DOI: 10.1002/ppul.25276

LETTER TO THE EDITOR

PEDIATRIC PULMONOLOGY WILEY

High-flow oxygen therapy in COVID times: Where affordability meets utility

To the Editor,

COVID-19 pandemic has put an unprecedented survival challenge to mankind. The tiny coronavirus has created mayhem across the world with colossal financial implications. Healthcare facilities have been badly affected globally despite being working at the supra-optimal potential. Almost one-third of the symptomatic patients have developed either single or multiorgan failure during the disease course.[1] As the respiratory system bears the major brunt of current viral infection, hypoxemia has been the predominant presenting sign. Oxygen therapy, along with other supportive measures, is the key available treatment for many. Numerous devices are in medical practice presently to deliver oxygen at variable flow rates and concentrations. High flow oxygen therapy (HFOT) is considered as a noninvasive rescue modality to suffice a patient's inspiratory demand in mild to moderate hypoxemic respiratory failure, thus preventing invasive ventilation in the majority if timely initiated.[2] Gershengorn et al. have demonstrated a significant reduction in mortality and ventilatory requirement by using high-flow oxygen in patients with respiratory distress.[3]

HFOT, commonly delivered by Airvo 2 machine (Fisher & Paykel Healthcare), can administer flow rates up to 60 L/min nasally with an added advantage of preheated and humidified air. By reducing the anatomical dead space, HFOT improves ventilation along with the patient's work of breathing.[4] It also enhances respiratory secretion clearance and ventilation-perfusion ratio with reduced atelectatic areas, thus helps in better oxygenation.[4] Li and colleagues have nicely summarized the aerosol dispersion distances with various available oxygen devices, lowest dispersion during HFOT as compared to non-rebreathing or venturi mask, making it a safer technique.[5] The simplicity of the procedure can allow the provision of adequate respiratory support in wards and step-down areas, thus saving the critical care beds for the sicker ones.[6] However, to avail the aforesaid advantages of HFOT, one needs to pay outstandingly. The standard Airvo 2 machine (with in-built humidifier) with a 1-year warranty costs 4330 USD (1 USD = 74 INR) to the medical establishment. Another 150 USD for the specified disposable circuit (tubing with nasal canula) will be billed to each patient individually along with the other hospital expenses. In the absence of any reliable medical insurance coverage or third-party payer system, especially in developing countries like India with per capita national annual income of 2130 USD, it is a nightmare for many to afford even this basic life-saving modality.[7] The sad state of affairs has further worsened during COVID times due to the narrowing of the income-expenditure gap, hugely contributed by the loss of livelihood for the masses.

A much economical and simple blender, attached to air and oxygen flowmeters along with an external humidifier, can serve the purpose in

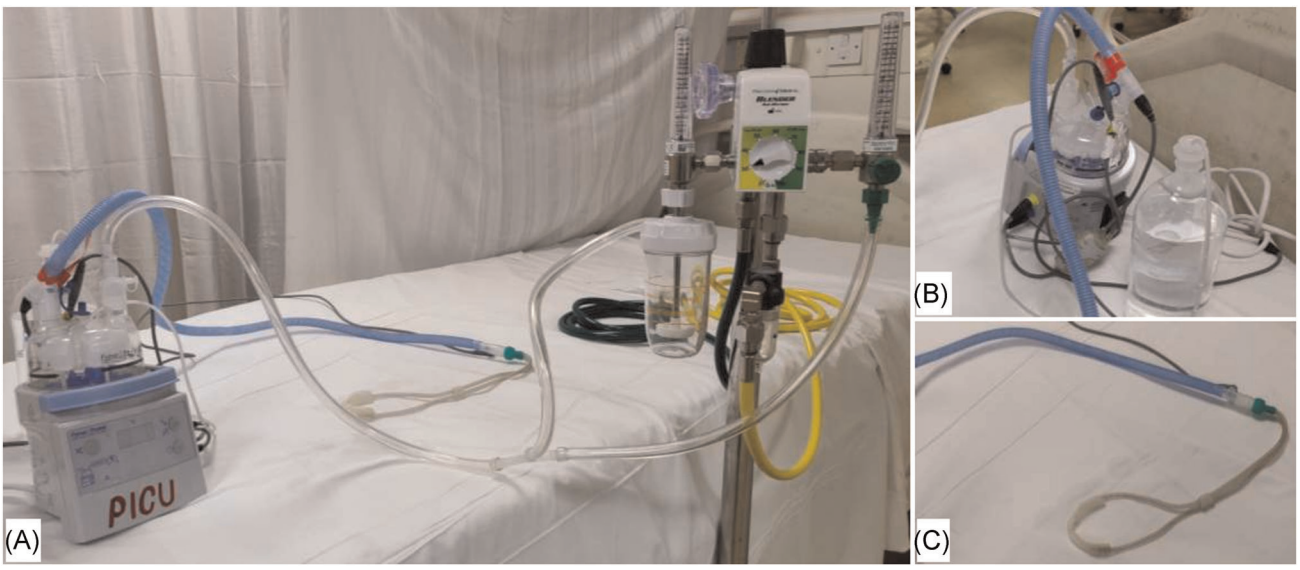

FIGURE 1 (A) Heated humidified oxygen delivery setup via blender and flowmeters; (B) attachment of tubings at humidifier; (C) nasal canula as a patient interface [Color figure can be viewed at wileyonlinelibrary.com]

most clinical situations, especially in the pediatric population. We are using an air-oxygen blender (Precision Medicine) attached to central pressurized oxygen and air supply with a flowmeter to achieve desired flow rates and oxygen concentrations (Figure 1) in our unit. The available blender can deliver a maximum airflow of 30 L/min, satisfying the inspiratory demands of infants, toddlers, and pre-schoolers conveniently. Widely accessible sterile tubing can be used for traversing blended air to humidifier inlet, where it can be humidified and warmed at a pre-set temperature (Figure 1A). One limb of the ventilatory circuit can be used to bridge the gap between the humidifier outlet and nasal canula (Figure 1B,C). Different size and color-coded nasal cannulas are available, as an interface, for divergent flows.

The cost of a blender, with a 2-year warranty, is 1350 USD to the healthcare facilities. Disposable nasal cannulas increase patient's expenses by a meager 50 USD. Humidifiers, for repeated use, are generally available in hospitals, whereas dual tubing of a single ventilatory circuit (30 USD) can be shared between two patients. Inability to achieve higher flow rates (>30 L/min) is the only limiting factor for use in adults and school-age children with higher inspiratory demand, which can be overcome by increasing the capacities of flowmeters and blenders. The potential utility of a simple blender-based device (at less than a third cost to both consumer and provider) with good efficacy can serve more people in a short time and rationalize the medical resources (ventilators and standard HFOT machines) to the indigent.

Twenty-first century has witnessed a lot of medical advancements both in diagnostics and therapeutics. Ultimately, the cost-benefit ratio decides the transfer of fruits from bench to bedside. Improvement in gas exchange with minimal aerosol outspread by this safe, economical, and easily accessible technique can be advantageous during the current COVID-19 pandemic. We need to devise more such novel methods to make available medical services acceptable and affordable to the majority.

CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

AUTHOR CONTRIBUTIONS

Neeraj Gupta: Conceptualization (lead); data curation (lead); formal analysis (lead); methodology (lead); resources (lead); writing original draft (lead); writing review and editing (lead). **Anil Sachdev**: Conceptualization (supporting); writing original draft (supporting); writing review and editing (supporting). **Suresh Gupta**: Conceptualization (supporting); writing original draft (supporting); writing review and editing (supporting). **Dhiren Gupta**: Conceptualization (supporting); writing original draft (supporting); writing review and editing (supporting).

Neeraj Gupta DCH, DNB
Anil Sachdev MD
Suresh Gupta MD
Dhiren Gupta MD

Department of Pediatrics, Division of Pediatric Emergency, Critical Care, Pulmonology & Allergic Disorders, Institute of Child Health, Sir Ganga Ram Hospital, Rajinder Nagar, New Delhi, India

Correspondence
Neeraj Gupta DCH, DNB, Department of Pediatrics, Division of Pediatric Emergency, Critical Care, Pulmonology & Allergic Disorders, Institute of Child Health, Sir Ganga Ram Hospital, Rajinder Nagar, New Delhi 110060, India.
Email: drneeraj1979@gmail.com

ORCID

Neeraj Gupta https://orcid.org/0000-0002-7131-4985
Anil Sachdev https://orcid.org/0000-0002-7624-6985

REFERENCES

1. Goyal P, Choi JJ, Pinheiro LC, et al. Clinical characteristics of Covid-19 in New York City. *N Engl J Med*. 2020;382(24):2372-2374.
2. Messika J, Ben Ahmed K, Gaudry S, et al. Use of high-flow nasal cannula oxygen therapy in subjects with ARDS: a 1-year observational study. *Respir Care*. 2015;60(2):162-169.
3. Gershengorn HB, Hu Y, Chen JT, et al. The impact of high-flow nasal cannula use on patient mortality and the availability of mechanical ventilators in COVID-19 [published online ahead of print October 13, 2020]. *Ann Am Thorac Soc*. https://doi.org/10.1513/AnnalsATS.202007-803OC
4. Rali AS, Garies T, Narendra D, Patel P, Guntupalli K. High-flow nasal cannula: COVID 19 and beyond. *Ind J Respir Care*. 2020;9:134-140.
5. Li J, Fink JB, Ehrmann S. High-flow nasal cannula for COVID-19 patients: low risk of bio-aerosol dispersion. *Eur Respir J*. 2020;55(5):2000892. https://doi.org/10.1183/13993003.00892-2020
6. Guy T, Créac'hcadec A, Ricordel C, et al. High-flow nasal oxygen: a safe, efficient treatment for COVID-19 patients not in an ICU. *Eur Respir J*. 2020;56(5):2001154. https://doi.org/10.1183/13993003.01154-2020
7. World Bank. GNI per capita, Atlas method (current US $); 2020.

How to cite this article: Gupta N, Sachdev A, Gupta S, Gupta D. High-flow oxygen therapy in COVID times: Where affordability meets utility. *Pediatric Pulmonology*. 2021;56:1782–1783. https://doi.org/10.1002/ppul.25276