HIGH FLOW NASAL OXYGEN IN THEATRES

Introduction

PHU main theatres now have four Fisher & Paykel high flow nasal oxygen (HFNO) systems – two Optiflow THRIVE systems and two Optiflow Airvo 2 systems (see Appendix for photos). Optiflow THRIVE is a HFNO system which delivers 100% oxygen only and is designed to aid airway management in theatres. The Optiflow Airvo 2 HFNO systems have oxygen/air mixers and provide respiratory support and humidification for patients who are post-op or possibly awake/sedated undergoing procedures in theatre. The systems have different disposable circuits which are not interchangeable.

NB The acronym THRIVE (Transnasal Humidified Rapid-Insufflation Ventilatory Exchange) refers to the physiological process of apnoeic oxygenation and ventilation[1], but the term has been used by Fisher & Paykel for their 100% oxygen only HFNO system which is used for airway management purposes with patients who may be breathing spontaneously or apnoeic.

Purpose

To guide safe use of high flow nasal oxygen in the theatre and recovery setting.

Absolute contraindications for both HFNO systems

- Blocked nasal passages/choanal atresia
- Trauma/surgery to nasopharanyx
- Severe epistaxis
- Basal skull fractures/CSF leaks
- Laryngeal/tracheal disruption (surgical emphysema) or oesophageal disruption

Relative contraindications for both HFNO systems

- Untreated pneumothorax (be prepared to decompress)

Specific patient groups

- Upper GI surgeons at PHU support the use of HFNO post-oesophagectomy/gastrectomy if indicated

HFNO during COVID-19 pandemic[2]

- At the time of writing HFNO is considered an aerosol generating procedure. Latest evidence suggests that IF there is any increased dispersion of droplets / production of aerosols with HFNO then the effect is modest (when compared to having no mask).
- If HFNO has significant clinical benefit, it can be used in theatre with staff observing aerosol risk precautions.

OPTIFLOW THRIVE USE (please see page 3 for Airvo 2 use)

Indications

- Upper airway obstruction. HFNO may stabilise the patient with a critical airway by improving oxygenation and reducing the work of breathing

- Awake tracheal intubation. HFNO facilitates this by improving oxygenation and the patency of the upper airway[3]
- Apnoeic oxygenation during intubation of anticipated difficult airway
- Tubeless ENT surgery (excluding laser)
- High-risk extubation

Complications

- Failure to maintain oxygenation, especially some patients with morbid obesity. HFNO is not effective at re-oxygenating an apnoeic patient when it has failed. For that reason, check facemask ventilation should be considered.
- Hypercarbia with associated cardiovascular instability
- Gastric distension
- Pressure areas - nasal mucosal ulceration with prolonged use
- Blockage due to secretions
- Surgical fires: these may be airway fires or external fires due to oxygen pooling in operative field / under drapes[4]

Anaesthetist grade

Most of the airway management uses for HFNO represent high risk cases which warrant consultant anaesthetist presence and it should only be used with consultant approval. In airway emergencies it is appropriate for junior staff to instigate HFNO management with prior consultant discussion and imminent attendance.

Storage

The Optiflow THRIVE systems will be kept in the Anaesthetic Equipment storeroom (by ThE12/13). NB: The Airvo 2 systems will be kept in E-level Recovery.

Set-up

An Optiflow THRIVE circuit can be used for up to 24 hours after water is added to the humidifier and is multi-patient use. Please use the supplied yellow label to write the time that water is added to the circuit. The nasal prongs and filter are changed with each additional patient use within 24 hours.

Procedure for pre-oxygenation and apnoeic oxygenation during intubation of anticipated difficult airway

1. Turn on system with gas flow at minimum 10 $l.min^{-1}$ for approximately 5-10 minutes to ensure that the water is warmed up to 37^0C (check temperature displayed on screen).
2. Use ramped patient position. Put nasal prongs on the patient ensuring they do not completely occlude the nares. Start oxygen flow at 40-50 $l.min^{-1}$ then gradually increase to 70 $l.min^{-1}$ as tolerated.
3. Pre-oxygenate for a **minimum 3 minutes**, encouraging the patient to breathe through their nose.
4. Induce anaesthesia and maintain a patent upper airway with a jaw thrust. Turn oxygen up to 70 $l.min^{-1}$ if this flow rate was not reached during pre-oxygenation.
5. Lift nasal prongs and place on forehead then check face mask ventilation (optional).
6. Return nasal prongs to nostrils and maintain jaw thrust until time to intubate.
7. Stop oxygen and remove nasal prongs only after correct endotracheal tube position is confirmed. The flow rate may need to be reduced to allow the ODP to hear if there is a leak when inflating the endotracheal tube cuff.

Cautions

- DO NOT ATTEMPT TO POSITION A FACEMASK OVER THE NASAL PRONGS WHEN USING HFNO AS THIS RISKS BAROTRAUMA AND GASTRIC INSUFFLATION
- RISK OF AIRWAY FIRE
    - Do not use whilst laser surgery is underway
    - There is the potential for fire if diathermy is used in the head or neck whilst HFNO is in use. If used during awake tracheostomy be aware that there is a risk of airway fire should the surgeon use diathermy before or after opening the trachea. Maintain close communication with surgeon and reduce HFNO significantly prior to using diathermy.

Procedure for tubeless airway surgery (in brief)

Please do not undertake this without support if you have not done so before.

- Make clear at team brief that tubeless airway surgery is limited in duration and the theatre and surgical equipment must be completely prepared so that there is minimal time loss after induction of anaesthesia.
- Initial steps as per procedure for pre-oxygenation and apnoeic oxygenation. Jaw thrust should be maintained until suspension laryngoscopy is underway.
- **THERE MUST BE A PLAN IN PLACE TO OXYGENATE THE PATIENT SHOULD THRIVE OXYGENATION FAIL.** Depending on the nature of the surgery this may be intubation through a surgical laryngoscope which will already be in place intra-op. If jet ventilation is to be used, then the jet ventilator should be set up in advance.
- As transcutaneous CO_2 monitoring is not available, prolonged apnoea (e.g. beyond 20-30 minutes) is not recommended unless an arterial line is in situ to monitor $PaCO_2$.

Adverse events

In case of adverse events related to HFNO use please complete a Datix report and bring to attention of one of the department Airway Leads.

OPTIFLOW AIRVO 2 USE

Please see Respiratory Medicine Guidelines for caring for patients requiring Airvo2 Nasal High Flow Oxygen system. This guideline remains relevant in the theatre setting. Key points regarding Airvo 2 use include:

Indications

Self-ventilating patients with:

- Acute hypoxaemic / Type 1 Respiratory Failure
- An increased work of breathing secondary to Type I Respiratory failure
- Increased secretion viscosity with an impaired ability to clear secretions and when other treatments e.g. nebulisers are ineffectual.

The potential benefits are reversal of hypoxaemia, reduced work of breathing, improved sputum clearance and possible avoidance of intubation. Single patient consumables. The system can be used with an interface to connect to a tracheostomy tube or with a tracheostomy mask for laryngectomy patients.

Cautions

Patients with acute hypercapnic / Type 2 Respiratory Failure should be considered for NIV and escalation to higher levels of care for closer monitoring if appropriate. HFNO will not correct ventilatory failure. Staff should be aware that if a patient on HFNO deteriorates then desaturation may be a late sign and so close attention must be paid to other physiological parameters including respiratory rate, heart rate etc

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References

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Keywords

High flow nasal oxygen, Optiflow, THRIVE, Airvo 2, pre-oxygenation, tubeless surgery

Appendix



Optiflow THRIVE system (left) with THRIVE circuit (middle) and Optiflow Airvo 2 system (right

STANDARD OPERATING PROCEDURE TO BE FOLLOWED WHEN USING OPTIFLOW THRIVE SYSTEM

What you need

1 x Optiflow THRIVE machine (anaesthetic equipment storeroom)
1 x Optiflow THRIVE disposable circuit (anaesthetic stock room)
1 x nasal cannula (S/M/L) (anaesthetic stock room)
1 x sterile water bottle (scrub side / fluid store adjacent to recovery))

Preparing the system for use

1. Plug in Optiflow THRIVE machine and connect oxygen hose to overhead boom (oxygen splitter in basket may be used).
2. Open Optiflow THRIVE component package (AA451) and carefully remove and discard yellow plastic tube holder.
3. Connect short blue tube from humidifier to point beneath oxygen regulator.

1. **Optiflow THRIVE machine**

2. **Optiflow THRIVE AA451 component kit**

3. **Connect short blue tubing**

4. Slide and clip in humidifier by pushing down on blue bumper and aligning electronic interface.

4. **Slide and clip in humidifier unit by depressing blue bumper and connecting electronic interface.**

5. Hang water bag from stand and fill with up to 1 litre of water for irrigation (lasts 7 hours).
6. Attach yellow date sticker for 24 hour period of multi-patient circuit use.
7. Attach single patient Optiflow nasal cannula to circuit (S/M/L sizes available) and **change for each new patient.**
8. Switch on machine and select low flows until warming of oxygen to 37°c (this may take a few minutes).

5. **Hang and fill bag with sterile water**

6. **Attach yellow date sticker onto circuit**

7. **Attach nasal cannula to circuit**

8. **Switch on machine and await warming.**

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