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Letter to the Editor

Emergency front-of-neck airway in the COVID-19 patient: Cannula or surgical cricothyroidotomy?

A R T I C L E   I N F O

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Dear Editor,

The preferred emergency front-of-neck airway (eFONA) technique is controversal. The 2015 Difficult Airway Society’s (DAS) guidelines recommend a surgical cricothyroidotomy, whilst Heard and colleagues recommend a cannula cricothyroidotomy as it is simpler and less invasive [1,2]. The UK (coronavirus 2019) COVID-19 guidelines recommend the surgical technique “due to the risk of aerosolisation with the oxygen insufflation associated with cannula techniques” [3]. We therefore evaluated the extent of aerosol contamination with both eFONA techniques in a TruCric™ airway training manikin (Trucorp®, Belfast, Ireland).

1. Methods

Glo Germ™ (Glo Germ Company, Moab, UT, USA) fluorescent powder was first deposited inside the manikin’s lung (1/8 tsp) and trachea (1/16 tsp). The lung was fully inflated and its proximal end clamped. The lung was reattached to the trachea and, after releasing the clamp, was squeezed to aerosolise the Glo Germ™ powder. Ultraviolet light was shone over the manikin and any externally leaked Glo Germ™ powder was thoroughly cleaned away. This was repeated between attempts at eFONA.

Two anaesthetists (PW and TW), who are eFONA trainers performed cannula and surgical cricothyroidotomy on the manikin (Fig. 1A) as follows.

1.1. Patent airway setup–surgical cricothyroidotomy

Surgical cricothyroidotomy was performed as per the DAS guidelines using a scalpel with a size 10 blade, a bougie and a 6.0 mm tracheal tube [1] in the manikin set-up as described. A self-inflating bag was attached to the tracheal tube and four manual breaths were administered.

1.2. Patent airway setup–cannula cricothyroidotomy

Cannula cricothyroidotomy was performed through the neck skin and cricothyroid membrane using a 14G Insyte™ cannula (BD Medical, Sandy, Utah) [4]. The oxygen insufflation device, which is our institution’s version of the Rapid-O2™ (Meditech Systems, UK), was connected to a 15 L/min oxygen supply from a flowmeter and attached to the cannula. A 4-second insufflation was provided by occluding the thumb operated Y-piece, which delivered 1,000 ml of oxygen to the lung. The thumb was released for 20 seconds to allow oxygen from the flowmeter and test lung to escape out of the Y-piece. Thereafter, 2-second insufflations were administered every 20 seconds for two minutes [4]. There was no lung hyperinflation due to the air leaks around the detachable trachea, simulating a patent airway.

1.3. Obstructed airway setup – cannula cricothyroidotomy

A splint test lung was attached to a model trachea, which had its proximal end occluded by a stopper, simulating a completely obstructed airway. Prior testing of the set-up to ensure no air leaks was performed. A cannula cricothyroidotomy was performed and oxygen insufflated as per test 2. During the initial 4-second insufflation, the splint lung inflated to a high ‘airway’ pressure of approximately 35 cmH2O. When the thumb was released from the Y-piece, oxygen escaped via the Y-piece, allowing the splint test lung to completely deflate (Fig. 1B).

2. Results

Glo Germ™ deposition, a surrogate of aerosol contamination, is shown in Fig. 1C–H.

In the patent airway set-up with surgical cricothyroidotomy, particles were seen on: the operator’s glove and gown, and surrounding drapes (Fig. 1C); the manikin neck (Fig. 1D); and, on the bougie, syringe, kidney dish (Fig. 1E) and self-inflating bag (Fig. 1F).

In the patent airway set-up with cannula cricothyroidotomy (Fig. 1G), no particles were seen.

In the obstructed airway set-up with cannula cricothyroidotomy and oxygen insufflation, particles were seen on the drapes cephalad to the trachea (Fig. 1H).

In both cannula cricothyroidotomy set-ups, no particles were seen on the Insyte™ needle, within the oxygen insufflation device tubing or Y-piece, on the operator’s thumb, or on the drapes purposely placed at outflow of the Y-piece.

Duration of eFONA was defined as the time from picking up the cannula or scalpel to the time of lung inflation. Median (IQR) duration for the cannula and surgical techniques were 25.5 (20–31) and 39.5 (30–49) seconds, respectively.
Our study provides preliminary evidence that, in a manikin patent airway set-up, surgical cricothyroidotomy was associated with the most Glo Germ™ deposition. This was secondary to contamination from the bougie after withdrawal from the tracheal tube. It may also have occurred during the front-of-neck incision but we could not verify this, as cricothyroidotomy was performed without ultraviolet light illumination. Cannula cricothyroidotomy with oxygen insufflation resulted in no deposition in the patent airway set-up. However, deposition occurred in the obstructed airway set-up and is likely due to the higher airway pressures. Contamination may be minimised by placing wet gauze around the cannula insertion site.

There are limitations to these tests. First, the low fidelity manikin does not replicate true human anatomy and airway temperature and humidity. Second, the Glo Germ™ powder does not have the same properties as aerosol droplets, and may not travel up the oxygen insufflation device. Third, we used a FONA manikin, which had no laryngeal outlet to evaluate aerosol from this site.

3. Conclusion

The choice of eFONA technique in the COVID-19 patient must take into account the possibility of inadvertent contamination from accessory devices, as seen during surgical cricothyroidotomy. Further research is warranted to establish the safest eFONA technique in COVID-19 patients.

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Authors’ contribution
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Disclosure of interest
The authors declare that they have no conflicts of interest.

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References
[1] Freerk C, Mitchell VS, McNarry AF, Mendonca C, Bhagrath R, Patel A, et al. Difficult Airway Society 2015 guidelines for management of unanticipated difficult intubation in adults. Br J Anaesth 2015;115:827–48.
[2] Heard AMB, Green RJ, Eakins P. The formulation and introduction of a “can’t intubate, can’t ventilate” algorithm into clinical practice. Anaesthesia 2009;64:601–8. http://dx.doi.org/10.1111/j.1365-2044.2009.05888.x.
[3] Cook TM, El-Boghdadly K, McGuire B, McNarry AF, Patel A, Higgins A. Consensus guidelines for managing the airway in patients with COVID-19: Guidelines from the Difficult Airway Society, the Association of Anaesthetists the Intensive Care Society, the Faculty of Intensive Care Medicine and the Royal College of Anaesthetists. Anaesthesia 2020;75:785–99.
[4] DrAMBHeardAirway. 06 Jet Oxygenation 2013. https://www.youtube.com/watch?v=QR7ek7VBNIQ.(accessed June 4, 2020).
