http://jmscr.igmpublication.org/home/
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossref DOI: https://dx.doi.org/10.18535/jmscr/v8i12.06

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Original Article

An audit of Aerosol Box for Airway Management in COVID Era

Authors
Dr Karthika Asokan[1], Dr Bhagyalakshmi Ramesh[2*], Dr Rachel Cherian Koshy[3], Dr Jagathnath Krishna[4]
[1]Intensivist, Dept of Anaesthesiology, Regional Cancer Centre, Trivandrum, Kerala, India
[2]Associate Professor, Dept of Anaesthesiology, Regional Cancer Centre, Trivandrum, Kerala, India
[3]Professor and Head, Dept of Anaesthesiology, Regional Cancer Centre, Trivandrum, Kerala, India
[4]Assistant Professor, Dept. of Epidemiology and Biostatistics, Regional Cancer Centre, Trivandrum, Kerala, India
*Corresponding Author
Dr Bhagyalakshmi Ramesh

Abstract
Background: *Exponential rise in SARS CoV cases, shortage in supply of personal protective equipment (PPE) and inadequate surface decontamination necessitates the use of a barrier between the laryngoscopist and patient so as to decrease macroscopic contamination with respiratory secretions.*
Methodology: *Consecutive intubations that were done between May 2020 and July 2020 were reviewed and data was collected retrospectively from anaesthesia records.*
Results: *Seventy patients were studied, of which 42 were intubated with the help of aerosol box. Of these 42 patients, 6 of them required second attempt during laryngoscopy for successful endotracheal intubation. No patients desaturated below 92%, but intubation time was more than 3 minutes in 9 patients, 6 of whom were intubated with aerosol box. Aerosol box was used for all extubations without any complications*
Conclusion: *Aerosol boxes were very useful during extubations in terms of patient and intubator comfort. The potential efficacy of the aerosol box during intubation needs further evaluation with randomised controlled trials.*
Keywords: *COVID-19, intubation, operating room, prevention, aerosol box.*

Introduction

As the Coronavirus disease 19 (COVID-19) is wreaking havoc in many countries, several techniques have been developed in healthcare sector to protect the personnel involved in providing care during procedures involving airway manipulations. The short supply of personal protective equipment (PPE) and high turnover of patients in operating rooms after the country-wide lockdown has been lifted has put a tremendous responsibility on the shoulders of anaesthesiologists to provide safe anaesthesia to patients as well as take drastic measures to protect themselves and other operating room (OR) personnel. The high incidence of asymptomatic carriers of COVID-19 virus, necessitates the use of full precautions to be taken while anaesthetizing each patient especially during

airway manipulations as necessitated during general anaesthesia. As of now, India has entered the stage of community spread of the pandemic and there are high chances of an enormous rise in the number of cases in the near future.

Barrier devices placed between the anaesthesiologist and the patient's airway with the intention of avoiding droplet scatter during airway interventions like intubation and extubation is of utmost importance. Two common methods adopted by healthcare workers all over the world are transparent plastic sheets and aerosol boxes [1, 2]. Though both the techniques fail to completely contain aerosols, they can effectively decrease scatter of infected droplets and hence prevent soiling of our PPE and immediate surroundings. This is particularly important in order to avoid surface contamination, as the primary mode of disinfection of coronavirus is surface cleaning with hypochlorite rather than fumigation [3].

Methodology

In our institute anaesthesiologists are using both plastic sheet as well as the aerosol box as per individual preference during the conduct of general anaesthesia. Hence we decided to conduct this study to observe certain parameters during airway management that were measurable and which could indirectly indicate the ease of intubation using these devices.

Data Collection

Case records of all consecutive intubations that were done between May 2020 and July 2020 were reviewed and data was collected from Anaesthesia record regarding intubations and extubations done in OR and intensive care unit (ICU). Details collected included the following: Patient's demographic details including body mass index(BMI), presence of respiratory failure, type of surgery, airway assessment, experience of the anaesthesiologist, attempts at intubation, use of rapid sequence intubation, baseline and desaturation during intubation, type of laryngoscope used, route of intubation (nasal/oral), time taken for intubation, difficulties encountered during intubation and extubation, difficulty in Ryles' tube insertion were noted.

Each anaesthesiologist was given 5 minutes of instruction and opportunity to perform intubations on at least 10 patients with no anticipated airway difficulties to become familiar with each technique before collecting data. We retrospectively collected data of all patients in whom airway intervention was done using either a plastic sheet or aerosol box, as well as those in whom none were used. The intubator wore full PPE including water-resistant gown, gloves, goggles or visor, N95 mask, shoe cover and cap. Patient consent was taken and barrier device placed over the upper torso and head. Preoxygenation was performed to attain EtO2 >85% before inducing anaesthesia. The OR table/ ICU bed height was adjusted accordingly for comfortable placement of forearms of intubator for each technique. Rapid sequence induction (RSI) was done for all cases as per protocol to avoid mask ventilation. However, for critically ill patients in respiratory distress, gentle mask ventilation was provided to avoid desaturation during laryngoscopy. The model of aerosol box we used was one developed by Asokan[4] and colleagues which has a front panel, upper surface, intubator surface with two armholes (12 cm diameter) and two side panels with C-shaped curves. A drape sheet was used to cover the open front portion during intubation and extubation to reduce forward scatter of droplets. Intubation was attempted 60 seconds after administration of suxamethonium. All intubations were done using Karl Storz C-MAC-D Video laryngoscope.

The primary outcome was intubation time defined as the time from removing face mask until first effect breath was delivered by a correctly-placed endotracheal tube. Secondary outcomes included first pass success rates and desaturation due to increased intubation times. We also observed for difficulties encountered during extubation, Ryle's tube insertion, visibility and breach in PPE. After use, plastic sheets were carefully rolled outside in

and discarded in appropriate waste bin and a new one was taken for extubating the patient. Aerosol box was disinfected by wiping with 0.5% hypochlorite solution and allowed a contact time of at least 10 minutes before next use.

Results

We enrolled 12 anesthesiologists and 6 anesthesia trainees for this audit. There were 70 patients for intubation, of which 6 patients were intubated in ICU following respiratory failure. All patients were intubated using RSI technique. Aerosol box was used in 42 patients, plastic sheet was used in 6 patients and no barriers were used in 22 patients. MPC was I in 8 patients, II in 42 patients, III in 16 patients and IV in 2 patients. 1 patient also had trismus. BONES criteria was positive in 45 patients, ULBT was class 1 in 46 patients while all other patients were class 2. 60 patients were intubated in first attempt. Of the 42 patients in whom aerosol box was used, 6 needed more than one attempt, among which 3 patients had BMI more than 30 and one was a nasotracheal intubation. For the remaining 2 patients, there was difficulty in laryngoscopy due to difficulty in manoeuvrability of hands with aerosol box. Of these 6 patients, 1 patient desaturated to 92% whereas saturation was maintained above 95% for the other 5 patients. All patients in ICU were intubated with aerosol box and none of them desaturated below 96%. There was no difference noted regarding experience of the intubator.

Of the 9 patients where intubation time was more than 3 minutes, 7 patients were intubated with aerosol box and video laryngoscope while no barriers were used in the remaining 2 patients. Nasotracheal intubation was done in 12 patients (17.4%). Aerosol box was used for extubation in all 70 patients and there were no difficulties reported. PPE was not breached in any of the cases.

Discussion

The high incidence of asymptomatic COVID-19 cases mandates adequate level of personal protection during all airway procedures. N95 respirator is essential for protection from infected aerosols. If we have an additional barrier to prevent spillage of respiratory droplets generated during cough while intubating and extubating, surface contamination and soiling of PPE may be avoided[5]. There also arise circumstances when a single physician may need to cater to the management of several patients at a time and there may be insufficient time to change PPE frequently. Barriers like box and plastic sheets have been used in many centres to overcome this problem.

The original design of aerosol box developed by Dr. Lai Hsien-yung was a 50 × 50 × 40 cm box with two arm holes of 10 cm diameter with rectangular side panels and no front panel [6]. The box we used has a front panel, upper surface, intubator surface with two armholes (12 cm diameter), two side panels with C-shaped curves and made of high-quality 4 mm transparent acrylic sheet with a gross weight of 3900 g. C-shaped curves helped to make laryngoscopy easy in obese individuals, as they could rest their arms comfortably on arm boards allowing the breasts to fall laterally. The anaesthesia circuit was taken inside from below the front panel, whereas the side curves gave sufficient space for the assistant to apply cricoid pressure, pass the endotracheal tube, remove stylet, etc. A base-width of 48 cm offered more stability and avoided fall with slight movement when using on OR table [4]. Due to the possibility of scatter of droplets through the gap below the front panel we used drapes to cover the open portion. When difficulty was encountered during securing the airway, the box was lifted off and placed bedside without much hassle as it is lightweight and compact.

Plastic sheets do not limit hand mobility much, but the need to get new sheets for each patient for intubation and extubation or setting up stands with plastic poles or Mayo stand in areas like ICU or triage is cumbersome. Intubations may be required in several areas in a hospital setting and availability of plastic sheets is not feasible in

many scenarios. Medical management of hospital waste in the current scenario of COVID-19 pandemic itself is a mammoth task and use of such large amounts of plastic sheets each day would add up to a tremendous amount of plastic waste.

In a prospective study by Wakabayashi et al[10] ,18 experienced anaesthetists intubated the trachea of a manikin with a normal airway 6 times using a direct laryngoscope, a McGrath MAC video laryngoscope, or an airway scope AWS-S200NK video laryngoscope with or without an aerosol box. They concluded that aerosol box has almost no effect on the difficulty in tracheal intubation regardless of the type of laryngoscope when an experienced anaesthetist intubates the trachea in a normal airway. We used CMAC-D (as CMAC unavailable in our institute) for all video scope intubations (for 45 patients) due to the current recommendations in COVID pandemic. In a randomized trial, 26 experienced anaesthesia providers rated the D-Blade laryngoscope as more difficult to use than the C-MAC and the Macintosh in normal airway[7]. This could explain the added difficulty posed while intubating patients with aerosol box and CMAC-D. The most frequent difficulty encountered with aerosol box was the hitting of stylet on the upper surface during its removal. This was noted in 4 cases which required a second attempt at laryngoscopy with aerosol box. There was no visibility issue with full PPE in any of the intubations with aerosol box or plastic sheets.

There is also a concern raised by many anesthesiologists regarding futility of a barrier during intubation as laryngoscopy will be attempted only after complete muscle paralysis is ensured. It is a crucial moment where the primary concern is to secure the airway without trauma and hypoxia. However, study has shown that during the SARS outbreak, the healthcare professionals involved during intubation had a very high chance of contracting the infection [8]. Intubation being done under full relaxation is more controlled and it would be wise to use these barrier techniques especially in patients without anticipated difficult airway and the intubator is familiar with the technique. However, extubation is very unpredictable and there are higher chances of violent coughing. During such circumstances, using an aerosol box (after covering front portion with a drape sheet) or a plastic sheet can help to avoid macroscopic contamination of out PPE and workstation. The covering of open front portion of aerosol box has demonstrated to reduce the spillage of aerosols onto the laryngoscopist and surroundings, though not completely abolished [9]. Microscopic contamination due to aerosols is unavoidable due to the gaps under the sheets and holes in the aerosol box, and emphasizes the need for a good-fitting N95 mask to protect ourselves.

Drawbacks of the study include: i)unequal number of patients in each group, ii)patients with anticipated difficult airway like morbidly obese patients and those with reduced mouth opening (mouth opening less than 2 fingers) were excluded from the study, and iii)use of same laryngoscope and same route of intubation(nasal/oral) was not employed for all cases.

Conclusion

As of now, aerosol box cannot be fully relied upon in all cases during intubation. In cases of difficult airway and when ramping is required in morbidly obese patients, it is difficult to place aerosol boxes as securing the airway quickly is of prime importance. However, aerosol boxes were very useful during extubations in terms of patient and intubator comfort without any untoward events noted in any of our patients. If the intubator is confident in using either of the technique, it must be adopted even during intubation due to the high risk of transmission of disease during this procedure as observed during the SARS outbreak.

Conflicts of Interest: There are no conflicts of Interest.

Financial support and sponsorship: Nil

Authors' contributions: All authors contributed equally.

References

1. Au Yong PS, Chen X. Reducing droplet spread during airway manipulation: lessons from the COVID-19 pandemic in Singapore. Br J Anaesth. 2020; 125(1): e176-e178. doi:10.1016/j.bja.2020.04.007
2. Everington K. Taiwanese doctor invents device to protect US doctors against coronavirus. Taiwan News. March 23, 2020. (https://www.taiwannews.com.tw/en/news/3902435).
3. Centre for Disease control and Prevention. Interim infection prevention and control recommendations for patients with suspected or confirmed coronavirus disease 2019 (COVID-19) in healthcare settings. Available from: https://www.cdc.gov/coronavir us/2019-ncov/infection-control/control-recommendations.html.
4. Asokan K, Babu B, Jayadevan A. Barrier enclosure for airway management in COVID-19 pandemic. Indian J Anaesth. 2020; 64, Suppl S2:153-4.
5. Canelli R, Connor CW, Gonzalez M, Nozari A, Ortega R. Barrier enclosure during endotracheal intubation. New England Journal of Medicine. 2020 May 14; 382(20):1957-8.
6. Yung Lai H. Aerosol box: protects healthcare workers during endotracheal intubation. Available: https://sites.google.com/view/aerosolbox/design [Accessed 20 August 2020].
7. Kılıçaslan A, Topal A, Erol A, Uzun ST. Comparison of the C-MAC D-Blade, Conventional C-MAC, and Macintosh Laryngoscopes in Simulated Easy and Difficult Airways. Turk J Anaesthesiol Reanim. 2014; 42(4):182-189. doi:10.5152/TJAR.2014.59672
8. 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 systematicreview. PLoSOne 2012;7:e35797.doi:10.1371/journal.pone.0035797 pmid: http://www.ncbi.nlm.nih.gov/pubmed/22563403
9. Jazuli F, Bilic M, Hanel E, Ha M, Hassall K, Trotter BG.Endotracheal intubation with barrier protection. Emergency Medicine Journal 2020; 37:398-399.
10. Wakabayashi R, Ishida T, Yamada T, Kawamata M. Effect os an aerosol box on tracheal intubation difficulty. J Anesth (2020). https://doi.org/10.1007/s00540-020-02835-2