

Continuous positive airway pressure in COVID-19 patients with acute respiratory failure

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Summary

Continuous positive airway pressure (CPAP) provides an effective method of treating respiratory distress from congestive heart failure. When the coronavirus disease 2019 (COVID-19) pandemic started, specific clinical guidelines recommend the use of CPAP for acute hypoxaemic respiratory failure due to COVID-19. It provides symptom relief and avoid the need for intubation and invasive mechanical ventilation of the patient as well as ICU admission.

The O-Two single-use open CPAP delivery system provides accurate continuous positive airway pressure delivery through a compact device. By minimizing the pressure drop on inspiration and the peak pressure on expiration, the O-Two CPAP system produces a more uniform pressure throughout the respiratory cycle. This provides a lower work of breathing for the patient when compared to other, commonly used, prehospital devices.

The COVID-19 pandemic has challenged the management of hypoxaemic respiratory failure, as limited intensive care capacity is strained by a novel disease with a high mortality and large numbers of patients requiring prolonged periods of invasive ventilation¹.

Early after the COVID-19 outbreak in Italy, there was a European expert consensus in favor of CPAP and non-invasive ventilation (NIV) as first-line treatments for the associated acute hypoxaemic respiratory failure (AHRF). NIV and CPAP are widely recommended for AHRF due to cardiogenic pulmonary oedema, but no recommendation had been made for viral pandemics until recently, because of the lack of randomised studies showing their efficacy and concerns of infection dissemination^{2,3}.

The systematic use of CPAP to avoid or delay oro-tracheal intubation has been reported in a few studies in 2020²⁻⁵. Early use of CPAP leads to a significant reduction in mortality in patients with AHRF; specially when CPAP is used as a treatment option during the first days of hospital admission⁶⁻⁷. Moreover, it is possible to

administer CPAP outside the walls of a critical care or high dependency unit environment and avoid, in most patients, invasive mechanical ventilation with high survival rate⁸.

In mid-2020, clinical guidelines regarding the use of NIV and CPAP during the COVID-19 epidemic tried to balance the risks of topping NIV or CPAP against the potential risk of increased aerosol-related transmission⁹. WHO guidelines advocate the use of these ventilatory support methods, provided that appropriate personal protective equipment is worn¹⁰⁻¹¹. NIV does generate droplets, but using a non-vented mask with a viral filter reduces the spread significantly²⁻⁹. A good interface fitting for CPAP or NIV systems minimize widespread dispersion of exhaled air and, consequently, should be associated with low risk of airborne transmission from patients. With the use of personal protective equipment, use of NIV for AHRF was not associated with an increased risk of transmission of the virus to health-care workers; whereas, endotracheal intubation was associated with an increased risk of aerosolisation and infection of health-care workers^{10,12}.

Patients with COVID-19 pneumonia can develop AHRF with the need for positive end-expiratory pressure (PEEP)^{1,2,5,6,13-16}. Oranger *et al.* explain that CPAP could be administered using a face mask connected to a home mechanical ventilator in most cases. In their study, CPAP was initially set at 10 cmH₂O and then adjusted between 8 and 12 cmH₂O according to clinical tolerance, leaks and SpO₂⁴.


The administration of continuous positive airway pressure improves oxygenation and avoids intubation. Most patients required FiO₂ of 0.4-0.6 and PEEP of 10-12 cmH₂O. The use of low tidal volumes of 6 mL/kg IBW, or even lower, is also recommended strongly in patients with COVID-19¹². The studies²⁻⁴ showed that no patients were intubated during the first hours after CPAP initiation or under high emergency conditions¹². Brusasco *et al.* main finding was that the vast majority of COVID-19 patients treated by CPAP recovered from moderate-to-severe AHRF, including cases with gas exchange and radiological findings similar to those considered as indications for IMV in typical adult respiratory distress syndrome (ARDS)³.

In summary, CPAP provides an effective method of treating respiratory distress from congestive heart failure. When the COVID-19 pandemic started and after the development of specific clinical guidelines, the use of CPAP has been extended to other respiratory problems such as acute hypoxaemic respiratory failure due to COVID-19 in order to provide symptom relief and avoid the need for intubation and ventilation of the patient as well as ICU admission.

The O-Two single-use open CPAP delivery system provides accurate continuous positive airway pressure delivery through a compact device. By minimizing the pressure drop on inspiration and the peak pressure on expiration, the O-Two single-use open CPAP delivery system produces a more uniform CPAP pressure throughout the respiratory cycle. This provides a lower work of

breathing for the patient when compared to other, commonly used, prehospital devices.

The adjustment of the CPAP level is achieved by adjusting the output flow from your oxygen therapy regulator or wall outlet. The setting selections noted on the device provide an accurate constant airway pressure at each flow setting:



FLOW RATE (L/min)	8	10	12	15	20	25
PRESSURE (cmH ₂ O)	5.0	8.0	10.0	15.0	20.0	25.0
OXYGEN (%)	54	59	62	67	73	77
CYLINDER DURATION (L tank (45L))	52 MIN	42 MIN	35 MIN	28 MIN	21 MIN	17 MIN

* Over a tidal volume range of 100 to 750ml

With an open system, the device allows unrestricted inspiratory flows, since the patient has access to ambient air.

Nebulizer treatments can be provided in-line, with the nebulizer positioned between the facemask and the CPAP unit.

The ambient air intake port and the location of the in-line oxygen hose are designed to eliminate the possibility of accidental occlusion, removing the risk of barotrauma due to the patient or rescuer inadvertently blocking the port.

Ideal for the treatment of the respiratory impaired patient suffering from a range of obstructive pulmonary diseases, as well as mild-to-severe COVID-19 AHRF; the O-Two CPAP system is a simple, cost-effective alternative to invasive ventilation and possible intensive care admissions.

References

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