

Closed positive end-expiratory pressure system: Pre-oxygenation and ventilatory support in COVID-19

To the Editor: From our limited experience with the critical hypoxic COVID-19 patient under investigation who requires invasive ventilation, we have recreated a device from Dr Scott Weingart's methodology^[1] for preoxygenation prior to intubation and for ventilatory support if deemed necessary. We have called it the closed PEEP (positive end-expiratory pressure) system (CPS), and we put it together using equipment readily available in a South African (SA) emergency department (ED). Components of the system (Fig. 1) are a non-invasive ventilation full-face mask (non-vented), a Humid-Vent Filter Compact S with Expandi-Flex/Swivel, 3 m of Green Bubble tubing, an adult bag valve mask (BVM) (Ambu bag) with reservoir, a fixed-value PEEP valve preset at 2.5 cm H₂O, a resuscitation PEEP valve adaptor, a pressure inflator (optional) and a tube for the pressure inflator (optional). The PEEP valve used can be replaced with an adjustable PEEP valve. The oxygen supply to the BVM reservoir should be set at 15 L/min and the additional oxygen supply attached to the end-tidal carbon dioxide port on the filter at 6 L/min.

The advantages of using the CPS include that it is a closed and low-flow system that prevents leakage, thereby protecting medical staff. It also generates PEEP to recruit alveoli prior to intubation and provides additional oxygen supply.

In April 2020, a middle-aged man presented to an ED in acute respiratory distress with an initial pulse oximetry saturation of 77% on room air. The chest radiograph was suggestive of COVID-19 (COVID-19 was later confirmed). The decision was made to intubate the patient, but he needed effective preoxygenation. Using a nasal prong cannula at 6 L/min, the patient's saturation merely went up to 79%; facemask oxygen was equally ineffective. We initially used the CPS with a fixed-value PEEP valve preset at 15 cm H₂O, but quickly realised that the patient could not cope with such a high-value PEEP. We then decided to start lower and use a 2.5 cm H₂O preset PEEP valve, and successfully passively preoxygenated the patient up to pulse oximetry saturation of 98%. In retrospect, we cannot sufficiently stress the importance of good preoxygenation in these patients. Once apnoea set in after induction was done, the patient's saturation dropped remarkably within a few seconds.

In the current pandemic, we suggest that the CPS may be useful to other EDs across SA. It is a safe, easy to set up and cost-effective system for preoxygenation and ventilatory support in the critically ill



Fig. 1. Set-up of the closed positive end-expiratory pressure system.

COVID-19 patient. It is also possible that intubation can be avoided with this method.

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1. Weingart S. COVID airway management thoughts. 27 March 2020. <https://emcrit.org/emcrit/covid-airway-management/> (accessed 27 April 2020).