High flow heated humidified Oxygen therapy (HFNC) – What is it's role?

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Objectives

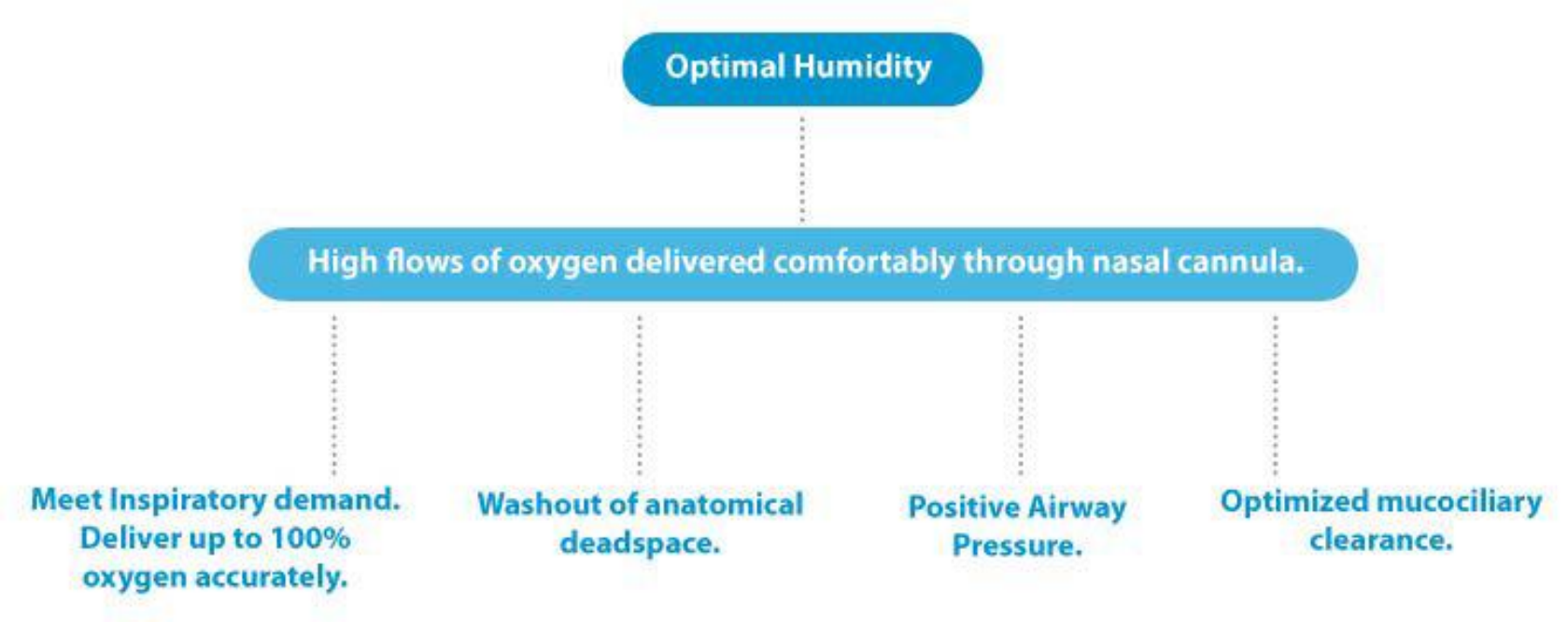
- What is HFNC?
- Key benefits
- Which patients?
- Delivering HFNC
- Weaning…

What is HFNC?

- Comfortable and effective delivery of oxygen and humidification via nasal cannula

- Hypoxaemia
- Hypercapnoea
- Mild to moderate respiratory distress

Key Benefits



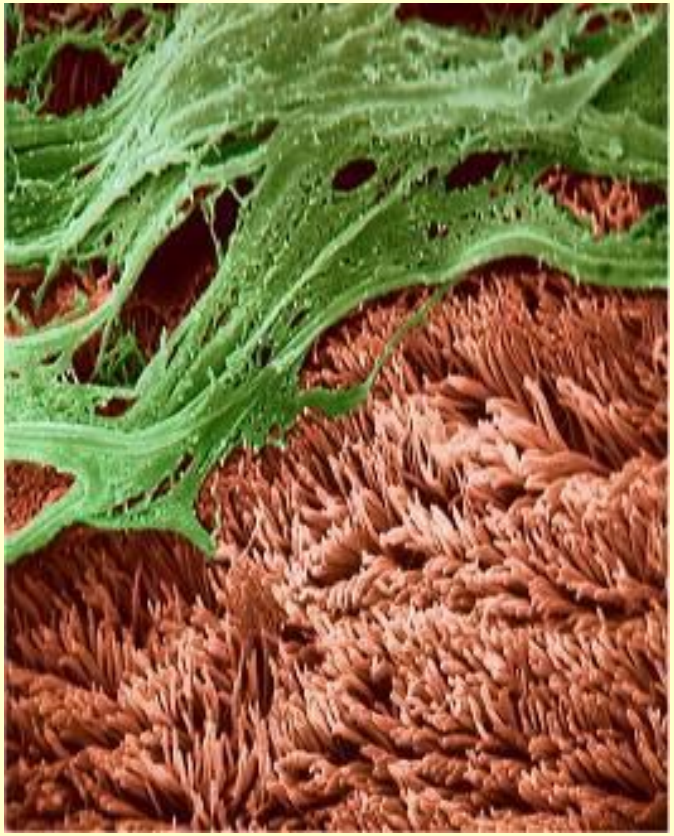
1. Optimised mucociliary clearance

- HFNC provides humidification technology that emulates the natural balance of temperature and humidity in healthy lungs

- The air/ oxygen blend delivered with HFNC is conditioned to provide optimal humidity

- $37^{o}C$, 44mg/L

- Delivering optimal humidity improves mucociliary clearance
- Reduced secretion viscosity
- Improved transport of mucous from the airway



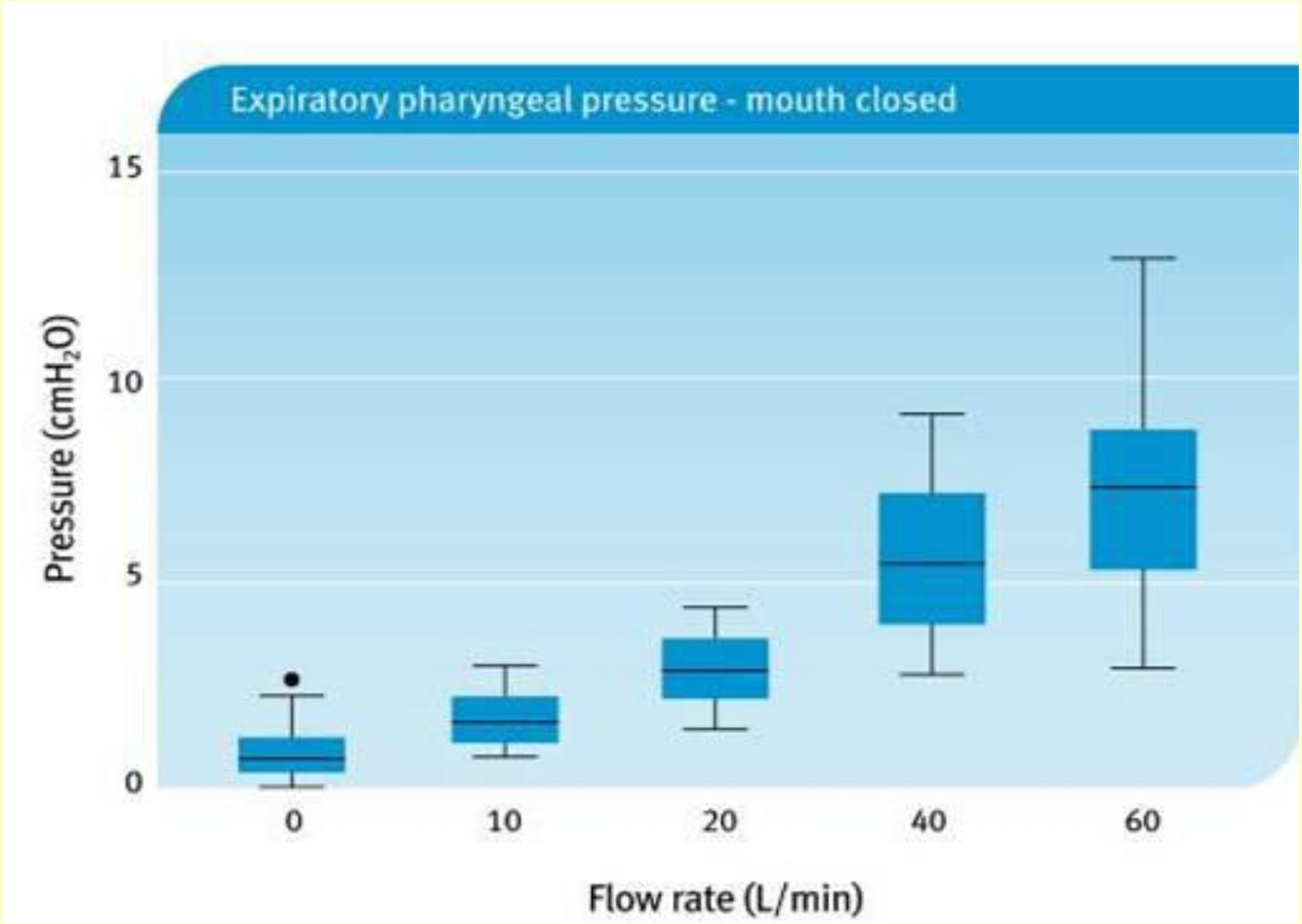
Schiffmann, 2006

2. Positive airway pressure

- Low levels of positive airway pressure may be generated

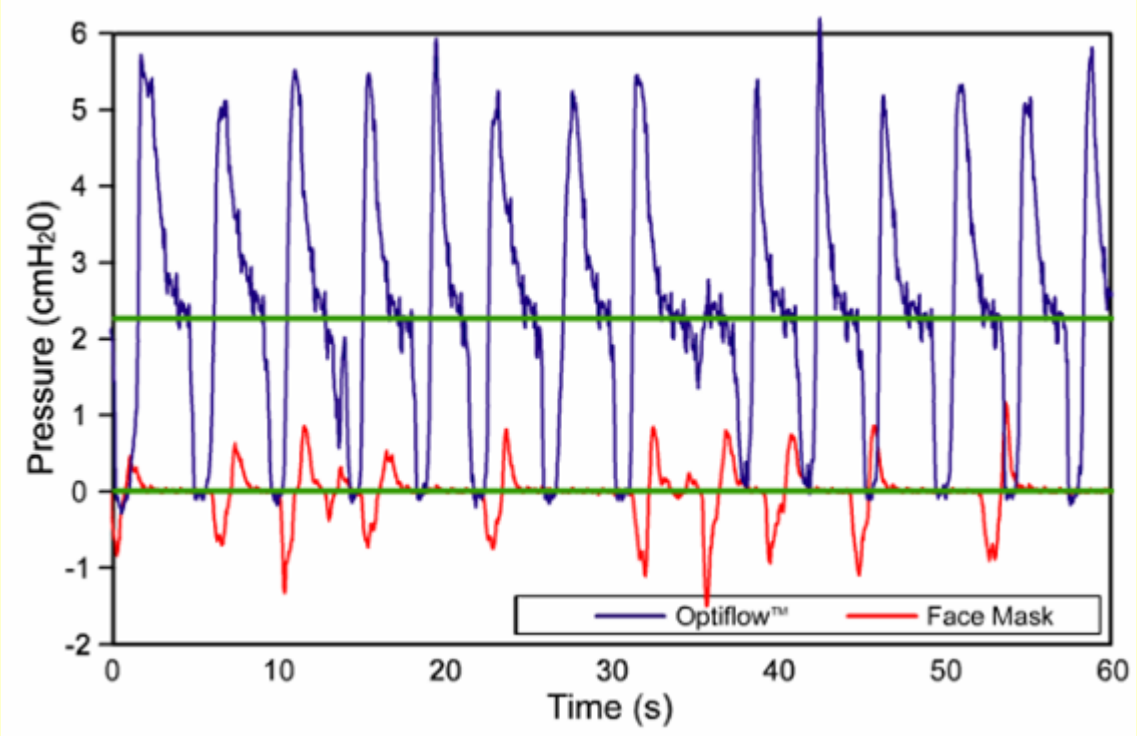
- Amount is dependent on a number of variables:
  - Flow (5-60L/min)
  - Upper airway anatomy
  - Nasal cannula size relative to nares
  - Mouth open or closed

Parke *et al*., 2009 and Kubicka *et al*., 2008)



(Corley *et al*., 2011)

Parke *et al*., 2009 (Adult study)



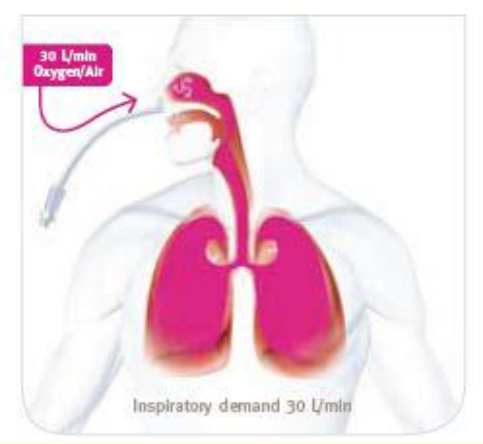
Comparing NP pressures with HFNC and face mask oxygen therapy with mouth open and closed

3. Effective Oxygen delivery

- Flow delivered with HFNC aims to meet or exceed the patient's inspiratory demand:

a) Minimises room air entrainment

b) Dilution of oxygen and humidity reduced



4. Washout of anatomical dead space

- Washout of the anatomical dead space by the continuous delivery of high flow gas

a) Reduces re-breathing of expired CO_2

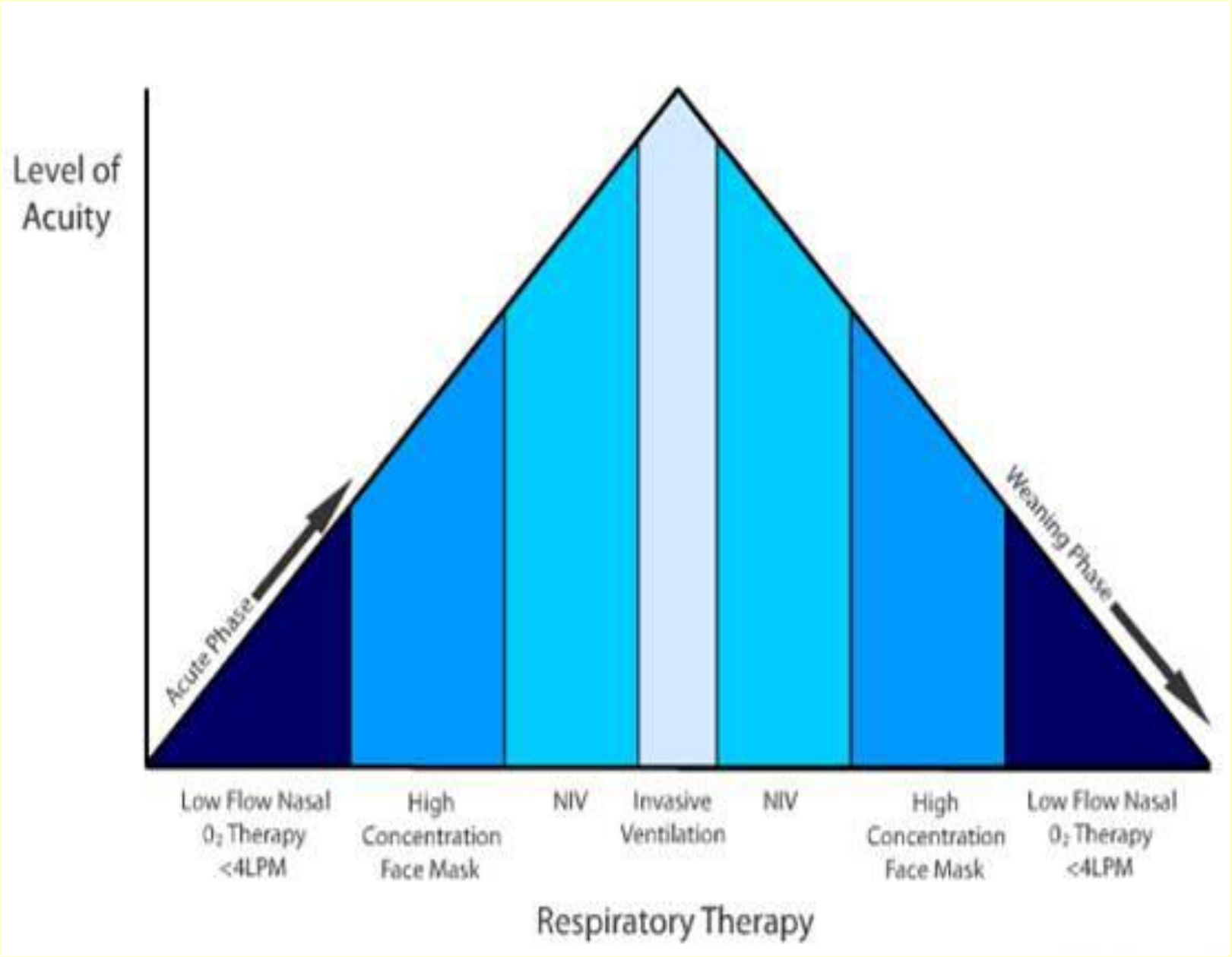
b) Provides reservoir of fresh gas in the upper airway for each breath

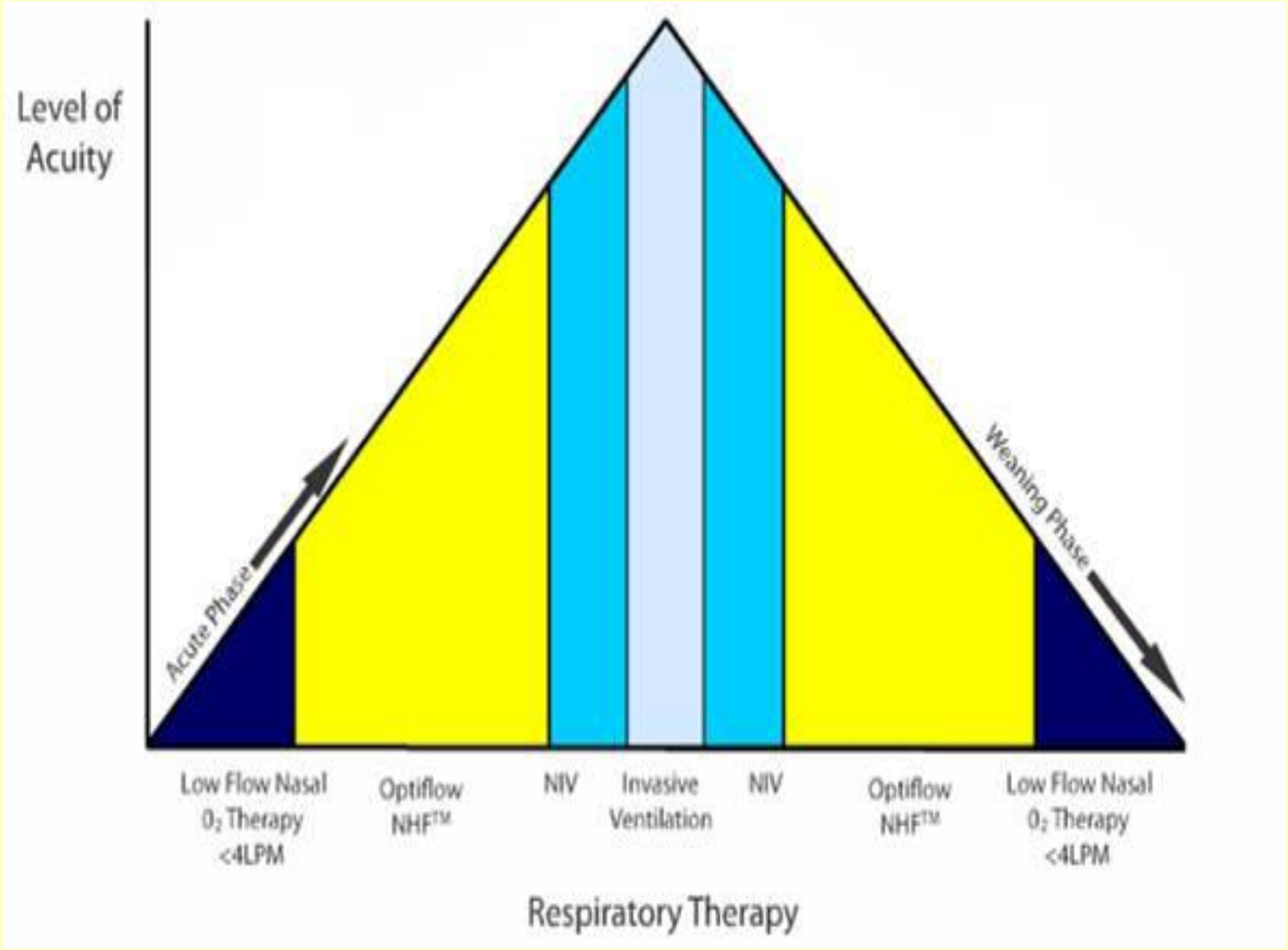
❖ May assist in more efficient gas exchange

Spentzas *et al*., 2009

Which patients?

- HFNC is a comfortable and effective means of delivering oxygen and humidification to infants and children in respiratory distress
- It provides a bridge between low flow O_2 therapy and CPAP/non invasive ventilation
- It MAY reduce the requirement for CPAP and intubation in some clinical scenarios, if used at the right time... (Abboud *et al*., 2012)


Level of Acuity
Acute Phase
Weaning Phase
Low Flow Nasal O_2 Therapy <4LPM
High Concentration Face Mask
NIV
Invasive Ventilation
NIV
High Concentration Face Mask
Low Flow Nasal O_2 Therapy <4LPM
Respiratory Therapy


Level of Acuity
Acute Phase
Weaning Phase
Low Flow Nasal 0_2 Therapy <4LPM
Optiflow NHF™
NIV
Invasive Ventilation
NIV
Optiflow NHF™
Low Flow Nasal 0_2 Therapy <4LPM
Respiratory Therapy

Cautions/ Contra-indications

- Maxillofacial trauma
- Complete nasal obstruction
- Basal skull fracture
- All contraindications to CPAP/ BiPAP apply

Patient group	Examples	Clinical issues	Presentation
Obstructive pulmonary disease	Bronchiolitis Asthma	Thick secretions Blocked airways (structural or secretions)	Mild /moderate hypoxaemia/ hypercapnoea ↑ WOB ↑ O_2 requirements
Restrictive pulmonary disease	Fibrosing alveolitis	↓ FRC ↓ Gas exchange	As above
Pneumonia	Influenza	Airway obstruction due to secretions Consolidation	As above
Atelectasis	Post op patient Trauma	V/Q mismatch Mucous plugging	As above

When to initiate?

- High oxygen requirement
- Increased work of breathing
- Poor tolerance of mask
- Patients who may benefit from humidity/assistance clearing secretions

- Do we really need a gas?

Delivering HFNC

Optiflow ™

Vapotherm ™

Optiflow™ and Vapotherm® are equally effective for weaning from NCPAP without increasing the risk of pneumothorax or bronchopulmonary dysplasia (Mahoney *et al.,* 2011)

Airvo™ and Airvo2™

- <u>Advantage</u> – does not require high pressure air source
- Air is entrained
- O_2 added via standard green bubble tubing

Delivering HFNC (Optiflow)

- Heated wire humidity delivery circuit

- F&P MR850 humidifier

- Air/Oxygen blender with standard or higher flow flow meter (<u>air and O_2 source</u>)

- Nasal cannula interface

Delivering HFNC (Airvo)

- Heated wire humidity delivery circuit
- O_2 source (cylinder or flow meter)
- Nasal cannula interface

Cannula size and recommended flow AIRVO

Description	Approx weight	Max Flow
Premature nasal cannula	<2kg	6-8 L/min
Neonatal nasal cannula	1-8Kg	8 L/min
Infant nasal cannula	3-15kg	20 L/min
Paediatric nasal cannula	12-22Kg	25 L/min

Management of HFNC
Don't forget the BASICS!

Baseline observations

- Respiratory rate
- Heart rate
- FiO_2
- SpO_2
- Work of breathing
- (Auscultation)

Level of support

- FiO_2
- Flow – (2litres/kg approx)
- Humidification temp
- Positioning
- Consider ↓ volume and ↑ frequency of feeds
- Regular reassessment and titration of support

Indicators of success

- Normalising respiratory and heart rates
- Improved work of breathing
- Improved SpO_2
- Reduction in FiO_2
- Timescale?
- Don’t flog!!
- ***Plan for deterioration***

Weaning (be flexible!)
In our experience...

First reduce FiO2

- Keep SpO_2 within normal limits
- Reverse change if ↓ SpO_2 or ↑WOB
- Wean until FiO_2 0.3 (depends on normal O_2 requirement)

Next reduce flow

- Reduce flow by 0.5 or 1.0 L at a time (more if tolerated)
- Reverse change if ↓ SpO_2 or ↑WOB
- Consider change to normal nasal cannula O_2 once flow at 2 L/min, with low FiO_2, normal SpO_2, and no ↑WOB
- Timescale varies +++

Caution!!

- At low flow rates (compared to the age/size of the patient), entrainment of room air will occur
- Therefore, accurate FiO_2 measurement is not possible

Where?

- **Any** area that has skilled clinicians capable of recognising the deteriorating (and improving) child 24 hours a day

Take home message

- Easy to set up and maintain
- Provides accurate Oxygen delivery
- Helps improve mucociliary clearance
- Can prevent intubation and mechanical ventilation if used at the right time
- If it's going to work, it will work quickly if the right level of support is given

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