Exploring and Creating New Evidence in a Pandemic Plays a Crucial Role in Guiding Clinical Practice

Early in the COVID-19 pandemic, high-flow nasal cannula (HFNC) was categorized as an aerosol-generating procedure, due in part to the evidence from an in vitro study using smoke-imaging technology.[1] The concerns of virus dispersion and transmission by HFNC led to a reduced use of HFNC to treat hypoxemia induced by COVID-19.[2] As a result, aggressive intubation strategies were utilized, which contributed in part to the worldwide shortage of mechanical ventilators.[3] However, after a careful review of existing literature, Li et al[4] proposed that the risk of bio-aerosol dispersion was actually low. Since that publication, several in vivo studies using different technologies have been implemented to evaluate the transmission risk of using HFNC.[5-10]

In this issue of RESPIRATORY CARE, Bem et al[7] compared aerosol particle concentrations between HFNC and conventional oxygen devices in 3 healthy volunteers and 17 subjects. Nine of those subjects had a confirmed diagnosis of COVID-19. No significant differences in aerosol particle concentrations were found between use of HFNC and conventional oxygen devices in both the healthy volunteer and the patient group. These findings agree with 2 previously published studies that included 9 subjects with COVID-19[6] and 10 healthy volunteers.[5] Additionally, using laser light scattering technology to visualize the aerosol particles, Bem et al[7] observed that aerosol particles generated during HFNC were negligible compared to particles generated by coughing. This finding is important, as it implies that health care workers should take particular caution when patients with COVID-19 are coughing or sneezing.[11]

Studies indicate that placing a surgical mask over the face of a patient during HFNC oxygen therapy significantly reduces the aerosol particle concentrations, especially in areas with close proximity to the patient.[6,8] Montiel et al[12] even reported that placing a surgical mask on a patient during HFNC oxygen therapy slightly improves oxygenation for patients with COVID-19 without influencing P_{aCO_2}. Thus, wearing a surgical mask over HFNC is recommended for patients with COVID-19 as a way to reduce aerosol dispersion.[2]

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The aforementioned methods to assess aerosol transmission risks (eg, aerosol particle concentration measurements, and imaging methods such as laser light scattering technology or smoke dispersion) are indirect measures of risk. The actual virus load in the aerosol and its infectivity are still unknown based on current understanding and technology.[13] Because these indirect assessments of transmission risk are fast, noninvasive, and cheap, it is worthwhile for researchers to investigate their accuracy in evaluating true transmission risk, with comparisons to direct measures of virus load and infectivity. This might help identify the optimal indirect method to quickly assess the transmission risks of different respiratory therapies under different circumstances, such as varying room sizes and air exchange frequency, both of which are known to be influential factors of respiratory transmission.[11]

Infection rates among health care providers who cared for patients with COVID-19 receiving HFNC oxygen therapy might provide indirect evidence of transmission risk. In a cohort study conducted by Westafer et al,[14] there were no significant differences in COVID-19 infection among their emergency department staff before and after implementing a HFNC oxygen therapy protocol used to treat patients with COVID-19. Similarly, none of the staff in the observational study implemented by Vianello et al[15] contracted COVID-19 after using HFNC to treat 28 patients with COVID-19. These findings suggest that staff members can safely care for patients receiving HFNC oxygen therapy if proper precautions are taken.

In all, the indirect evidence suggesting low transmission risks from aerosols may help reduce clinicians' concerns regarding the use HFNC for patients with COVID-19. It appears there is no need to utilize intubation and mechanical ventilation as a way to protect clinicians, which in turn may promote the proper utilization of resources.[16] The COVID-19 pandemic, while profoundly difficult in many ways, forced us to learn and adapt in ways that will surely

Dr Li has disclosed relationships with Fisher & Paykel Healthcare, Aerogen, the Rice Foundation, and the American Association for Respiratory Care. She also serves as Section Editor for RESPIRATORY CARE. Dr Scott has disclosed a relationship with Teleflex.

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DOI: 10.4187/respcare.09227

benefit patients in the future. We learned to cautiously evaluate the evidence and seek additional evidence to better understand the transmission risk of different respiratory treatments. The efforts were made to simultaneously alleviate clinician concerns for safety and avoid unnecessarily aggressive treatments.[17]

Bem et al[7] are the first to report fugitive aerosols generated by nebulization via HFNC in vivo. They reported that the aerosol particle concentrations with nebulization via HFNC were 100 times greater than with HFNC alone.[7] Because the in-line placement of nebulizers with HFNC has been increasingly utilized in clinical practice,[18] and nebulization is still a controversial treatment for patients with COVID-19,[19] this finding is of great importance. In contrast to medication aerosols, bio-aerosols carry microorganisms. Special caution should be taken to avoid nebulizer contamination with patient secretions.[11] Small-volume jet and ultrasonic nebulizers have a direct connection to the patient airway, particularly when delivered via a mouthpiece. As such, they can easily be contaminated by patient saliva or secretions, which contain a vast amount of microorganisms. The risk of generating and dispersing bio-aerosols with a small-volume jet and ultrasonic nebulizer is high.[19] In contrast, placing the nebulizer at the inlet of humidifier in-line with HFNC may help reduce the risk of contamination. It is possible that because the nebulizer is far from the patient, the risk of nebulizer contamination from patient secretions is low. However, this is speculation on our part, and research is needed to confirm how nebulizer placement during HFNC oxygen therapy affects transmissions risks.

The evidence available to date suggests that the transmission risk of COVID-19 when using HFNC is low. That said, it is imperative that researchers continue to create and disseminate high-quality evidence which will guide future clinical practices that relate to patient and clinician safety. It is only a matter of time before the next pandemic.

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