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CHEST

Circuit Set-ups to Reduce Virus Aerosolization During Noninvasive Positive Pressure Ventilation

Dancing in the Dark

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During initial COVID-19 surges, some authors proposed that noninvasive respiratory support therapies (NRST) should be avoided to minimize the staff risk.[1]

However, subsequent experimental studies suggested that NRST were not "generating" bioaerosols but more "dispersing" bioaerosols farther away from the patient.[2] In addition, it has been suggested recently that early invasive mechanical ventilation was associated with an increased risk of day-60 death,[3] and NRST, like high-flow nasal cannula, may lead to an increase in ventilator-free days and a reduction in ICU length of stay, when compared with early initiation of invasive mechanical ventilation.[4]

Recently updated "Surviving Sepsis" guidelines, suggest that, in patients with COVID-19 and with hypoxemic acute respiratory failure not responding to conventional oxygen therapy, a trial of noninvasive positive pressure ventilation if high-flow nasal cannula is not available and that there is no urgent indication for endotracheal intubation.[5]

In fact, through the current COVID-19 pandemic, NRST have been paramount in the management of acute respiratory failure.[6]

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The majority of published series in COVID-19 reported the use of advanced noninvasive-ventilators or home ventilators; 63% of them mentioned the use of viral filters in the expiratory port of the circuit.[7] Indeed, use of nonvented oronasal masks was strongly recommended early in the course of COVID-19 pandemic to decrease the risk of virus transmission.[1]

So, although these adaptations to the circuitry to reduce the risk of aerosolization were reported commonly, no data were found regarding ventilator performance with these changes.

In this issue of *CHEST*, Patout et al[8] need to be commended for setting up such detailed and interesting bench study, to better clarify the impact of such modifications.

Although, in the last decade, there has been significant technologic advancement in ventilators, with new modes and algorithms designed to increase patient comfort,[9] small changes in the circuitry can jeopardize the efficacy of the ventilation.[10]

Bench assessment of the performance of ventilators and interfaces is a useful tool to help clinicians in their real world practice.[11] The assessment should be performed under consistent experimental settings, with uniform terminology, and standard measurement criteria to enhance generalization of their results.

The bench study of Patout et al,[8] who used a precise method, analyzed eight different circuit set-ups that were evaluated both during noninvasive positive pressure ventilation and CPAP with the Astral 150 ventilator version 0601 (ResMed, San Diego, CA). In their experiment, the best performance was achieved with the use of a dual-limb circuit with an oronasal mask, whereas the worst performance was achieved with the use of a dual-limb circuit with a helmet interface. It is important to recognize that their conclusions are valid for the specific circuits, ventilator, and mask tested. One important issue, sometimes overlooked and contrary to their set-up, is the use of a nonvented oronasal mask with an embedded antiasphyxia valve. These antiasphyxia valves may also contaminate the environment with the virus and increase the risk to the staff, but with single-limb circuits, they should be used for patient safety.[12]

As the authors acknowledge, it is important that, when using NRST during this COVID-19 pandemic, clinicians monitor not only patient-ventilator interaction but also the impact of the different circuit set-ups on the comfort of patients.[13] In the numerous publications on the use of NRST in COVID-19, authors typically neglect a lot of relevant indicators that are essential for the interpretation of the prognostic impact of this technique.[7]

In the absence of ventilators allowing for dual-limb circuits, clinicians should adjust the ventilator settings to help overcome eventual patient-ventilation asynchronies. In case this is not attained, balancing the risk of increased virus dispersion vs dys-synchrony and worse outcomes with the technique must be considered always.

While we wait for new real world data, with the use of different ventilator models and nonvented oronasal masks with or without antiasphyxia valve, the article from Patout et al[8] should serve as an useful guide for performing the best NRST delivery during COVID-19 pandemic.

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