

Helmet CPAP Guideline (including operational instructions)

Indication: For patients treated initially with HFNC or NRB, who have an SpO₂ < 94% with FiO₂ of 0.6 - 0.8, in the absence of hypercapnic respiratory failure (see Oxygen Escalation algorithm).

Initiation of therapy:

The Starmed Helmet (we are no longer using the Sealong Helmet) will arrive in the configuration below (**Figure 1**). The collar cannot be cut and the size of the helmet will be chosen based on neck circumference (see detailed instructions below under **Starmed helmet circuit assembly**). Respiratory therapist must be present during placement and removal of the helmet.

With the helmet configured, set PEEP valve to 5 cm H₂O, turn on oxygen flowmeter and ensure a minimal total gas flow of at least 50 LPM (see below for more specific recommendations related to the gas delivery configuration used), then place helmet on patient's head and secure arm straps. To set up the Anti-asphyxiation valve follow the detailed instructions below.

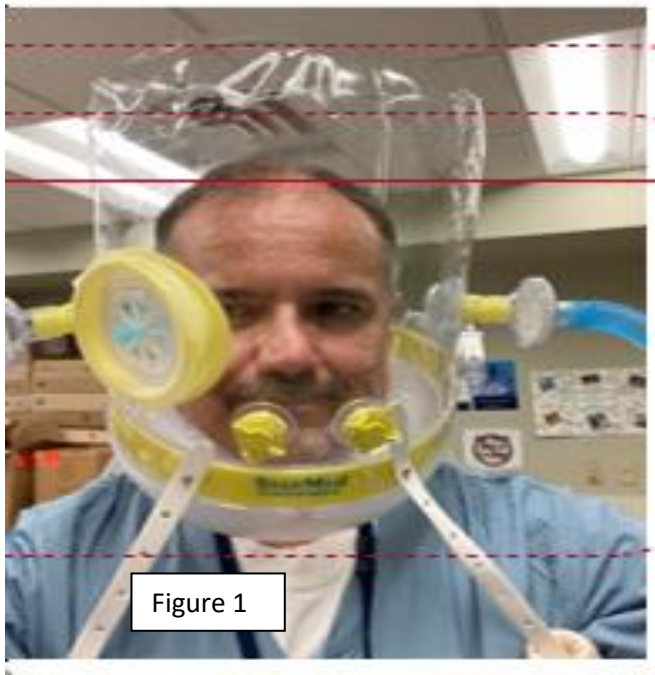


Figure 1

Starmed helmet circuit assembly (see below):

The Starmed device comes in one piece and does not require clips (**Figure 2**). Choose the helmet size by measuring the neck circumference with the tape included in the package (the collar cannot be adjusted). Connect filters, PEEP valve, and inspiratory tubing to the inspiratory and expiratory ports of the helmet, which are identical to each other and interchangeable. Remove the anti-asphyxiation valve (**Figure 3**), dial the gas flow to the desired rate and FiO₂, and then place helmet on patient's head (two people pulling on the membrane). Make sure the Anti-asphyxiation valve moves smoothly, then place it and screw it on the large round port (**Figure 3**). **Pull the blue tab on the valve until helmet is inflated (Figure 4), then let go.** The valve will open automatically whenever the pressure in the helmet is lost. Finally, attach the straps. Note: There is an optional neck cushion which can be inflated to enhance comfort via a cuff inflation bulb (purchased separately via Intersurgical). This is not necessary for normal function of the Helmet and should be used only in conjunction with the medical team (instructions below). Important: RT always needs to be involved in Helmet care especially when removing helmet or Antiasphyxiation valve.



Figure 2

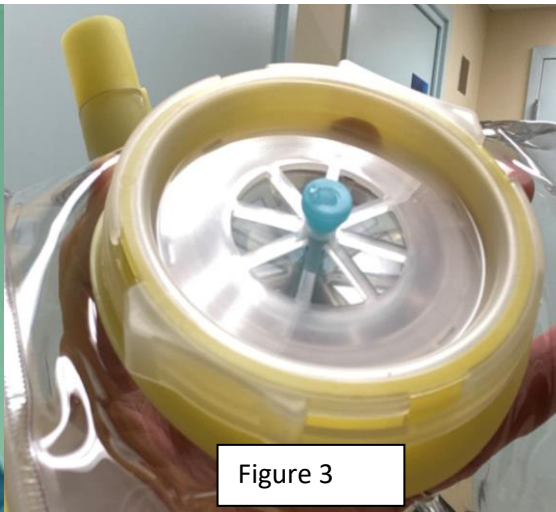


Figure 3

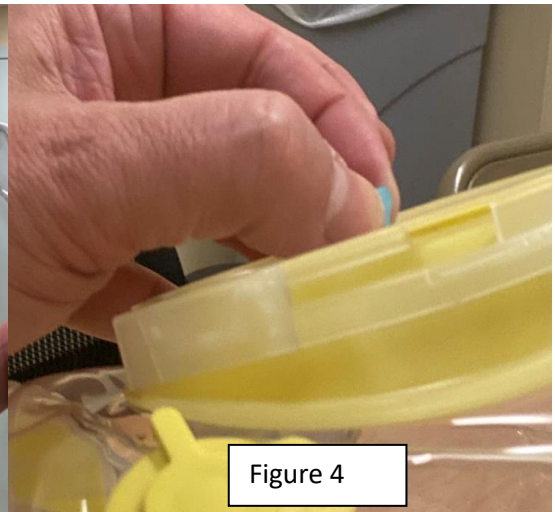


Figure 4

StarMed Neck cushion inflation and deflation (see below): Directions below are for proper inflation and deflation of neck cushion. The StarMed inflation bulb is also described below. Note: Education from StarMed manufacturer Intersurgical is recommended for proper CPAP Helmet usage.

- Attach the inflation bulb to the adaptor on the neck cushion, inflate the neck cushion by pumping air until fit is comfortable for the pt. The white clamp is then closed to prevent air from escaping (**figure 5**).
 - Bulb can then be saved for re-inflation later.
 - Bulb is NOT used to deflate the neck cushion.
- To deflate neck cushion, OPEN white clamp, release of Air will begin immediately. Neck cushion may not deflate completely (**figure 6**)
- To complete deflation, 2 therapists can take the cushion and squeeze air out until cushion is appropriately deflated. After neck cushion is deflated helmet can be removed by 2 therapists (**figure 7**).
 - Suction (from wall) could be used to deflate more quickly by connecting to adaptor in figure 6 (using football/suction adaptor).
- Note: Therapist will only inflate the neck cushion in consultation with the Medical team as per Dr. Maurizio Cereda. The neck cushion is usually not necessary and does not need to be inflated for helmet to function properly. Remember there should always be 2 therapists when placing or removing helmet.



Initial settings:

FiO₂ 100%, PEEP 5 cm H₂O, Gas Flow 50-60 LPM.

Patient Assessment:

Reassess SpO₂ and work of breathing (see Oxygen Escalation Algorithm):

- If SpO₂ > 98%, consider lowering FiO₂ (all O₂ devices except venturi adapter).
- If SpO₂ < 94%, increase PEEP up to 10 cm H₂O.
- If SpO₂ remains < 92% and/or respiratory rate or work of breathing fail to improve, consider intubation.

Note: When increasing FiO₂, make sure the Venturi system (e.g. Max Venturi) is able to achieve ≥ 50 lpm, to prevent CO₂ rebreathing, and consider the reduction in humidity that will occur due to less entrainment of room air.

Continuation:

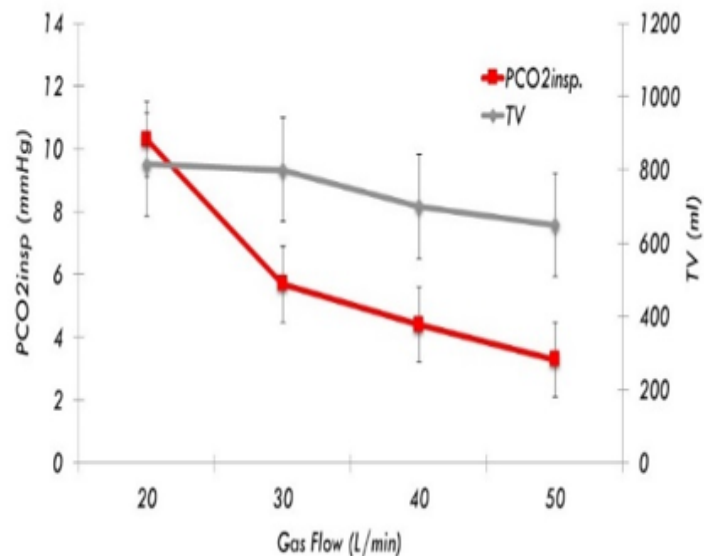
Duration of use is determined by patient comfort; typically, sessions of 4-6 hours at a time with breaks for PO meds and meals. Mobilize patient OOB with helmet as tolerated. Incentivize cough and deep breathing while in helmet. May take daytime naps with helmet on. At nighttime, sleeping in semi-recumbent position is safe, but transition to HFNC during breaks and to facilitate self-proning.

Weaning:

Consider weaning when patient tolerates FiO₂ 40-50% with SpO₂ >94% and has no significant work of breathing. Then reduce PEEP to 5 and reassess. If patient tolerates this, consider transitioning to nasal cannula, either high flow or standard.

WARNING

Please always maintain total gas flow above 50 LPM at all times to avoid CO₂ rebreathing. These helmets are designed for hyperbaric O₂ delivery. Patients who are not alert and collaborative need to be closely monitored. Consider intubation if patient is agitated.



Delivery Configurations

Several configurations are possible based on equipment availability. The MaxVenturi setup is preferred as it allows for natural humidification, low noise burden, easy transition to HFNC during breaks and is the recommended way to transport patients. If indicated, set humidifier temperature in non-invasive mode (30-32°) via MR850 to avoid fogging. Note: Active humidification at higher temperatures is not recommended as it may cause fogging of the helmet and discomfort.

MaxVenturi Device (ICUs/transport): Connect inflow limb to humidifier outlet (**Figure 8**), set oxygen flow at 50-60 LPM and FiO₂ to 50%-60%. FiO₂ can be changed but do not decrease flow below 50 LPM. Note: This device is the recommended transport set-up.

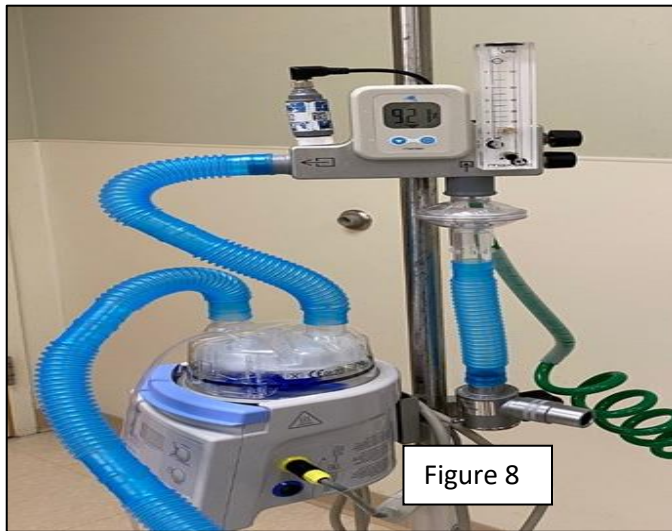


Figure 8

Blender Device (ICUs): Connect flowmeter to oxygen tubing. Attach the tubing to Helmet inflow limb (**Figure 9**). Set oxygen flow rate at 50-60 LPM and FiO₂ 50%-60%. FiO₂ can be changed but do not decrease flow below 50 LPM. Caution: Monitor for patient discomfort due to lack of natural humidification with this setup.

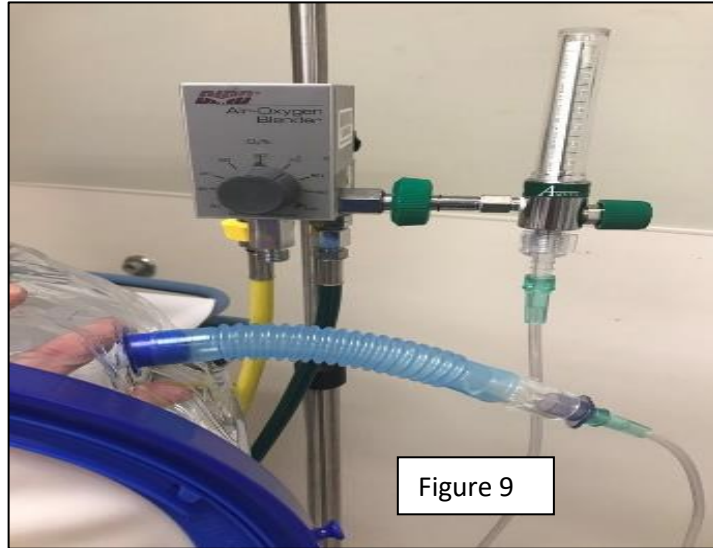


Figure 9

3. Ventilator setup (Servo U/ Hamilton C-1): Using HFNC mode on the ventilator, connect inflow limb to humidifier (Servo--Figure 10, Hamilton--Figure 11). Dial total oxygen flow of 50-60 LPM and desired FiO₂.

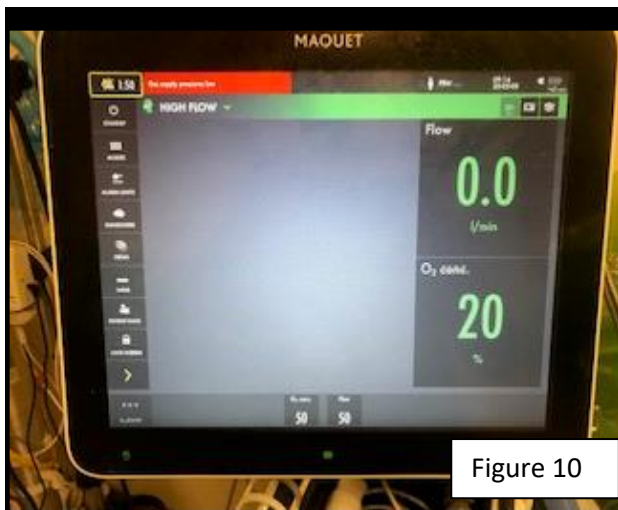


Figure 10

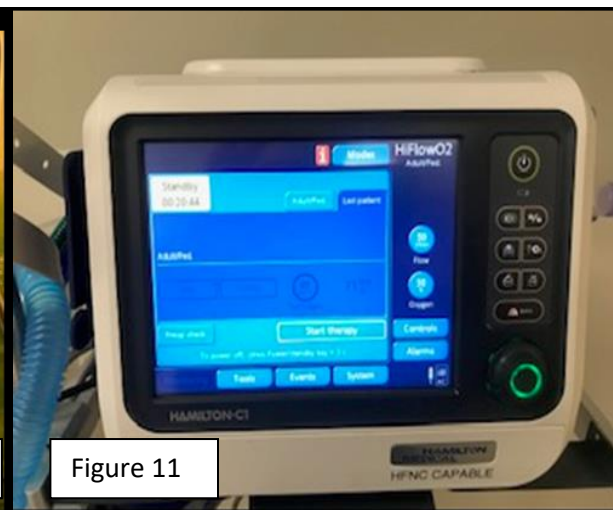
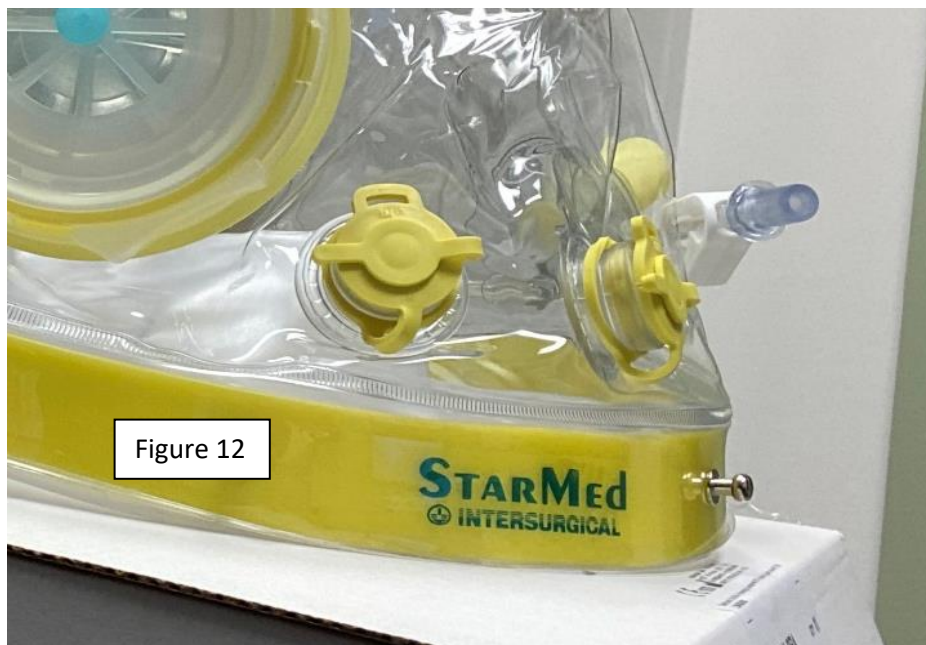


Figure 11

Other Considerations

- Assess for skin breakdown at the **neck** and underarms during each break. If skin breakdown or irritation is present, use mepilex to protect the skin at these areas during the subsequent helmet session.
- The Anti-asphyxiation valve can be removed for access to food and drinks. Rubber ports are also available (**Figure 12**).
- Internal Jugular central lines or NG/dobhoff can be fed through rubber collar for nutrition or through rubber ports (**Figure 12**).
- Self-proning with helmet has *not* been tested and not yet determined to be safe.
- Helmet CPAP is currently recommended for ICU use only



Original Document 4-20-20

Updates 5-5-20

Current Version 4-14-21

Troubleshooting

- If helmet needs to be removed, two staff members on opposite sides of the bed should remove it simultaneously. First turn off the flow from the oxygen device, then place fingers inside rubber collar and stretch it to remove over patient's head (fro neck cushion see above).
- If helmet deflates, ensure all tubing is secure at helmet and oxygen delivery device.
- Consider HNFC or Vent. standby if needed.

If questions arise, please reach out Maurizio Cereda (215-300-1519) or Mike Frazer (215-439-7363) or site respiratory supervisor/manger.

Penn Medicine COVID-19 Clinical Guide: Helmet CPAP

Updated 4/7/21 – Recommendations may evolve rapidly – See latest version at Penn COVID-19 Learning Homepage



Indication

- SpO₂ < 94% despite HFNC or NRB with FiO₂ 0.6-0.8
- Absence of hypercapnia (if RR>30 or increased WOB must check PaCO₂ prior to use)



Use & Titration

- Duration determined by patient comfort – typically 4-6 hour sessions with breaks for PO meds and meals. Sleeping in semi-recumbent position with helmet is safe.
- During breaks, transition to HFNC or alternate oxygen device
- Mobilize patient OOB with helmet as tolerated.

Initial Settings: FiO₂ 1.0, PEEP 5-10, Total Flow ≥50 LPM

Assess Spo₂ and WOB

Spo₂ >98%

Consider decreasing FiO₂

Spo₂ <94% and/or ↑ WOB

Increase PEEP to 10 cm H₂O (if at 5 cm H₂O)

FiO₂ 1.0, PEEP 10, Total Flow ≥50 LPM

Spo₂ >98% and nl WOB

Sequentially downtitrate FiO₂ and PEEP as tolerated*

Spo₂ <92% and/or ↑ WOB

Intubate

*Consider weaning off helmet (to HFNC or NC) once stable on FiO₂ 40-50% and PEEP 5



Oxygen Delivery Configurations

Device	Image	Flow	Notes
MaxVenturi (preferred)		50-60 LPM	➢ Easy transition to HFNC during breaks ➢ Provides natural humidification (decreased at FiO₂ > 60%) ➢ Use for patient transport
Ventilator		50-60 LPM	➢ Ventilator with HFNC mode needed (Servo-U/Hamilton C-1)
Oxygen Blender		50-60 LPM	➢ No natural humidification; monitor for discomfort with longer use



Safety

- ✧ Consider ICU transfer at HFNC settings ≥ FiO₂ 0.6/50 LPM.
- ✧ Helmet recommended for use only in ICU or during transport to ICU
- ✧ Always maintain total gas flow above 50 LPM to avoid CO₂ rebreathing
- ✧ Monitor for mental status changes; avoid use in patients with AMS or agitation
- ✧ If helmet deflates, check oxygen device and tubing connections for leak
- ✧ RT should be present whenever helmet is placed or removed



Tips

- ✧ An inflatable neck cushion may be placed inside helmet to provide neck support
- ✧ Monitor for skin breakdown at neck. Can use mepilex for skin protection
- ✧ Feeding tubes and IJ central lines can be threaded under rubber collar
- ✧ Straw can be fed through port at base of helmet for short periods of drinking
- ✧ Self-proning has not been tested for safety with helmet

Created by Serge Gajic, MD, Pulmonary & Critical Care Medicine; Adapted from UPHS Critical Care Committee Guidelines