

Why use non-invasive ventilation in acute respiratory failure?

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Non-invasive ventilation (NIV) is any form of ventilatory support applied to patients without the use of an endotracheal tube, including continuous positive airway pressure (CPAP) and pressure support ventilation (PSV) with or without positive end expiratory pressure (PEEP). Provided that patients receive adequate ventilatory assistance using NIV the problems associated with endotracheal intubation can be avoided. These include loss of airway defence mechanisms, ventilator-associated pneumonia, the risks of intubation and extubation, discomfort and sedative drugs. Providing NIV at an early stage on the general ward can prevent further deterioration and may avoid intensive care unit admission.

NIV has a clear role in the management of patients with acute exacerbations of chronic obstructive pulmonary disease. When compared to standard medical therapy on a general ward (Plant et al, 2000), patients receiving NIV required intubation less (15% vs 27% in the standard group) and had a reduced mortality (10% vs 20%). It can also reduce the need for intubation in patients with cardiogenic pulmonary oedema (Masip et al, 2000). Other roles for NIV in acute respiratory failure are less well studied. Emerging uses for NIV include the management of acute hypoxaemic respiratory failure, postoperative respiratory failure and during weaning from conventional ventilation (Evans et al, 2001).

The rationale for using NIV in a particular patient depends on their underlying pathophysiology and there are

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several ways in which it may be beneficial. In chronic obstructive pulmonary disease patients the positive pressure provided by CPAP or PEEP can overcome the effect of intrinsic PEEP in partially obstructed alveoli, decreasing the work of breathing, increasing tidal volume and resting the respiratory muscles. This leads to a decrease in respiratory rate and PaCO₂ (Evans et al, 2001). The addition of inspiratory assistance with PSV may further decrease the work of breathing. In cardiogenic pulmonary oedema NIV can improve cardiac output by lowering afterload, improving oxygenation and decreasing work of breathing (Masip et al, 2000). In hypoxaemic respiratory failure NIV may also improve PaO₂ by re-expanding collapsed alveoli.

Full face masks are better than nasal masks at providing a good seal in patients with acute respiratory failure. They reduce leaks which make monitoring tidal volumes and inspiratory/expiratory cycling in PSV easier. Many different ventilators and modes of ventilation have been used successfully: the method chosen should be familiar to the staff involved and tailored to patient need.

CPAP using a high flow circuit is the simplest and is effective for spontaneously breathing patients. PSV can be added to provide inspiratory assistance triggered by the patient's inspiratory effort, and mandatory breaths can also be imposed. PSV using flow- rather than pressure-triggered systems is preferable because of their greater sensitivity and pressure- rather than volume-limited modes are better at compensating for leaks and poor chest compliance. Monitoring should be dic-

tated by the location and the severity of illness but should include clinical assessment, pulse oximetry, arterial blood gases and appropriate equipment alarms.

NIV is contraindicated in patients who require intubation as a result of cardiac or respiratory arrest, in severe non-respiratory organ failure and possibly in basal skull fracture. Patients must be conscious, be able to cough and protect their own airway. Facial surgery or deformity may make NIV impossible. Complications of NIV include trauma to the nose and eyes from a tight mask and gastric distension. Failure can occur because of inability to tolerate the mask, leaks, or worsening respiratory failure. Despite NIV 15% of patients may eventually require intubation (Plant et al, 2000).

In the UK NIV is frequently performed on a general ward, but this requires additional staff training and resources, and probably a greater nursing workload. Patients with more severe respiratory acidosis (pH <7.30), and those that fail to improve or deteriorate in the first few hours are better managed in the intensive care unit (Evans et al, 2001). **HM**

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Masip J, Betbese AJ, Paez J et al (2000) Non-invasive pressure support ventilation versus conventional oxygen therapy in acute cardiogenic pulmonary oedema: a randomised trial. *Lancet* **356**: 2126-32

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