Logistics to mitigate oxygen crisis with non-invasive ventilation: "*Aahana Pradhi technique*"

Sir,

The year 2020 started with a burdened health crisis from 2019 known as coronavirus disease (COVID)-19) with unprecedented challenges globally.[1] The scenario was very gloomy in India, where the daily count on April 15, 2021 itself was double of the first peak. There existed an exponential increase in the requirement of oxygen cylinders for corona-positive patients, whereas the medical infrastructure was falling short of supplies. In such a crisis, we looked for alternatives to oxygen cylinders. Noninvasive ventilation (NIV) has been used widely to treat COVID-19 positive patients with moderate to severe acute respiratory failure. NIV is a ventilation succour system without endotracheal access.[2] It has evinced to be efficacious in both acute and chronic ventilatory failure settings.[3] Primary reports from worldwide trials have also advocated NIV especially bilevel positive airway pressure (BiPAP) as a preferable mode of ventilation in COVID 19 pandemic.

Clinically, supplemental oxygen is needed additionally to the NIV circuit (to maintain oxygen saturation) connected to an oxygen cylinder via a flow meter or to central supply via an inbuilt hospital pipeline system. Oxygen crisis in the current wave of COVID-19 has led to increased morbidity and mortality and turned the spotlight on the judicial use of this life-saving drug called 'oxygen'. To find an alternative to the oxygen cylinder used at high flow in NIV, we gleaned a technique named the 'Aahana-Pradhi' (first ray of light in life) technique and successfully used it in our patients. In this technique, we altered the source of oxygen attached to BiPAP via a cylinder and instead used 'oxygen concentrator' (OC) with a fixed oxygen concentration output despite of a flow rate [Figure 1]. Nasal tubing attached to the OC is connected near to the BiPAP mask in lieu of the oxygen cylinder. OC can give 94–95% oxygen at a low flow rate of 5–6 L/min. OCs also have pulse mode delivery in contrast to oxygen cylinders that work on the principle of continuous flow. Pulse mode delivery delivers a pulsed bolus of oxygen when the user begins to take a breath and thereby prevents unnecessary wastage of oxygen.[4]

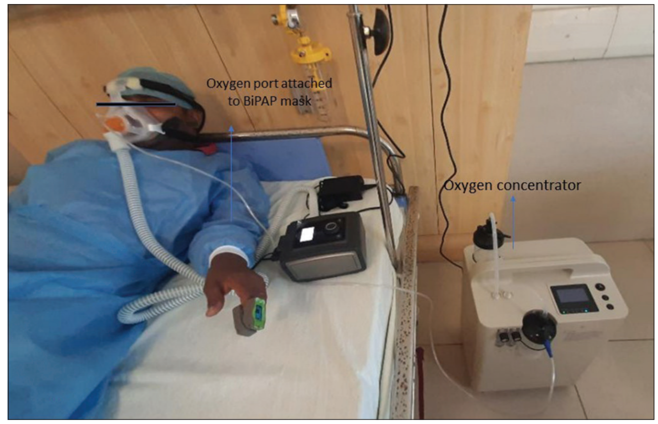

Figure 1: Patient-receiving oxygen through oxygen concentrator attached to BiPAP mask

An OC provides a safe source of oxygen-enriched air. It can be a low-flow OC, which delivers oxygen flows of 0.5–5 L/min or a high-flow OC delivering up to 10 L/min.[5] It draws room air and removes bacteria, dust, and other particles through a series of filters. In the first step, the air is forced into one of the cylinders containing a semipermeable membrane or sieve material and absorbs nitrogen, keeping concentrated oxygen (90% or higher). Nitrogen is than desorbed back into the atmosphere [Table 1].[6]

When oxygen is administered with BiPAP therapy, the delivered oxygen concentration is afflicted by oxygen flow. When increased oxygen flow is used, fraction of inspired oxygen (FiO_2) decreases proportionally with the IPAP. These findings confirm the preceding idea of the ''dilution effect' generated by high airflow as a consequence of the increase of volume minute ventilation generated by non-invasive positive pressure ventilation. High flow rates in BiPAP settings may also cause logistic problems since oxygen tanks will need to be changed more often. It is noteworthy that this technique may not be beneficial in moderate to severely infected COVID-19 patients who may require high flow rate (15–20 L) with increased minute ventilation and a peak inspiratory flow rate.

In conclusion, an OC can be used as a backup to an oxygen cylinder in the BiPAP mode of ventilation amid the crippling shortage of oxygen in mild to moderately ill patients with a less flow rate and FiO_2 requirement. The second wave of the pandemic has exposed the glaring gaps in the health infrastructure and preparedness in dealing with this monster wave that came without any warning sign.[7] Furthermore, clinical evidence in patients with a high inspiratory

Table 1: Advantage of OCs over a cylinder
OC do not need to be refilled.
The continuous flow of oxygen is provided to the patient by reversing the function of cylinders in a time cycle.
The concentrators run on an electrical power supply and thereby supply an unlimited amount of oxygen. They are designed for continuous operation and can produce oxygen for 24 h a day for weeks together.[6]
Recently, portable concentrators are also available that can be used in an 'on-the-go' mode with a battery pack, resulting in up to 12 h of continuous use in some models.
Concentrators are more cost effective than compressed gas cylinders and last for up to 1500 h of continuous use.

OC-Oxygen concentrator

peak flow rate (>15 L) is lacking, and this may warrant further clinical research.

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Conflicts of interest

There are no conflicts of interest.

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