Using non-invasive ventilation on acute wards: how to provide an effective service

Non-invasive ventilation is now used to treat acute type 2 hypercapnic respiratory failure on acute wards. Setting up a successful service is vital to ensure quality care.

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Non-invasive ventilation is increasingly used on acute wards to treat patients with acute type 2 hypercapnic respiratory failure. This article highlights the main factors that should be considered in providing an acute NIV service outside of a critical care setting.

Non-invasive ventilation (NIV) is now used on acute wards as well as critical care units as a first line treatment for patients with acute type 2 hypercapnic respiratory failure (AHRF) (Royal College of Physicians et al, 2008). There is a strong evidence base for using it to treat chronic obstructive pulmonary disease (COPD), and it is also used to treat other causes of AHRF (British Thoracic Society Standards of Care Committee, 2002). The indications for using this treatment are listed in Box 1.

NIV is a form of mechanical ventilation that uses a ventilator connected to a well-fitting facemask rather than an endotracheal tube. It allows patients to breathe spontaneously and each breath triggers the ventilator to produce an inspiratory positive airway pressure, resulting in increased tidal volume and improved ventilation. As it is bi-level it leaves a second set pressure in the airway on expiration — that is, expiratory positive airway pressure — which splits the smaller airways. These can collapse when patients breathe out, preventing air leaving distal alveoli where gaseous exchange occurs. If the respiratory rates fall below a set level, ventilators can be set to give back up breaths.

**Evidence for NIV Services**

A 24 hour NIV service should be available in hospitals admitting patients with AHRF (RCP et al, 2008; BTS Standards of Care Committee, 2002). The benefits of such a service for patients and the health service are outlined in Box 2.

Outcomes of NIV treatment depend on a number of factors, including:

- The severity of the exacerbation (identified by arterial blood gas analysis);
- The number of comorbidities or coexisting problems such as pneumonia;
- The setting in which NIV is delivered.

NIV can be successfully delivered in respiratory and general wards, critical care areas and in accident and emergency departments (Elliot, 2005). Patients must be assessed to ensure they are treated in an appropriate clinical setting (RCP et al, 2008). Patients with severe acidosis (pH<7.26) have poor outcomes with reduced survival (RCP et al, 2008; Plant et al, 2000). It is recommended they be managed in a critical care environment with higher staffing levels, where treatment can be rapidly escalated.

**Box 1. Indications for use**

Non-invasive ventilation can be used to treat acute type 2 hypercapnic respiratory failure as a result of the following conditions:

- Chronic obstructive pulmonary disease;
- Neurally mediated disease;
- Chest wall deformities such as kyphoscoliosis;
- Decompensated sleep apnoea or obesity hypoventilation;
- Cardiogenic pulmonary oedema responsive to continuous positive airway pressure.

**Practice Points**

- Nurses on acute wards have an important role in providing acute non-invasive ventilation for acute type 2 hypercapnic respiratory failure.
- Setting up a service with good support structures, local protocols, audit and training helps ensure the safe delivery of effective NIV.
- Patients require assessment before being started on NIV on an acute ward.

Local protocols based around national guidance should be developed, agreed and reviewed (RCP et al, 2008), and should include indications for NIV, exclusion criteria and clinical settings where it can be delivered.

The key factors in delivering a successful NIV service are clinical experience (Antonelli et al, 2005; Elliot et al, 2002) and a comprehensive training programme (Elliot et al, 2002).

It is difficult to calculate the ratio of staff to patients needed to provide NIV on acute wards. Ten years ago, a study on general respiratory wards suggested that starting NIV increased the nursing workload by only 26 minutes in the first eight hours, with no difference after this time (Plant et al, 2000).

Arguably, patient dependency on acute wards has increased since this study and nurses now manage increasing numbers of patients who are older and sicker.

There is no established evidence based method of calculating the staff levels required to provide acute NIV services.

**Assessment for NIV**

The decision to start NIV should be made after assessment by a doctor at specialist training level 2, taking into account:

- Patients’ premorbid state;
- The severity of any psychological disturbance;
- The potential to reverse acute illness;
- Any contraindications to NIV;
- Patients’ wishes (BTS Emergency Oxygen Guidelines Group, 2008).

Inappropriate patient selection will fail to produce favourable outcomes, may result in adverse outcomes and will affect staff morale.

The decision on the ceiling of treatment and resuscitation status needs to be documented as early as possible. Escalation of treatment may be inappropriate if patients are near the...
end of life so they need to understand the potential outcomes and give consent. If intubation and mechanical ventilation is considered, involving intensive care doctors at an early stage is recommended.

**Optimising medical treatment**

It is essential to optimise medical treatment, such as bronchodilators and steroids (for managing COPD), and carry out blood tests, including blood gases, and chest X-rays before considering NIV. Other treatments may be needed, such as antibiotics to treat infection or diuretics for pulmonary oedema.

Oxygen must be titrated to maintain a target saturation (SpO₂) of 88-92%. This ensures adequate hypoxaemia treatment while minimising the risk of high oxygen concentrations increasing hypercapnia and worsening acidosis. Reducing oxygen concentrations to achieve this target is likely to improve acidosis and may exclude the need for NIV (BTS Emergency Oxygen Guidelines Group, 2008).

Patients presenting with a critical illness should be treated with high concentrations of oxygen until stable and re-evaluated at the earliest opportunity. Repeat blood gas should demonstrate a respiratory acidosis before proceeding with NIV.

**CONTRAINDICATIONS TO NIV**

There are no absolute contraindications to NIV (Elliot, 2005) although guidelines do suggest very careful consideration with certain groups. Cautions associated with NIV are listed in Box 3.

**SELECTING EQUIPMENT**

There are numerous ventilators available to deliver NIV but selecting one model for use across a hospital simplifies training, makes it easier for staff and reduces the risk of errors as staff are familiar with equipment.

It is important to have a selection of masks as an appropriate and well fitting mask is essential for effective treatment. Styles of mask include: full face, covering nose and mouth; nasal, covering the nose (Fig 1); and total face, covering nose, mouth and eyes (Fig 2).

A poor fitting mask leaks, compromising ventilation and patient comfort, and can result in skin damage.

Most patients will start with a full face or total face mask as many are mouth breathers. Those using a nasal mask must have a patent nasal airway and no nasal congestion. They must also be able to keep their mouth closed or tolerate using a chin strap to minimise leaks.

**PATIENT MONITORING**

Nurses must monitor patients’ respiratory rate, level of consciousness, chest wall movement and accessory muscle use and comfort every 15 minutes after NIV starts; this frequency can be reduced as their condition improves.

Pulse oximetry and electrocardiogram monitoring should be continuous for the first 12 hours. Blood gases must be taken one hour after starting NIV, after setting changes and then every 4-6 hours once patients are stable. It is important to monitor for leaks around the mask and that patients’ breathing and the ventilator are synchronous.

**DISCONTINUING NIV**

NIV should be continuous for the first 24 hours with short breaks to eat, drink, attend to hygiene needs or receive other treatments. It is helpful to discontinue NIV during the day as patients are more vulnerable to deterioration at night. Sometimes weaning may take a number of days. A small number of patients who are repeatedly admitted for AHRF may need to be assessed for home NIV (BTS Standards of Care Committee, 2002).

**CONCLUSION**

Nurses on acute wards have an important role in providing acute NIV for the treatment of AHRF. Setting up a well run service with good support structures, local protocols, audit and training on the essential components is crucial. Adequate resources are important but there is no method to calculate minimum staffing levels required.

**REFERENCES**


**FIG 1. NASAL FACE MASK**

**FIG 2. TOTAL FACE MASK**

**BOX 2. BENEFITS OF AN ACUTE NON-INVASIVE VENTILATION SERVICE**

- Improved survival.
- Reduced need for endotracheal intubation and mechanical ventilation.
- Reduced length of hospital stay.
- Reduced hospital costs.
- Patients feel less breathless and can have a break to eat, drink or receive other treatments such as physiotherapy or nebulisers.

**BOX 3. CAUTIONS LINKED TO NON-INVASIVE VENTILATION**

- Upper airway obstruction.
- Vomiting.
- Copicous respiratory secretions.
- Facial: trauma/burns/recent surgery.
- Patient is in the last days or hours of life.