A novel method of metered-dose inhaler delivery in intubated COVID-19 patients

Dear Sir,

COVID-19 disease had been declared a pandemic by the World Health Organization in March 2020. Critically ill intubated COVID-19 patients develop increased airway resistance and require bronchodilator therapy either due to obstructive airway disease or due to acute bronchospasm. The delivery of inhaled bronchodilators can be facilitated either by nebulizers or metered-dose inhaler (MDI). Nebulizers are popularly used for bronchodilator delivery in mechanically ventilated patients but studies have shown that MDI is as effective as nebulizers for bronchodilator delivery. Moreover in COVID-19 patients, there is an increased risk of SARS-CoV-2 infection to health care staff due to aerosolization which may require management of these patients in negative pressure isolation rooms. Many experts prefer in-line MDIs in such patients. During pandemic times the in-line MDIs are difficult to acquire because of increased demand and high cost. To overcome this issue, we are using syringe-actuated MDI for COVID-19 patients.

We load MDI canister in the barrel of 50 ml Luer lock syringe with the tip placed into the nozzle of the syringe and the plunger of the syringe placed back into the barrel so that the syringe is actuated by depressing the syringe plunger. We tightly attach the Luer connection of the syringe to the Luer port of 15 mm–22 mm fixed elbow connector [Figure 1]. The mode of ventilation is changed to volume control mode; aerosol delivery is achieved by depressing the plunger of the syringe and actuating the syringe just before the start of inspiration. This is followed by an inspiratory hold maneuver. This procedure can be repeated as many times as required. The syringe can be left in place to avoid ventilator disconnection and positive end expiratory pressure loss.

There are various advantages of MDI over nebulizer such as ease of administration, reduced cost, more predictable drug dosing, and less risk of aerosolization. Use of nebulizers in mechanically ventilated patients may lead to volume loss and this could lead to dangerous hypoventilation which may not be detected by alarm function because ventilators may falsely detect bias flow as minute ventilation. Also, expiratory volume measurements may not be reliable as nebulizers may damage the expiratory transducer. The bronchodilator therapy...
via MDI was previously considered ineffective due to drug deposition in the endotracheal tube and ventilator circuit. Peterfreund et al.\[4\] conducted a study in a laboratory model that showed syringe-actuated MDIs through nozzle extensions proved an efficient method of aerosol delivery distal to the tip of the ETT.

We connected the syringe holding canister using Luer lock to elbow connector. The drug being delivered during the onset of inspiration tends to travel with the flow right into the airways, and with the inspiratory hold maneuver, the drug is retained in the smaller airways during the maneuver so as to maximize the delivery as well as the therapeutic effect of the drug. We are routinely using syringe-actuated MDIs in our ventilated COVID-19 patients in whom the nebulizers are not considered safe due to the risk of infection transmission to the health care staff.

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Conflicts of interest
There are no conflicts of interest.

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