International Journal of Community Medicine and Public Health
Bogari AF et al. Int J Community Med Public Health. 2022 Feb;9(2):1005-1009
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20220008

Review Article

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

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Received: 14 December 2021
Accepted: 29 December 2021

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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.[5-7] 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.

DISUCSSION

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.[8] 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.[8,9] 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 infection 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 bioburdens.[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.[24,25] 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 (CO_2) 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.[16]

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

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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.