Non-invasive ventilation is increasingly being used to treat people with chronic obstructive pulmonary disease at home, both in the UK and worldwide, despite a lack of evidence supporting its use in this setting (Crimi et al, 2016). This article explores the issues around providing NIV to people with COPD in their own homes, concluding that national guidance on home NIV and better training of professionals is needed.

Non-invasive ventilation (NIV) is increasingly being used to manage patients with COPD at home, but the evidence base is poor and competent professionals are insufficient in number.

Issues of home-based non-invasive ventilation

In this article...
- How non-invasive ventilation (NIV) works
- The rationale for using NIV in the home setting
- Challenges of home NIV for patients with COPD

Non-invasive ventilation (NIV) is increasingly being used to treat people with chronic obstructive pulmonary disease at home, both in the UK and worldwide, despite a lack of evidence supporting its use in this setting (Crimi et al, 2016). This article explores the issues around providing NIV to people with COPD in their own homes, concluding that national guidance on home NIV and better training of professionals is needed.

Non-invasive ventilation can improve the efficiency and length of a person’s sleep.
Effects of NIV on respiratory physiology.

NIV boosts oxygenation. Table 1 describes the effects of NIV on respiratory physiology.

**Rationale behind home NIV**

NIV is increasingly being used in the home setting due to the development of smaller, portable machines and improvements in the masks available for patients to use. Companies that supply the technology for home NIV also support health professionals and patients in their own environment so these patients can remain at home. This support includes telephone and web-based support and assistance with downloading data from machines.

Numerous studies have examined the use of NIV in the non-acute environment, but most of them have been criticised for being too small and having inappropriate patient selection and significant follow-up issues (Agency for Clinical Innovation (ACI), 2012). To develop its consensus statement on domiciliary NIV, the ACI (an Australian organisation) reviewed several studies. While these showed no survival benefit from home NIV, no evidence to reject it was found either.

The ACI seems to suggest that home NIV can reduce hospital admissions; this is supported by Funk et al (2011), who found that the withdrawal of home NIV was associated with a worsening of symptoms. In their cost-effectiveness study, Dretzke et al (2015) concluded that the evidence for home NIV is unclear, and that further work is needed to identify the best time to start therapy and which patients may benefit from it. Struijk et al (2013) found no evidence to support the use of home NIV in stable patients with COPD, but did suggest a series of theories explaining why it is increasing in popularity, despite the lack of evidence in support of it. These theories are given in Box 1.

Home NIV aims to relieve nocturnal hypoventilation and maintain adequate oxygen saturation, thereby improving nocturnal gaseous exchange and resting the respiratory muscles (Comer, 2013). This forms some of the rationale for the decision to start NIV in patients’ homes.

### Who is a suitable candidate?

Starting patients on home NIV or sending them home on NIV is not without its problems. Patients’ home environments or lifestyles are paramount when considering home NIV. There is a dearth of evidence and discussion in literature on these issues, and a lack of guidance about when and for whom home NIV is appropriate.

The ACI (2012) says home NIV can be considered for people who have had two or more hospital admissions requiring NIV, and in people who have had difficulty being weaned off invasive ventilation; patients with COPD who have sleep-disordered breathing may also benefit. However, not all patients who have been admitted twice or more with acute respiratory failure needing NIV will be good candidates for home therapy. Some patients may be considered for home NIV after one admission only, while others may never be suitable candidates. The lack of guidance makes decision making difficult, and a team decision is needed for each individual case.

Each person’s suitability for home NIV needs to be checked; Road et al (2011) suggested there should be a transition during which the health professional in charge checks patients are suitable candidates. Consideration of the underlying disease and comorbidities, along with a clear rationale for the goal of therapy is essential. Health professionals need to think about what they are trying to achieve.

Another factor to consider is psychological status, as patients with COPD often feel high levels of anxiety and distress. Is NIV going to reduce their anxiety or make it worse? And, most importantly, do they want NIV? Box 2 lists a range of questions that can help assess patients’ suitability.

### Educating and monitoring

Once the decision to start home NIV has been made, patients and carers/families will need training in how to use the ventilator and related equipment (tubing, mask, etc). They will need to understand:

- What it is meant to achieve;
- What the alternatives are if it does not work or if they struggle with it.

The likely disease progression and its consequences need to be explained: how do patients recognise worsening symptoms? What should they do if this happens? Finally, care and maintenance of the equipment also needs to be discussed. Verbal information should be complemented by clear, written information at every opportunity. Signposting patients and families/carers to organisations, such as the British Lung Foundation (www.blf.org.uk) can also be useful. Patients will need to be regularly reviewed by a practitioner competent in the use of NIV to...

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**TABLE 1. EFFECTS OF NIV ON RESPIRATORY PHYSIOLOGY**

<table>
<thead>
<tr>
<th>Overall effects</th>
<th>Specific effects EPAP</th>
<th>Specific effects IPAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Decreases total lung resistance</td>
<td>● Decreases work of breathing</td>
<td>● Decreases work of breathing</td>
</tr>
<tr>
<td>● Increases lung compliance</td>
<td>● Improves V_e</td>
<td>● Improves V_e</td>
</tr>
<tr>
<td>● Decreases work of breathing by decreasing the energy needed to re-inflate the alveolar sacs with each inspiration</td>
<td></td>
<td>● Increases functional residual capacity (recruits collapsed alveoli) and improves VQ matching (more alveoli are ventilated in addition to being perfused)</td>
</tr>
<tr>
<td>● Increases end-expiratory lung volume</td>
<td></td>
<td>● Decreases elevated CO2</td>
</tr>
<tr>
<td>● Prevents expiratory alveolar collapse</td>
<td></td>
<td>● Creates a dynamic pressure via a transitional flow</td>
</tr>
<tr>
<td>● Alveolar patency throughout both phases of the respiratory cycle allows more time for gas exchange (causing increased arterial oxygenation and CO2 elimination)</td>
<td></td>
<td>● Treats hypoxaemia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>● Creates static pressure via a fixed flow</td>
</tr>
</tbody>
</table>

CO2 = carbon dioxide, EPAP = expiratory positive airway pressure, IPAP = inspiratory positive airway pressure, V_e = minute ventilation, VQ = ventilation quotient.

Source: Adapted from Mace (1999)
ensure patient comfort, compliance and appropriate clinical response. Generally, a review is undertaken 4-6 weeks after setting up home NIV, at three months and then at six months when the patient is stable. Patients should be able to contact the practitioner if they have any concerns.

Depending on symptoms and blood gas results, machine settings might need to be changed. Regular review of the mask will ensure that it, too, is still fit for purpose.

Many NIV machines store and issue data on how much the patient is using NIV and how effective it is. This data can be accessed remotely and used to guide management. Private companies do this in some clinical areas, while in others it is managed by local health authorities. Whatever system is used, mechanisms need to be in place to ensure the practitioner responsible for the patient reviews looks at the data and derives clinically useful information from it as much as possible.

End-of-life issues

COPD is a chronic, progressive illness and hypercapnic exacerbations are likely to occur at a late stage in the disease trajectory so end-of-life issues should be discussed. As there are many ethical challenges with this, it would seem appropriate to follow guidance from the field of palliative and end-of-life care (Spathis and Booth, 2008).

Being diagnosed with end-stage COPD does not preclude the use of NIV, as it can help reduce hospital admissions and improve quality of life – a key goal of end-of-life care. Davidson et al (2016) state, however, that, although justifiable, using NIV to relieve pain and distress in patients at the end of life can be difficult. Stopping therapy is fraught with difficulties. End-stage COPD is often accompanied by high levels of anxiety and it is not uncommon for patients with end-stage disease to increase their use of NIV and become almost entirely dependent on it; some might use NIV for up to 22-23 hours a day, only coming off it briefly for meals.

Before starting therapy, professionals and patients/families must discuss what is to be achieved by NIV and whether it might be suitable to stop it. Treatments that can help patients when NIV is stopped – such as opioids and benzodiazepines – should also be discussed. This can be extremely challenging for patients and their families/carers as they may not be at a stage where they want to have conversations about the end of life. Treating them as partners in the discussion and decision-making process is essential to prevent unnecessary distress.

Training professionals

Patients need support, not just from their families/carers but also health professionals. This is a challenge, as there is a lack of health professionals who are competent and confident in managing patients on long-term NIV in the community. To increase the use of home NIV, we must train all practitioners likely to come into contact with it – these include community nurses, GPs and practice nurses. Training must take place at different levels, depending on what is expected of health practitioners; for example, all practitioners should be able to check mask fit but being able to decide on changing the patient’s care setting based on test results should only be expected from advanced practitioners.

Conclusion

Despite the lack of evidence on home NIV for people with COPD, its use is rising both nationally and internationally (Crimi et al, 2016). As more people live longer with COPD and hypercapnia, this trend is likely to continue. With little guidance to inform the decision-making process, this is an area fraught with problems. The time has come to develop formal national guidelines on home NIV. Given the current lack of robust evidence, this will be challenging despite there being pockets of good practice around the UK and Australian and Canadian groups having developed position statements. However, this would encourage consistent practice nationwide and help inform future research.

References


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