

HUMIDIFIED HIGH FLOW NASAL CANNULA THERAPY

PRACTICE GUIDELINE[®]

DOCUMENT SUMMARY/KEY POINTS

- This guideline aims to support the safe and effective use of Humidified High Flow Nasal Cannula Therapy (HHFNC) for acute respiratory distress with moderate to severe work of breathing
- Use in conjunction with the [HHFNC Flowchart](#) to support clinical decision making in relation to initiation, continuation, escalation and weaning
- Children with chronic respiratory or cardiac failure or those who are palliative will have individual HHFNC therapy management plans documented by their medical team that may be outside the scope of this guideline
- Commencement of HHFNC should be with 2L/kg/min gas flow & FiO₂ 30%
- HHFNC 2L/kg/min may be administered on wards with appropriate consideration given to patient safety
- Continuous monitoring of SpO₂ and HR with hourly documented observations including HHFNC settings in the Standard Paediatric Observation Chart (SPOC) are required
- Any patient who does not exhibit signs of clinical stabilisation within 2 hours of commencement of HHFNC at 2L/kg/min and appropriate adjunct interventions (e.g. suction/NGT insertion/NBM) are to be reviewed by the intensive care service (PICOS/CICU consult)
- The circuit (excluding heater wire and temperature probe) is disposable, for single patient use only, and complete circuits must be replaced every seven days

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

Approved by:	SCHN Policy, Procedure and Guideline Committee	
Date Effective:	1 st September 2018	Review Period: 3 years
Team Leader:	Staff Specialist	Area/Dept: General Medicine

- Children with chronic respiratory or cardiac failure or those who are palliative will have individual HHFNC therapy management plans documented by their medical team that may be outside the scope of this guideline
- This guideline does not cover Post op Tonsillectomy & Adenoidectomy children receiving HHFNC Therapy

CHANGE SUMMARY

- Amalgamation of multiple guidelines for a consistent network evidence-based approach of safe administration of HHFNC therapy for children with respiratory distress
- Changes to restrictions for HHFNC administration – all wards can administer up to 2L/kg/min HHFNC (up to a maximum of 50L/min) if appropriate consideration is given to patient acuity, nursing ratios, skill mix and monitoring capability to ensure patient safety
- Two circuits and a variety of nasal prong sizes (flow limited to different rates depending on size) are available to deliver flows up to 2L/kg/min
 - Paediatric for < 13kg (25L/min maximum flow- blow off valve when reached)
 - Adult for >13kg (50L/min maximum flow)
- 15L, 30L and 70L flow meters are available to deliver up to 2L/kg/min
- Weaning protocol for use by all clinicians
- A nebuliser attachment is available for delivery of nebulised medication through the HHFNC circuit and prongs

READ ACKNOWLEDGEMENT

- All clinical staff involved in the care of children where HHFNC may be delivered are to read and acknowledge this document

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1 Introduction

- Respiratory distress and respiratory failure are one of the most common, life threatening presentations in childhood (40% of all paediatric presentations)
- The mainstay of treatment for children with respiratory distress are supportive therapies including oxygen delivery, hydration, assistance with secretion clearance and rest
- Breathing cool dry gases can produce deleterious effects to the respiratory tract such as mucosal damage, reduced ciliary motility, decreased mucous production, bronchospasm and nasal discomfort
- HHFNC therapy is used to deliver a continuous humidified flow of gas to provide respiratory support aiming to improve ventilation and oxygenation in moderate to severe respiratory distress
- HHFNC delivery produces some positive distending pressure, aiding in preventing airway collapse, resulting in increased functional residual capacity, promotion of alveolar gas exchange and CO₂ elimination
- HHFNC has been demonstrated to deliver effective oxygenation, attributed to the continuous washing of exhaled gas from the upper airways resulting in a reduction in anatomical dead space
- HHFNC delivers some of the advantages of formal airway occlusive CPAP without the complicated patient interface and potential risks such as complete airway obstruction and nasal septum necrosis

2 Indications

- Relief from moderate to severe respiratory distress due to diseases such as bronchiolitis or pneumonia in patients that fail to respond to nasopharyngeal suction and low flow nasal prong oxygen
- Persistent desaturation ($SpO_2 < 92\%$) in children with acute lower respiratory tract infection despite use of low flow oxygen therapy
- Respiratory support for infants and children with respiratory distress from congestive heart failure or chronic lung disease

ALERT: HIGH RISK PATIENTS

The following patient groups are at risk for more severe illness and rapid deterioration and should be considered for early PICU review:

▲ Congenital heart disease

▲ Prematurity ▲ Neonates

▲ Complex chronic conditions

3 Contraindications

- Critical illness with immediate need for NIV/intubation
- Apnoeas requiring NIV/intubation
- Life threatening hypoxia
- Decreased level of consciousness
- Upper airway obstruction/nasal obstruction (e.g. choanal atresia, large polyps)
- Craniofacial malformations
- Foreign body aspiration – suspected or confirmed
- Open Chest wound / Chest trauma
- Maxillofacial trauma/surgery
- Pneumothorax – use with caution
- Any patient with known lung disease or other conditions that have not been discussed with either the treating physician or respiratory consultant
- Asthma (consider NIV)

4 Initiation

- Prior to commencement of HHFNC therapy, secretion clearance (nasopharyngeal suction) should be undertaken and may negate the need for HHFNC initiation
- HHFNC therapy is to be ordered by the treating medical officer or senior clinical nurse (Clinical Nurse Specialist or team leader)

ALERT – NASOGASTRIC TUBE INSERTION

Nasogastric tube placement should be encouraged prior to initiation of HHFNC therapy (after suction for secretion clearance) for GIT decompression

COMMENCE FLOW RATE 2L/kg/min FiO₂ 30%

Titrate FiO₂ to maintain SpO₂ ≥ 92%

ALERT – ALTERED CALLING CRITERIA FOR SpO₂

In consultation with admitting officer

Yellow Zone 88-92%

Red Zone < 88

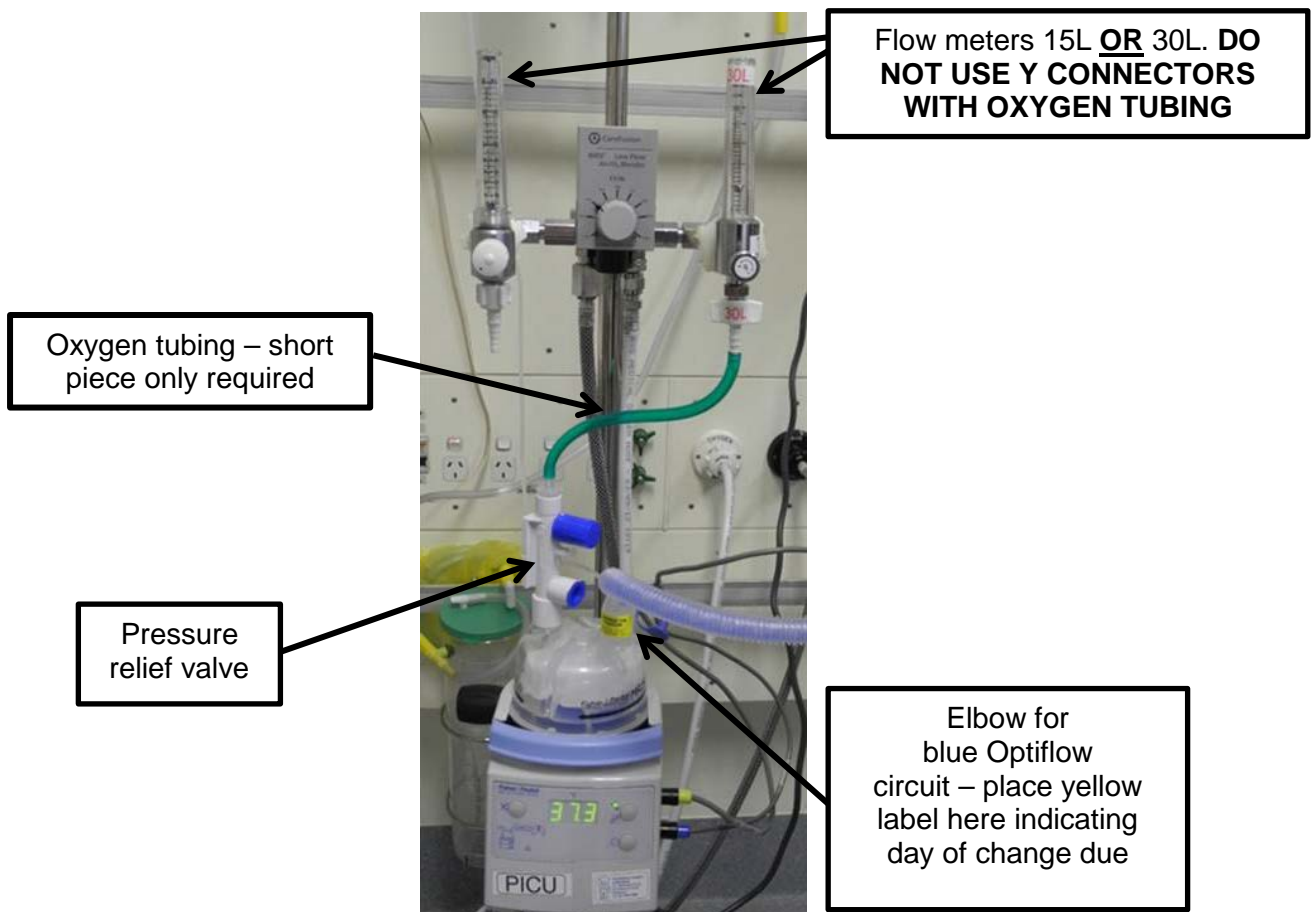
Children with complex medical backgrounds (e.g. CLD/CHD) will need individual ACC plans

5 Equipment & Set up

- Humidifier circuit – two circuits available
 1. **<13kg** Infant Respiratory Care System RT330 for flows \leq 25L/min (PICTURE 1) – only compatible with paediatric prongs Optiflow Junior
 2. **>13kg** Adult Breathing Circuit Inspiratory System RT202 for flows \geq 25L/min (PICTURE 2) – only compatible with adult prongs Optiflow
- Nasal Cannula – see sizing guide in Section 6
- MR850 Humidifier
- Oxygen Blender
- Flow meter (attached to Blender) – 15L, 30L or 70L
- Green O2 tubing cut to required size (approx. 20cm) to connect flow meter to circuit
- Sterile Water bag

Step by step set up

PICTURE 1 – paediatric circuit <13kg



1. Fit the chamber

- Slide humidification chamber onto the humidifier base
- Remove blue caps

2. Hang the waterbag

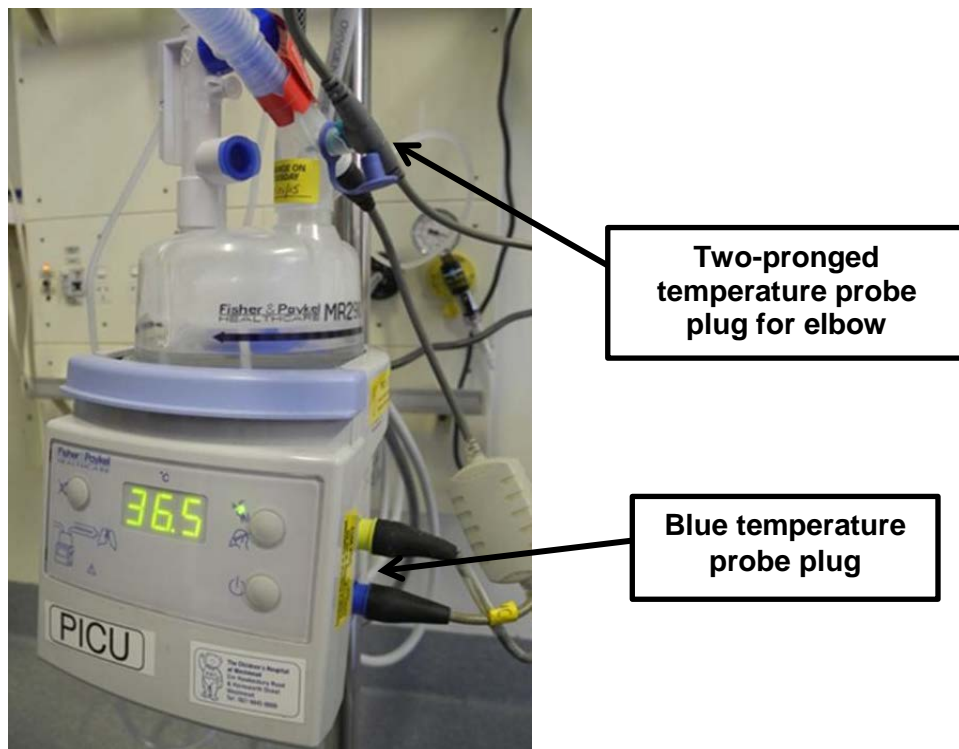
- Hang the water bag from the pole
- Unwind the water feed set and spike water bag

3. Connect the circuit

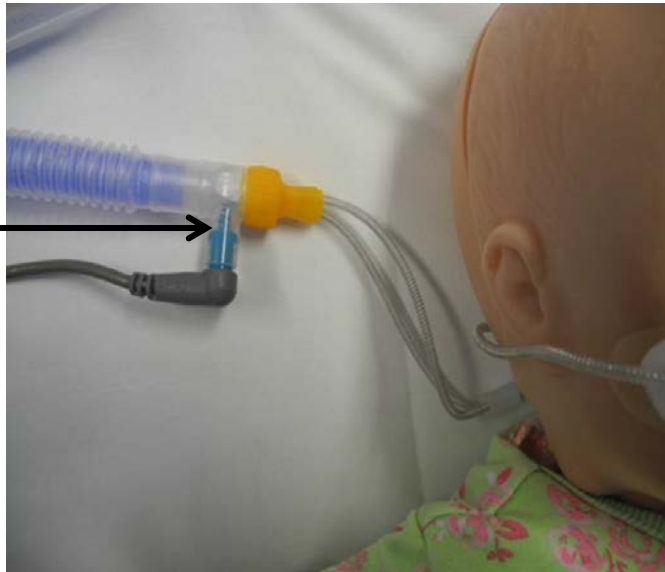
- Connect the white air entrainer to the humidification chamber
- Connect green Oxygen tubing between top of white air entrainer and flow meter (15L OR 30L - NO Y CONNECTORS ARE TO BE USED)
- Connect the elbow of the blue optiflow circuit to the humidification chamber
- Connect correct size nasal cannula to patient end of optiflow circuit

4. Connect the temperature probe

- Connect the blue temperature probe plug into the blue socket on the side of the humidifier
- Insert the two-pronged temperature probe plug into the socket on the elbow of Optiflow circuit
- Insert the other end of the blue probe into the port at the patient end of the Optiflow circuit



Temperature probe port at patient end of circuit



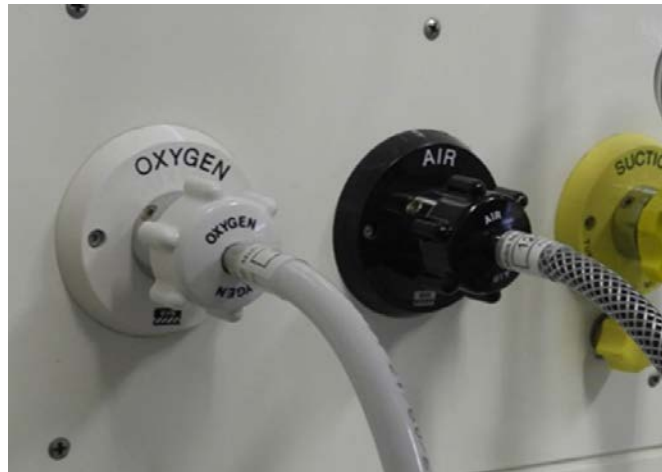
5. Connect heater wire

- Connect the yellow heater wire plug into the yellow socket on the side of the humidifier
- Insert the other end into the socket on the back of the Optiflow circuit elbow above the chamber



Yellow heater wire connections

6. Connect air and oxygen hoses from blender to wall outlets



ALERT – Oxygen outlet with flow meter for emergency use required

If no additional oxygen outlet available at bedside, utilise a double outlet adapter

7. Humidifier

- Turn humidifier on by pressing button on lower right hand side of humidifier
- Ensure ETT mode (37 deg) selected (default setting) highlighted by green light



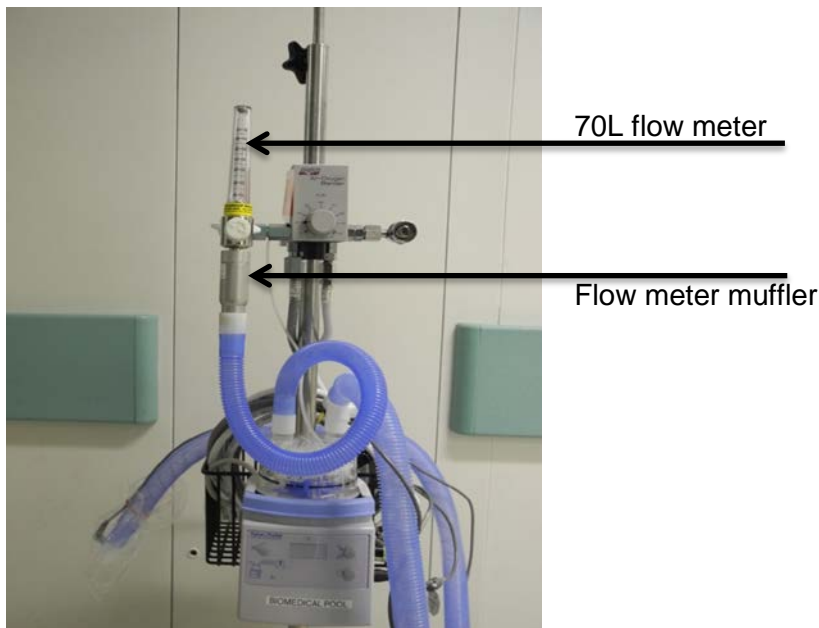
8. Set blender and gas flow meter

- Set blender to desired FiO_2 - commence at 30% and titrate to maintain $SpO_2 \geq 92\%$
- Set flow meter – starting flow 2L/kg/min (consider maximum flow limitations of nasal cannula depending on size and appropriate flow meter)
- Humidifier and gas should be turned on and allowed to warm until at least 36 degrees before being attached to the child

9. HHFC for children > 13kg

- Use adult circuit as shown in PICTURE 2 and commence flow as for paediatric circuit
- Flow rate not to exceed 50L/min
- Only compatible with adult Optiflow prongs

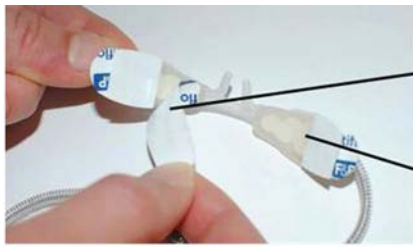
PICTURE 2 adult circuit >13kg



6 Nasal Cannula - Size selection & application

Paediatric prongs for < 12.5kg – flow limitations

PRODUCT	OJR410 	OJR412 	OJR414 	OJR416 	OJR418 
Nasal cannula size	XS	S	M	L	XL
Cannula weight	6.7 g	7.1 g	9.3 g	13.5 g	13.8 g
MAXIMUM FLOW RATES* (L/min)					
MR850 	0.5 - 8	0.5 - 9	0.5 - 10	0.5 - 23	0.5 - 25
COMPATIBLE SPARES					
F&P Wiggelpad™ 2	 WJR110		 WJR112		
PRODUCT SPECIFICATIONS					



Remove first layer of backing paper from nasal prong wiggle pads

Wiggle Pads



Position nasal prongs into the nares, ensuring a gap of at least 2mm between the nasal septum and the prongs is present to avoid possible pressure necrosis.



When happy with placement, remove second layer of backing paper from wiggle pads, securing nasal prongs to patient face.

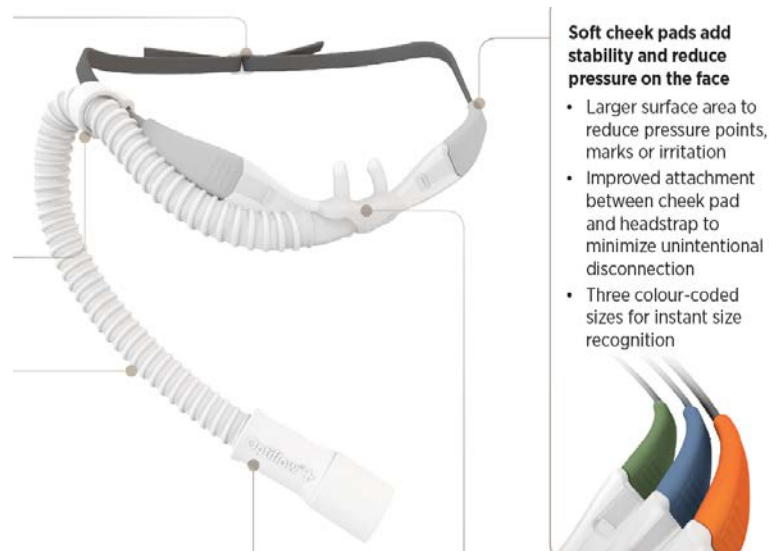
- Ensure patient is not lying on the tubing and that flow path is maintained
- DO NOT place any adhesive tape over the cannula onto the face
- Secure NGT below nasal cannula, try not to tape over the cannula as this will hinder removal of the cannula in an emergency
- Note flow limitations for different prong sizes

Adult prongs > 13kg

For use with Adult Breathing Circuit Inspiratory System

RT202 for flows \geq 25L/min (PICTURE 2 in section 5)





7 Clinical stabilisation & care

- Continuous SpO₂ monitoring
- At commencement of therapy record observations (work of breathing, air entry, respiratory rate, heart rate and SpO₂) appropriate to the clinical situation for first two hours or until deemed stable
- Hourly recording of HHFNC settings - total flow rate, FiO₂, humidifier temperature
- Nasopharyngeal suctioning to prevent secretions blocking airways
- Initially children on HHFNC should be Nil by Mouth for up to 2 hours with consideration of age/weight, last feed time and BSL check
- If meeting stabilization criteria as outlined below discuss feeding regime with medical team (route, amount, frequency – initial regime continuous NGT 2/3 maintenance and consider increasing total fluid requirement to 100-120ml/kg/day as able)
- If no improvement in WOB, remain NBM and for IV cannula and commencement of 2/3 maintenance IV fluids with NGT aspirated/on free drainage
- Oral and nasal care 4 hourly - monitor nasal prong position and pressure areas
- Consultant/senior medical staff review should occur once a day
- A medical review should occur if the child is deteriorating

Clinical stabilisation is indicated by:

- FiO₂ < 50% to maintain SpO₂ ≥ 92%
- Heart rate & respiratory rate reduction - e.g. from red to yellow zone or yellow to blue zone

- Improved work of breathing/respiratory distress

ALERT - Seek medical review if:

- Patient not stabilizing according to BTF chart
- Worsening respiratory distress
- Hypoxemia persists
- $FiO_2 \geq 50\%$ required to maintain $SpO_2 > 92\%$

8 Weaning

- Weaning can commence once stable for a period of time as indicated by
 - HR, RR & WOB in white or blue zones on SPOC
 - Decreased work of breathing and effort
 - $FiO_2 < 50\%$ to maintain $SpO_2 \geq 92\%$
- Weaning commences with decreasing FiO_2 in 5%-10% increments whilst maintaining $SpO_2 \geq 92\%$
- Once FiO_2 reaches 21-25% and $SpO_2 \geq 92\%$ for 2 hours, flow can be reduced to 1L/kg/min then stopped
- If not maintaining $SpO_2 \geq 92\%$ or increased WOB returns, recommence 2L/kg/min of flow and increase FiO_2 until SpO_2 in target range -> for mild hypoxia without WOB consider low flow nasal prong oxygen
- Once stabilised with $SpO_2 \geq 92\%$ for at least four hours, weaning can recommence
- If successful weaning for at least 2 hours HHFNC can be removed and continue to monitor SpO_2 for 2-4 hours

WEAN FiO_2 first - 21-25%

REDUCE TOTAL FLOW 1L/kg/min

CEASE total flow

9 Escalation

HHFNC may be inadequate and escalation of respiratory support in ICU may be required if:

- There is an increase in respiratory distress
- Desaturation / Apnoea / Bradycardic episodes
- pCO_2 measured by venous or capillary blood gas $>60\text{mmHg}$ and / or $pH < 7.25$

- FiO₂ requirement ≥ 60%

ALERT - Between the Flags

Any clinical deterioration whereby a child is recorded in the yellow or red zones on SPOC must result in a formal CLINICAL REVIEW or RAPID RESPONSE

In babies < 8kg consider increasing flow to 3L/kg/min after consultation with Intensive Care Outreach

10 Transfer of patients between clinical areas

HHFNC must NOT be disconnected for transfer as this may lead to an acute deterioration

Transfer from ED to wards

- Notification of admitting teams as per local process

ALERT: Between the Flags

Patients should NOT be transferred with SPOC Observations in RED zone unless there is a documented plan of care and altered criteria in place by admitting team/ED Consultant or as per local process

Transfer to ICU

- Medical officer or Nurse Practitioner to accompany patient with nursing staff or as per local process

Transfer Setup

- Child remains in bed / cot
- Local emergency transport equipment – including extra oxygen cylinder with flow meter attached
- 1 x FULL oxygen cylinder with regulator for connecting HHFNC O₂ hose
- 1 X FULL Air cylinder with regulator for connecting HHFNC Air hose
- 2 x holders for the HHFNC Air & O₂ cylinders attached securely to the bed/cot/HHFNC Pole setup
- Connect HHFNC set up via oxygen & air hose
- Humidifier base has no battery backup & will not operate whilst disconnected from mains power - disconnect immediately prior to transfer
- Entire HHFNC set up is transferred with the patient

- On arrival to new bed space, transfer oxygen and air hoses to wall, ensuring the blender and flow settings have not changed during transport and plug in humidifier base to recommence humidification

11 Nebuliser attachment – for paediatric circuit only

- When clinically indicated, nebulised medications can be delivered through the HHFNC setup via the nebuliser attachment OPT016 Optiflow Junior Adaptor Kit
- The kit comes with two pieces (elbow & circuit connector) and requires a separate green Cirrus nebuliser bowl (see pictures below)



Nebuliser attachment set up

- attachment fits between prongs and circuit
- elbow used only if required to aid with angle of nebuliser bowl which must remain upright for delivery
- green Cirrus nebuliser bowl comes separately and fits onto the prong attachment when the blue cover is removed
- Oxygen tubing is required to run from the nebuliser bowl to either a wall oxygen flow meter or second flow meter on HHFNC set up (if present)

Nebuliser operation

- Put pieces together, insert nebuliser solution (add saline to total 4mL if necessary) into green nebuliser bowl and attach into high flow circuit as shown in picture

- Connect oxygen tubing from nebuliser bowl to alternate flow meter (either on HHFNC set up or wall OXYGEN)
- Turn on flow meter to 6L/min and reduce total flow on HHFNC meter by same amount (so as not to alter total flow delivery)
- Once nebulised solution has vaporised, turn off nebuliser flow meter and increase total flow on HHFNC meter back to original flow
- Remove nebuliser attachment and reattach prongs directly to circuit
- Nebuliser attachments and bowl are for single patient use only - Keep at the bedside whilst needed and discard once patient no longer requires
- Flow through nebuliser attachment needs to be higher than total humidified flow otherwise nebuliser may not atomise

12 Cleaning

- The entire circuit including humidification chamber are disposable (with exception of the heater wire and temperature probe) and should be changed every 7 days on the same patient
- Water bag to be changed every 3 days
- The humidifier and blender will require cleaning prior to new circuit being set up

13 Definition of Terms

- HHFNC – Humidified High Flow Nasal Cannula
- Hypoxemia – Low arterial oxygen tension (in the blood)
- Hypoxia – Low oxygen level in the tissue
- SpO₂ – Arterial oxygen saturation measured via pulse oximetry
- FiO₂ – Fraction of inspired oxygen concentration (%)
- pCO₂ – Carbon dioxide in blood
- Humidification – The addition of heat and moisture to gas
- NIV – Non-invasive ventilation
- CLD – Chronic Lung Disease
- CHD – Congenital Heart Disease
- ACC – Altered Calling Criteria
- WOB – Work of breathing

14 Related Guidelines

Nasopharyngeal And Oropharyngeal Suctioning – SCH -

<http://webapps.schn.health.nsw.gov.au/epolicy/policy/3668>

Between The Flags (BTF): Clinical Emergency Response System (CERS) -

<http://webapps.schn.health.nsw.gov.au/epolicy/policy/3183>

Humidified High Flow Nasal Cannula Oxygen Guideline for Metropolitan Paediatric Wards and EDs (NSW Health) -

http://www1.health.nsw.gov.au/pds/Pages/doc.aspx?dn=GL2016_004

Infants and Children - Acute Management of Bronchiolitis (NSW Health) -

http://www1.health.nsw.gov.au/pds/Pages/doc.aspx?dn=GL2018_001

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16 Appendix – Flowchart

