drugs for 8 days. Patient showed improvement and was then discharged after seven days of hospitalization.

Conclusion: HFNC can be an alternative therapy in COPD therapy with COVID 19, because it has good tolerance and physiological effects

Keywords

COPD (Chronic Obstructive Pulmonary Disease), COVID-19, High Flow Nasal Canula (HFNC), and Non-Invasive Ventilation (NIV)

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INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a heterogeneous lung condition characterized by chronic respiratory symptoms (dyspnea, cough, sputum production) due to abnormalities of the airways (bronchitis, bronchiolitis) and/or alveoli (emphysema) that cause persistent, often progressive, airflow obstruction.[1] The main environmental exposures leading to COPD are tobacco smoking and the inhalation of toxic particles and gases from household and outdoor air pollution, but other environmental and host factors (including abnormal lung development and accelerated lung aging) can also contribute.[2]

COPD and COVID-19 share many potentially negative associations, which could lead to worse outcomes from COVID-19, including impaired lung function in older patients and the presence of co-

morbidities. In addition, COPD patients may also be more susceptible to viral infections, including COVID-19.[3] Oxygen therapy is the main treatment method for patients with COPD and hypoxemia.[4] Noninvasive ventilation (NIV) has gradually become the gold standard for the treatment of patients with acute exacerbation COPD and type II respiratory failure. However, good tolerance to NIV is sometimes difficult to achieve due to frequent leaks around the mask, possibly leading to patient-ventilator asynchrony and even to intubation.[5] In the other hand, HFNC (High Flow Nasal Canula) can improve ventilation and oxygenation and improve comfort by providing oxygen that is heated and humidified with precise oxygen concentration. Compared with NIV, HFNC can significantly reduce the incidence of pressure injuries such as facial and nasal bridge rupture.[6] And also HFNC could be a valuable and feasible treatment option for patients with COVID-19 pneumonia, with remarkable clinical advantages.[7]

RESULT

A 63-year-old man came to Emergency Department in Hasan Sadikin Hospital, with a complaint of shortness of breath that had been felt for one days before entering the hospital and was not affected by weather and dust. The shortness of breath had been felt since 1 month before entering the hospital. The patient had been in and out of the hospital frequently with a diagnosis of COPD, and consuming theophylline purchased from the pharmacy every month routinely. The patient had no history of high blood pressure, diabetes, cholesterol before. The patient lived at home every day and has a habit of smoking 2 packs per day from a young age. The patient had never had TB (tuberculosis) before. There was no history of contact with TB or COVID-19 patients.

Sensorium was compos mentis with normal blood pressure. Heart rate was 86 beat per minute (bpm), regular rhythm, adequate volume, with respiration rate was 22 times per minute and normal temperature. On auscultation of the lungs, minimal wheezing breath sounds were found, with 98% oxygen saturation using a nasal cannula 3 lpm. At the same time, an COVID-19 antigen swab examination was carried out, with a positive test result for COVID-19. And later on, complete blood count, blood gas analysis, electrolytes, kidney function, liver function, ECG and chest x-ray were performed. (Fig.1) After that the patient was treated in the inpatient room.

	ER
pH	7.310
pCO2	67.8
pO2	163.2
HCO3	34.3
BE	5.7
SatO2	99.8

Figure. 1 Chest X-ray and blood gas analysis in ER

Therapy	Dose	Day in ICU
Anticoagulant	Enoxaparin 0,4 cc/12 jam s.c	Day 1-8
Antibiotic	Levofloxacin 1 x 750 mg i.v	Day 1-8
Antivirus	Remdesivir 1 x 100mg p.o	Day 1-8
Steroid	Dexamethasone 1 x 6mg i.v	Day 1-8
Vit C	1000mg/24 jam i.v	Day 1-8
Vit D	5000IU/24 jam p.o	Day 1-8
Aminophylline	Aminophylline 30 mg/ hr	Day 1-3

Figure 3. Therapy in ICU

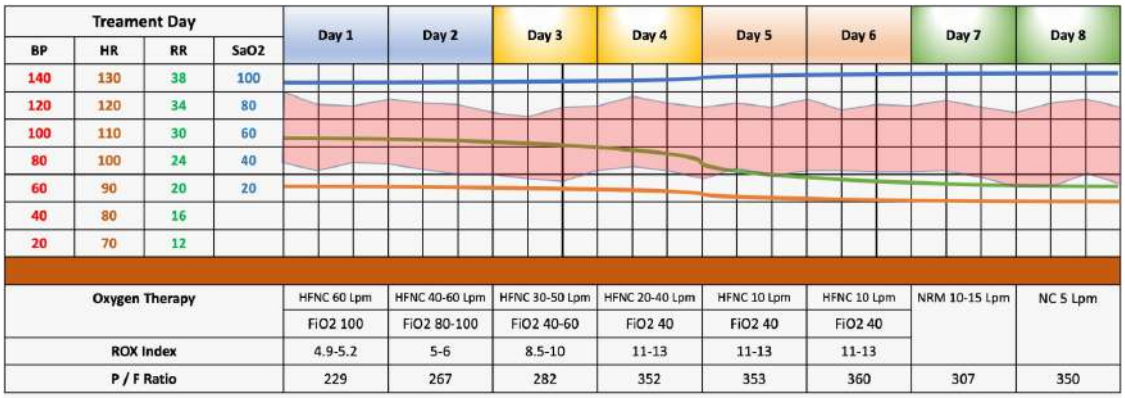

Figure 2. Hemodynamic Monitoring during in ICU

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
pH	7.340	7.330	7.350	7.380	7.400	7.390	7,34
pCO2	77.6	85.7	65	58.1	49.5	51.6	48
pO2	229.3	241.5	142	142.1	144.2	123	140,4
HCO3	41.9	45.9	43.4	35.0	31.2	31.5	35,5
BE	11.8	14.2	13,0	8.0	5.7	5.5	4,7
SatO2	99.9	99.9	99.8	99.7	99.7	98.0	99,2

Figure 3. Serial of blood gas analysis during in ICU

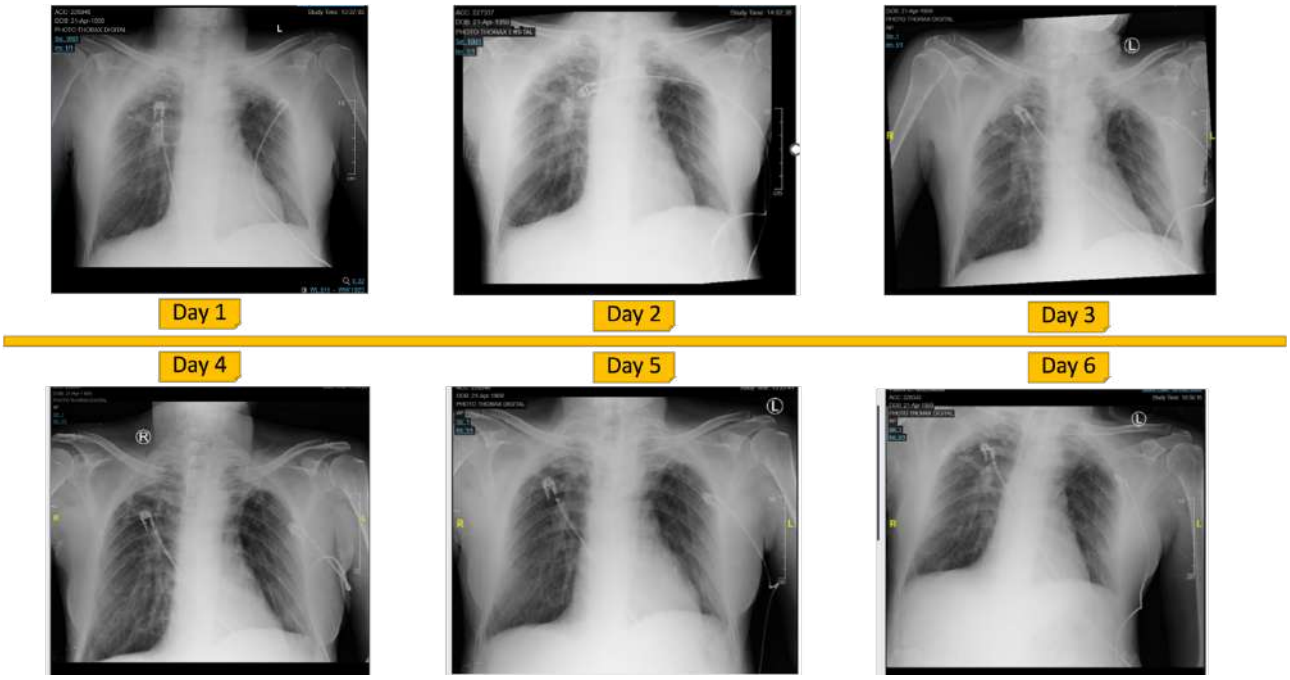

Figure 4. Serial of chest x-ray during in ICU

During 4 days in the inpatient room, the patient was consulted to the Intensive Care Unit (ICU) because of worsening breathing and was given oxygen therapy with HFNC for a few days, and the patient's condition improved.(Fig. 2) Patients were given medicines according to COPD and COVID-19 therapy.(Fig. 3) Serial blood gas analysis examinations and chest x-ray were performed. (Fig. 4 and 5) After the patient was treated for 8 days in the ICU, the patient experienced an improvement in his condition, then he was transferred to the

usual inpatient room for further treatment. After 4 days of being treated in the patient's room, the patient returned home with a swab test for the COVID-19 antigen with negative results

DISCUSSION

The main reason for the hospitalization of COPD patients is due to the continuous progress of the disease and severe respiratory failure [2]. Emergency tracheal intubation is often used during the treatment process, and invasive ventilator-assisted ventilation is required [6]. The main factors of organ dysfunction in COPD patients and type II respiratory failure are respiratory acidosis, hypercapnia and hypoxemia. When the PaCO2 level in the body rises to a certain level, the PaO2 level usually decreases, leading to cardiac arrest, pulmonary heart disease, etc., which will have a serious impact on the life of the patient. Oxygen therapy with HFNC is a type of therapy that can provide stable oxygen concentrations, increase mucosal clearance, prevent dead space in the nasopharynx and open alveoli, so it has good clinical value. 27 Evidence emerged during the COVID-19 pandemic showing that implementing HFNC is feasible for treating patients with acute hypoxemic respiratory failure due to COVID-19 even with COPD.

A meta-analysis study comparing HFNC with NIV, it turned out that HFNC was more useful in reducing PaCO2 values, length of hospital stay and incidence of facial and nasal skin damage, and there was no difference in effect on PaO2 values, incidence of tracheal intubation and mortality found between HFNC and NIV treatments [7]. Another meta-analysis study also showed no difference in PaO2 values between patients treated with HFNC or NIV, but in a smaller study population. Another study, has also compared HFNC and conventional NIV to evaluate the risk of death and intubation in acute COPD exacerbations in 8 RCTs and 492 patients, and produced evidence that HFNC does not increase the risk of death and intubation events.[5]

In this patient, complaints of shortness of breath were found on admission, physical and supporting examinations were carried out, the patient was diagnosed with COPD accompanied by COVID-19. During 4 days of treatment in inpatient room, the patient was admitted to the ICU because of worsening breathing and was treated with HFNC and other drugs for 8 days. We used the patient's clinical assessment, ROX index and PF ratio as a guide to determine whether the patient will be intubated or not. The patient's clinical improvement was getting better during treatment in the ICU by looking at the ROX index value obtained by the patient after administration of HFNC which was always more than 4.88 every day during treatment in the ICU. The PF ratio value also showed improvement, which indicated that lung compliance was also getting better. The patient's condition has improved, then moved to the usual inpatient room, and went home from the hospital 4 days later.

CONCLUSION

HFNC can be an alternative therapy in COPD therapy, because it has good tolerance and physiological effects, even compared to NIV there is no difference in the effect on PaO2 values, on the incidence of tracheal intubation and death during treatment.

DECLARATIONS

Ethics approval and consent to participate. Permission for this study was obtained from the Ethics Committee of Universitas Padjadjaran (UNPAD) / Center General Hospital Dr. Hasan Sadikin.

CONSENT FOR PUBLICATION

The Authors agree to publication in Journal of Society Medicine.

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COMPETING INTERESTS

None.

AUTHORS' CONTRIBUTIONS

All authors significantly contribute to the work reported, whether in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas. Contribute to drafting, revising, or critically reviewing the article. Approved the final version to be published, agreed on the journal to be submitted, and agreed to be accountable for all aspects of the work.

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