Guideline for the use of High-Flow Nasal Oxygen therapy

AIM: To provide guidance on the equipment and practice of HFNO
SCOPE: All adult ICUs within Brighton and Sussex University Hospitals

Choose HFNO

- Consider use of HFNO in hypoxaemiac acute respiratory failure of any cause, but particularly in Type I respiratory failure
- This includes: Pneumonia, COVID-19, pneumonitis, post-operatively and post-extubation, following chest trauma and for patients with impaired ventilation due to pain
- HFNO may also be used to reduce hypoxia during induction of anaesthesia, during procedures under sedation, and can be a helpful adjunct to patients receiving CPAP or BiPAP, to allow breaks from face-mask based therapies
- HFNO may be an option for patients not considered suitable for invasive ventilation, or for those requiring palliative care

Complete respiratory assessment

- Optimise current management: consider CXR, ABGs, physiotherapy, diuresis, etc.
- Discuss decision with critical care medical team and ICU nurse in charge

Set up and monitor

- Follow guidelines for equipment assembly and settings
- Monitor SaO_2, work of breathing and respiratory rate, vital signs and blood gases

Reassess and adjust therapy

- Reassess patient after 15 minutes
- Titrate flow and FiO_2 as necessary to achieve target parameters
- Continue close monitoring
- Seek medical review if no improvement

1. INTRODUCTION

High flow nasal oxygen therapy (HFNO) is a respiratory therapy delivering warmed and humidified high flow oxygen, through specifically designed nasal cannula. Optiflow™ is the high flow nasal cannula system used in the Critical Care department at Brighton and Sussex University Hospitals NHS Trust.

HFNO therapy is an alternative to low flow oxygen and the British Thoracic Society guideline for oxygen use in adults in healthcare and emergency settings (2017) recommends that as part of good clinical practice, high-flow nasal oxygen should be considered as an alternative to reservoir mask treatment in patients with acute respiratory failure without hypercapnia.

Indications

• Hypoxaemic acute respiratory failure • exacerbation COPD • Pneumonia • Post extubation respiratory failure • Pulmonary oedema • Asthma • Acute lung injury • Apnoeic oxygenation

Contraindications

• Suspected pneumothorax • facial trauma • very recent nasal, oropharyngeal or oesophageal trauma

Physiological effects of HFNO (Renda, 2017)

The combination of optimal humidity with nasal cannula allows a greater level of respiratory support than traditional nasal cannula, delivering high flows effectively and comfortably. Contributing to this is the delivery of five key benefits:

1. Accurate administration of oxygen concentration

The aim of the high flow therapy is to meet, or exceed, the patient's normal inspiratory demand, creating minimal air dilution, as indicated by Images 1 and 2.[4 6]
Minimising oxygen dilution with room air, the delivered fraction of inspired oxygen (FiO_2) corresponds closely to set FiO_2. In addition, it can diminish the inspiratory resistance associated associated with the nasopharynx, and thus reduce the work of breathing.

2. Flushing of anatomical pharyngeal dead space

The delivery of high gas flows directly into the nose, can lead to a washout of nasopharyngeal deadspace. The high flow generates a reservoir of oxygen that minimises CO_2 re-breathing, it contributes to establishing improved fraction of alveolar gases with respect to carbon dioxide as well as oxygen.

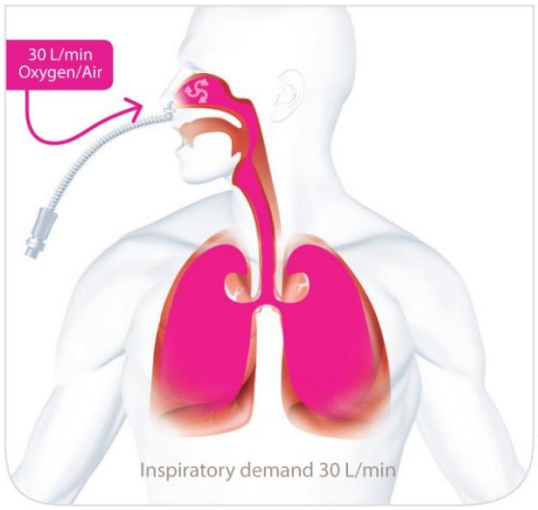


Image 1 – Nasal High Flow

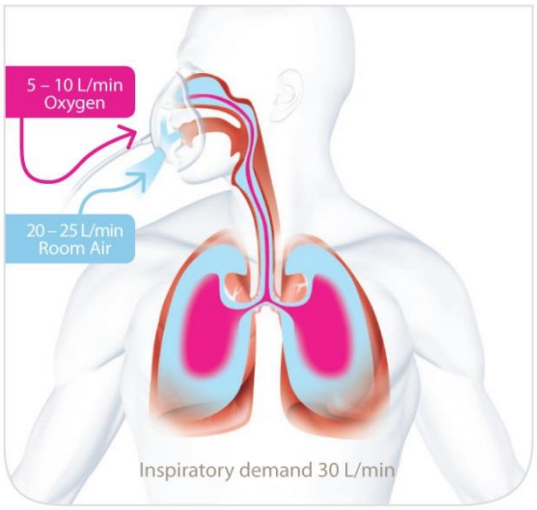


Image 2 – Face Mask Oxygen Therapy

3. Positive airway pressure throughout the respiratory cycle

Mean airway pressure during the respiratory cycle has been shown to be elevated with the delivery of high flow oxygen therapy, generating low levels of positive pressure in the airways (mean values ranging between 2.7 and 7.4 cmH_2O.) This improves functional residual capacity thereby reducing work of breathing. The exact level of pressure is likely to be dependent on a number of variables including flow rate, geometry of the upper airway, breathing method (through the nose or mouth) and size of the cannula relative to the nare.[2 10]

4. Optimized mucociliary clearance

By delivering effective humidification, drying of the airway is reduced, which maintains the function of the mucociliary transport system, clearing secretions more effectively and reducing the risk of respiratory infection.

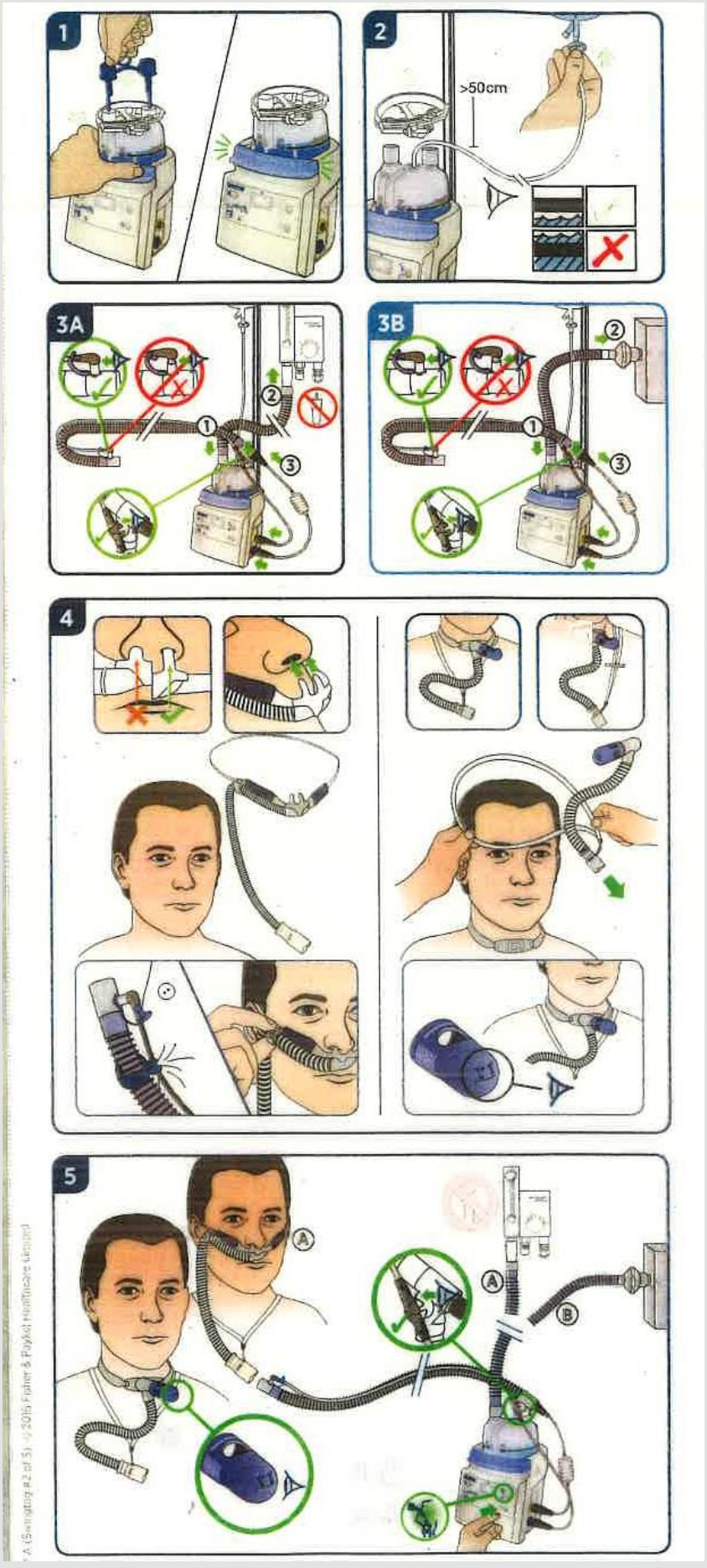
5. Greater patient comfort

Nasal cannula can promote greater patient comfort and compliance than face masks in some patients. Patients can continue to eat, drink, talk and sleep easily without therapy interruption while still receiving benefits similar to face mask oxygen therapy or low-level continuous positive airway pressure (CPAP).

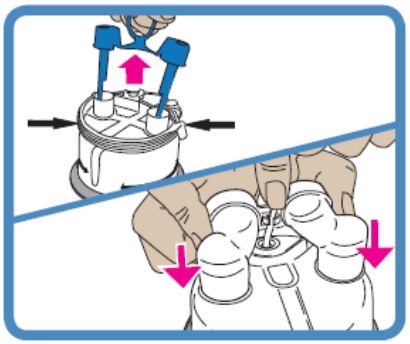
2. PROCESS

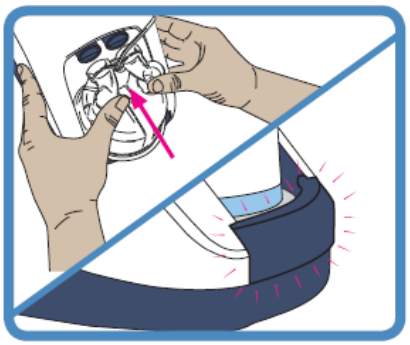
	Recommendation (Action)	Justification (Rationale)
1	Consider need and appropriateness of HFNO	Indications include: Hypoxaemic acute respiratory failure Exacerbation of COPD Pneumonia Post extubation respiratory failure Pulmonary oedema Asthma Acute lung injury Apnoeic oxygenation Contraindications include: Suspected pneumothorax Facial trauma Very recent nasal, oropharyngeal or oesophageal surgery
2	Set up the HFNO equipment	On either site, use the Airvo2 system On the RSCH site only, use the separate blender and Fisher & Paykel heater/humidifier system
3	MaxBlend HFNO	➢ Select hi-flow stand with Max-Venturi blender and Fisher & Paykel humidifier attached ➢ Slot the hi-flow nasal cannula heated circuit into the Fisher & Paykel heater base ➢ Hang a bag of sterile water and spike bag with connector from the reservoir. The water bag must run freely and be placed as high as possible above the humidifier to achieve flow of water into the humidifier chamber. Because flows used are high, heated water humidification is necessary to avoid drying of respiratory secretions and to maintain nasal cilia function. ➢ Turn on the heater unit, this allows heating to commence whilst system is set up. ➢ Ensure the amber light is lit, indicating that the ETT mode of heating is activated. This mode will heat the coil wire in the blue tubing to 40^{o}C then cut off and deliver in to the nares a temperature of 37^{o}C ➢ Place yellow bacterial filter into grey connection at base of O_2 blender. There is no piped air supply to the blender so it entrains room air; the filter filters the entrained air ➢ Calibrate O_2 cell before titrating FiO_2 – this is done by removing O_2 cell from back of blender (leave attached to black spiral cable). Whilst holding in room air, push and hold down arrow on front of blender, ‘cal’ should appear on screen. This will then calibrate to 21%, replace into hole on blender.

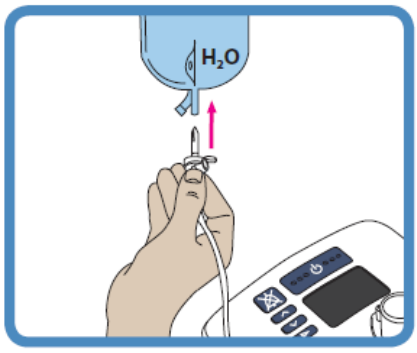
	Recommendation (Action)	Justification (Rationale)
		➢ Attach short green ventilation tubing from high flow meter to water reservoir ➢ Attach long green ventilation tubing to remaining port on water reservoir ➢ Connect heater wire and three-pronged temperature wire to humidifier base and green tubing ➢ Attach the long heater detection wire to the proximal port and the distal ports at the patient end of the green tubing ➢ Attach high flow nasal prongs (size to fit nostrils comfortably) to green tubing ➢ Dial up FiO_2 setting on blender – titrate to patient's target oxygen saturations ➢ Dial up flow as per senior nurse / medical order – usual flow rates start at 40 L/min, increase the delivered flow until a reduction in respiratory rate and a stable SaO_2 has been achieved. Maximum flow is 60 L/min ➢ Explain the procedure and benefits of high flow nasal prong oxygen to the patient; encourage them to breathe through their nose if possible. ➢ Place the blue lanyard (attached to the nasal prongs) over the patient's head, this will support the weight of the prongs ➢ Insert the prongs into nasal nares and secure with elastic draw strings ➢ Assess patient's respiratory rate, respiratory effort, arterial blood gases ➢ Document flow / FiO_2 settings.

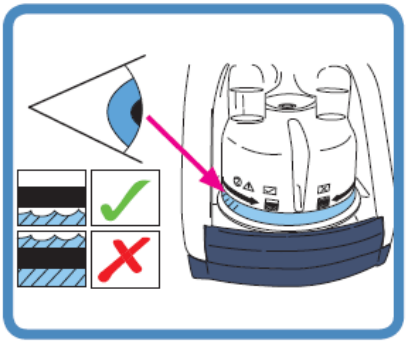

1
2
>50cm
3A
3B
4
5
A
B

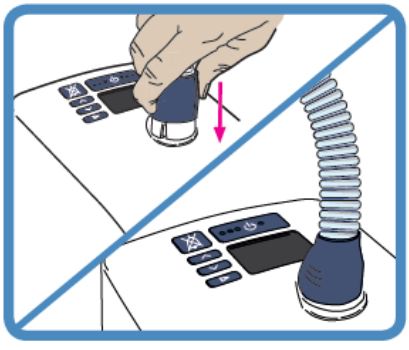
4	Airvo2	➢ Select hi-flow stand with the Fisher & Paykel Airvo2 attached ➢ Open the Airvo2 chamber and tubing set (900PT56) ➢ Install the water chamber: remove the blue port caps by pulling the tear tab upwards, then remove the bracket holding the water supply tube. Fit the adapter over the two vertical ports on the chamber and then clip the water supply tube into position. Fit the water chamber to the Airvo2 unit by pressing down the finger guard and sliding the chamber in. Push it until it clicks into place ➢ Hang a bag of sterile water and spike bag with connector from the reservoir. Open the vent cap on the side of the bag spike. The water bag must run freely and be placed at least 20cm above the humidifier to achieve flow of water into the humidifier chamber. Because flows used are high, heated water humidification is necessary to avoid drying of respiratory secretions and to maintain nasal cilia function. Check that water flow into the chamber but is maintained below the maximum water level line. (NB: high gas flow rates will mean regular water bag changes) ➢ Install the heated breathing tube by lifting the blue plastic sleeve and sliding the connector onto the Airvo2 unit. Push the sleeve down to lock in place ➢ Plug the white oxygen supply cable into the wall oxygen outlet. Connect oxygen tubing to the inlet port on the side of the Airvo2 unit, and the other end to the oxygen flowmeter on the stand. ➢ Turn on the heater unit, and check the disinfection status (a single green dot shows it is safe to use. An amber dot means it must be cleaned and disinfected prior to use on a new patient – see below) ➢ Whilst the unit warms up, you can configure initial settings: this allows heating to commence whilst system is set up. ➢ Press the up and down buttons together for 3 seconds to unlock setting menu ➢ Use up/down and the triangle buttons to select temperature and flow rate. Titrate FiO_2 by adjusting the oxygen flowmeter on the stand. The screen will display the current delivered FiO_2, but may takes some seconds to stabilise ➢ Explain the procedure and benefits of high flow nasal prong oxygen to the patient; encourage them to breathe through their nose if possible. ➢ Place the blue lanyard (attached to the nasal prongs) over the patient's head, this will support the weight of the prongs ➢ Insert the prongs into nasal nares and secure with elastic draw strings ➢ Assess patient's respiratory rate, respiratory effort, arterial blood gases ➢ Document flow / FiO_2 settings. ➢ See full user manual for further information



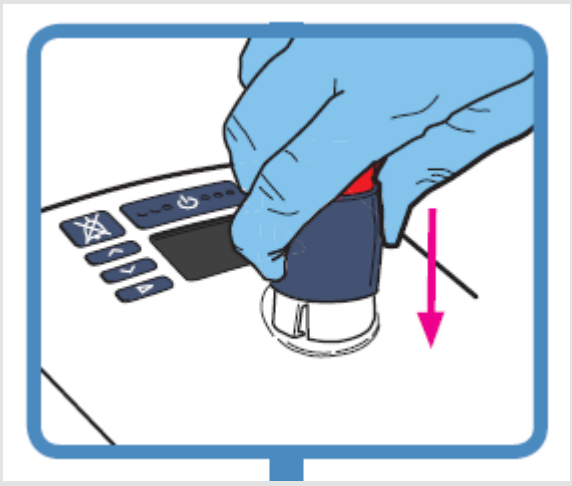


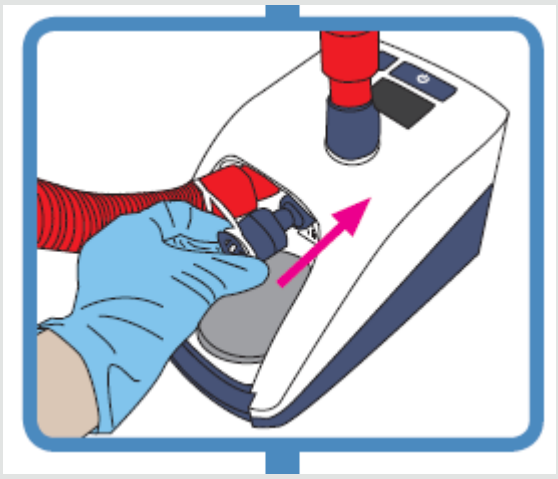

H_2O



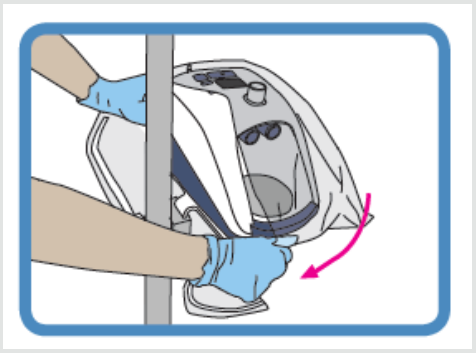


5	Wean therapy once patient has stabilised	➢ FiO_2 should be reduced before the flow ➢ Reduce FiO_2 to keep oxygen saturations at target level ➢ When oxygen is reduced to FiO_2 of ≤ 0.4 decrease the flow rate in 5-10L/min increments, reassess after 1-2 hours ➢ Consider weaning from HFNO completely, with flow rates 25 L/min and FiO_2 <0.40 or on advice of medical team.
6	Cleaning and disinfecting the Airvo2	➢ The Airvo2 must be cleaned and disinfected between patients. It is particularly important that the outlet elbow at the heated breathing tube connection port is cleaned and disinfected properly. Do this promptly after the patient has finished using the Airvo2 ➢ Unplug from the mains electricity supply before cleaning, and remove water chamber, heated breathing tube and patient interface ➢ Clean the outlet elbow: using a Clinell wipe (or cleaning sponge stick dipped in mild detergent solution) clean the right hand chamber port with its outlet elbow, but *do not clean the left hand chamber port* ➢ Wipe down the external surfaces of the Airvo2 with a Clinell detergent wipe ➢ Once dry, prepare for the disinfection cycle by connecting the red disinfection tube. The blue end connectdd to the outlet port on the top of the Airvo2; the red end pushes on to the left hand chamber port. Fit the blue filter onto the right hand chamber port ➢ Plug the Airvo2 into the mains electricity *but do not connect to the oxygen supply* ➢ Hold down the on/off button for 3 seconds (until it beeps) to start the disinfection cycle ➢ The unit will perform its warm-up and calibration, then commence disinfection, which takes 55 minutes ➢ After completing disinfection, the display will reach 0:00 and an audible signal will sound. Remove the red disinfection tube and blue filter. The Airvo2 can now be covered for storage or used on a new patient. ➢ (If not the Airvo2 is not going to be protected with a storage cover, the red tube and filter should be left in place)






55:00



3. RESOURCES

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