Intubation Call for Coronavirus Disease 2019 (COVID-19) Patients

Pawinee Pangthipampai, Rattanaporn Tankul, Manee Raksakietisak
Department of Anesthesiology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand

During COVID-19 pandemic, the anesthesiologists have responsibility for intubation in COVID-19 patients who develop hypoxia and require ventilatory support. Intubation is a critical time of viral spreading. We would like to share and compare our intubation experiences with COVID-19 patients in the context of existing guidelines and recommendations. There were four COVID-19 patients involved by anesthesiologists at Siriraj Hospital. Three patients required intubation while one patient required endotracheal tube changing. There were both similar and different in intubation processes with existing guidelines and recommendations. However, several topics are still controversies. Reliable use of personnel protective equipment significantly prevents contact disease. All involved staff were healthy afterward. The excellent communication sharing updated information for clinicians is necessary in every hospital. Finally, the local guidelines also need to be regularly updated and revised following the updated knowledge that rapidly changes.

Keywords: Anesthesiologist, COVID-19, Intubation

วิสัญญีสาร 2563; 46(3) ฉบับพิเศษ: 54-60. • Thai J Anesthesiol 2020; 46(3) supplement: 54-60.

Introduction

Siriraj Hospital, Faculty of Medicine, Mahidol University, is a 2,500-bed supertertiary, teaching hospital in Thailand. Since early March in 2020, the faculty has massively prepared to manage this pandemic. One task for anesthesiologists is intubation when COVID-19 patients develop hypoxia and require ventilatory support. The intubation process is clearly a time of high risk in spreading the virus from patients' airway. It is also a precious time for anesthesiologists to use our expertise to help patients and to protect other healthcare workers from this highly contagious virus. The authors would like to share and compare our intubation experiences with COVID-19 patients in the context of existing guidelines and recommendations. The study was approved by the Siriraj Institutional Review Board (SIRB) of Mahidol University, Bangkok, Thailand (COA no. 365/2020).

COVID-19 can spread through respiratory droplets (>5 μ) produced when people cough or sneeze. During a simulation of a forceful cough in operating room, there is contamination of the floor within approximately 1 m from the head of the bed and also on a monitor located more than 2 m away.[1] Contaminated surfaces can be a contact hazard, as viable virus have been detected up to several hours after hitting surfaces and even up to 72 h on plastic surfaces.[2] Aerosols (<5 μ) are more dangerous because they are too small to fall to the ground as droplets do. These small particles of water are carried by air currents and dispersed by diffusion and air turbulence. A recent study found that COVID-19 aerosols remain viable for up to 3 h.[2] Thus, aerosol-generating procedures, especially intubation, have been associated with the burden of a viable virus within the created aerosol, which poses a great risk of transmission to healthcare workers.[3] Moreover, in a systematic review, the ranked airway procedures in descending order of risk of transmission are tracheal intubation, tracheostomy, non-invasive ventilation, and mask ventilation, respectively. Other potentially aerosol-

Correspondence to: Pawinee Pangthipampai, MD., E-mail: pawinee141@gmail.com
Received 25 May 2020, Revised - , Accepted 27 May 2020

generating procedures include disconnection of ventilatory circuits during use, tracheal extubation, cardiopulmonary resuscitation (before tracheal intubation), bronchoscopy, and tracheal suction without a closed in-line system.[3]

Case 1

A 47-year-old man who is a taxi driver had hypertension and non-insulin dependent diabetes mellitus (NIDDM). His body weight was 106 kg. and his height was 175 cm. (BMI 34.6). Three days after admission, his respiratory symptoms deteriorated. Despite using high-flow nasal cannula (HFNC) (60 LPM, FiO2 0.4), his oxygen saturation (from pulse oximetry) was 84%. His next step treatment was ventilator support. The anesthesiologist and one nurse anesthetist were called for intubation. They wore powered air-purifying respirator (PAPR) into the negative-pressure isolation room. They decided to put the patient into the RAMP (Rapid Airway Management Positioner) position and pre-oxygenate him via previous HFNC therapy. The patient's oxygen saturation could increase up to 95%. Rapid-sequence induction with a McGrath VDO laryngoscope with disposable blade No. 4 was used. Thiopental 400 mg and succinylcholine 150 mg were given to him. Intubation was successful on the first attempt; he didn't cough or require suction. His oxygen saturation dropped down to 80% and then rapidly increased after inflating the endotracheal cuff and connecting him to a ventilator. There was no significant hemodynamic change during and immediately after intubation. Intubation was confirmed by seeing the endotracheal tube pass through his vocal cord, and observing his chest rise after he was connected to the ventilator. The intubator had difficulty dealing with high-flow nasal cannula. He wanted to turn it off after the patient experienced apnea, but he wasn't sure, so he decided to remove it from the patient's nose, instead. This patient was on a ventilator for 15 days and stayed in the ICU for 23 days. He was discharged to the hospital, which is near his house, for pulmonary rehabilitation.

Case 2

A 38-year-old female Thai traditional masseuse who had frequent contact with foreigners developed a high-grade fever that persisted even though she took antipyretic drugs for several days at home. She went to hospital and her respiratory swab was positive for COVID-19. Three days after admission, she developed dyspnea and hypoxemia, despite having treatment with HFNC 60 LPM, FiO2 0.4. Her saturation was 92%. Her body weight was 96 kg, and her height was 160 cm (BMI 37.5). She had no underlying diseases. The anesthesiologist, one nurse anesthetist, and one ICU staff worked together during the intubation. High-flow nasal cannula was carried on for pre-oxygenation. The patient's oxygen saturation could reach 98%. Glycopyrrolate 0.4 mg, propofol 250 mg, and succinylcholine 200 mg were given to her. Rapid-sequence induction with a McGrath VDO laryngoscope with disposable blade No. 4 was used. The patient developed bradycardia and hypotension for a short while, and were improved without treatment. Intubation was successful on the first attempt; she didn't cough and there were no interventions. The oxygen saturation level dropped down to 80% and rapidly improved after she was connected to the ventilator. Intubation was confirmed by watching the endotracheal tube pass through her vocal cord and seeing her chest rise after she was connected to the ventilator. The ICU staff was very helpful by adjusting the HFNC, turning it off when patient had apnea, and then connecting and adjusting the ventilator afterward. During the anesthesia team left the isolation room, the patient started to wake up and move a lot. The endotracheal tube was cephalad displaced for 1 cm. Then, she was sedated and paralyzed to prevent fighting ventilator. She remained intubated for 15 days and stayed in the hospital for 23 days. She was discharged after COVID-19 was not detected in her via two consecutive tests. She was advised to do home isolation for six weeks.

Case 3

This was a 66-year-old Thai-Indian man with hypertension, NIDDM, hypothyroidism, and colon cancer who had previous surgery and chemo-radiation treatment. After traveling back from India, he developed a low-grade fever and a loss of appetite. He was first admitted at a private hospital with a diagnosis of a mild form of COVID-19 infection. After five days, his respiratory symptoms were getting worse. He was transferred to Siriraj Hospital and tried HFNC therapy. His oxygen saturation climbed up to 92%. The next day, he needed to be intubated and put on ventilator support. His body weight was 108 kg, and his height was 170 cm (BMI 37.4). Propofol 100 mg and succinylcholine 150 mg were given to him. The previous HFNC was used for pre-oxygenation. A rapid-sequence induction with a McGrath VDO laryngoscope with disposable blade No. 4 was used. The patient developed tachycardia and hypertension for a short period. Intubation was successful on the first attempt, without coughing. However, due to the soft type of endotracheal tube, after removing the stylet, there was difficulty in passing the tube into his vocal cord. The oxygen saturation level dropped down to 54%. After inflating the cuff and connecting him to a ventilator, the oxygen saturation level was better. Moreover, there was another difficulty: strapping the endotracheal tube because of the patient's beard. He was on a ventilator for 6 days before successful extubation and weaning to HFNC. After staying in the ICU for 27 days, he was transferred to a cohort hospital (the Golden Jubilee Medical Center, Faculty of Medicine, Siriraj Hospital, Mahidol University).

Case 4

This was a 69-year-old man with underlying hypertension, NIDDM, and benign prostatic hypertrophy. He was intubated at a private hospital because he had pneumonia after six days of unspecified symptoms such as a low-grade fever, fatigue, and abdominal pain. He did not report any risky history. When his COVID-19 test was positive, he was transferred to Siriraj Hospital. After 14 days in the ICU, his endotracheal was leaking. Fentanyl 50 mcg, dormicum 2 mg, and rocuronium 50 mg were given to him for tube-changing. After full relaxation, the intubator applied a laryngoscope until seeing the vocal cord, and then the endotracheal tube was clamped, and the ventilator was put on a stand-by-mode. His hemodynamic was stable throughout the tube-changing period. There was no desaturation at all. We thought that, in order to avoid aerosol from the patient's respiratory tract, we had to turn off the ventilator and clamp the tube before applying the blade. However, this process was not our normal workflow.

Discussion

Generally, anesthesiologists do not intubate patients with a highly contagious disease. The safety of the patient and the individuals who are involved in the COVID-19 intubation requires special consideration and precautions.[4] It is critical to include the risk of mental-bandwidth saturation as a risk for contamination before starting the task.[5] Not only these two principles are not equally weight for the normal workflow, but also unfamiliar working equipment and environment such as personal protective equipment (PPE) is a great obstacle. Thus, both preparing and practicing in advance are mandatory, as suggestion in simulation-based education for COVID-19.[6-8] Moreover, the stress of contracting a deadly disease may degrade healthcare workers' performance and lead to an increased likelihood of non-adherence to infectious-disease protocols, increasing the risk of provider exposure.

The most experienced anesthesiologists and limit number of healthcare workers during the intubation process have been endorsed almost in all guidelines.[9-12] Similarly, at our institution, anesthesiologist staff members do the intubation; nurse anesthetists facilitate with drug injection and intubation; while one ICU staff who works in the negative-pressure isolation unit helps with the high-flow nasal cannula and ventilator machine. Dedicated intubation teams are used in some hospitals.[4, 13] In China, a total of 2.7-3.8% of healthcare workers were infected with COVID-19,[14, 15] and their mortality rate was about 0.3%.[16] Transmission of infection to tracheal intubators was assessed continuously by symptoms and signs of COVID-19 during a 14-day quarantine in a private hotel room. Anesthesiologists without clinical symptoms after quarantine were tested with reverse transcriptase (RT)-polymerase chain reaction (PCR) in respiratory samples. Following confirmed negative PCR test results, the anesthesiologists were allowed back home or to work in the hospital again.[17] This was not done in our institute. Fortunately, all eight staff members involved with intubations had not contacted the virus and remained healthy. All of us wore powered air-purifying respirators (PAPR) and were checked both at the donning and doffing period by an experienced nurse who works in the negative-pressure isolation ward. There was a report from Canada that healthcare workers became infected during the resuscitation of patients with severe acute respiratory syndrome-related coronavirus (SARS), despite wearing N95 masks.[18] It is mandatory to report any inadvertent contamination of the skin or mucosa to the hospital infection-control office to assess the need for quarantine.[19] Comparing personnel positive equipment (PPE) with goggles or face shields, PAPR provide full facial and head coverage and eliminate N95 fit-testing concerns. However, PAPR may be more complicated to be removed and can thus lead to a greater risk of contamination.[10] A shower and the use of oral, nasal, and external auditory canal disinfectants are recommended after completion. Moreover, we consider excluding staff who are vulnerable to infection from the intubation call, including staff who are retirement-age (> 60yrs) or pregnant; this corresponds with some guidelines.[9]

Intubation by using the rapid-sequence induction technique with full paralysis and no ventilation have universal acceptance.[9, 19] Laryngoscopy and tracheal intubation only causes aerosols if coughing is precipitated or another aerosol-generating procedure is performed, such as positive-pressure ventilation or suction. The drugs used, such as propofol, ketamine, or midazolam with etomidate, depend on the patient's status or hemodynamic baseline before intubation.[9, 17, 20] The key is to ensure profound paralysis before instrumenting the airway. Fortunately, all our patients were hemodynamically stable without using any inotrope or vasopressor before their airway management. The extended duration of the action of rocuronium may be benefit over succinylcholine by preventing coughing in case more intubation attempts required or allowing more time to fix the endotracheal tube, settle the ventilator, etc. However, the Cochrane review showed that succinylcholine was superior to rocuronium in achieving excellent intubating conditions.[21] High-dose opioids should be used with caution, due to their potential coughing.[19, 22] Giving opioids to suppress laryngeal reflexes and optimize the intubation conditions was suggested after the accomplishment of satisfactory muscle relaxation.[19] Antisialagogues do not appear in any guidelines; we used that drug in the second case. Up to now, a productive cough may not be a common symptom of COVID-19.[23] Protective barriers such as two wet gauzes,[4, 24] a three-layer plastic drape,[25] or the more sophisticated plastic box,[26] were introduced to limit the spreading of droplets and aerosols during intubation and extubation. A study found that the plastic box can restricted hand movement and required training before use in the treatment of patients.[1] Thus, it is advised that intubators should be ready to abandon use of the box when facing airway difficulties. These may imply with other barriers too. All patients in our series were obese and were admitted into a negative-pressure isolation room. Thus, to avoid difficult intubation and achieve a simple, accurate, and swift intubation, we chose not to use any former barriers. However, we believe that all barriers will be useful after proper training and if airway management occurs outside a negative-pressure isolation room or in situations in which there is a shortage of PPE.

Pre-oxygenating with passive breathing and minimal oxygen flow in a well-fitting face mask for 3-5 min is ideal. Nasal cannula or face masks are mostly not adequate for impending-respiratory-failure COVID-19 patients. A non-rebreathing circuit such as Mapleson C with a fit face mask may be considered. However, this trade with the fact that spontaneous ventilation requires a high flow of approximately twice-a-minute ventilation to prevent rebreathing.

A high-flow nasal-cannula (HFNC) delivery system is not recommended[9, 19]and should be limited to patients in a negative-pressure isolation room.[10] During the SARS outbreak, there were reports of significant transmission secondary to non-invasive ventilators (NIV).[10] However, manikin studies suggest that dispersal of liquid from HFNC at 60 LPM is minimal, and significantly less than that caused by coughing and sneezing, providing that nasal cannula are well-fitted.[27, 28] Novel version machines which are better fitted may expose staff to lesser risk. Our patients failed to show improved oxygenation via HFNC therapy. The patients' obesity made them susceptible to rapid desaturation in periods of apnea. Even though we considered using previous HFNC for pre-oxygenation, their oxygen saturations went down significantly. One forgotten strategy is the patient's position while pre-oxygenating. Obesity is one risk factor for COVID-19 respiratory failure,[29] and this was similar manifested with our patients. The Reverse Trendelenburg or head-up position while pre-oxygenating helps to maximize the safe apnea time.[17] Capnography with a triangular rather than square wave or a low numerical value during pre-oxygenation helps to indicate any leak around the face mask.[30] And a bag collapses when using Mapleson systems provides a sensitive indication of face-mask leaks and thus potential aerosolization.[30] The authors suggest any patient's beard should be removed upon admission, as the beard can be a place of droplet accumulation. Moreover, beard obscures the adequate seal when mask ventilation is required.

A videolaryngoscope is recommended, and a separate display from patients helps intubators keep distance from patients' airway.[10, 11] Disposable VDO laryngoscope blades are preferred and, if reusable, are unavoidable, the disinfection after being used must be planned. Our department has prepared the McGrath laryngoscope with disposable blades and plastic coverage of the handle. It has a lightweight handle and a built-in battery. Its blade is the Macintosh-type slim profile, without a tracheal-tube guide channel. There was no anti-fog mechanism, so strategies for clarity of vocal-cord imaging were mandatory. All of us used alcohol pads to wipe the distal lens tip, and there was no hampering of vision at all. There had not been any published reports on factors associated with failed intubation specifically involving the McGrath device. However, the limited neck motion, and inexperienced staff, was found to be associated with failed intubation via VDO laryngoscopes.[31, 32] The stylet, gum elastic bougie, and tube exchanger are basic things that help with first-pass success. In our series, McGrath with the stylet endotracheal tube were used in all cases.

Verifying and confirming endotracheal intubation should be confirmed with end-tidal carbon dioxide (capnography) detection. Listening to the breath sound is impractical with PAPR. Visualization of the endotracheal tube passing through the vocal cord may not be reliable in laryngeal view grades 3 and 4. In our series, a capnograph was not available in the first case. In the second case, there was a cable, but it did not have a module. After that, capnograph were well-prepared and ready to be used. The authors believe that simulation with all involved departments can help to prepare for and avoid several problems in advance. Inflating the tracheal cuff to seal the airway was ensured before starting the ventilation. Seeing the endotracheal cuff pass approximately 2 cm beyond the vocal cord and watching the bilateral chest rise helps correct the depth of the endotracheal tube.[17] However, chest radiography will be finally used to confirm the correct position, as COVID-19 patients mostly need to be in the prone position afterward.

Fortunately, there were no cases of unexpected difficulties. A careful and efficient airway evaluation, whenever possible, should be performed ahead of the intubation. In our case, negative-pressure isolation rooms were built with transparent glass so that the intubation team could assess the patients' airway. Some specialists recommend using the MACOCHA score (Malampatti, obstructive sleep apnea, c-spine movement, mouth opening, coma, hypoxemia, non-anesthetist intubator) to predict a difficult airway.[9] However, the authors believe that this depends on an individualized airway-management strategy, along with the staff's experiences and the characteristics of the instruments used. If there is difficult intubation, or a can't- intubate/can't-oxygenate situation happens, there are several more issues at play. However, the safety of the patient and the risk of viral transmission are fundamentals. Because we did not encounter such a situation, the authors have chosen not to discuss it in this paper.

Checklists, cognitive aids, and flow diagrams help reduce the incidence of errors during airway management. Moreover, clear communication is vital while managing the COVID-19 patient group, due to the risk of staff contamination. At the same time, PPE may impede clear communication. Briefings are very important within the intubation team and ICU staff. Finally, the reliable use of PAPR or PPE with correct donning and doffing significantly reduced the transmission risk, even though several small errors might happen, such as turning on the ventilator while applying the laryngoscope blade in the fourth case.

Conclusion

The authors suggest that every hospital needs a single, highly reliable message source so it can be in line with the local authorities. We must have an excellent source of communication for sharing information and keeping clinicians updated. Knowledge of COVID-19 is changing every day, and this includes information on the best practice of airway management for patients. The local guidelines need to be regularly updated and revised, not only from more available data, but also from the experiences of local staffs in detecting their potential risks after working with COVID-19 patients.

Acknowledgment

We sincerely appreciate the working group for COVID-19 at Department of Anesthesiology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand for preparing equipment, workflows, brief guidelines and update information for handling with COVID-19 patients.

Conflicts of interest

There are no conflicts of interest.

References

1. Canelli R, Connor CW, Gonzalez M, Nozari A, Ortega R. Barrier enclosure during endotracheal intubation. N Engl J Med 2020;14;382:1957-58.
2. van Doremalen N, Bushmaker T, Morris DH, et al. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. N Engl J Med 2020;382:1564-7.
3. 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. doi: 10.1371/journal.pone.0035797.
4. Luo M, Cao S, Wei L, et al. Precautions for intubating patients with COVID-19. Anesthesiology 2020;132:1616-1618.
5. Runnels S, Ferranti D, Davis AN, Pollard J. The Utah model: Mental bandwidth and strategic risk generation in COVID-19 airway management. Anaesthesia 2020. doi: 10.1111/anae.15086.
6. Abrahamson SD, Canzian S, Brunet F. Using simulation for training and to change protocol during the outbreak of severe acute respiratory syndrome. Crit Care 2006;10:R3. doi: 10.1186/cc3916.
7. Fregene TE, Nadarajah P, Buckley JF, Bigham S, Nangalia V. Use of in situ simulation to evaluate the operational readiness of a high-consequence infectious disease intensive care unit. Anaesthesia 2020;75:733-8.
8. Matava CT, Kovatsis PG, Summers JL, et al. Pediatric Airway management in COVID-19 patients - consensus guidelines from the Society for Pediatric Anesthesia's Pediatric Difficult Intubation Collaborative and the Canadian Pediatric Anesthesia Society. Anesth Analg 2020. doi: 10.1213/ANE.0000000000004872.
9. Cook TM, El-Boghdadly K, McGuire B, McNarry AF, Patel A, Higgs 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.
10. Wax RS, Christian MD. Practical recommendations for critical care and anesthesiology teams caring for novel coronavirus patients (2019-nCoV) patients. Can J Anaesth 2020;67:568-76.
11. Sorbello M, El-Boghdadly K, Di Giacinto I, et al. The italian coronavirus disease 2019 outbreak: recommendations from clinical practice. Anaesthesia 2020;75:724-32.

12. Peng PWH, Ho PL, Hota SS. Outbreak of a new coronavirus: what anaesthetists should know. Br J Anaesth 2020;124: 497-501.
13. Zhang HF, Bo L, Lin Y, et al. Response of Chinese anesthesiologists to the COVID-19 outbreak. Anesthesiology 2020;132:1333-38.
14. Wang J, Zhou M, Liu F. Reasons for healthcare workers becoming infected with the novel coronavirus disease 2019 (COVID-19) in China. J Hosp Infect 2020;105:100-101.
15. Wu Z, McGoogan JM. Characteristics of and important lessons from the Coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72,314 cases from the Chinese Center for Disease Control and Prevention. JAMA 2020. doi: 10.1001/jama.2020.2648.
16. Guan WJ, Ni ZY, Hu Y, et al. Clinical characteristics of the coronavirus disease 2019 in China. N Engl J Med 2020;382: 1708-20.
17. Yao W, Wang T, Jiang B, et al. Emergency tracheal intubation in 202 patients with COVID-19 in Wuhan, China: Lessons learned and international expert recommendations. Br J Anaesth 2020. doi: 10.1016/j.bja.2020.03.026.
18. Christian MD, Loutfy M, McDonald LC, et al. Possible SARS coronavirus transmission during cardiopulmonary resuscitation. Emerg Infect Dis 2004;10:287-93.
19. Meng L, Qiu H, Wan L, et al. Intubation and ventilation amid the COVID-19 outbreak: Wuhan's experience. Anesthesiology 2020;132:1317-32.
20. Zuo MZ, Huang YG, Ma WH, et al. Expert recommendations for tracheal intubation in critically ill patients with the Noval Coronavirus disease 2019. Chin Med Sci J 2020. doi: 10. 24920/003724.
21. Tran DTT, Newton EK, Mount VAH, et al. Rocuronium vs. succinylcholine for rapid sequence intubation: A Cochrane systematic review. Anaesthesia 2017;72:765-77.
22. Bohrer H, Fleischer F, Werning P. Tussive effect of a fentanyl bolus administered through a central venous catheter. Anaesthesia 1990;45:18-21.
23. Wujtewicz M, Dylczyk-Sommer A, Aszkielowicz A, Zdanowski S, Piwowarczyk S, Owczuk R. COVID-19-What should anaethesiologists and intensivists know about it? Anaesthesiol Intensive Ther 2020;52:34-41.
24. Chen X, Liu Y, Gong Y, et al. Perioperative management of patients infected with the Novel Coronavirus: recommendations from the Joint Task Force of the Chinese Society of Anesthesiology and the Chinese Association of Anesthesiologists. Anesthesiology 2020;132:1307-16.
25. Matava CT, Yu J, Denning S. Clear plastic drapes may be effective at limiting aerosolization and droplet spray during extubation: Implications for COVID-19. Can J Anaesth 2020;3;1-3.
26. Malik JS, Jenner C, Ward PA. Maximizing application of the aerosol box in protecting healthcare workers during the Covid-19 pandemic. Anaesthesia 2020. doi: 10.1111/anae. 15109.
27. Hui DS, Chow BK, Lo T, et al. Exhaled air dispersion during high-flow nasal-cannula therapy versus CPAP via different masks. Eur Respir J 2019;53(4) doi: 10.1183/13993003.02339-2018
28. Kotoda M, Hishiyama S, Mitsui K, et al. Assessment of the potential for pathogen dispersal during high-flow nasal therapy. J Hosp Infect 2020;104:534-7.
29. Simonnet A, Chetboun M, Poissy J, et al. High prevalence of obesity in severe acute respiratory syndrome Coronavirus-2 (SARS-CoV-2) requiring invasive mechanical ventilation. Obesity (Silver Spring) 2020. doi: 10.1002/oby.22831.
30. Brewster DJ, Chrimes N, Do TB, et al. Consensus statement: Safe-Airway Society principles of airway management and tracheal intubation specific to the COVID-19 adult patient group. Med J Aust 2020. doi: 10.5694/mja2.50598.
31. Suzuki K, Kusunoki S, Tanigawa K, Shime N. Comparison of three video laryngoscopes and direct laryngoscopy for emergency endotracheal intubation: A retrospective cohort study. BMJ Open 2019;9(3):e024927. doi: 10.1136/bmjopen-2018-024927.
32. Cook F, Lobo D, Martin M, et al. Prospective validation of a new airway management algorithm and predictive features of intubation difficulty. Br J Anaesth 2019;122:245-54.