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Effectiveness of video tutorial on compliance of medical officers to sequence of intubation protocol in simulated Covid-19 patients

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Abstract

Introduction: The use of full PPE, aerosol box, and video laryngoscope are recommended when performing intubation on a Covid-19 patient. However, this technique may be difficult for medical officers unfamiliar with the intubation protocol sequence, especially for those with less experience in anaesthesia. Video tutorials may play a vital role in improving the technique. This study evaluated the compliance of medical officers in our anaesthesia department to the intubation protocol and the effect on compliance before and after viewing the video tutorial on the protocol.

Methods: A total of 70 medical officers (n = 70) in the Department of Anaesthesia, Hospital Universiti Sains Malaysia, Kelantan participated in this study. The participants performed the intubation protocol sequence on a simulated Covid-19 mannequin. Participants then viewed a video tutorial after their initial attempt and repeated the intubation sequence afterward. The outcomes measured include the proportion of participants compliant with the intubation protocol, the association

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between years of experience and compliance, and the compliance score before and after the video tutorial.

Results: There was no significant association between years of anaesthesia and compliance score (p = 0.058). A large proportion of the subjects were compliant (n = 57, 81.4%). There was a significant difference between initial and repeated compliance score post-video tutorial ($p < 0.05$).

Conclusion: Years of experience in anaesthesia was not a determining factor for compliance with the intubation protocol sequence on simulated Covid-19 patients. However, the video tutorial played a significant role in improving compliance with the intubation sequence.

Keywords: Covid-19, intubation, protocol, video laryngoscope, video tutorial,

Introduction

Covid-19 is a highly contagious disease and the highest viral load is found in sputum and upper airway secretions.[1] Personnel that performs tracheal intubation on Covid-19 patients may be exposed to the disease as the procedure may cause aerosolization and contaminate the airway of the operator along with the personal protective equipment (PPE) and parts of the exposed area of the body.[2] Performing tracheal intubation in such patients may be difficult when wearing eye goggles, face shields, or using an aerosol box.[3] However, some authors and guidelines recommend using the box as part of the protective strategy in handling Covid-19 patients.[3,4]

Experts also recommend using a video laryngoscope (VL) for the initial attempt of tracheal intubation in these patients for optimum intubation.[5,6] The use of a VL decreases the risk of contamination as it creates a distance between the operator and the patient's face.[7] Different VLs may perform differently depending on the setup and work.[8] In our setup, the Insighters© VL (iS3 type , Shenzhen Insighters Medical Technology, Shenzhen, China) was used by anaesthetists to handle Covid-19 patients who required tracheal intubation for ventilator support. Video tutorials are one of the tools used for teaching; well-designed and assessment-focused tutorial videos improve outcomes, especially in university settings.[9]

Simulated training and workshops improve performance outcomes of health care providers[10] and the use of mannequin training in simulations also aid in management strategies, improving performance, and skill retention.[11] Hence, the

use of video tutorials may improve performance post-tutorial, which can easily be assessed.

The anaesthetist must be familiar and compliant with the protocol involving the steps to tracheal intubation of Covid-19 patients when using the VL and aerosol box. Determining the compliance with the intubation protocol for anaesthetists in our department using VLs, specifically the Insighters VL, which is primarily used to handle Covid-19 patients in our setup, has been crucial during the Covid-19 pandemic outbreak.

Methods

This study, designed as a pre- and post-interventional study, was approved by the Medical Research and Ethics Committee (JEPEM) of Universiti Sains Malaysia (USM/JEPeM/20120687). Recruitment was open to all anaesthesia trainees in our institution within the Department of Anaesthesia, who were invited to participate in the study through serial announcements within the department. Inclusion criteria included medical officers with any experience in anaesthesia who consented to participate in the study.

The sample size was estimated using GPower software. Since there have been no previous studies looking at the effectiveness of video tutorials on intubation protocol compliance for Covid-19 patients, we assumed that the proportion of outcome post-intervention was at least 50% with an alpha value of 5%, power of 80%, and attrition rate of 20%, giving a desired sample size of 70. Seventy anaesthesia trainees were recruited for this study. All participants consented to participate in the study and attended the intubation station, which included the Insighters VL, an aerosol box, and a simulated Covid-19 patient (mannequin). Years of experience in anaesthesia for each trainee was recorded.

Each trainee then performed the intubation sequence using the Insighters VL pre-video tutorial. Each trainee was allowed only one session for attempt at the simulation station. All trainees were required to don full PPE with face shields for the simulation. An assistant was provided to aid in preparing the intubation equipment and to assist during the intubation. Participants were allowed a maximum of 2 attempts to intubate the mannequin. The researcher marked the subjects' performance based on the checklist steps in the pre-intubation, during intubation, and post-intubation phase (pre-video tutorial). The intubation sequence ended after the trainee successfully intubated the mannequin, connected the endotracheal tube to the self-inflating bag, and was able to provide

ventilation. After the initial intubation sequence was completed, the trainee then immediately viewed the video tutorial. After fully viewing the video tutorial, the trainee repeated the intubation sequence and the researcher marked the subjects' performance based on the same checklist (post-video tutorial).

The participants' compliance to the intubation sequence protocol was then scored based on the pre- and post-video tutorial by a single assessor, who was one of the researchers in this study during all the sessions. Each step completed during the intubation sequence was given a score of one point for a total score of 22 points. Compliance was checked by awarding points based on the steps completed during the intubation sequence and according to the correct sequence. A score of less than 80% was defined as non-compliant with the intubation protocol sequence, while a score of 80% or more was defined as compliant with the intubation protocol sequence. Initial compliance was regarded as the completion of the sequential steps based on the checklist for pre-intubation, during intubation, and post-intubation before the trainees viewed the video tutorial.

Our study assessed the compliance of trainees to successfully follow the correct steps from pre-intubation until completion of the procedures, including successful intubation and ventilation via self-inflating bag, where the total score achieved was the determinant of success. However, there have been no previous studies that incorporated a scoring system for checking adherence to the specific steps. Our study defined completion of at least 80% of the steps of the protocol as compliant since no other reference could be quoted.

Results

Seventy subjects were enrolled in the study and included in the final analysis. Baseline demographic for all participants showed the mean age of subjects recruited was 34.1 years (SD = 1.626) of age. They were predominantly female (*n* = 42, 60%). Of the 70 participants, trainees with < 2 years of experience were the minority (*n* = 5, 7.14%), followed by trainees with 2–4 years (*n* = 27, 38.57%), and > 5 years of experience (*n* = 38, 54.29%).

The results showed that trainees with < 2 years of experience had a mean compliance score of 17 (SD = 1.58), while trainees with 2–4 years and > 5 years of experience had an almost similar mean compliance score with 18.4 (SD = 1.28) and 18.7 (SD = 1.34), respectively. Table 1 shows that the majority of trainees were compliant with the intubation protocol (*n* = 57, 81.4%). Trainees with < 2

Table 1. Association between years of anaesthesia and initial compliance score (*n* = 70)

Years of experience	Initial compliance		
	Compliant, *n* (%)	Non-compliant, *n* (%)	*p*-value
< 2 years	2 (40)	3 (60)	0.058[a]
2–4 years	22 (81.5)	5 (18.5)	
> 5 years	33 (86.8)	5 (13.2)	
Total	57 (81.4)	13 (18.6)	

[a]Fisher's exact test

Table 2. Comparison on initial and repeated compliance score (*n* = 70)

Variable	Mean (SD)				
	Initial	Repeat	Mean difference (95% CI)	Statistic (df)	*p*-value
Initial-repeat	18.5 (1.39)	21.2 (1.14)	2.67 (2.48, 2.89)	25.6 (69)	> 0.000a

[a]Paired t-test

years of experience had the largest proportion of non-compliance (n = 5, 60%). Trainees with 2–4 years and > 5 years of experience had the largest proportion of compliance, with only a small proportion being non-compliant (*n* = 27, 18.5%) and (*n* = 38, 13.2%), respectively.

The association between years of anaesthesia and compliance to the sequence of intubation protocol was evaluated (Table 1). Our findings showed that the association between years of experience in anaesthesia and compliance score was not statistically significant ($p = 0.058$).

An evaluation of initial *versus* repeated compliance score was carried out (Table 2). The results showed that initial compliance score (mean = 18.5) *versus* repeated compliance score (mean = 21.2) were found to be statistically significant at p-value < 0.05.

Discussion

Covid-19 is a highly contagious disease, easily transmissible via aerosol-generating procedures, posing a risk to health care workers if necessary precautions are not

taken.[2] The medical officer must not only fully adapt to the use of full PPE, but also be well-versed in the standard intubation protocol sequence along with the use of the aerosol box and VL, which may be difficult if the officer is not familiar or compliant with the protocol.[3-5]

Trainees with long years of experience, especially in the field of anaesthesia, may be more competent in terms of skills and knowledge, including the intubation protocol and technique for dealing with Covid-19 patients. However, there is no standard definition on the exact years of experience to denote whether trainees are novices, experts, or truly experienced, or specific criteria to denote that an officer has sufficiently mastered the use of certain VLs or techniques. Our study showed that most of our department's medical officers were compliant with the intubation protocol (n = 57, 81.4%) compared to those who were non-compliant.

Our study found no significant association between years of anaesthesia experience and intubation protocol compliance (p = 0.058). This suggests that although experience is crucial, adequate training on the intubation protocol among trainees regardless of years of experience may be sufficient to allow them to be familiar and compliant with the protocol. Despite the indication that years of experience may not be a significant factor for compliance, our study does indicate that medical officers with < 2 years of experience had the largest proportion of non-compliance (n = 5, 60%). However, since the number of trainees with more than 2 years of experience comprised the majority of participants, the proportions were skewed. Thus, another properly planned study is required to assess this.

Binstadt *et al.* and Kuduvalli *et al.* conducted a study that showed that simulated training and mannequin simulation improved performance and skills.[10,11] We found that the video tutorial and mannequin simulation improved the medical officers' performance in handling the VL as well as their compliance with intubation protocol on simulated Covid-19 patients significantly (p < 0.05). This suggests that video tutorials are an essential tool to be incorporated into training protocols.

Our study had several limitations. First, subjects recruited in this study were from a single institution. Hence, this study may not represent the true population of medical officers or trainees in anaesthesia departments globally. Second, the compliance score used in our study was not based on existing literature, as to our knowledge, no studies have been conducted regarding intubation sequence compliance. Our study was the first to incorporate a specific compliance score on intubation protocol for Covid-19 patients. The results of this study may not represent true compliance with the intubation protocol.

The third limitation involves the intubation protocol sequence used as a standard protocol at our institution. Our department drew up the protocol for intubating Covid-19 patients from various recommendations and articles from the World Health Organization, British Journal of Anaesthesia, and New England Journal of Medicine. Different institutions incorporate different elements in their intubation protocol. Hence, our study may not be representative of other institutions. Finally, our study did not include blinding of the assessor and may therefore be at risk of bias.

Conclusion

The video tutorial significantly improved the compliance to the intubation protocol. Years of experience in anaesthesia did not significantly affect compliance to intubation protocol for Covid-19 patients.

Declarations

Ethics approval and consent to participate
This study involving human participants, materials, and/or data have been performed in accordance with the Declaration of Helsinki, had informed and explicit consent, and was granted approval by the Jawatankuasa Etika Penyelidikan Manusia Universiti Sains Malaysia (JEPeM-USM), study protocol code USM/JEPeM/20120687.

Competing interests
Dr. Rhendra Hardy Mohamad Zaini and Dr. Wan Mohd Nazaruddin Wan Hassan serve as Section Editors of Malaysian Journal of Anaesthesiology. Neither has been involved in any part of the publication process prior to manuscript acceptance; peer review for this journal is double blind. The remaining authors state no conflict of interest.

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Appendix

Checklist for compliance check on of intubation protocol sequence (1 point for each step completed in the correct sequence). Maximum 2 attempts for intubation on mannequin.

Pre-intubation steps	**Yes/No**
Use full protective personal equipment (PPE) as appropriate	
Prepare endotracheal tube (ETT) with J-shaped stylet; (lubricate with jelly and insert stylet into ETT)	
Mentioned left hand to handle Insighter and right hand to handle ETT	

Intubation steps	**Yes/No**
Mentioned Insighter prepared from outside of the aerosol box and participant will bring the device inside the box through left opening	
Insighter blade inserted into the mouth centrally	
Glide the blade slowly until able to visualize the epiglottis	
Just lift the blade gently to fully visualize the airway opening/vocal cord	
Prepared ETT will be passed by assistant to the participant through the box right opening	
ETT should be held transversely and not vertically prior to insertion	
ETT inserted from the right side of mouth	
Glide the ETT above the Insighter's blade as pushing it inwards	
Once ETT pass through the vocal cord, push out the upper stylet from ETT with the right thumb	
Push the ETT further inside as appropriate to desired level	
Take out the Insighter and put it beside patient at the left side	
Stabilize the ETT by holding it with the left hand	

Intubation steps	**Yes/No**
Take out the stylet from the ETT with the right hand	
Cuff inflated with the help of assistant	
Connect the ETT with self-inflating bag/ventilator	

Post-intubation steps	**Yes/ No**
Detach the Insighter blade while it's still within the aerosol box	
Blade should be put inside a plastic bag	
Mentioned assistant to take the plastic bag containing the blade for decontamination	
Clean the scope with alcohol swab before it is taken out from the aerosol box	