

## Nebulizations: are they a safe practice?

### *¿Son las nebulizaciones una práctica segura?*

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Dear Editor,

We have recently reviewed articles on inhalation devices, such as the article by Madrid et al. published in the October issue in the *Boletín Médico del Hospital Infantil de México*. In that article, the authors report exhaled nitric oxide measurement by analyzing different devices<sup>1</sup>. Although the management of respiratory infections by respiratory devices has been performed since 1828 with liquid atomizers<sup>2</sup>, the first pressurized inhaler was introduced to the market in the 1950s for epinephrine delivery. Since then, new and improved devices have been developed with differences in design, construction, sound, output, and particle size.

The effectiveness of nebulization depends on several factors, such as the compressor-nebulizer system used, its maintenance, the characteristics of the drug to be nebulized, and the proper inhalation technique used by the patient<sup>3</sup>. In this regard, there is a minimum deposition of the drugs in the upper airways since the speed of the inhaled nebulizer droplets is similar to that of the child's respiratory flow, which minimizes the impact on the oropharynx. Therefore, in the best of cases, it will vary from 5 to 10% of the inhaled dose<sup>3</sup>. The minimum inspiratory flow required for the aerosol produced by a nebulizer to reach the lungs is 6-8 L/min. However, significant drug losses occur as much of the medication is retained in the nebulizer as dead space or is lost to the ambient air during exhalation<sup>2,3</sup>. Lung scintigraphy studies similar to those reported by Madrid et al.<sup>1</sup> have shown that only 10% of

the dose initially placed in the nebulizer will be deposited in the lungs.

With the emergence of the COVID-19 pandemic, the CDC (Centers for Disease Control and Prevention) have recommended limiting the use of nebulizers and have even contraindicated their use, arguing that "nebulization causes saline droplets in contact with the respiratory tract to break up and produce a fine mist that becomes a vapor that transmits disease" and that "airborne transmission of the COVID-19 virus may be possible in specific circumstances, and in settings where procedures are performed or treatments are administered that may generate aerosols (e.g., administration of a drug by nebulization)." In addition, studies have shown that particles contaminated with SARS-CoV-2 can remain in the environment for up to one hour<sup>4</sup>.

The Society of Critical Care Medicine recommends using ventilators when nebulizing a patient in a negative pressure room, as it is considered a high-risk procedure for contagion<sup>5</sup>. The GINA 2020 Guidelines recommend avoiding their use during the pandemic or substituting them for other devices<sup>6</sup>.

In contrast, the British National Institute for Health and Care Excellence (NICE) recommends using nebulizers, arguing that SARS-CoV-2 remains in the nebulizer mask in liquid form and not in aerosol form with the potential for contagion<sup>7</sup>. Furthermore, a recent systematic review by pulmonologists concluded that it is not possible to define nebulization as a source of contamination by aerosol particle dispersion<sup>8</sup>.

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The American College of Chest Physicians and the American College of Asthma, Allergy, and Immunology recommend that drugs, such as bronchodilators and steroids be administered with other types of inhalation devices, such as pressurized devices, fine mist inhalers, and dry powder devices with inhalation chambers. These devices are not only more effective in drug delivery but are also more hygienic, more practical, and prevent the dispersion of infectious particles not only from COVID-19 but from respiratory viruses and bacteria<sup>9,10</sup>.

A study published in the *Pediatrics* journal concluded that parents prefer to use nebulized medications due to their perception of inhalation drug delivery, even when inhalation devices are portable, easy to use, and less expensive<sup>11</sup>.

There is controversy regarding the possible dispersion of contaminating viral particles in the environment using nebulizers. Some authors suggest that the particles generated may remain in the environment for more than 10 minutes and, therefore, may contribute to the contagion of other individuals in the same room<sup>2-4</sup>. Other authors mention that when the mask is correctly positioned and fixed to the face, the viral particles will not be dispersed in the environment since they will remain adhered to the mask itself<sup>4,10</sup>. Unfortunately, correct mask placement in pediatrics is often a challenge because patients do not accept it attached to the face.

Considering that inhaled drugs with spacers or chambers have a good effect and that there is no evidence that the effect of nebulizer administration is comparatively better, we believe that nebulized drug therapy should be reserved only for a few cases in which no other method of delivery is available. This is especially the case in patients with acute respiratory disorders, regardless of the virus involved, and mainly in pediatric patients, in whom it is often difficult to achieve a complete seal between the mask and the face.

On this basis, the question arises as to whether nebulizers are indispensable or already obsolete.

## Ethical disclosures

**Protection of human and animal subjects.** The authors declare that no experiments were performed on humans or animals for this study.

**Confidentiality of data.** The authors declare that they have followed the protocols of their work center on the publication of patient data.

**Right to privacy and informed consent.** The authors declare that no patient data appear in this article.

## Conflicts of interest

The authors declare no conflict of interest.

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