# *Non-Invasive Ventilation (NIV)*

Ventilatory support without using an invasive artificial airway

## *Types*

**CPAP** = continuous positive airway pressure

- Tight fitting mask which delivers fixed positive air pressure to keep the airways open
- Indications: sleep apnoea; type 1 respiratory failure (e.g. acute pulmonary oedema)

**BiPAP** = bi-level positive airway pressure

- Similar to CPAP, but the air pressure increases during the patient's inspirations
  - **ePAP** = pressure during expiration
  - **iPAP** = pressure during inspiration
  - **Pressure support** = difference in pressure between ePAP and iPAP (i.e. the amount of 'help' given on inspiration)
- Indication: type 2 respiratory failure (e.g. COPD exacerbation) with acidosis (pH<7.35) or exhaustion despite optimal medical therapy

NB. The oxygen concentration in the air can be adjusted because tubing from an oxygen supply can plug directly into the machine

## *Background physiology*

Hypercapnia

**$pCO_2$ α minute volume**

**minute volume = respiratory rate x tidal volume**

Can't be affected by NIV

Can be increased by a higher NIV pressure support. Therefore **to reduce hypercapnia, iPAP can be increased** (relative to ePAP).

Hypoxia

**$pO_2$ α $FiO_2$ & PEEP**

Can be increased by increasing oxygen flow rate

PEEP = positive end expiratory pressure

**PEEP = CPAP = ePAP**

PEEP maintains alveolar recruitment which proportionally affects oxygenation of the alveoli. Hence, **to reduce hypoxia, CPAP/ePAP can be increased.**

## *Settings*

CPAP

- **Start at** $4cmH_2O$ and gradually increase to reduce hypoxia
- **Maximum of** $12cmH_2O$

BiPAP

- **Start at** $12/4cmH_2O$ (i.e. iPAP of $12cmH_2O$, ePAP of $4cmH_2O$) and gradually increase iPAP to $20cmH_2O$ or maximum tolerated
- **Maximum of** $20/12cmH_2O$
  - Increase iPAP to reduce hypercapnia
  - Increase ePAP to reduce hypoxia (but remember iPAP should also be increased proportionately to maintain the same pressure support which is what affects $CO_2$)

Oxygen

- **Titrate up to maximum of** 15L to aim for sats of 94-98% in non-COPD patients and 88-92% in COPD patients
    - For COPD patients on BiPAP, start at 2L oxygen and titrate up
    - For heart failure patients of CPAP, start using high flow oxygen and titrate down

## *Complications*

- **Too high CPAP or ePAP:** reduced venous return which can cause hypotension
- **Too high iPAP:** mask leak; stomach inflation leading which can cause aspiration (oesophageal opening pressure is 25cm$H_2O$)
- **Both:** patient discomfort; claustrophobia; pressure sores; dryness; pneumothorax

## *Contraindications*

- Undrained pneumothorax
- Severe epistaxis
- Vomiting
- Apnoea
- Severe agitation
- Unable to tolerate or fit mask
- Low GCS
- NIV should not be used for asthma (just delays inevitable intubation) or pneumonia (unless patient is not for intubation)

## *Monitoring required*

- Oxygen saturation monitoring (aim 88-92% in COPD patients, 94-98% in non-COPD patients)
- Regular arterial blood gasses (~30mins after each change to monitor $pCO_2$ and subsequent pH)
    - In COPD, aim $PaO_2$~8mmHg and improving pH
- Blood pressure (check not becoming hypotensive)
- Respiratory rate

## *Weaning off NIV*

- Once the medications have had time to work, NIV can be gradually weaned
- Options:
    - Give patient time off NIV and gradually extend time off (but not overnight as respiratory drive naturally decreases)
    - Gradually reduce pressures