Protocols and safety measurements used in intubation of COVID-19 patients

Ahmed Fouad Bogari1*, Nada Mohmmad Alharbi2, Mohammed Abdulrahman Alaqlan3, Turki Salem Aljaza4, Ali Ibrahim Alibrahim5, Fadwa Ahmed Ali6, Ibrahim Saad Alduhayshi7, Yasmeen Marwan Ghandoora8, Majed Nasser Alhajeri9, Abdullah Yahya Alshehri10, Naif Hussain Alqahtani10

1Department of Anaesthesia and Intensive Care Unit, King Fahad General Hospital, Jeddah, Saudi Arabia
2Department of Emergency Medicine, Prince Sultan Military Medical City, Riyadh, Saudi Arabia
3College of Medicine, Wroclaw Medical University, Wroclaw, Poland
4Department of Anaesthesiology, King Khalid Hospital, Hail, Saudi Arabia
5Department of Emergency Medicine, Jafr General Hospital, Al Ahsa, Saudi Arabia
6Department of Anaesthesiology, King Khalid Hospital, Najran, Saudi Arabia
7College of Medicine, Majmaah University, Majmaah, Saudi Arabia
8Department of Emergency Medicine, East Jeddah Hospital, Jeddah, Saudi Arabia
9College of Medicine, Riyadh Colleges, Riyadh, Saudi Arabia
10Department of Emergency Medicine, King Abdulaziz Specialist Hospital, Taif, Saudi Arabia

Received: 14 December 2021
Accepted: 29 December 2021

*Correspondence:
Dr. Ahmed Fouad Bogari,
E-mail: DrBogari@hotmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

The COVID-19 pandemic has forced many countries to pose an emergency to contain the contamination and prevent the further spread of the infection. In this context, many societies and research papers were published to optimize guidelines and protocols for patients undergoing surgery and subsequent intubation. Accordingly, infection control is a critical approach to reduce the rate of contamination and risk of catching infections for suspected and confirmed COVID-19 patients. As a result, various guidelines were discussed in the current literature review, including guidelines to the patient, healthcare workers, operating room, anesthesia equipment, and patient transportation. For instance, healthcare workers can protect themselves from catching infections by wearing personal protective equipment and conducting adequate disinfection measures following each operation, in addition to the proper disposal of the contaminated objects. Strictly following these protocols should be done to reduce the risk of contamination in the operating room and enhance the outcomes of the patients and healthcare workers.

Keywords: COVID-19, Intubation, Prevention, Intubation, Surgery, Decontamination

INTRODUCTION

Since the COVID-19 was declared a pandemic, many worldwide investigations and reports aimed to innovate approaches to reduce infection risk.1,2 Besides, healthcare facilities were significantly burdened, and limitations regarding available resources were reported among various countries. Furthermore, the burden was further exacerbated due to the increased rates of transmitting infections within the healthcare facilities. Healthcare workers were also affected, which impacted patients' outcomes and increased the burden over these healthcare facilities.3,4

Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) infection can be significantly transmitted to the
patient and primary healthcare workers within the hospital settings, particularly within aerosol-generating procedures (like intubation and extubation). Accordingly, infection control is a critical approach to reduce the rate of contamination and risk of catching infections for suspected and confirmed COVID-19 patients. Such measures would protect both the patient and the healthcare worker and enhance the outcomes of these personnel. Different protocols and guidelines were published among specific research papers and society guidelines. Accordingly, we aim to collect evidence from these reports to elaborate on intubation protocols and safety measurements for COVID-19 patients based on a literature review.

LITERATURE REVIEW

This literature review is based on an extensive literature search in Medline, Cochrane, and EMBASE databases which was performed on 27th November 2021 using the medical subject headings (MeSH) or a combination of all possible related terms, according to the database. To avoid missing potential studies, a further manual search for papers was done through Google Scholar while the reference lists of the initially included papers. Papers discussing protocols and safety measurements used in intubation of COVID-19 patients were screened for useful information. No limitations were posed on date, language, age of participants, or publication type.

DISCUSSION

The rate of COVID-19-related acquired hospital infections has been demonstrated to be higher during the pandemic more than during standard settings. For example, a previous report showed that 41.3% of patients with COVID-19 infections (n=138 cases) were attributed to hospital-acquired infections. Besides, more than two-thirds of these cases (70%) were healthcare providers. Therefore, taking care of the appropriate interventional approaches and following the specified guidelines is mandatory to reduce the rates of infections among healthcare providers when performing intubation and other healthcare-related approaches. Furthermore, for individuals conducting intubation, it has been recommended that these healthcare workers should follow standard level 3 protection. The intubation team should also wear double gloves, gowns, N95 1860 filter, and double masks. The third pair of gloves is also recommended to wear by the healthcare worker providing the intubation process. This equipment should be disposed of shortly after intubation based on the specified guidelines. During the intubation process, evidence also indicates that wearing full protective headgear and goggles is vital to maximize the benefits and reduce the risk of transmitting or catching the infection.

Recommendations to designing a standardized operating room were also described in the literature. For instance, it has been shown that it is advisable to install a powered air-purifying respirator system during intubation. In addition, before having contact with any furniture or equipment within the room and following direct patient contact, the outer part of the protective appliance should be immediately removed to prevent further contamination. Using alcohol-based disinfectants is also recommended to hand cleansing and minimize the risk of transmitting the infection. A disposable cover should also be used when endotracheal intubation via video laryngoscopy is indicated. Although the feasibility of fiber optic intubation has been proven in the literature, it has been shown that performing proper disinfection to these devices is not convenient. Therefore, following strict disinfection measures should be performed when this process is indicated. For instance, using different coverings for each patient might be suitable. Contaminated instruments and appliances should be not be moved from one place to another (especially to a clean area) and should be limited to the contaminated field only. Strict guidelines should be followed to minimize the risk of transmitting the infection. Considerable care should also be provided when dealing with potentially contaminated gowns, gloves, head covers, and masks.

Extra tools and personnel might be needed when intubation is conducted to overcome certain challenges and circumstances in the operating room. Accordingly, healthcare facilities should provide additional equipment and a backup plan to overcome these issues. For instance, a multidisciplinary team should be available and prepared to overcome any potential sudden events during intubation. Moreover, it has been advised that a laryngeal mask should be used as an alternative bridging approach in cases of intubation failure until successful intubation or bedside tracheostomy has been achieved.

Evidence shows that anesthesia is vital for conducting successful intubation for COVID-19 patients. However, it has been reported that the importance of this step decreases during times of pandemics, as the COVID-19 pandemic, because of the increased risk of transmitting infections. Accordingly, it has been demonstrated that anesthesia and intubation of COVID-19 patients require integrating certain considerations and precautions to achieve the best care practice and enhance patient outcomes. In this context, many previous investigations in the literature have formulated evidence regarding integrated approaches for conducting successful intubation among COVID-19 patients. In the present literature review, we aim to collect information from these relevant investigations that discussed the precautions and recommendations of intubation for COVID-19 patients, aiming to enhance the quality of care for both the healthcare provider and the patient.

Intubation might be a challenging approach for COVID-19 patients. These patients are at increased risk of developing multiple organ failure and myocardial injuries. Accordingly, it has been demonstrated that the affected patients will suffer from low oxygen saturation...
secondary to hemodynamic instability. Thus, the oxygen supply in the affected patients will be impoverished, particularly among patients suffering from severe illness. In these events, evidence shows that rapid sequence induction should be recommended to overcome these limitations and make the intubation process easier. Moreover, assisted mask ventilation should not be used in the surgical field to intervene against virus scattering. Covering the patient’s mouth and nose with a wet sterile gauze is also recommended when positive mask ventilation is needed according to the clinical manifestations of the affected patients. This is designated to reduce any potential viral spread during the surgical procedure. Moreover, it is recommended that muscle relaxants should also be used in these events to facilitate the procedure.\(^5^{,}\)\(^9\) To maximize the safety of the operating patient, it has also been recommended that performing tracheal intubation should only be conducted by an expert anesthesiologist, another experienced healthcare provider, and a nurse. This will also reduce the risk of developing potential circulatory failure and severe hypoxemia among patients. Evidence furtherly indicates that the administration of muscle relaxants is advisable in these events. Shortly after administering muscle relaxants, video laryngoscopy should be conducted to achieve successful tracheal intubation. As healthcare providers usually wear personal protective equipment (PPE), it is hard to identify the appropriate intubation depth during the surgery through auscultation. Accordingly, it has been recommended that the depth of intubation be determined by respiratory parameters, ventilator breathing waveform, and bilateral chest expansion. Successful tracheal intubation should preferably be done by end-tidal CO\(_2\). This is because oxygen saturation might not be sensitive enough in these events. After all, COVID-19 patients might have impaired gas exchange, indicating false oxygen saturation results.

When the fasting time is vague, and cord exposure is difficult, guidelines show that circoid displacement or decompression is usually needed. Suction should also be prepared to be used whenever needed. Repeated attempts of endotracheal intubation can also exacerbate viral spreading events. Accordingly, tracheal intubation should be conducted for one time, and if it fails, a laryngeal mask should be recommended. Another potential issue that might make intubation challenging is fogging glasses during rapid intubation. This might complicate the procedure and make airway management challenging to achieve. In addition, increased risk of infection and potential injury might develop secondary to these events. Covering the inner aspects of glasses with anti-moist measures might be an easily applicable approach to overcome this issue.

Transporting patients within a medical facility should be done, with patients wearing a surgical mask. Besides, the transported patients should be moved directly to the operating room without passing through the pre-induction or bypassing areas. Previous studies reported that some healthcare facilities might use HEPA filtration and tenting systems when transporting COVID-19 patients within their institutions.\(^10^{,}\)\(^11\) It has furtherly been recommended that a highly productive heat and moisture exchanging filter (HMEF) should be inserted between the transported patient and the Ambu or self-inflating bag when transporting intubated patients. During the transportation process, attending clinicians should not also contact any surrounding environmental surfaces (like elevator buttons) and should get help from other personnel whenever needed (for instance, a security officer).\(^12\) Recovering from anesthesia should not be conducted in the post-anesthesia care unit. Instead, intubated patients should be directly transported to an airborne isolation room to recover or recover within the operating room.

There are also additional guidelines for protecting anesthesia equipment in the current literature. Generally, evidence shows that it is recommended that only necessary equipment should be present within the operating room when an aerosol generation has taken place for COVID-19 patients. Accordingly, avoiding unnecessary equipment within the operation room can reduce the risk of transmitting infections and decreases the need for conducting disinfection procedures. Backup equipment should also be kept just outside the operating room. In this context, if this equipment was requested, an assistant that wears appropriate PPE should bring it to the operating room. In addition, evidence indicates that it is critical to prevent and intervene against the widespread infection through contaminated surfaces and anesthesia devices (including surfaces, ventilators, and breathing circuits). These suggestions are based on the Anesthesia patient safety foundation (APSF) recommendation and the American society of anesthesiologists (ASA) guidelines.\(^13^{,}\)\(^17\) Accordingly, adequate care and strict procedures should be conducted not to contaminate unnecessary surfaces and anesthesia equipment within the operating room.\(^17^{,}\)\(^19\) For instance, it has been demonstrated that large plastic bags were used to cover anesthesia machines within the operating room to reduce the risk of contamination and decrease the bioburden.\(^20^{,}\)\(^21\) In addition, it has been reported that such plastic bags should be provided for non-disposable materials, including keyboard, mouse, ultrasound machine and related monitor, video laryngoscope monitor, and touch screen. However, it should be noted that the risk of contamination and transmission of infection when removing these plastic bags is unknown, and it is probably similar to the risk of removing PPE.\(^22^{,}\)\(^23\)

Protecting the internal components of the anesthesia machine (especially the breathing circuit) should also be provided not to make it a vector for transmitting infections among subsequent patients following the different surgical procedures. Accordingly, it has been recommended that a two-filter system (with a high viral filtration efficacy) should be installed within the breathing circuit to prevent any spread of the infection.
among different patients. It should be noted that applying these filters should be done based on the operated patients. For instance, children and adults with high tidal volumes should offer special techniques. These techniques have been extensively discussed among other previous investigations. In addition, meticulous routine cleaning should also be conducted now and then. Moreover, it has been recommended that disposable equipment be removed and replaced. These disposable materials might include a forced-air warming blanket, mask, reservoir bag, and breathing circuit. When COVID-19 positive patients are intubated, replacing the gas sampling tube is mandatory. On the other hand, there is no need to replace the water trap for these patients when highly efficacious HMEF was installed. There is unclear evidence regarding replacing the soda lime carbon dioxide (CO₂) absorber, and no related guidelines support it because the previously installed filter usually protects this portion within the breathing circuit. Besides, the machine's internal components should not be removed and disposed of when a high-quality filter is installed. After finishing the operation, the room should remain closed until decontamination for the next operation occurs.

**CONCLUSION**

The COVID-19 pandemic has forced many countries to pose an emergency to contain the contamination and prevent the further spread of the infection. In this context, many societies and research papers were published to optimize guidelines and protocols for patients undergoing surgery and subsequent intubation. As a result, various guidelines were discussed in the current literature review, including guidelines to the patient, healthcare workers, operating room, anesthesia equipment, and patient transportation. Strictly following these protocols should be done to reduce the risk of contamination in the operating room and enhance the outcomes of the patients and healthcare workers.

**Funding:** No funding sources

**Conflict of interest:** None declared

**Ethical approval:** Not required

**REFERENCES**

1. Lotfi M, Hamblin MR, Rezaei N. COVID-19: Transmission, prevention, and potential therapeutic opportunities. Clin Chimica Acta; Int J Clin Chem. 2020;508:254-66.
2. Rahmani AM, Mirmahaleh SYH. Coronavirus disease (COVID-19) prevention and treatment methods and effective parameters: A systematic literature review. Sustainable Cities Society. 2021;64:102568.
3. Alajmi J, Jeremjenko AM, Abraham JC. COVID-19 infection among healthcare workers in a national healthcare system: The Qatar experience. Int J Infect Dis. 2020;100:386-9.
4. Sabetian G, Moghadami M, Hashemizadeh Fard Haghighi L. COVID-19 infection among healthcare workers: a cross-sectional study in southwest Iran. Virol J. 2021;18(1):58.
5. Chen X, Shang Y, Yao S, Liu R, Liu H. Perioperative care provider’s considerations in managing patients with the COVID-19 infections. Transl Perioper Pain Med. 2020;7(2):216-24.
6. Zucco L, Levy N, Ketchandji D, Aziz M, Ramachandran SK. Anesthesia Patient Safety Foundation. Recommendations for Airway Management in a Patient with Suspected Coronavirus (2019-nCoV) Infection. Available at: https://www.apsf.org/wp-content/uploads/news-updates/2020/apsf-coronavirus-airway-management-infographicpdf. Accessed on 18 May, 2020.
7. Luo M, Cao S, Wei L. Precautions for Intubating Patients with COVID-19. Anesthesiology. 2020;132(6):1616-8.
8. Wang D, Hu B, Hu C. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhuan, China. JAMA. 2020;323(11):1061-9.
9. Dibas M, Doheim MF, Ghovy S, Ros MH, El-Helw GO, Reda A. Incidence and survival rates and trends of skull Base chondrosarcoma: A Population-Based study. Clin Neurol Neurosurg. 2020;198:106153.
10. Wittgen BP, Kunst PW, Perkins WR, Lee JK, Postmus PE. Assessing a system to capture stray aerosol during inhalation of nebulized liposomal cisplatin. J Aerosol Med. 2006;19(3):385-91.
11. Lavorini F, Usmani OS, Dhand R. Aerosol delivery systems for treating obstructive airway diseases during the SARS-CoV-2 pandemic. Internal Emergency Med. 2021;16(8):2035-9.
12. Ghozy S, Kacimi SEO, Elfil M. Transient ischemic attacks preceding ischemic stroke and the possible preconditioning of the human brain: a systematic review and meta-analysis. Frontiers in Neurology. 2118.
13. Gosling AF, Bose S, Gomez E. Perioperative Considerations for Tracheostomies in the Era of COVID-19. Anaesthesia Analgesia. 2020;131(2):378-86.
14. Awad ME, Rumley JCL, Vazquez JA, Devine JG. Perioperative Considerations in Urgent Surgical Care of Suspected and Confirmed COVID-19 Orthopaedic Patients: Operating Room Protocols and Recommendations in the Current COVID-19 Pandemic. J Am Academy Orthop Surg. 2020;28(11):451-63.
15. Al-Balas M, Al-Balas HI, Al-Balas H. Surgery during the COVID-19 pandemic: A comprehensive overview and perioperative care. Am J Surg. 2020;219(6):903-6.
16. Dexter F, Parra MC, Brown JR, Loftus RW. Perioperative COVID-19 Defense: An Evidence-Based Approach for Optimization of Infection Control and Operating Room Management. Anesthesia Analgesia. 2020;131(1):37-42.
17. Maguire D. Oral and Nasal Decontamination for COVID-19 Patients: More Harm Than Good? Anesthesia Analgesia. 2020;131(1):e26-7.
18. Loftus RW, Dexter F, Goodheart MJ. The Effect of Improving Basic Preventive Measures in the Perioperative Arena on Staphylococcus aureus Transmission and Surgical Site Infections: A Randomized Clinical Trial. JAMA Network Open. 2020;3(3):e201934.
19. Munoz-Price LS, Bowdle A, Johnston BL. Infection prevention in the operating room anesthesia work area. Infect Control Hospital Epidemiol. 2019;40(1):1-17.
20. Biddle CJ, George-Gay B, Prasanna P, Hill EM, Davis TC, Verhulst B. Assessing a Novel Method to Reduce Anesthesia Machine Contamination: A Prospective, Observational Trial. Can J Infect Dis Med Microbiol. 2018;2018:1905360.
21. Bowdle A, Munoz-Price LS. Preventing Infection of Patients and Healthcare Workers Should Be the New Normal in the Era of Novel Coronavirus Epidemics. Anesthesiology. 2020;132(6):1292-5.
22. El-Qushayri AE, Dahy A, Reda A. A closer look to the high burden of the psychiatric disorders among health care workers (HCWs) in Egypt during COVID-19 outbreak: A meta-analysis of 3137 HCWs. Epidemiol Health. 2021:e2021045.
23. El-Qushayri AE, Ghozy S, Reda A, Kamel AMA, Abbas AS, Dmytriw AA. The impact of Parkinson's disease on manifestations and outcomes of Covid-19 patients: A systematic review and meta-analysis. Reviews Med Virol. 2021:e2278.
24. Son PT, Reda A, Viet DC. Exchange transfusion in the management of critical pertussis in young infants: a case series. Vox Sanguinis. 2021;116(9):976-82.
25. Nguyen TM, Huan VT, Reda A. Clinical features and outcomes of neonatal dengue at the Children's Hospital 1, Ho Chi Minh, Vietnam. J Clin Virol. 2021;138:104758.

Cite this article as: Bogari AF, Alharbi NM, Alaqlan MA, Aljaza TS, Alibrahim AI, Ali FA et al. Protocols and safety measurements used in intubation of COVID-19 patients. Int J Community Med Public Health 2022;9:1005-9.