

## COVID-19: A Flow-Inflating Device for Providing Continuous Positive Airway Pressure for Children in Resource-Limited Setups

Sir,

Continuous positive airway pressure (CPAP) may prove useful in pediatric COVID-19 patients by providing non-invasive ventilation (NIV). Positive pressure NIV, bubble CPAP, and bilevel positive airway pressure ventilation have been recommended to manage children infected with COVID-19.<sup>[1]</sup> Environmental safety concerns and effects on work of breathing when attaching filters in mechanical model with CPAP for use in COVID-19 pediatric patients have also been evaluated.<sup>[2]</sup>

Jackson-Rees circuit (Mapleson F system) has been used to alleviate respiratory failure in a wide variety of primary pulmonary disorders.<sup>[3,4]</sup> Jackson-Rees circuit consists of an adjustable expiratory valve at the end of the reservoir bag. Partial closure of the valve during spontaneous respiration provides CPAP, while intermittent compression of the bag delivers positive pressure ventilation. We describe a modification in the Jackson-Rees circuit using an NIV mask that can be used for this purpose in situations where no other equipment is available.

The reservoir bag of the Jackson-Rees circuit is accommodated inside an appropriately sized transparent plastic container [Figure 1]. A tubing of breathing circuit is attached from the other end of the container to serve as an exhaust for the accumulated gases in the container. Now, all the exhaled gas emitting from the valve of the reservoir bag is collected within the container and is carried away through the exhaust tubing. The distal end can be dipped into an underwater seal system containing 1% sodium hypochlorite solution to inactivate the contaminated



**Figure 1:** The assembled device with the yellow arrow shows the direction of oxygen flow, and the red arrow shows the direction of scavenging the exhaled gases

gas.<sup>[5]</sup> Alternatively, a bacterial and viral filter can be attached to the distal end to prevent environmental contamination.<sup>[2]</sup>

An NIV mask is attached to the child's face to cover the nose and mouth, providing an air-tight seal and fixed in position using the headgear. The inspiratory limb of the circuit is attached to an appropriate oxygen source. The valve of the reservoir bag is kept partially opened. Oxygen flow (three times the patient's minute volume) is started to prevent rebreathing. After observing oxygen saturation by a pulse oximeter, the valve is gradually closed to provide CPAP. It has been suggested that if the expiratory valve is kept partially open so that the reservoir bag is neither overinflated nor collapsed, it will produce CPAP.<sup>[3]</sup> The aim is to achieve an oxygen saturation of more than 95%. Now, the reservoir bag is disconnected and kept inside the container. The container's lid is screwed tightly after attaching the bag to the expiratory limb of the Jackson-Rees circuit so that all the exhaled gas is scavenged after being collected in the container.

Disconnection, airway obstruction, and apnea can be detected by observing the intermittent inflation and deflation of the reservoir bag. In the case of apnea, the container can be removed, and positive pressure ventilation can be instituted through the bag. A nasogastric tube can be placed if the child develops abdominal distension due to aerophagy.

The limitations of this system include the inability to titrate inspired oxygen concentration and patients in whom it is difficult to maintain the airway. A bystander clinician should always be present as quantification of oxygen delivered is impossible, and no backup respiratory rate can be set. CPAP is not a substitute for invasive ventilation, and prompt intubation must be performed when the need arises.

Keeping in view its utility and limitations, we suggest its use for stabilizing and transporting sick children during the pandemic surge.

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### Conflicts of interest

There are no conflicts of interest.

**Prakash K. Dubey, Preksha Dubey<sup>1</sup>, Niyati Dubey<sup>2</sup>**

Department of Anesthesiology, Indira Gandhi Institute of Medical Sciences, Patna, Bihar, <sup>1</sup>Department of Maxillofacial Surgery, All India Institute of Medical Sciences, Patna, Bihar, <sup>2</sup>Department of Undergraduate, MGM Medical College, Navi Mumbai, Maharashtra, India

**Address for correspondence:** Prof. Prakash K. Dubey,  
E ¾, IGIMS Campus, Patna - 800 014, Bihar, India.  
E-mail: [pkdubey@hotmail.com](mailto:pkdubey@hotmail.com)

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