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What special precautions are required while anesthetizing COVID-19 patients in the operation room?

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Received: 23 July 2023

Accepted: 20 October 2023

ePublished: 4 Dec. 2023

Keywords: COVID-19, Novel coronavirus, Operating room, Theatre, Anesthesia

Abstract

On The emergence of the COVID-19 pandemic has impacted not only the daily routines of individuals, but also the procedural approaches of medical and anesthesia experts, encompassing surgical procedures, operating room administration, patient welfare, and healthcare personnel. One of the most susceptible direct contact groups with COVID-19 patients is the operating room staff. The primary objective of this investigation is to conduct a literature review of specific articles pertaining to the requisite precautions during anesthesia administration for patients afflicted with COVID-19. The literature was carried out in PubMed, Web of Science, and Scopus were used to search for English-language articles. All type of articles was included. Keywords were COVID-19, novel coronavirus, 2019- nCoV, coronavirus disease 2019, operating room, theatre, measures, medical staff, health providers, and anesthesia. In this study, we aimed to identify essential information needed by operating room staff, especially anesthesiologists, to manage the entire anesthesia process in COVID-19 patients in a relatively safe manner. We found that necessary points included avoiding the airway and other biologic secretions such as cerebrospinal fluid and blood, using fiber-optic or video laryngoscopy, adequate pre-oxygenation with a well-fitted mask, avoiding awake intubation, selecting a rapid sequence approach, using disposable equipment, delaying elective surgery, and wearing a N95 mask, eye shield, gown, and gloves.

Citation: Aghazade N, Arjmand A, Arabsorkhi M, Rahmani. What special precautions are required while anesthetizing COVID-19 patients in the operation room? J Prev Epidemiol. 2024;x(x):e35226. doi: 10.34172/jpe.2023.35226.

Introduction

An outbreak of pneumonia with unknown origin in Wuhan city of China caused global health concerns due to its high rate of transmission in December 2019 (1) Since the global pandemic of the virus, the topic of the risk factors causing the disease's severe forms and its worldwide mortality has been raised (2,3).

COVID-19 is an acute respiratory disease with symptoms resembling seasonal influenza and colds, including cough, congestion, fever, shortness of breath, etc. (4,5). The lungs are the first organ to be infected by this virus, and a computerized tomography (CT) scan reveals opaque glass, which is also indicative of pneumonia (6). In addition to the lungs, the virus can affect the heart, kidney, liver, brain, arteries, etc. in adults and children (7). In addition, concomitant diseases such as high blood pressure, cardiovascular disease, and pulmonary disease, as well as the

Key point

The emergence of the COVID-19 pandemic has impacted not only the daily routines of individuals but also the procedural approaches of medical and anesthesia experts. Not only airway secretions but also any biological samples such as cerebrospinal fluid, serum, urine, tear, blood, and seminal secretions can be a source of infection.

medications used to treat patients, can have a significant impact on the prognosis of viral diseases like COVID-19 (7-9).

The transmission of COVID-19 occurs through respiratory secretions and direct contact with mucosal surfaces. Additionally, the virus has been detected in fecal matter and blood. The typical method of diagnosis involves the collection of a nasopharyngeal swab specimen followed by polymerase chain reaction (PCR) analysis. Frequent clinical presentations of the disease comprise pyrexia (88.7%), cough (67.8%), exhaustion (38.1%),



expectoration (33.4%), dyspnea (18.6%), pharyngitis (13.9%), and cephalalgia (13.6%). Additionally, some patients have exhibited gastrointestinal symptoms such as diarrhea (3.8%) and emesis (5%), which are more pronounced in individuals with pre-existing chronic ailments. The laboratory results indicate the presence of lymphocytopenia and, on occasion, leukopenia. Elevated levels of neutrophil, D-dimer, urea, and creatinine may be observed in instances of severe pathology. Elevated levels of inflammatory markers, including interleukins 6 and 10 and tumor necrosis factor α (TNF α), have been observed (10). The epidemiological characteristics of the patients in question are contingent upon additional factors, such as elevated viral loads in the upper respiratory tract (11, 12). As a result of the unprecedented nature of the COVID-19 pandemic, there is a pressing need for extensive research to evaluate anesthesia techniques and associated care, with the aim of minimizing complications and improving the management of the anesthesia process. For instance, Wen and Li revealed that a small tidal volume (4–8 mL/kg ideal body weight) during ventilation can be a way to reduce ventilator-related lung injury. Also, positive end-expiratory pressure (PEEP) less than 8 cm H₂O is suitable strategy in these patients (13). It is noteworthy that anesthesia care may differ based on various factors such as the nature of the surgery, patient positioning, timing of the procedure, and disease status, even in the absence of an underlying medical condition (14). Therefore, the purpose of this study was to present a comprehensive analysis of anesthesia-related care in patients with COVID-19.

Search strategy

In this review, we conducted a search using international databases such as PubMed, Web of Science, and Scopus. We included all types of articles written in English. The keywords used were COVID-19, novel coronavirus, 2019-nCoV, coronavirus disease 2019, operating room, theatre, measures, medical staff, health providers, and anesthesia. After collecting the relevant articles, we imported the references into Endnote software and removed any duplicate titles. The selected studies focused on human subjects and were published in English.

Results

Selecting the type of anesthesia

Given that the transmission of COVID-19 (15) happens either in symptomatic or asymptomatic status, the team of anesthesia must be aware of aerosol-generating procedures and must be selected the techniques decreasing or avoiding them altogether (16). Lie et al to decrease the rate of transmission suggested applying regional anesthesia rather than general anesthesia if possible and recovering the operated patient in the theatre to reduce exposure to hospital personnel and other patients because regional anesthesia is not an aerosol-generating procedure (17).

Awake intubation techniques triggering cough is not good selection because coughing leads to aerosolization of the virus in the theatre (18).

While regional anesthesia was chosen, face mask must be used at all times in the operating room. It is better to administrate sedative drugs to tolerate face mask during surgery, and supplemental oxygen through nasal cannula needs another cover to include all faces of the patients to prevent the expiration of the patients (19).

Additionally, there is some evidence that COVID-19 can be spread through small (< 5 μ m) respiratory droplets remain in the room air for prolonged time e.g., during coughing at the time of extubation, these droplets are generated, also forceful expiration and loud speech can produce these droplets (20). Today, thousands of infected patients need intubation for long time after invasive surgical procedures. Since the COVID-19 can be transmitted through droplets as well as possibly aerosols, therefore the optimal situation should be selected to prevent the spread of this virus during intubation and extubation (21).

Suitable position for surgery

We know that prone positioning instead of supine position is a simple way to improve oxygenation in ventilated patients under general anesthesia in patients with acute respiratory distress syndrome and COVID-19 patients are no exception to this rule (22). Some different measures are expected by type of surgery (23,24).

High-risk conditions related to anesthesia

SARS-CoV-2 remains viable as aerosols for hours in the operating room and on surfaces up to days (21), consequently airway manipulation is one of the main reasons to develop COVID-19 among anesthesiologists, respiratory therapists and nurses. Given that the infection can be transmitted by droplets and aerosols, strict cautions is needed to reduce the spread of the COVID-19 during intubation and extubation (21).

Two part are of great importance for anesthesia field intubation and extubation in which each part consists of some steps for instance intubation needs Mallampati score assessment, pre-oxygenation and endotracheal tube insertion or intubation (25).

Some actions during COVID-19 pandemic related to anesthesia team include reduction of the elective surgeries, checking the PCR test for the patient candidate for surgery before 48 hours, wearing N95 mask, eye protection, gown and gloves for all medical staff. In addition, the patients with COVID-19 should be transferred to the theatre with specific way, corridor or elevator, without stopping in the preoperative or post-anesthesia care unit to reduce the transmission of the COVID-19 to other patients, staff, and other units. It is helpful to adhere “COVID-19 precautions” signs on all doors of rooms which the patient with COVID-19 is dwelled to inform people of possibly

risks (26).

Specific consideration

The American Society of Anesthesiologists had presented some recommendations for all anesthesia professionals in which one of the important recommendation is the use of PPE in the process of diagnostic, therapeutic, and surgery to reduce the probability of the infection (27). Measures to reduce infection among medical staff are of great importance because the COVID-19 pandemic affects many health workers exposing the patients with COVID-19. One of the vulnerable groups that are at high risk are medical staff such as physicians and nurses working in hospitals to present perioperative, preoperative, intraoperative and postoperative care (28).

To reduce contamination of the tools needed for anesthesia, equipment and drugs should be brought into the theatre that are essential and it is fundamental to discard the disposable materials and tools (18). Disposable equipment should be prepared and provided by companies if possible or at least disinfect the used tools after any usage to minimize the transmission of the COVID-19 (29).

The manager of the operating room must try to postpone the elective surgery in patients with COVID-19 and in specific condition involve less medical staff to assist operation and limited the involved staff in the process of the invasive procedure (19, 30, 31). Negative pressure is ideal to reduce the transmission of the virus in the operating room. Hence, air changes and scavenging up to 25 time per hour deeply reduces viral load in the operating rooms (19).

Pre-oxygenation is essential via a well-fitting face mask before intubation in these patients. Rapid sequence induction using suitable relaxants must be done to minimize the need for ventilation before intubation. It is suggested that in these patients try to insert in the first attempt by skilled staff using enough protective equipment such as mask and eye shield. In other word, it is strongly suggested to choose a person who is the most experienced in the field of intubation (32). Additionally measure like high flow nasal cannula and non-invasive positive pressure ventilation such as the transnasal humidified rapid-insufflation ventilatory exchange should not be used because can worsen the risk of viral spread in the room (33).

Cautions

However, studies have demonstrated that some strict and rigorous guidelines to control infection can result in less infection among medical staff; though hospital staff involving invasive procedures consisting of anesthesiologists and nurses working in the operating room and intensive care units are at high risk and have to consider strict care (34, 35). Not only airway secretions but also any biologic samples such as cerebrospinal fluid,

serum, urine, tear, blood, seminal secretions and etc. can be a source of infection (36).

At the time of induction and intubation, it is strongly suggested that the anesthesiologist be alert and enough skilled to intubate under the 15 seconds and more likelihood of first-pass intubation. In the room which the COVID-19 patient is going to be operated, limit the staff of anesthesia or surgical technologists. Using video laryngoscopy can reduce the likelihood of transmission among anesthesiologists compared to the routine intubation. Pre-oxygenation must be done by 100% inspired oxygen with well-fitted mask to ventilate (26). Due to the epidemic of this disease, it is necessary to train anesthesiologists and operating room personnel equipped with the latest knowledge of their profession so that while learning, they also pay attention to improving their clinical competence (37).

Conclusion

Some main and key point regarding measure in patients with COVID-19 that anesthesiologist should be consider include keep away from any airway or other biologic secretions such as cerebrospinal fluid and blood, intubation with enough skilled anesthesiologist to intubate under the 15 seconds and more likelihood of first-pass intubation, callout less staff for anesthesia team and surgical technologists, use of fiber-optic or video laryngoscopy, enough pre-oxygenation with well-fitted mask, selecting rapid sequence approach, use of disposable equipment and disinfection of non-disposable tools, postponing the elective surgery, checking the PCR test for the patient candidate for surgery before 48 hours, wearing N95 mask, eye shield, gown and gloves and avoiding awake intubation.

Authors' contribution

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Conflicts of interest

The authors declare that they have no competing interests.

Ethical issues

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the authors.

Funding/Support

None.

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