References

1. Peng PWH, Ho P-L, Hota SS. Outbreak of a new coronavirus: what anaesthetists should know. *Br J Anaesth* 2020; **124**: 497–501
2. Rhodes A, Ferdinande P, Flaatten H, Guidet B, Metnitz PG, Moreno RP. The variability of critical care bed numbers in Europe. *Intensive Care Med* 2012; **38**: 1647–53
3. McNulty G, Eyre L. Humidification in anaesthesia and critical care. *BJA Educ* 2015; **15**: 131–5

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Comparison of three tracheal intubation methods for reducing droplet spread for use in COVID-19 patients

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Keywords: aerosol-generating procedure; COVID-19; infection prevention; simulation; tracheal intubation; videolaryngoscopy

Editor—Tracheal intubation is a life-saving procedure for respiratory failure caused by coronavirus 2019 (COVID-19),[1] however it is a high-risk aerosol generating procedure.[2] Healthcare workers have been compelled to discover novel forms of physical barrier and develop specific techniques of tracheal intubation with the least risk of transmission.[3,4] One such barrier method is an 'intubation protection box', a transparent box with openings for the hands that is placed over the patient's head to physically capture droplets and protect the laryngoscopist. Inspired by a previously described design,[5] we created a similar model with some modifications (Supplementary File S1).

We compared three methods of tracheal intubation: direct laryngoscopy, videolaryngoscopy, and video-laryngoscopy with the protective intubation box (see online video and Supplementary File S2). In a simulated intubation, we measured the trajectory and amount of droplet spread. We used an airway mannequin with its airway connected to a laryngo-tracheal mucosal atomisation device (MADgic, Teleflex Medical, Ontario, Canada) to simulate a cough and aerosolisation of droplets, which was attached via a short connector tubing to a 10 ml syringe containing a red-dye solution. The first test with direct laryngoscopy showed a large amount of dye on the laryngoscopist's faceshield, gown, arms, glove, neck, and hair. The second test with the videolaryngoscopy technique showed a significantly lower amount of dye on the laryngoscopist in similar locations, visually less than half the quantity compared with direct laryngoscopy. The third test with videolaryngoscopy and the box showed dye only on the gloves and forearms within the box; no dye was visible on any part of the laryngoscopist located outside the box including gown, face shield, neck, and hair (Fig. 1).

Fig. 1. Videolaryngoscopy with the protective intubation box.

Supplementary video related to this article can be found at https://doi.org/10.1016/j.bja.2020.04.083.

Our simulation method is one of the few simulations to show both large and small droplet trajectory. In the video, it is interesting to note that microdroplets lingered longer. Out of the three methods, videolaryngoscopy, as compared with direct laryngoscopy, was the preferred method of tracheal intubation given the significant decrease in the amount of aerosolised droplets on the laryngoscopist. The box offered an

additional physical barrier as compared with videolaryngoscopy. However, we believe that with proper personal protection equipment, there is minimal additional benefit in terms of droplet protection. Our technique measured droplet spread primarily, and may be less sensitive to fine aerosols. A potential disadvantage of the box is the restriction to movement and adapting to a new way of intubation.[6] In the event that the airway proves to be difficult, the box should be immediately abandoned.

Declaration of interests

The authors declare that they have no conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.bja.2020.04.083.

References

1. Peng PWH, Ho P-L, Hota SS. Outbreak of a new coronavirus: what anaesthetists should know. *Br J Anaesth* 2020; **124**: 497–501
2. Tran K, Cimon K, Severn M, Pessoa-Silva CL, Conly J. Aerosol generating procedures and risk of transmission of acute respiratory infections to healthcare workers: a systematic review. *PLoS One* 2012; **7**, e35797
3. Odor PM, Neun M, Bampoe S, et al. Anaesthesia and COVID-19: infection control. *Br J Anaesth* 2020. https://doi.org/10.1016/j.bja.2020.03.025. Adv Access published on April 8
4. Yao W, Wang T, Jiang B, et al. Emergency tracheal intubation in 202 patients with COVID-19 in Wuhan, China: lessons learnt and international expert recommendations. *Br J Anaesth* 2020. https://doi.org/10.1016/j.bja.2020.03.026. Adv Access published on April 10
5. Everington K. *Taiwanese doctor invents device to protect US doctors against coronavirus* 2020. Available from: https://www.taiwannews.com.tw/en/news/3902435. [Accessed 30 March 2020]
6. Dalli J, Khan MF, Marsh B, Nolan K, Cahill RA. Evaluating intubation boxes for airway management. *Br J Anaesth* 2020. in press

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Modified tracheal extubation for patients with COVID-19

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Keywords: aerosol-generating procedure; airway management; COVID-19; coronavirus; extubation; tracheal intubation

Editor—We read with interest the article by D'Silva and colleagues[1] in the *British Journal of Anaesthesia*. They describe an extubation technique for patients with coronavirus disease 2019 (COVID-19) using two airway filters, with one attached to the tracheal tube and another attached to the facemask. We agree with the concept of using two airway filters for tracheal extubation and believe it is one of the safest ways currently described in the literature. However, we propose three modifications that we use at our institution when extubating patients with COVID-19 that improve upon the technique of D'Silva and colleagues.

Before extubation we recommend disconnecting the gas sampling line and moving it to the new filter attached to the facemask. This will allow for detection of end-tidal CO_2 immediately after extubation. As the gas sampling line port is downstream from the filter, the port can either be left open or sealed with the plug that either comes attached with the existing filter or with the plug from the new filter. Second, instead of stacking the airway filters on top of each other we recommend discarding both the tracheal tube and its filter upon extubation. This results in the standard facemask, filter, and circuit setup that we find to be both less awkward and less likely to disconnect inadvertently compared with the double airway filter setup proposed by D'Silva and colleagues. Furthermore, using one filter will reduce the overall dead space of the circuit, which could be an important factor in paediatric cases. Finally, we recommend using a surgical mask with elastic ear loops attached to the patients' ears and under their chin before removal of the facemask so that it can be quickly positioned into place after facemask removal. Oxygen