Ancillary protective gears in the COVID-19 Era

Has COVID-19 actually changed our airway management strategy?

It’s basically not a change, but a shift towards a more cautious and circumspect approach. This is due to the risk lingering among the airway managers owing to the airborne spread, especially during aerosol-generating procedures (AGPs) of the contagion: severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). As relatively higher viral loads of SARS-CoV-2 are found in sputum and upper respiratory tract secretions of patients with COVID-19, endotracheal intubation is considered as a high-risk procedure for exposure and transmission of SARS-CoV-2 owing to the proximity of the person performing endotracheal intubation to the patient’s airway.

All this has called for a strategic protocolization of the airway-management focused on a single target: Minimizing the aerosolization and thereby minimizing the risk at each and every step of airway management.

The outline of Airway Management protocol for a COVID-19 patient is:

1. Use of personal protective equipment (PPE): The person securing the airway should be donned with full PPE cover
2. Preference should be given to a two-hand technique over a single-hand technique for mask ventilation
3. Use of neuromuscular blocking agents before an attempt of airway access
4. Use of rapid sequence induction
5. Preference for video laryngoscope over direct laryngoscope.

In addition to this protocolized approach, the need for minimizing the aerosol contamination has led to a plethora of new airway adjuncts in these COVID times. How useful these adjuncts or engineering innovations are in the clinical scenario is a matter of debate. A rational discussion on the pros and cons of these devices can give us a better insight into their use in clinical settings. Some of these in the literature are:

1. Aerosol intubation Box: One of the initial innovations was in the form of aerosol box manufactured by Lai, Hsien Yung of Mennonite Christian Hospital, Hua Lian, 2020.

**Description**

It is made using an acrylic or transparent polycarbonate sheet.
Canelli et al. in their initial report on the device described it with a possible utility in preventing cough dispersion of particles on the laryngoscopist.\[7\]

**Advantages**
These aerosol boxes undoubtedly generated a concept to protect the health care workers, especially during the AGP. If we analyze this, based on the limited simulation-based evidence, it has an advantage of protecting the facial part of the person performing the procedure from the droplets generated through the direct cough during the procedure.\[7\]

**Disadvantages**
Although these devices offer droplet protection, there is no data about whether the boxes protect health care workers from invisible aerosolized virus particles generated during the process of intubation, which have the potential to stay in the air for hours.\[8\]

Another hindrance in the use of these aerosol boxes is their basic structure, which is rigid and bulky making the device cumbersome to use. This can act as a major hurdle during airway management in difficult airway scenarios, like using a bougie to assist in endotracheal intubation. The fixed shape hampers the maneuverability of hands through the holes. Moreover, one model does not work for all patients like the obese requiring a ramp position, those with fixed flexion deformity or short neck, to name a few.

The bottom panel of the box is left open, which potentially exposes the assistant to the risk of being exposed to aerosolized respiratory secretions.

An in-situ simulation crossover study conducted by Begley et al. using an aerosol box for intubation in COVID-19 patients highlighted the intubation difficulty faced by the anesthetists in the form of increased intubation time and lower first-pass success rate. Anesthetists found difficulty in maneuvering through the holes of the boxes during intubation, increasing the discomfort. Most importantly, it led to an increase in breaches in the PPE.\[9\]

The Amalgamation of all these findings increases the doubt about the actual safety of the health care providers.

Second Generation Aerosol Box: Overcoming the shortcomings of the initial version of the aerosol box, various manufacturers have come-up with modifications in the initial design like holes for the assistant’s hands, a hole on top for the insertion of a bougie to aid intubation, and ports for applying suction to generate negative pressure.\[9\] Begley in his study demonstrated a greater number of PPE breaches with second-generation boxes compared to the earlier generation.\[9\]

2. Aerosol Shield, or Drs. INK (Disposable Resuscitation, Intubation, and Nebulization Kit Shield):\[10\] This equipment has been innovated by experts at the University of Birmingham to reduce exposure to COVID-19 during intubation procedures.

**Description**
The aerosol shield consists of a wrapped, disposable, mini pop-up tent covering the patient’s head, neck, and shoulder-level chest area, with a drape providing further coverage of the chest.

**Advantages**
The material with which it is made is optically clear and has self-sealing access points, which allow easy hand access in case of intubation or extubation, with a full line of sight for medical staff.

Being significantly lighter than the rigid intubation boxes these can be easily assembled. These are much more economical than rigid intubation boxes. The disposal is relatively simpler as they can easily be collapsed and disposed of in standard yellow clinical waste bins.

3. Plastic tent or screen for intubation:\[11\]

**Description**
The initial design of the plastic tent involved combining two transparent plastic bags into a single bag large enough to be draped over the patient’s head to the chest. Two drip stands were used to hold the tent up. After use, the tent is disposed and the drip stands wiped down.\[11\]

The authors have suggested an alternative approach wherein a plastic sheet is draped over the patient’s head and chest and taped down at the sides to minimize the leak. This plastic sheet can be left in the same position for the duration of the operation, if it is away from the surgical site, proving the additional advantage of protection intraoperatively.

**Advantages**
The tent is more economical and easily available compared to the aerosol boxes. It allows room for maneuvering the tube...
and can be raised enough to allow the use of bougie in case of difficulty in intubation. It can be easily disposed-off after use. Most importantly, a single model works for all with slight adjustments. It would not require specific alterations to be used in obese or children.

**Disadvantages**
The disadvantages are the same as for the aerosol shields mentioned under point-2 above.

As highlighted by a few examples above, there have been innovations in these times of COVID-19 pandemic with an aim to make airway management safer, and then the improvisations to improve the safety profile, adaptability, and user-friendliness of these innovations. Understanding the pros and cons of each, a clinician needs to select whichever works best for him.

This special issue has some more such innovations and improvisations. A negative pressure aerosol containment box is described,[12,13] which can be brought to multipurpose use during intubation and extubation, noninvasive ventilation, a high-flow nasal cannula (HFNC), nebulization, and oxygen therapy. It can also be used during inter and intrahospital patient transfers. We feel that in spite of its obvious usefulness in reducing aerosolization, any sort of containment device in awake patients can be suffocating and might not be well-tolerated. More so if this polyvinylchloride (PVC) box is to be cleaned and used repeatedly because it will lose its transparency on repeated cleaning that could make a conscious patient feel more claustrophobic and hinder the performance of the operator.

There is another interesting improvisation in the plastic tents and sheets in this issue.[14] One mentions the use of Mayo stands with circumferential self-sealing ports in the plastic sheets to provide easy access for airway maneuvers. Being more pliable, the use of these plastic tents or sheets and their improvisations might prove a better solution among the available ancillary devices.

**Conclusion**
Enthusiastic innovators from around the globe need to be appreciated for their efforts in developing new ways to protect health care workers from infection during the present highly infectious COVID-19 pandemic. However, we need to realize that specific standards have been set for all types of personal protective equipment, including the N95 masks, visors, and Hazmat suits. Similarly, it is absolutely essential that these ancillary equipment undergo both a standardized rigorous testing for safety and more importantly, proper simulation-based training in both normal and difficult airway situations before they can be put to use. The clinician needs to select whichever works best for him and familiarize himself with it through practice and training. Lack of proper training with the use of these newer tools can prove more hazardous both to the health care worker performing the procedure and the patient. However, we need to remember these innovations are only ancillary equipment and in no way are meant to replace PPE.

**Acknowledgement**
The authors acknowledge the executive committee of the Airway Management Foundation (AMF) for their support and encouragement.

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