Noninvasive ventilation and COPD

The British Thoracic Society (BTS) guidelines for noninvasive ventilation (NIV) provide overwhelming evidence that NIV is effective in supporting patients with acute hypercapnic respiratory failure (AHRF) (BTS, 2002). AHRF, which causes a rise in carbon dioxide levels and a fall in pH, is common in patients presenting with acute exacerbations of chronic obstructive pulmonary disease (COPD). NIV is also beneficial to patients with chest wall deformity and neuromuscular diseases.

Hypercapnia (raised carbon dioxide levels) associated with COPD is due to:
- The increased work of breathing causing respiratory muscle exhaustion;
- Low tidal volumes (the amount of air inhaled and exhaled during normal ventilation) because of airflow obstruction;
- Loss of elastic recoil in the lungs resulting in premature collapse of the smaller airways, which causes air to become trapped and hyperinflated (overly expanded lungs);
- Airway plugging due to retained secretions in the lungs.

What is noninvasive ventilation? In contrast to mechanical ventilation, NIV offers support to patients who can protect their own airway and are making some respiratory effort. Bi-level ventilators deliver a prescribed pressure or volume of air as the patient breathes in, called inspiratory positive airway pressure (IPAP). On expiration, a lower pressure or volume is delivered, called expiratory positive airway pressure (EPAP) (Fig 1).

IPAP supports the breath, improves tidal volume, maximises the removal of carbon dioxide, and reduces the work of breathing.

EPAP aims to act as a splint to collapsing airways on expiration – it reduces air-trapping, improves oxygenation and reduces the work of breathing. Oxygen can be added to the circuit if required. The pressure or volume can be increased or decreased according to the patient’s response to therapy.

The BTS guidelines (2002) recommend the use of pressure-controlled ventilators for the treatment of COPD as this can compensate for air leaks around the tightly fitting nasal or face mask, and the patient can receive the prescribed ventilation pressures.

Masks Correct sizing and fitting of the face or nasal mask is essential for the success of NIV. A variety of masks and sizing gauges are available. Some practitioners prefer to try a nasal mask first as it is less claustrophobic. If this is not successful, a full face mask is used. An exhalation valve is used with the mask to remove exhaled carbon dioxide. It is essential that the manufacturers’ instructions are carefully followed.

Monitoring and care with NIV The patient requires close monitoring and care, which includes:
- Continuous pulse oximetry for at least the first 24 hours to monitor oxygen saturation (BTS, 2002);
- Monitoring of arterial blood gases, which should show improvement within four hours. Pressures and oxygen concentration should be adjusted in response to results;
- Assessment of respiratory rate – a reduction in the rate indicates reduced work of breathing;
- Observation of chest wall movement – check that the patient is breathing with the ventilator (synchronous);
- Ventilate as much as possible in the first 24 hours;
- Breaks taken for meals, drinks, physiotherapy and medications;
- Protection of the bridge of the patient’s nose to prevent pressure ulcers;
- Reporting signs of patient discomfort or intolerance;
- Weaning, beginning when the patient is clinically stable.

Positive effects of NIV The use of NIV as a treatment for COPD can have a number of benefits:
- Rapid improvement of arterial blood gases and rapid reduction in the work of breathing and breathlessness;
- Reduced complications, mortality and length of hospital stay;
- Avoidance of endotracheal intubation, which leads to a reduction in demand for intensive care beds.

NIV can be delivered in non-critical care areas. However, current research recommends that patients with a pH of less than 7.30 should be managed in a higher dependency area (BTS, 2002; Plant et al, 2000).

[key words]
Acute hypercapnic respiratory failure
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REFERENCES

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Noninvasive ventilation (NIV) provides ventilatory support to patients via the upper airway using a mask or similar device. Increasingly, this treatment is being delivered in non-critical care areas. Anne Riches explains NIV and how it is used.

Nurses should consult local procedures and receive supervised training before using NIV.

[FIG 1. THE TWO PRESSURES DELIVERED THROUGH THE USE OF BI-LEVEL VENTILATORS]

Comparison of Expiratory and Inspiratory Positive Airway Pressure (EPAP and IPAP).

EPAP – Expiratory positive airway pressure
IPAP – Inspiratory positive airway pressure

IPAP set at 15cm H2O
EPAP set at 5cm H2O

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