



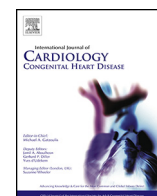
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Role of high-flow nasal oxygen therapy in COVID-19 pneumonia with Eisenmenger syndrome: A case report



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ABSTRACT

Since the coronavirus disease 2019 (COVID-19) pandemic emerged in November 2019, various international guidelines and local protocols have been published to assist clinicians face the pandemic effectively. Medical and ventilatory strategies have evolved and researchers have come out with multiple studies and solutions within a short period of time. The patient's best interest is always the goal of the management. We present a case report of COVID-19 pneumonia in a patient with underlying Eisenmenger syndrome and the potential benefits of high-flow nasal oxygen therapy in this patient.

1. Introduction

The underlying pathophysiology of Eisenmenger complex was redefined by Paul Wood in 1985 as pulmonary hypertension (800 dynes-sec/cm⁵) with a large ventricular septal defect (1.5–3 cm²) and a bidirectional or reversed shunt. Subsequently, a variety of cardiac lesions presented with cyanosis due to systemic-to-pulmonary circulation and pulmonary hypertension is termed as Eisenmenger syndrome. The lesions could arise from atrial septal defect, ventricular septal defect, single ventricles anomalies, patent ductus arterioles and several others [1].

Despite advances in diagnosis and therapy, almost 10% of patients with congenital heart disease (CHD) develop pulmonary arterial hypertension [2]. In the case of the coronavirus disease 2019 (COVID-19), adults with CHD may be at increased risk of cardiorespiratory compromise. Mechanical ventilation and acute respiratory distress syndrome could cause a rise in pulmonary arterial pressure, putting patients with right heart dilatation or malfunction at the risk of right heart failure [3].

High-flow nasal oxygen therapy (HFNOT) was shown to reduce the risk of intubation and the requirement of invasive ventilation compared to conventional oxygen devices in patients with acute hypoxemic respiratory failure [4]. In COVID-19 pneumonia, the prone position with HFNOT also improves oxygenation, and this care strategy could be useful in resource-constrained areas, where sophisticated intensive care unit facilities and techniques are not available [5].

2. Case presentation

We report the case of a 44-year-old lady who presented with shortness of breath at rest with productive cough, pleuritic chest pain, fever for 3 days associated with orthopnea, paroxysmal nocturnal dyspnea, watery loose stools, and bilateral lower-limb swelling. She was a known patient with large ASD with Eisenmenger syndrome. Her medications include oral sildenafil, oral digoxin, and oral spironolactone. She had a history of massive pulmonary embolism in July 2018, underwent thrombolysis, and was on oral rivaroxaban 20 mg once daily subsequently. Under room air, her baseline saturated oxygen (SPO₂) was 88%.

On arrival in the casualty, the patient was alert, conscious, had a good pulse volume, peripheral cyanosis, warm peripheries, and was tachypneic, with a respiratory rate of 35 breath per minute. Her vital signs were a blood pressure of 107/65 mmHg, heart rate of 80 bpm, glucose level of 6.1 mmol/L, and SPO₂ 62% under room air. After using a high-flow mask oxygen (HFMO₂) at a rate of 15 L/min, her SPO₂ increased to 80%. On further examination, an ejection systolic murmur was noted on auscultation, lung auscultation was equal with crepitation over the bilateral mid-zone, and there was bilateral pedal edema up to the mid-shin. A bedside echo revealed poor contractility, all dilated chambers, mild pericardial effusion, and aortic root 2.2 cm, and a lung scan revealed bilateral pleural effusion with B lines in all zones. Both sides of the two-point compression test were negative. A chest radiograph revealed

Abbreviations: Congenital heart disease, CHD; Atrial septal defect, ASD; High flow nasal oxygen therapy, HFNOT.

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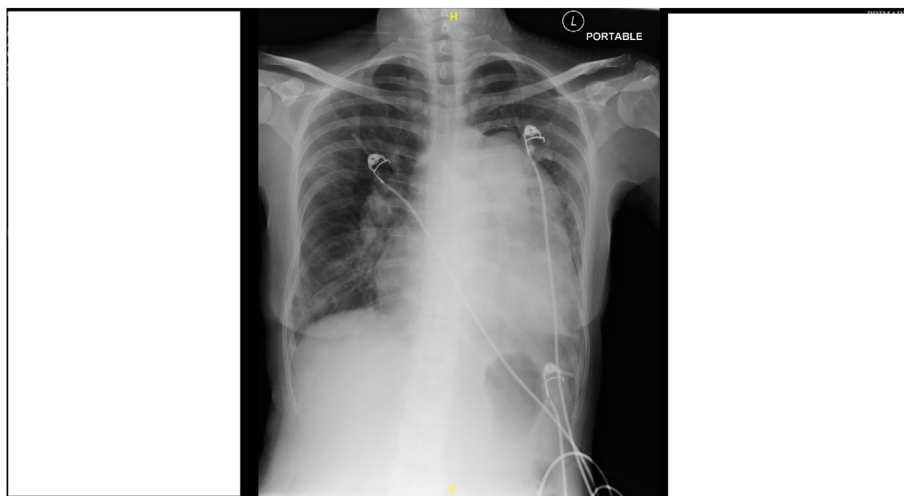


Fig. 1. Air space opacities with air bronchogram within seen at the periphery of right lower zone and left mid zone. Enlarged bilateral pulmonary artery with pruning at the periphery.

cardiomegaly and bilateral lung heterogeneous opacities (Fig. 1).

The results of blood tests showed a white blood cell count of $11.2 \times 103/L$, hemoglobin 13.5 g/dL, platelet count of $226 \times 103/L$, pH 7.397, pCO₂ 29.7 mmHg, pO₂ 30.8 mmHg, HCO₃ 19.1 mmol/L, base -6.1 mmol/L, and lactate 1.4 mmol/L. She was found to be positive for COVID-19 using the RTK Antigen and GeneXpert Rapid RT-PCR.

She was then hospitalized for COVID-19 pneumonia, category 5, on the fourth day of illness, with decompensated heart failure due to the underlying Eisenmenger syndrome. She was put on HFNOT FiO₂ 1.0, flow 60 L/min, and intravenous tocilizumab, 8 mg/kg body weight (320 mg), was given to her immediately. For COVID-19 treatment, a local protocol, consisting of intravenous dexamethasone 10 mg thrice daily and subcutaneous Clexane 40 mg twice daily, was used. To cover the superimposed bacterial infection, intravenous Tazocin 4.5 g thrice daily was started.

She was put on HFNOT on days 1–3 of admission and advised on self-prone positioning. The initial setting was FiO₂ 1.0, flow 60 L/min, and temperature 34 °C. Clinically, she was less tachypneic, and SPO₂ was maintained above 80% with the partial pressure of oxygen ranging from 40 to 43 mmHg. On days 4 and 5 of admission, she was put on HFMO₂ 15 L/min. However, she was not compliant to oxygen therapy with HFMO₂.

As the patient became more docile, we decided to switch back to a HFNOT. She was effectively weaned for oxygenation from HFNOT, high-flow mask oxygen, venturi mask oxygen, nasal prong, and finally room air on the following day. The partial pressure of oxygen was between 50 and 60 mmHg, and SPO₂ was greater than 80%. She was deisolated and more comfortable with room air on day 15 of her illness, not tachypneic, and her SPO₂ remained at 80–82%. She was subsequently discharged home well.

3. Discussion

HFNOT was first used in neonates⁶ Recognizing the potential of HFNOT in providing positive pressure to the airway, similar to continuous positive pressure ventilation, its use was later expanded to the adult population [6]. Besides providing positive end-expiratory pressure, the advantages of HFNOT include providing humidity, reducing heat and moisture loss, and reducing anatomical dead space; hence, it improves oxygenation and patient compliance [6].

When it comes to managing patients with COVID-19 with multiple illnesses, such as in our patient, selecting the appropriate devices for oxygen therapy can be challenging. The patient was classified with category 5 of the illness when she presented to us. Knowing the potential harm of placing the patient on invasive ventilation, we opted to use

HFNOT.

At the moment, international guidelines by multiples bodies have different approaches to oxygen therapy, and the stance on the use of HFNOT in patients with COVID-19 varies [7]. In countries with limited resources, the availability of negative pressure rooms may be inadequate, thus carrying the risk of exposing healthcare personnel to the potential aerosolization concern [7].

The pleural pressure differences between dependent and nondependent lung areas is reduced in prone positioning [8]. Prone positioning is also believed to be able to generate more equivalent lung aeration and strain distribution, thereby promoting the recruitment of dorsal lung areas [8]. The phenomenon of pulmonary shunting is also reduced when there is constant perfusion pressure and improvement in the ventilatory distribution pattern [9].

4. Conclusion

With this case report, we share the potential benefits of HFNOT in avoiding invasive ventilation in a patient with category 5 COVID-19 with an underlying Eisenmenger syndrome. Besides, prone positioning also serves as essential means of managing the patient acutely and hence avoiding intubation. The pivotal role of medical therapy in this case is also important.

The patient has provided written consent for writing and publication of the case.

Authorship

Muhammad Rafiqi Hehsan, Ahmad Dzarrin Hanafi and Huda Zainal Abidin: These authors helped write the manuscript. Wan Fadzlina Wan Shukeri, Kamaruddin Ibrahim and Laila Abdul Mukmin: These authors helped revise and review the manuscript.

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Presentation

The study has not been presented in any conferences.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Huda Zainal Abidin reports was provided by Universiti Sains Malaysia. Huda Zainal Abidin reports a relationship with Universiti Sains Malaysia that includes: employment. Huda Zainal Abidin has patent issued to Assignee. No conflict of interest

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