Guidelines for Health Organizations: European Perspectives and Experience in Pandemics

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41.1 Introduction

In Europe, the rate of noninvasive ventilation (NIV) use in intensive care units (ICUs) is about 35 % for ventilated patients and higher (roughly 60 %) in respiratory ICUs or emergency departments. In North America, this form of ventilation is begun most often in emergency departments (EDs), most patients being transferred to the ICU or step-down units in hospitals with such facilities. This low rate of use in some hospitals is related to scarce knowledge on or experience with this technique, insufficient technical equipment, and inadequate funding. Despite these limitations, NIV is increasingly being used outside traditional and respiratory ICUs, including EDs, postsurgical recovery rooms, cardiology, neurology, and oncology wards, and palliative care units.

41.2 Analysis

Approximately 10–30 % of hospitalized patients with H1N1 virus infection require admission to the ICU (where available). Critically ill patients include those suffering from rapidly progressive lower respiratory tract disease, respiratory failure, and acute respiratory distress syndrome (ARDS) with refractory hypoxemia [1].

Before the severe acute respiratory syndrome (SARS) outbreak in 2003, there was no evidence to support the idea that the use of NIV might increase the risk of

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infectious disease transmission. Despite the paucity of epidemiological data, the idea that NIV leads to increased occupational risk has gained currency. In fact, some organizations such as the Canadian Diseases Advisory Committee have published recommendations to avoid NIV in patients with febrile respiratory illness [2]. Other studies show that NIV can be used effectively and safely in such situations by applying strict infection-control procedures [3–5].

The European Society of Intensive Medicine and the European Respiratory Society guidelines recommend when NIV should be considered (or not) after reviewing studies following the last H1N1 pandemics in Europe [6]: NIV must not be considered in patients with severe hypoxemic acute respiratory failure (ARF), rapid development of ARDS, or multiorgan failure. Invasive ventilation is recommended for these patients. NIV may be considered to prevent further deterioration and intubation needs in patients with mild-to-moderate hypercapnic ARF due to cardiogenic pulmonary edema or exacerbation of a chronic respiratory disease secondary to H1N1 infection in the absence of pneumonia, multi-organ failure (MOF), or refractory hypoxemia. It can also be used to prevent postextubation respiratory failure in patients with resolving ARDS secondary to H1N1 infection, preferably when patients are no longer contaminated.

There is growing concern about droplet dispersion during NIV, but it is important to note that similar exposures may occur during routine oxygen therapy by mask, coughing or sneezing, or procedures such as bronchoscopy and aerosol delivery.

Recommendations for droplets include patient isolation with protective measures for health care providers and other patients, use of double-circuit tubes and special filters for nonrebreathing devices, minimization of leaks, preferably full-face mask or helmet interfaces, avoidance of heated humidifiers, and disposing of mask and tubes after use according to routine infection control procedures [7].

The Spanish Society of Intensive Care Medicine, after collecting data from its hospital network, developed a document with recommendations for the management of severe complications in the H1N1 flu pandemic [8]. The document states that:

> …noninvasive mechanical ventilation cannot be considered a technique of choice in patients with acute respiratory distress syndrome, but could be useful in experienced centers and in cases of respiratory failure associated with exacerbation of chronic obstructive pulmonary disease or heart failure. It can be used in highly experienced centers, with appropriate helmet-type interfaces and patients who have reported very good results, although only in a few cases.

The use of NIV and its risks have been discussed in many documents. In 2009, the Scottish government published a guide on NIV in pandemic flu patients. The recommendations on NIV are somewhat complex, but they ultimately suggested that NIV could be used effectively and safely in such situations under strict infection-control procedures. These conclusions were reached in the United Kingdom are shown in Table 41.1 [9]. The recommended equipment and materials are shown in Table 41.2.

In some circumstances, a continual leak of unfiltered gas from the exhalatory circuit may be anticipated, and consideration should be given to adopting a policy

Table 41.1 Conclusions of guidance on infection control for critical care and NIV of Scottish Government and Health Protection Scotland

Staff should be trained in infection control.
Gown, gloves, and eye protection should be worn for all aerosol-generating procedures. The use of an FFP3 respirator instead of a surgical mask may be advisable until there are data that allow better assessment of the risk associated with the various procedures.
Patients should be managed in negative-pressure single rooms with anterooms, where this condition is available. If such facilities are not available, the patients should be cared for in standard single rooms or, if there is no other option, in cohorted groups.
A nonvented patient mask or helmet should be used.
Although bilevel pressure support (BiPAP) NIV is likely to be preferred, CPAP ventilation may be used in certain circumstances. A high-efficiency bacterial/viral breathing system filter (BS EN 13328-1) should be used between the nonvented mask and the expiratory port and at the outlet of the ventilator.
Expiratory port options include a whisper swivel or controlled leak valve (each with a proximal filter, as above). Ideally, expiratory flow should be directed through a single jet away from patients and staff.
NIV masks should be applied to the patient's face and secured before the ventilator is turned on.
Double-tube circuit ventilators may be advantageous.
The ventilator should be turned off before removing the close-fitting mask or when lifting the mask away from the face (e.g., for mouth care or fluid sips).
Water humidification should be avoided.

Table 41.2 Recommended equipment and material for infection control in critical care patients

Disposable patient respiratory equipment must be used wherever possible.
Reusable equipment must be decontaminated in accordance with local policy and the manufacturer's guidelines.
Closed systems should be used wherever possible (e.g., suction).
All respiratory equipment used on patients, including transport ventilator circuits and manual resuscitation aids, should include a high-efficiency bacterial/viral breathing system filter (BS EN 13328-1).
Breathing filters should be changed in accordance with the manufacturer's guidelines.
The ventilatory circuit should not be broken unless absolutely necessary.
Staff should be alert regarding power supply due to unplanned breathing circuit disruption: (1) Breathing circuits should be checked regularly for tightness of fit in component parts. (2) Caution is necessary when moving or performing other care on ventilated patients to minimize the risk of accidental disconnection.
For planned circuit breaks, appropriate PPE and FFP3 respirators should be worn as for aerosol-generating procedures.
Procedures for the rapid deployment and use of appropriate PPE and FFP3 respirators in the event of an unplanned breathing circuit disruption should be developed and rehearsed.

for the staff working close to the patient of wearing FFP3 respirators and eye protection for extended periods throughout a shift. Examples of leaks of unfiltered gas include: (1) situations where no bacterial/viral filters are available and therefore

ventilator circuits have to be used unfiltered and (2) when high-frequency oscillatory ventilators are used.

The World Health Organization recommends special considerations in NIV-treated patients, including additional precautions in EDs and ICUs [10].

- Noninvasive ventilation [bilevel positive airway pressure (BiPAP), continuous positive airway pressure (CPAP)]: standard and droplet precautions unless indicated otherwise by new evidence of increased transmission risk.
- Nebulization: standard and droplet precautions. Nebulizer treatment should be performed in an area that is physically separated from other patients (e.g., treatment room, screened enclosure).

In relation to supportive therapies for hypoxemia treatment, oxygen support is recommended but with no distinction between invasive and noninvasive ventilation, except in lung-protective ventilation strategies [1].

Regarding NIV in pandemics, Italian and French guidelines refer to the World Health Organization or the Centers for Disease Control and Prevention for its implementation, without further information.

Conclusions

The currently suggested best practice for NIV delivery in patients with pandemic flu pneumonia in Europe are summarized in Table 41.1. After a revision of the necessary organization and infrastructures in case of a pandemic, the following conclusion was drawn: Each hospital bed must dispose of its oxygen supply and suction, especially in areas involving expected NIV use [11].

Key Major Recommendations

- Noninvasive mechanical ventilation cannot be considered a technique of choice in patients with ARDS but could be useful in experienced centers and in cases of respiratory failure associated with exacerbation of chronic obstructive pulmonary disease or heart failure.
- It is preferable to perform NIV using an appropriate helmet-type interface.
- Concerning droplet dispersion during NIV, similar exposures may occur during routine oxygen therapy by mask or procedures such as bronchoscopy and aerosol delivery.
- Water humidification should be avoided.
- All respiratory equipment used on patients, including transport ventilator circuits and manual resuscitation aids, should include a high-efficiency bacterial/viral breathing system filter (BS EN 13328-1).

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