Modified T-piece jet nebulizer with high-flow nasal cannula in a severe COVID-19 patient with intensive care unit delirium

Sir,

A high-flow nasal cannula (HFNC) has become to be widely used in intensive care units (ICUs) treating patients suffering from COVID-19. Due to the confirmed effectiveness, comfort, and convenience of HFNC in the treatment of hypoxemic respiratory failure, HFNC may prevent early intubation and prolonged ICU stay in patients with COVID-19.

Many of these patients require aerosolized drugs as a part of clinical management. Standard manner of nebulization in these patients is by jet nebulizer or mesh nebulizer using a face mask interface along with the HFNC as it has a maximum benefit of taking the aerosolized drug form into the lungs. The sudden interruption of the HFNC therapy for providing conventional aerosol therapy through facemask or mouthpiece may lead to derecruitment of the lungs, the interruption of high-flow inspired oxygen therapy, and increased work of breathing in patients with COVID-19.[1] These COVID-19 patients have longer length of stay in ICUs and they may have an increased risk of developing ICU-associated delirium.

We described a case of 50-year-old COVID-positive old female admitted to our ICU with sudden shortness of breath and she was immediately put on nonrebreathing mask with oxygen flow rate of 15 L/min and maintaining oxygen saturation of >93%. On 4th day after ICU admission, she has been intubated and was kept on ventilator for the next 6 days in view of severe COVID-19 pneumonia. Upon recovering and with a P/F ratio of 200 mmHg, the patient has been extubated, and then she has been kept on HFNC support for 2 days. On 11th day, she suddenly developed CNS symptoms including confusion, disorientation, and agitation, without symptoms of peripheral nervous system and skeletal muscle injury that met the delirium diagnostic criteria of confusion assessment method for the ICU,[2] including acute onset of mental status changes (Feature 1), attention disorder (Feature 2), and disorganized thinking (Feature 3). She then started rejecting all nebulized drugs such as salbutamol, budesonide, and n-acetyl cysteine support when jet nebulizer face mask was kept over the face with HFNC. To mitigate this difficult challenge, we made an assembly using HFNC circuit and T-piece jet nebulizer interface so that we can give the aerosolized drug through HFNC only instead of face mask interface which is not being accepted by the patient.

T-piece is connected between the HFNC circuit and nasal cannula interface. The drug required to be nebulized is put in the T-piece, and it has been connected to the nebulizer machine [Figure 1]. We set a flow rate of 40 L/min with fractional inspired oxygen of 0.6. Nebulization has been carried for over a period of 10 min and the T-piece has been disconnected from HFNC circuit and nasal cannula interface once the nebulization is completed. Throughout the procedure, the patient is resting and not irritable as there was no provocating factor, and nebulization has been carried successfully. She was started on tablet haloperidol 10 mg daily at night and then her delirium symptoms were relieved within 1 week. Although studies are not in large number when coming to nebulization with HFNC, some studies showed the advantage of nebulization carried out with HFNC. Reminiac *et al.*[3] in their study successfully carried out nebulization with HFNC using a mesh nebulizer and compared it with a jet nebulizer with face mask interface and found that nebulization through HFNC is noninferior to jet nebulizer with face mask interface. Imitazione *et al.*[4] found in their study that for those patients who had nebulization through HFNC recorded a significant improvement in quality of life. Valencia-Ramos *et al.*[5] concluded in their study that the use of a nebulizer in line with HFNC therapy showed a heightened level of comfort and satisfaction in patients with bronchiolitis.

Higher flow rates which further lead to turbulent flow, high level of humidified gas, the shape of the nasal cannula, and the anatomy of the upper airway tract physiologically retaining inhaled aerosols could give to rise to problems in efficient aerosol drug delivery through an HFNC circuit. To mitigate this problem, we set the flow rate at 40 L/min to

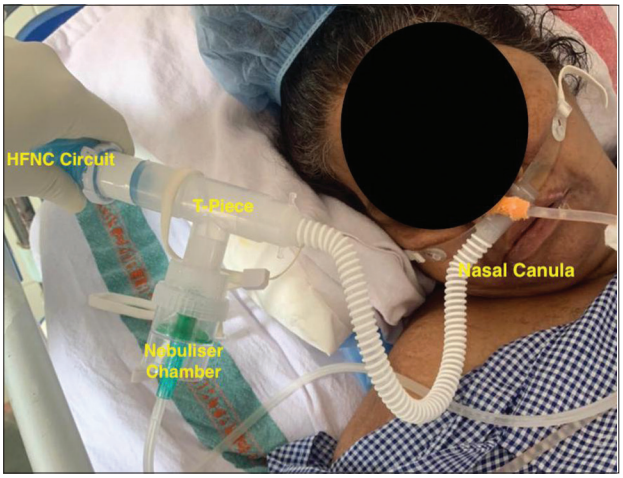

Figure 1: Assembly using T-piece jet nebulizer with high flow nasal cannula circuit

decrease turbulence and also to facilitate the aerosolized drug from HFNC to lungs. Throughout the nebulization, the patient is peaceful, and compliance is very good. As the studies involving nebulization using HFNC are very less, more studies are warranted in this area.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given her consent for her images and other clinical information to be reported in the journal. The patient understands that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

Neeraj Kumar[1], Pavan Kumar Kandrakonda[2], Sarfaraz Ahmed[2]

[1]Department of Trauma and Emergency, All India Institute of Medical Sciences Patna, Bihar, India, [2]Department of Anaesthesiology, All India Institute of Medical Sciences Patna, Bihar, India

E-mail: neeraj.jlnmc@gmail.com

Submitted: 05-Jul-2021 **Accepted:** 14-Jul-2021

Published: 26-Oct-2021

REFERENCES

1. Ari A, Moody GB. How to deliver aerosolized medications through high flow nasal cannula safely and effectively in the era of COVID-19 and beyond: A narrative review. Can J Respir Ther 2021;57:22-5.
2. Ely EW, Margolin R, Francis J, May L, Truman B, Dittus R, *et al*. Evaluation of delirium in critically ill patients: Validation of the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU). Crit Care Med 2001;29:1370-9.
3. Reminiac F, Vecellio L, Bodet-Contentin L, Gissot V, Le Pennec D, Salmon Gandonnière C, *et al*. Nasal high-flow bronchodilator nebulization: A randomized cross-over study. Ann Intensive Care 2018;8:128.
4. Imitazione P, Lanza M, Cobuccio R, Musella S, Cauteruccio R, *et al*. Nebulizer aerosol drug delivery through high flow nasal cannula in adult patients. Eur Respir J 2020;56 {Suppl 64}:641 Available from: https://erj.ersjournals.com/content/56/suppl_64/641. [Last accessed on 2021 Jun 20].
5. Valencia-Ramos J, Mirás A, Cilla A, Ochoa C, Arnaez J. Incorporating a nebulizer system into high-flow nasal cannula improves comfort in infants with bronchiolitis. Respir Care 2018;63:886-93. Available from: http://rc.rcjournal.com/content/early/2018/05/29/respcare. 05880. [Last cited on 2021 Jun 20].

Access this article online

Quick Response Code:

Website: www.lungindia.com

DOI: 10.4103/lungindia.lungindia_399_21

How to cite this article: Kumar N, Kandrakonda PK, Ahmed S. Modified T-piece jet nebulizer with high-flow nasal cannula in a severe COVID-19 patient with intensive care unit delirium. Lung India 2021;38:588-9.