Use of a Metered-Dose Inhaler Compared With a Vibrating Mesh Nebulizer During Mechanical Ventilation: Does It Really Matter?

Historically, the documentation of inhalation therapy dates back hundreds of years, although the formal study of aerosol and proliferation of applicable devices seemingly emerged circa the mid-twentieth century.[1] Today, many options are available, and newer aerosol technologies are being used with some success. Studies have suggested that the pressurized metered-dose inhaler (pMDI) and jet-type nebulizer are essentially equal in the efficacy of delivering aerosol.[2,3] There are still data lacking overall, however, relating to specific aerosol therapy delivery recommendations during mechanical ventilation.[3-6] Furthermore, some of the newer nebulizer technologies, although promising, have yet to be studied in depth.[7]

Categorically, only a few options currently exist for delivering inhaled aerosolized medications to patients receiving mechanical ventilation, including pMDI and the jet, ultrasonic, or vibrating mesh nebulizer. Specifically, the newer vibrating mesh nebulizer was introduced within the last 2 decades and can be used as an alternative to the traditional jet- or ultrasonic-type nebulizer.[3,8] There are no current definitive studies evaluating the more recently designed small-volume nebulizers (ie, vibrating mesh nebulizers), however, as a potential source of contamination and whether there is an increased risk for ventilator-associated pneumonia (VAP) with their use. Although the pMDI remains a feasible alternative to traditional nebulization, the cost of certain pMDIs in hydrofluoroalkane formulation is high, causing many pharmacy departments to request that respiratory therapy departments find cheaper alternatives.

It has been proposed that aerosol delivery during mechanical ventilation via pMDIs is preferred over nebulized delivery, based primarily on the idea that pMDIs are less likely to become contaminated, resulting in less incidence of VAP.[9-12] In this issue of RESPIRATORY CARE, Dubosky et al[13] compare the use of a pMDI with the use of a vibrating mesh nebulizer during mechanical ventilation. Their findings indicate there is no difference in VAP occurrence, ventilator days, or in-hospital mortality, between the use of a pMDI and a vibrating mesh nebulizer for medicated aerosol delivery during mechanical ventilation.

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Although the pMDI and nebulizer delivery systems remain the most commonly used modalities of inhalation therapy during mechanical ventilation,[3] there are additional variables to consider, such as those affecting the deposition of aerosol during mechanical ventilation. This subject is one of ongoing study[14] but beyond the scope of this editorial. VAP, nonetheless, is well known to be a significant cause of increased ICU length of stay and overall attributable mortality,[15,16] and contaminated aerosol reservoirs have been identified in the past as a potential individual risk factor for the development of VAP.[12,17,18] Current studies to establish whether contaminated medicated aerosol devices are a contributor to the development of VAP are lacking. The study by Dubosky et al[13] suggests that there is no greater incidence of VAP and, therefore, no increase in ventilator days or mortality in a population receiving medicated aerosol via a vibrating mesh nebulizer compared with treatments delivered via a pMDI. The study by Dubosky et al[13] did not specifically report ventilator-associated events.

Since the Centers for Disease Control and Prevention's convening of the VAP Surveillance Definition Working Group in 2011, there has been a recent shift away from concentrating on VAP alone to a more comprehensive evaluation of ventilator-associated events. This tiered approach to surveillance is changing the way that ICU patients are evaluated and treated with a more specific outcome predictability.[19] Respiratory therapists especially should be aware of this ongoing development at the national level to utilize ventilator-associated event incidence in place of VAP incidence as a quality indicator for ICUs.[20]

Although the pMDI has been a longstanding means of delivering aerosol therapy to patients receiving mechanical ventilation, the vibrating mesh nebulizer may offer a viable, safe alternative for aerosolization of medications not available in pMDI form without the disadvantages often seen with the use of conventional jet nebulizers. The

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vibrating mesh nebulizer, unlike other traditional small-volume nebulizers, does not introduce additional flow into the circuit and can remain in the circuit on the dry side of the humidifier.[14] The study by Dubosky et al[13] suggests that the use of a vibrating mesh nebulizer during mechanical ventilation is an alternative to pMDI use without increasing the risk of VAP. Moreover, the vibrating mesh nebulizer in particular is designed such that its particle size is more consistent, less condensate develops within the circuit during treatments, and residual waste is negligible.[8] Additionally, in analog models, the vibrating mesh nebulizer has been shown to be superior to the traditional jet nebulizer in the delivery of aerosol during mechanical ventilation.[14]

Although pMDI use remains common during mechanical ventilation, there is ongoing contention regarding the use of shared (common) canister protocol versus single canister therapy. Gowen et al[21] found that common canister protocol does yield cost savings but may result in more ventilator-associated events. A study by Ari et al[14] suggested that the use of a vibrating mesh nebulizer during mechanical ventilation was superior to the use of traditional jet nebulizer with a 2–4-fold greater drug delivery, but there may be significant variance among certain models of vibrating mesh nebulizers affecting the overall consistency of dosing.[22] The outcome data provided by Dubosky et al[13] suggest that the vibrating mesh nebulizer should be considered a safe option for the delivery of aerosol therapy during mechanical ventilation. Future studies are needed and should be ongoing to evaluate the latest nebulizers as their use is increased. As mechanical ventilation technology continues to progress, it is imperative that clinicians remain astute in providing aerosol therapy with the greatest fidelity, based upon sound evidence, and, as the costs of superior aerosol devices are driven lower, one might consider whether it is time to change the way "we've always done it."

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