



Perioperative Management of Elective Surgery in Patients with COVID-19 Infection

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ABSTRACT

Background: SARS-CoV2 is a deadly virus belonging to the family Corona-viridae, with the primary target pulmonary system, known as the coronavirus pandemic disease (COVID-19). This virus has caused a high death rate of approximately 9.500 deaths as of December 2020. Along this pandemic, the hospital will treat non-emergent conditions in COVID-19 patients require nonemergent surgery. Anesthesiologists have an important role in the anesthesia management in patients with COVID-19 utilization and require airway management. This article explains optimal preoperative evaluation, intraoperative management, and postoperative management of COVID-19 patients. Optimal treatment is expected to minimize complications and the spread of COVID-19 disease. The optimal time for elective surgery should be decided by a multidisciplinary committee that considers the risk of complications either the patient, the disease itself, the surgical procedure, or other alternatives with lower risk. Perioperative management is carried out preoperatively, intraoperatively, and postoperatively. The safety of anesthesiologists using personal protective equipment (PPE) to carry out preoperative evaluations is important. The number of disease severity can use a scoring system, the results of which can be used as a reference for multidisciplinary discussions related to perioperative management plans. General anesthesia can contribute to the spread of disease resulting from the risk of droplets resulting from airway action, so regional anesthesia can be considered to reduce the risk of spread. For this reason, optimal management is needed to reduce risks to patients as well as medical personnel.

Keywords: *anesthesia; COVID-19; elective; perioperative*



Manajemen Perioperatif Elektif pada Pasien dengan Infeksi COVID-19

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ABSTRAK

Pendahuluan: SARS-CoV2 merupakan virus mematikan yang menjadi bagian dari famili Coronaviridae, dengan target organ primer adalah sistem pulmonal yang dikenal sebagai penyakit Coronavirus pandemik (COVID-19). Virus ini telah menyebabkan angka kematian yang tinggi hingga kurang lebih 9.500 kematian sampai dengan Desember 2020. Dengan kejadian pandemik ini, maka rumah sakit akan menghadapi kondisi pembedahan nonemergent pada pasien COVID-19 yang membutuhkan pembedahan elektif. Ahli anestesia memiliki peran penting dalam tatalaksana anestesia pada pasien COVID-19 pembedahan dan membutuhkan manajemen jalan napas. Melalui artikel ini dalam dijelaskan mengenai evaluasi preoperatif yang optimal, tatalaksana intraoperatif, serta paska operasi pada pasien COVID-19. Penanganan yang optimal diharapkan dapat meminimalkan komplikasi dan penyebaran dari penyakit COVID-19. Waktu yang optimal untuk dilakukan pembedahan elektif harus menjadi keputusan dari komite multidisiplin ilmu yang mempertimbangkan risiko komplikasi baik terhadap pasien, penyakit itu sendiri, prosedur pembedahan, serta alternatif lainnya dengan risiko yang rendah. Manajemen perioperative merupakan manajemen yang dilakukan sejak preoperasi, intraoperasi, dan paska operasi. Keamanan ahli anestesi dengan menggunakan personal protective equipment (PPE) untuk melakukan evaluasi preoperasi adalah penting untuk dilakukan. Evaluasi keparahan penyakit dapat menggunakan sistem skoring, yang hasilnya dapat menjadi acuan untuk didiskusikan secara multidisiplin berkaitan dengan rencana manajemen perioperatifnya. Anestesia umum dapat berkontribusi pada penyebaran penyakit diakibatkan dari risiko droplet yang dihasilkan dari tindakan pada jalan napas, sehingga anestesia regional dapat dipertimbangkan untuk mengurangi risiko penyebaran. Untuk itu, manajemen yang optimal dibutuhkan untuk mengurangi risiko terhadap pasien juga terhadap petugas medis.

Kata Kunci: anestesia, COVID-19, elektif, perioperatif

INTRODUCTION

Coronavirus pandemic (COVID-19) is caused by SARS-CoV-2 virus infection, first described in Wuhan, China and virtually spread to all countries within a few months since its discovery.¹ As per 7 December 2020, there are > 20.0000 confirmed cases worldwide, with nearly 9.500 death toll.² This pandemic challenges healthcare providers especially in prevention, infection control, and treatment.³

Today the pandemic has persisted for almost a year and hospitals need to address the need of nonemergent surgery. There are increasing numbers of recovered COVID-19 patients and need for elective surgery in this patient population. There are specific concerns that needed to be addressed, i.e. the post symptomatic infectious period and higher risk of complications.^{4,5} Optimum preoperative evaluation and especially timing for elective surgery need to be reviewed thoroughly.⁶

Anesthesiologists have important role in this situation, as they give anesthesia in patients requiring surgery and provide airway management in critical in COVID-19 positive patients. An optimum strategy has to be developed in order to minimize complications and spread of the disease. Thorough knowledge about the disease is also required to ensure optimum anesthesia service.

SARS-CoV2, a deadly virus belonging to the family Corona-viridae, primarily targets the pulmonary system and manifests with symptoms of moderate to high fever, dry cough and difficulty breathing, pneumonia, and respiratory distress.⁷ Respiratory droplets, close contact transmission, and aerosol transmission in a relatively closed environment are the major routes of transmission.⁸ Coronavirus consists of four protein structures, namely spike (S), membrane (M), envelop (E), and nucleocapsid protein. There is clinical data collected from the non - survivors patients revealed that the most distinctive comorbidities of SARS-CoV-2 infection were hypertension (24–75%) and diabetes mellitus (16,2–35%). Notably, the most frequent comorbidities were reported in SARS-CoV-2 patients treated with angiotensin-converting enzyme (ACE) inhibitors. SARS-CoV-2 binds to host cells through the ACE2 receptor,

which is expressed by epithelial cells of the lungs, intestines, kidneys, brain, and blood vessels. The expression of ACE2 is substantially increased in diabetic and hypertensive patients, treated with ACE inhibitors and angiotensin II type-I receptor blockers (ARBs), which consequently promotes SARS-CoV-2 infection severity.^{7,8} Due to the unavailability of satisfactory treatment and vaccination, the management of COVID-19 depends upon the timely diagnosis and standard (symptomatic) treatment yet. Thus, for timely detection of virus, efficient diagnostics strategies should be required.⁹

There are two methods to diagnose COVID-19 infection with advances and conventional diagnostic approaches. For diagnosing of COVID - 19 using advanced approach, there are three categories of examinations, namely viral nucleic acid detection, isothermal nucleic acid amplification assay, and CRISPR nucleic acid assay.⁹ Real-time reverse transcription polymerase chain reaction (RT-PCR) can be used for the detection of COVID-19 nucleic acids in nasopharyngeal swabs, lower respiratory tract secretions, sputum, blood, feces and others. Thus, for conventional approach, we can use physical examination, CT Scan imaging and laboratory tests. CT imaging of the patient is strongly recommended for the diagnosis of patients, as reported by the researchers at Zhongnan Hospital of Wuhan University. The sensitivity of CT scan, however, for COVID-19 diagnosis is appeared to be 97,2%.¹⁰

Unfortunately, to date, no drug or vaccine has demonstrated an efficacy for COVID-19 patients. Some of the treatments are currently being assessed for their role in COVID-19. Most of these agents have shown efficacy for other diseases, but, their use for COVID-19 remains investigational and under trial.¹⁰ Convalescent plasma (CP) is one of pharmacological treatment that still need many trials before applying it to the patient with COVID-19. CP is a passive antibody therapy and has been recently in news for its potential use to treat COVID-19 patients.¹¹ Various antiviral therapies with much broader landscapes are being selected by WHO, including the experimental antiviral drug Remdesivir; the Malaria medication Chloroquine/ Hydroxychloroquine; a combination of Human

Immunodeficiency Viruses (HIV) drugs such as Lopinavir and Ritonavir; and finally, a combination of HIV drugs added to Interferon-beta.^{7,10}

Optimum time for Elective Surgery

Decision-making to prioritize and to plan an elective surgery should be carried out through a multidisciplinary committee, based on the following factors such as the risk of complications related to the patient, risk of complications related to the disease, surgical procedure, and availability of therapeutic alternatives to lower surgical risks (chemotherapy, radiotherapy, endoscopic procedures, thermal ablation, etc.), the pandemic evolution, and available resources in health center.¹²

According to Abdi Reza *et al.* surgical procedure was categorized to few categories such as: (1) Urgent surgery or limited surgery that the pathology of the disease still progressing to a constant adverse effect; (2) Elective surgery that could be planned or several months later without any considerable risk. Thus, for elective surgery it is suggested to postpone to save the health care providers.¹³

To postpone the surgery should be a result in at least one of the following clinical situation like threat to the patient's life if surgery or procedure is not performed, threat of permanent dysfunction of an extremity or organ system, risk of metastasis or progression of staging, and risk of rapidly worsening to severe symptoms. Elective surgery should not harm patients, providers, and staff.¹⁴

In the guideline from Indonesian Society of Obstetrics and Gynecology, if there is indication for elective surgery in pregnant patient with COVID-19, the urgency level needs to be evaluated. If the surgery could not be delayed, then surgery have to be done with full standardized PPE. In the surgical room, elective surgery of COVID-19 patient is scheduled with minimal personel.¹⁵

There are pathophysiological elements and epidemiological data that allow us to predict that adding surgical stress to a patient with COVID-19 or, conversely, the infection developing in an operated patient can be very harmful to patients undergoing major surgery.¹² Patients who are confirmed with COVID - 19 infection will be

managed by the symptoms by teams before undergo the surgery. Surgery will be deferred until resolution of symptoms and in the presence of two sets of negative PCR test, usually for the elective surgery, patient can wait until 12 days before the surgery.¹⁶

Kaidi Austin *et al.* had already suggested the suitable time for allowing reconsideration of surgical intervention. The indicator that could be used such as ESR (Erythrocyte Sedimentation Rate), c-reactive protein, procalcitonin, interleukin-6, and lactate to help dynamically characterize the patient's disease course. They also suggested using only isolated preoperative values of TNF- α , IL-1, and IL-10.¹⁷

Preoperative evaluation

Preoperative evaluation aimed to identify patient at risk, to prepare the patient for surgery and identify any high-risk procedure.¹⁸

The personal protective equipment (PPE) for anesthesiologist is the most important thing to ensure the safety of the anesthesiologist performing preoperative evaluation. The PPE should include medical gown, medical gloves, googgle, disposable surgical cap, and surgical or N95 respirator mask. Patients undergoing a preoperative evaluation should be carried out in isolation room to minimize close contact.¹⁸ The anesthesiologist should take a detailed history of the disease and perform a thorough physical examination. Determination of the diagnosis before entering the operating room is important to prevent cross infection.

Concern that needs to be taken by anesthesiologist in the preoperative setting was most of the patients were asymptomatic to minimal symptom at first. Data that must be collected from the patient's history including standard AMPLE (allergy, medication, past illness, last meal, event) and thorough history of dry cough, fever, and dyspnea as these symptoms were found in most of the patient with COVID-19 infection.¹⁹ Other less common symptom included palpitation, headache and gastrointestinal upset (diarrhea, nausea, vomiting). These symptoms were potentially under noticed and frequently found not being tested for SARS-CoV-2. Most of the patient develop dyspnea at days 5 to 8 after admitted to

to the hospital.¹⁹ History of travelling to pandemic region should be noticed too by clinicians since most of the patient were asymptomatic.¹⁸ For physical examination, body temperature is one of the most important data to collect during this pandemic era, besides signs of shock and peripheral oxygen saturation.

The significant value of laboratory test including lymphocyte count, leucocyte, neutrophil, albumin, lactate dehydrogenase, liver function, troponin, D-dimer, procalcitonin, C-reactive protein, prothrombin time, and creatinine. Any sign of pneumonia in radiology finding were found in most of the patient hospitalized with COVID-19. The finding usually are multiple mottling and ground glass opacity, typically bilateral and peripheral, and sometimes coexisting with consolidation.^{18,19} Standard diagnosis for SARS-CoV-2 is reverse transcriptase-polymerase chain reaction (RT-PCR).¹⁹ Samples were collected from throat or nasal swab. Serial testing and sampling from lower airway can improve the sensitivity of testing.

Even these modalities were helpful to recognize the infection, accuracy of each of the test needs to be considered. Some of literatures noticed that the chest CT-Scan more sensitive than RT-PCR.²⁰ Some biomarkers and using model of clinical prediction helped to predict severity and outcome in postoperative period.²⁰ Meanwhile, insensitivity of the RT-PCR test came in low-risk population and early in its incubation phase.

²¹ In the other side, some studies revealed the serious potential complication in patient with COVID-19 infection in the perioperative course that informed us the necessity to know the preoperative COVID-19 status of patient.²² Some of these conditions need multidisciplinary approach to prepare the patient for surgery in preoperative settings, including the necessity of surgery, medical staff preparation with proper protective equipment, thorough medical examination and usage of resources for COVID-19 screening test. Considering any high-risk procedures also would be very important in preoperative to guide intraoperative period.²³

As long as the surgery is not an emergency case, the surgery should be postponed. Postponing surgery will reduce the number of unnecessary patients in the hospital and reduce the spread

of the disease between symptomatic and asymptomatic patients in the hospital.^{7,8} In the setting of emergency cases, it should be arranged in OR with negative pressure and using particulate air filter should be considered. The medical center should be facilitated with isolation and quarantine care, or considered to refer patient to higher medical facility.²⁴

Using Early warningscore for COVID-19 (COVID-19 EWS) could be helpful to identify patient with suspicion for COVID-19.²⁵ If patient is considered high risk, discuss with surgeons on urgency of surgery, and delay if possible. Involve infection control team early in suspected cases. Consider performing rapid test to confirm diagnosis if time allows, especially for urgent surgery, besides performing reverse transcriptase polymerase chain reaction (RT-PCR).²⁵

In some region, especially in Indonesia, there are some strategies performed by several hospital. For parturient suspected with COVID-19 infection, imaging examination and diagnostic test should be done immediately.²⁶ They should be prevented from viral transmission of virus early even from the hospital entrance, transported to operating theatre equipped with negative-pressure ventilation and for every medical personnel should use an appropriate protective equipment with biosafety level-3. Minimizing personnel in the operating theater would be recommended.²⁷

In Dr Sardjito General Hospital, there is COVID-19 team for management of patient suspected with COVID-19 infection. For any elective and emergency patient who need the surgery, they are doing several tests, and if the result suggested for COVID-19, thorough rapid test and chest CT-scan are utilized to establish the diagnosis by COVID-19. But, for the emergency cases, the rapid test can be ordered by the surgeon without any consultation to the team and if positive, they will be sent to undergo an RT-PCR test.²⁸ One of the medical center in Surabaya, there is a surgery triage setting to decide the necessity of thoracic surgery at first, and then continued with scoring system for surgical preparation.²⁹

Intraoperative management

The perioperative management guidelines are mostly focusing on limiting exposure to health

care. There are still very limited studies on anesthesia management based on patient outcome. General anesthesia with rapid sequence intubation is preferred because it reduces droplets and secretion caused by coughing. Neuraxial anesthesia is also preferable especially in obstetric cases with the patient using N95 mask to avoid droplet transmission.³⁰ The emergency procedure is a life-saving procedure and should not be delayed to assess the patient's COVID status. But in an elective procedure where the urgency is not high, the risk and benefit calculation should be done before proceeding with the surgery. Corona virus infection is now more of an immunology disturbance than just merely a virus infection, in which some of our anesthesia drugs interfere and depress the body's normal immune mechanism. Intubation and mechanical ventilation could also harm patient's lung which is the main site of COVID infection.³⁰

Patients with positive PCR tests with no/mild/moderate symptoms who undergo surgery should be assessed carefully before the surgery. They are among the high-risk patient to developed ARDS and specific strategies should be applied perioperatively.

Identify patient risk

Patients aging more than 50 years old with multiple comorbidities, unstable pulmonary comorbidities, and current smokers are among patients with higher risk of postoperative pulmonary complications and mortality rates. Patient's functional state, comorbidities should be identified to assess the possibilities of worsening outcome.^{31,32}

Identify surgical risk

Risk factors such as long duration, moderate to high risk of bleeding and hemodynamic disturbance, open surgery such as laparotomy, cardiac or thoracic open surgery, general anesthesia with deep anesthesia sedation, opioid and neuromuscular blockade carry higher risk of pulmonary complication and ARDS.^{31, 32}

Intraoperative monitoring

High-risk patient with pulmonary and hemodynamics disturbance may require invasive and dynamics hemodynamic monitoring. Arterial

line or CVC could be place intraoperatively to assess patient hemodynamics status. Left ventricular assessment through echocardiography should also be assessed before surgery.^{31,32}

Anesthetic technique

Local or regional anesthesia could avoid several adverse effects caused by general anesthesia such as impairing immune system with mechanical ventilation. Non-COVID ARDS patients have shown potential benefit of local/peripheral nerve block/neuraxial anesthesia superior to general anesthesia to reduce the postoperative pulmonary complication such as pneumonia and ARDS. But this still needs further studies. Although maybe superior to general anesthesia, regional anesthesia could not be used in all of the patients and also rarely used in emergency settings. Short acting neuromuscular block, the use of inhalation anesthesia, and opioid-sparing pain management could be used to minimize effect of general anesthesia.^{31, 32}

Intubation and mechanical ventilation strategy Adequate preoxygenation should be done to avoid hypoxia during a difficult intubation. Anesthesiologist should use the largest diameter of ETT possible to decrease airway resistance and help with secretion clearance. Low tidal volume (VT) is a widely accepted strategy to reduce VILI in ARDS but it still needs further studies in COVID patient with ARDS.^{31,32}

Postoperative management

Pain management in COVID-19 could be challenging since treatment options are more limited due to several drugs are known for their effect on the immune system and respiratory function. Paracetamol can be used in mild pain or as an adjuvant to other pain management. And it's also regularly used as antipyretic in COVID patients. One of the concerns is high dose of paracetamol is associated with liver toxicity.³³ Non-steroidal anti-inflammatory drugs (NSAIDs) is relatively contraindicated in patient with pulmonary comorbidities due to its bronchospasm effect. Its renal toxicity is also a main concern since acute kidney injury is also a complication of COVID-19. A theoretical theory had mentioned that NSAIDs can upregulate the

Angiotensin-converting enzyme (ACE) 2 receptors which is the main entry channel of the SARS-COV 2 virus. But to date, there is no adequate evidence that NSAIDs are contraindicated in COVID-19.³³ Opioids affect the immune system in several stages. It affects both innate immunity and adaptive immunity. Chronic administration is also proved to decrease macrophage cells and lymphocyte production. Since COVID-19 impaired immune system and mortality is associated with the immunocompromised patient, the use of an opioid is relatively contraindicated. But several opioids such as tramadol, oxycodone, and buprenorphine have minimal immunosuppressant effect and could be considered. But further study is needed to prove this theory. Providing adequate pain management is very important since pain alone can cause many postoperative complications. And in major surgery, opioid use is unavoidable. Thus, the use of minimal immunosuppressant opioids is maybe the best choice. The use of epidural pain control is highly recommended whenever possible and not contraindicated.³³

Early planning of intensive care unit (ICU) admission in the high risk patients could help in monitoring the postoperative complication and early intervention could be done. The oxygen therapy and respiratory support are the main keys of postoperative management in COVID patient. In severe COVID - induced ARDS, high PEEP help to open the collapsed alveoli. The lung protective strategies, routine secretion clearance and PEEP titration should be done to improve gas exchange and pulmonary function. Prone position help with lung recruitment and reduce in alveolar shunting and lung alveolar inhomogeneity. Deep sedation is needed to avoid self-extubation. Higher level of inflammatory cytokines also linked to tolerance and higher dose or combine multiple sedation agents. Routine dexamethasone perioperatively may be beneficial in positive patient with mild to moderate symptoms, but the routine use is not recommended and need further research.^{31, 32,34,35}

CONCLUSION

The pandemic is a major public health problem that challenges the healthcare system in various sides. The most affected population are those who are infected by the virus, and some of them

requires elective surgery due to other health problems. Consequently, anesthesiologists should be well aware of the perioperative management of these patients. Some referral hospitals develop strategies to minimize in-hospital transmission without compromising service. Personal protective equipment is essential to ensure the provider's safety. Preoperative evaluation must be done thoroughly, especially of the symptoms related to COVID-19 as it could identify the patient at risk. Laboratory examinations is needed to confirm the diagnosis and assessing complications. The optimum time of surgery needs to be determined based on procedure's urgency. If the procedure is elective and the risk of delaying the procedure is low, it should to be postponed due to risk of transmission. Intraoperative management guidelines are mostly focusing on limiting exposure to health care, but there are very limited studies on anesthesia management based on patient outcome. Regional anesthesia or peripheral nerve block is generally preferred to avoid aerosol-generation procedure in general anesthesia. If a general anesthesia has to be done, rapid sequence intubation is recommended as it reduces coughing. Postoperative patients should be monitored closely due to higher complications and mortality rate in COVID-19 patients.

CONFLICT OF INTEREST

The authors declare there is no conflict interest.

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