Interfaces in non-invasive ventilation: one mask doesn't fit all

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Non-invasive ventilation (NIV) has become a standard of care in acute respiratory failure (ARF) caused by chronic obstructive pulmonary disease (COPD) exacerbations[1] or acute cardiogenic pulmonary edema, and in immunocompromised patients with ARF who are at high risk for infectious complications from endotracheal intubation [2]. NIV can also be used to facilitate extubation in patients with hypercapnic respiratory failure[3]. Furthermore, even though the evidence in other situations is less strong, NIV has been used to treat patients with ARF caused by other diseases. In general it can be considered as an important respiratory support tool that may help to decrease intubation rates and may even reduce mortality in some populations. In fact, its use is continuously increasing, not only in the critical care setting [4] but also in the home [5].

Several factors have been associated with the success or failure of NIV, such as underlying disease, the severity of respiratory failure, the type of the ventilator and its set-up, and the interface used. The choice of interface should be based on the patient's face shape, the presence of a mouth or nasal breathing pattern, the existence of nasal alterations and the patient's perceptions of comfort with the various options available [6]. Intentional air leaks are incorporated in mask design and NIV circuits in order to permit CO_2 removal. In contrast, unintentional air leaks around the edge of the mask can generate serious problems. It is also important to bear in mind that the higher the level of pressure used in the ventilator, the greater the likelihood of unintentional leaks. Moreover, as the volume of unintentional leak increases, the ventilator needs more time to achieve the set-up inspiratory pressure, and so the inspiratory time increases. This is an important cause of the patient-ventilator asynchrony that leads to NIV failure. On the other hand, smaller leaks increase rebreathing and may also be an important cause of NIV failure.

In this issue of Minerva Anestesiologica, Médrinal C et al[7] present a double-blinded randomized controlled pilot trial comparing the carbon dioxide rinsing capacities, as well as comfort, of three of the latest oronasal masks designed for NIV use at home in a small group of healthy volunteers. Non-invasive ventilation was applied under the

same ventilator settings but for three different 10-minute periods, each time using one of the analyzed masks in a random sequence. Each 10-minute period was separated by five minutes of rest. Respiratory variables, transcutaneous capnography ($PtcCO_2$) and comfort were assessed at the end of each 10-minute period. At the same pressure level, significant differences in the level of unintentional leak and perceived comfort were observed. In contrast, no differences in $PtcCO_2$ were observed between the three masks, suggesting that, with these masks, the level of pressure used might provide the sufficient flow to avoid rebreathing [8]. Significantly, a lower volume of unintentional leaks was not associated with greater comfort, suggesting that other variables apart from unintentional leakage may also play an important role in the final degree of comfort perceived by the patient.

Limitations of the study by Médrinal et al[7] were that it was a small pilot study performed in healthy volunteers with no respiratory disease and who did not present any baseline alterations in blood gas exchange. Furthermore, only one level of pressure was assessed, over a short period of time. Therefore, it is important to reproduce studies of this kind in real-life settings including patients with respiratory diseases and for longer time periods, in order to determine the real impact of these variables in the success of NIV.

In summary, the use of NIV is continuously increasing, both in the acute setting and in the home. Correct leak management is one of the key points for NIV success. Moreover, since the higher the patient's perceived comfort, the higher the likelihood of compliance with treatment, ensuring patient comfort is an important objective during NIV therapy. However, it should be noted that leaks and comfort are not necessarily associated. Hence, a correct assessment of the patient's facial anatomy and clinical status is crucial to the selection of the best mask and ventilator settings, and therefore to successful NIV treatment, in each particular case.

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