

# Non-Invasive CPAP by Helmet Setup for COVID-19

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<https://www.med.upenn.edu/apps/faculty/index.php/g363/c665/p4509816>

**Indication:**  $\text{SpO}_2 < 92\%$ , or increased work of breathing, despite supplemental oxygen up to 6 LPM NC O<sub>2</sub>.

**Initiation of therapy:** Set up helmet in either one of two configurations (Figure 1), set PEEP, open oxygen flowmeter and place on patient's head (earplugs or earbuds for noise reduction), secure arm straps. Set gas flow as indicated below,  $\text{FiO}_2$  60%, PEEP 5 cm H<sub>2</sub>O.

Reassess  $\text{SpO}_2$  and work of breathing. If  $\text{SpO}_2$  and work of breathing do not improve, increase PEEP to 10 cmH<sub>2</sub>O.



Reassess  $\text{SpO}_2$  and breathing effort. If  $\text{SpO}_2 > 96\%$ , can try lower  $\text{FiO}_2$ . If  $\text{SpO}_2 < 92\%$  and/or persistent respiratory distress at PEEP 10 cm H<sub>2</sub>O, proceed to intubate.

**Continuation:** Mobilize patient OOB with helmet as tolerated. Incentivize cough and deep breathing while in the helmet. Allow standing with support. If able to tolerate breaks, remove helmet at meal times (synchronize with PO meds). If unable, place NGT/DHT and feed enterally.

**Weaning:** Decrease PEEP if able to tolerate  $\text{FiO}_2$  40% for 12 hours. Wean to NC O<sub>2</sub> 2-4 L/min when able to tolerate PEEP 5 cmH<sub>2</sub>O and  $\text{FiO}_2$  40%.

**Helmet circuit assembly:** Helmet circuit is preassembled (Figure 2). Choose collar size (L, M, S) depending on neck size. Make sure PEEP valve is connected and set at desired PEEP (Figure 3). Make sure clips are in place to avoid undesired opening (Figure 4).

Make sure antimicrobial filters are present on both the inflow and outflow limbs and all connections are zip-tied.



Figure 2

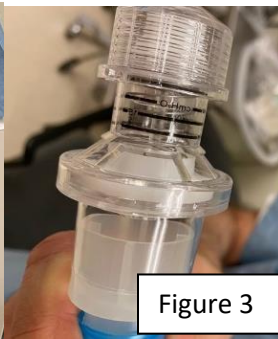


Figure 3

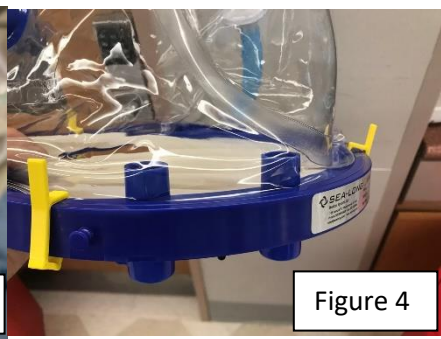


Figure 4

### Gas delivery.



Figure 5

**-Blender (ICUs):** connect flowmeter to oxygen tubing. Attach the latter to Helmet inflow limb (Figure 5).



Figure 6

**-MaxVenturi:** connect inflow limb to humidifier outlet (Figure 6), set oxygen flow at 50 l/min and FiO2 60%.

FiO2 can be changed but do not decrease O2 below 50L/min. Set humidifier temperature in non-invasive mode to avoid fogging.



Figure 7

**-Venturi piece (for floor):** Insert Venturi piece (40 or 60% FiO<sub>2</sub>) at the proximal end of the inflow limb (Figure 7). Connect side hose to wall oxygen (make sure hose is facing forward), then set wall flowmeter.

- O<sub>2</sub> flow 30 l/min for FiO<sub>2</sub> 60% (tot flow = 60 l/min)

- O<sub>2</sub> flow 15 l/min for FiO<sub>2</sub> 40% (tot flow 60 l/min)



Figure 8

**-Ventilator setup (ServoU):** Using the high flow-NC<sub>2</sub> set up on the ventilator, connect inflow limb to humidifier (Figure 8). Dial total flow of 50-60 l/min and desired FiO<sub>2</sub>.

## WARNING

Please always maintain total gas flow above 50 L/min at all time to avoid CO<sub>2</sub> rebreathing. These helmets are designed for hyperbaric O<sub>2</sub> delivery. They do not include a relief valve; undetected loss of gas supply can result in asphyxiation. Patients who are not alert and collaborative need to be closely monitored. Consider intubation if patient is agitated.

