Interfaces for noninvasive ventilation: Does it matter?

Interfaces para ventilação não-invasiva: Faz diferença?

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The reintroduction of interfaces other than the endotracheal tube to provide continuous positive airway pressure (CPAP) or noninvasive ventilation (NIV) remains one of the greatest advances in the care of patients with acute respiratory failure. The initial reports of the effectiveness of NIV, published in 1989,[1] were followed by a number of case series in the early 1990s, after which there was an exponential rise in the number of publications regarding this technology. Recent ssystematic reviews clearly support the use of NIV for patients presenting with severe exacerbations of COPD or cardiogenic pulmonary edema.[2,3] Randomized controlled trials involving acute respiratory failure patients without either of these diagnoses are few in number and have evaluated small patient samples. Although this does not suggest a lack of effectiveness of NIV in other patient populations but rather a lack of high-quality evidence, the success of NIV is undoubtedly related to the population being treated, the ventilatory technique used and the NIV interface adopted.[4]

As a therapeutic intervention, NIV is more complex than a pharmaceutical agent. To optimally apply NIV, a learning curve is necessary, and centers documenting their experience report better outcomes over time despite treating increasingly sicker patients.[5] Such centers are believed to achieve better outcomes as a result of a superior approach to patient selection, as well as to NIV application, titration and weaning. The application of NIV includes the fitting of the interface and the choice of the mode of ventilation. The latter will also include a decision on what the starting pressures or volume settings will be, as well as how to optimally titrate these settings to predetermined goals. Greater expertise is believed to translate into better patient compliance and more favorable outcomes.

In the past, the noninvasive interfaces most widely used were the nasal and oronasal masks. Except in the intensive care unit (ICU), nasal masks were most often used for the chronic ventilation of patients with restrictive lung disease and for the application of CPAP in those with obstructive sleep apnea. With the advent of a portable, bilevel, pressure support ventilator for obstructive sleep apnea, the potential for ventilation in the acute setting was recognized, and nasal masks were often the first choice of physicians more familiar with this interface. Independent of this course of evolution, other centers began to use their ICU ventilators to provide NIV. The difficulties caused by leaks in these earlier ventilators called for the use of oronasal masks, which had to be tightly fitted, resulting in a significant risk of skin breakdown. As NIV has become better established, interfaces and ventilators have evolved, allowing more comfortable application of the technique. Currently, the clinician is presented with a variety of potential interfaces, including mouthpieces, nasal masks, nasal pillows, orofacial masks, full face masks (sometimes referred to as total face masks) and helmets. Which should be used—and does it really matter?

In this issue of the Brazilian Journal of Pulmonology, Holanda et al. report their trial designed to determine the relative incidence, type and intensity of short-term adverse effects related to three interfaces (nasal mask, oronasal mask and full face mask), as well as evaluating their relative comfort.[6] To that end, they conducted a well-designed randomized crossover study of 24 healthy subjects, testing six possible sequences involving the three different interfaces and two different pressure settings (for expiratory positive airway pressure—EPAP—and inspiratory positive airway pressure—IPAP—levels): low-pressure (EPAP of 6 cmH_2O and IPAP of 11 cmH_2O); and high-pressure (EPAP of 10 cmH_2O and IPAP of 15 cmH_2O). They also used a tool, which they had developed previously and adapted for use in this study, to assess short-term adverse effects. They found no differences among the masks in terms of comfort scores or of their effects on respiratory rate, heart rate and oxygen saturation. End-tidal CO_2 levels were lowest for the full face mask and highest for the nasal mask. No differences in adverse effects were observed. Predictably, the

full face mask avoided pain about the bridge of the nose, as well as presenting no air leaks around the eyes and mouth. Although oronasal dryness and claustrophobia were noted to be greatest with the full face mask, it is important to note that humidification was not used in this study, and that the ventilation was only of short duration (20-25 min). This study adds to the current literature, suggesting that humidification be considered when the full face mask is used. Overall, it supports the use of the full face mask as a reasonable alternative to the nasal or oronasal mask, especially if there are problems related to pain about the bridge of the nose or air leaks into the eyes.

The optimal interface for NIV has yet to be identified. Although studies of healthy volunteers provide important information,[6,7] how well their findings can be generalized to the population of patients in acute respiratory distress is unclear. Most studies, including the one presented by Holanda, et al.,[6] employ a randomized, crossover design where each subject receives each interface studied in a random order, with an interval between each test to allow for washout of the effect from the previous test.[6-9] The advantage of this design is that the subjects act as their own controls, which has the potential to minimize confounding and also requires fewer subjects in total. The potential problem with this design is the assumption that, between study periods, there are no changes that would affect the outcomes studied. By definition, the patient should be stable, since fluctuations in clinical status would significantly confound the findings. As a result, such studies involve normal subjects or patients that have become stable on NIV for a period of time. The question the clinician ideally would like to have answered is this: "Which interface is the best to use for my patient in acute respiratory failure to ensure optimal compliance with NIV and thus avoid intubation and ventilation?" Studies involving normal subjects or patients who have already demonstrated an ability to tolerate NIV can provide only indirect answers. In two studies involving patients with acute respiratory failure, nasal masks were compared with full face masks and with oronasal masks, respectively,[10,11] both studies using the more conventional parallel group randomized controlled trial design. The first of those two studies examined patients with acute exacerbations of COPD and found no difference between the interfaces, although only 14 patients were studied.[10] In the second study, a mixed population of 70 patients with respiratory failure was evaluated, the majority presenting with either pulmonary edema or acute exacerbation of COPD.[11] In that study, mask intolerance was greater when the nasal mask was used, primarily due to persistent air leakage through the mouth.

In summary, although the potential of the interface to influence patient tolerance of NIV, as well as to alter its benefits, is generally accepted, evidence in the literature supporting one interface over another is limited. Most studies provide only indirect information, since they involve healthy individuals or clinically stable patients, neither of which represents the population of interest to the clinician. The findings of one study support the common belief that, in the dyspneic patient, nasal masks are less well tolerated than are oronasal masks.[11] Beyond this, we still have the options of oronasal mask, full face mask or helmet for the patient in respiratory failure. We need more studies using a parallel design, with an adequate sample size and involving patients with acute respiratory symptoms or respiratory failure at the time of initiation of NIV. We would also suggest that the patient populations studied be reasonably homogeneous, since it might be that different masks do make a difference in some populations and not in others (e.g., COPD patients versus those with acute lung injury). Although studies that include hard outcome measures such as need for intubation and hospital survival are warranted, the outcome measures evaluated in the study by Holanda et al. (comfort and adverse effects) should also be considered, since they are more sensitive and continue to be important to the patient.

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