

Anesthesia Management and Perioperative Infection Control in Patients with the Novel Coronavirus

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Abstract

Background: The COVID-19 The new coronavirus SARS-CoV-2 pandemic has not only profoundly altered surgical treatment across the world, but it has also presented unprecedented difficulties to global healthcare systems. There has been a significant change in how anaesthesia and infection control are handled in perioperative settings due to the increased potential of viral transmission. Strict procedures have been implemented to guarantee the safety of patients and healthcare personnel due to the highly infectious nature of the virus and its potentially devastating clinical effects.. **Objective:** The goal of this study was to provide the anesthesia care provider with an understanding of the basics, clinical aspects and recent advances of anesthesia management and perioperative infection control in coronavirus patients in order to diminish related morbidity and to avoid adverse perioperative event. **Conclusions:** The Patients who have healed with COVID-19 may be posted for elective procedures within 0-2 weeks after receiving negative results for SARS-CoV-2. As more and more COVID-19 survivors become surgical candidates, it becomes imperative to do a thorough preoperative examination and risk assessment before admitting them. In the lack of strong scientific data on outcomes for these individuals following elective procedures, integrating excellent clinical skills and a range of diagnostic studies may allow us to evaluate each patient.

Keywords: Anesthesia Surgery; COVID-19; Infection Control During Operation; Patient Safety.

1. Introduction

Coronaviruses (CoVs) are a group of viruses that may spread between animals and people and cause respiratory and gastrointestinal sickness. Humans often get a cold from them, but they have the potential to contract more serious infections, as shown by the outbreaks of severe acute respiratory syndrome (SARS) in China between 2002 and 2003 and Middle East respiratory syndrome (MERS) on the Arabian Peninsula in 2012.

Another coronavirus has been a global problem since December of 2019. The coronavirus responsible for the current epidemic of sickness (COVID-19) was first found in Wuhan, China, after complaints of severe pneumonia [2]. This virus is known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).

Wuhan, a metropolis in China's Hubei province with a population of over 11 million, was the first location to discover a new strain of coronavirus in December 2019. This happened after an unexpected influx of pneumonia cases. On March 11, 2020, the Globe Health Organization (WHO) proclaimed a pandemic since the virus has spread to more than 200 nations and territories throughout the world. As of 2020-10-13, there were 1,077,799 confirmed fatalities and 37,601,848 confirmed cases of coronavirus disease 2019 (COVID-19) worldwide. On March 16, 2020 [3,] the number of cases and fatalities outside of China exceeded those inside the nation. Major cold

symptoms, such as fever and a painful throat from enlarged adenoids, may be caused by coronaviruses. Additionally, coronaviruses may cause bronchitis by direct viral bronchitis or secondary bacterial bronchitis, and pneumonia via direct viral pneumonia or secondary bacterial pneumonia [4].

Medical personnel providing direct patient care are particularly vulnerable to contracting SARS-CoV-2 because of their close proximity to infected patients. It has been hypothesised that 10%-20% of all diagnoses are made by frontline healthcare providers [5].

Since anesthesiologists are responsible for airway and breathing control, they are at a higher risk than other healthcare professionals in other subspecialties. When providing perioperative care for patients having urgent and emergency operations, as well as during emergency intubation outside of the operating theatre, and when caring for critically sick patients in the intensive care unit (ICU), they must be in close proximity to the patients' airways [6].

Although the precise number of infected anesthesiologists is unclear, some have caught the virus after conducting tracheal intubations on patients who were later proven to have COVID-19. Anesthesiologists and other members of the perioperative team are especially vulnerable to nosocomial infections because of the hectic nature of the operating room. The perioperative care of patients

infected with COVID-19 necessitates the immediate implementation of safe medical practises and infection prevention strategies [7].

With the goal of reducing related morbidity and avoiding adverse perioperative event, this review aimed to equip the anaesthesia care provider with an understanding of the fundamentals, clinical aspects, and recent advancements of anaesthesia management and perioperative infection control in patients with coronavirus.

Management of Patients with Neurologic Conditions

Patients with baseline neurologic disease or on immunosuppressive therapy should prioritize infection control measures like vaccination, social distancing, and mask-wearing [8].

COVID-19 Vaccination:

The American Association of Neuromuscular and Electrodiagnostic Medicine and the National Multiple Sclerosis Society both suggest that patients with neurologic disorders, particularly those on immunosuppressive medication, be vaccinated against COVID-19. Neurological problems, such as stroke, may be avoided by vaccination. Vaccination efficacy may be reduced by immunosuppressive drugs; methods for maximising vaccine efficacy are explored elsewhere [8].

The advantages of vaccinations such as those against VITT and GBS exceed the potential dangers. COVID-19 infection has a larger risk of GBS than immunisation does, and the risk of thromboembolism is higher with COVID-19 than with VITT. Consider using a different vaccination for the prevention of GBS. The vaccines Ad26.COV2.S (Janssen/Johnson & Johnson) and ChAdOx1 nCoV-19/AZD1222 (AstraZeneca) have been related to instances of vaccine-associated immune thrombotic thrombocytopenia (VITT). The thromboses and death rates of VITT patients were much greater. Autoimmune VITT appears between 5 and 30 days after immunisation [9].

Guillain-Barré Syndrome (GBS), alternatively.

The nCoV-19/AZD1222 vaccination, as well as the Ad26.COV2.S vaccine, have both been linked to instances of GBS. With 13.2 million doses of Ad26.COV2.S in the United States, 123 cases were reported. The post-vaccination rate of GBS is greater than the baseline rate [10].

Taking Care of Immunosuppressive Drugs:

Most neurologic patients should continue immunosuppressive medication, with the

exception of those with severe COVID-19 [11].

Relating to MS There may be a diminished immune response in patients receiving B-cell depleting or sphingosine-1-phosphate receptor DMTs. If you want to maximise your response to anti-CD20 DMTs, you should be vaccinated before starting treatment. In ocrelizumab-treated individuals, T cell responsiveness may be maintained [12].

Illness caused by Myasthenia Gravis: If COVID-19 happens, keep taking immunosuppressants but think about switching to something else [13].

COVID-19 Severity Risk:

COVID-19 has a poor prognosis because of neurological illness. Patients with cardiovascular disease, such as stroke, have an increased risk of cerebrovascular disease. Higher likelihood of adverse outcomes in patients with epilepsy after COVID-19. Patients with cardiopulmonary problems or substantial neuromuscular weakness tend to have a more dire prognosis. COVID-19 and mortality risk may be increased in people with dementia. There may be an increased risk of readmission to the hospital for patients with neurological diseases [14].

Anesthetic Functions

Because of their frequent interaction with infected patients, healthcare personnel including anesthesiologists are at high risk during the COVID-19 pandemic. The Chinese National Health Commission has recommended a number of antiviral medications and therapies, though the evidence for their efficacy is mixed. These include - interferon, lopinavir-ritonavir tablets, ribavirin, and chloroquine phosphate; plasma from cured patients; and traditional Chinese medicines. There was a 3.5% infection incidence among Chinese healthcare personnel and a 0.3% fatality rate [15]. Due to their intimate contact with patients and potential exposure to respiratory droplets and aerosols, anesthesiologists are at an increased risk of infection. Intubation and other forms of invasive ventilation are necessary for around 3.2% of COVID-19 patients. When treating patients in a variety of settings, including emergencies, ICU transfers, and off-site airway care, anaesthesia personnel may come into contact with COVID-19-positive patients. It is noted that local standards and the availability of workers and protective equipment may cause certain recommendations for lowering the risk of transmission to change [16].

Safeguards Against Emerging CoV Strains:

Healthcare professionals must be properly trained in in-hospital infection control and

follow conventional preventative methods, including suitable isolation and protective measures, while caring for patients with new CoV infections. Healthcare staff caring for infected patients may also need psychological assistance. Universal precautions, hand hygiene, PPE usage, correct medical waste disposal, equipment and environment cleaning, and other routine infection control measures must be implemented immediately and adhered to [17].

Preoperative Assessment for Anesthesia Patients

Recommended PPE for use in the anaesthesia preoperative assessment clinic includes white medical gowns, gloves, eye protection shields, disposable surgical caps, and surgical masks or test fit N95 masks or respirators. Patients should enter the consultation room separately to minimise contact, and those with temperatures over 37.3 degrees Celsius should be sent for further assessment [16]. When initially meeting a patient, anaesthesiologists should take a thorough medical history and do a physical examination of the chest. It is important to practise good hand hygiene and report all occurrences of possible infection, regardless of whether or not a fever is present. Clinic surfaces and equipment should be cleaned and disinfected with 2 to 3 percent hydrogen peroxide at the conclusion of each shift [6].

Preparing Patients for Immediate Surgical Interventions

Anesthesiologists should do a secondary triage after patients admitted to the hospital for emergency surgery have been evaluated. The patient's medical history is reexamined, a

quick physical examination is performed, chest x-rays are obtained, and the patient's temperature is measured again as part of this secondary triage. Urgent surgeries may be performed on patients who have been ruled out for COVID-19. Urgent patients should be separated and operated on in a COVID-19 operating room, whereas elective procedures should be postponed if COVID-19 is suspected or proven. The infection control unit of any hospital where a case of COVID-19 is suspected or confirmed must be notified immediately, and any stable patients must be moved to a facility specifically authorised to treat patients with the virus [6].

The Stage Before Surgery

Certain operating rooms should be marked as "infectious surgery" and, if feasible, fitted with negative pressure devices in anticipation of COVID-19 patients who may need surgery. Only those who need to be there should be let in, and there should be strict standards in place for disinfecting the anaesthetic machine and the room it will be used in [18]. Medical scrubs, protective coveralls, masks, goggles or face shields, latex gloves, and boot coverings should be donned in a specified order, and the patient's respiratory and cardiovascular state should be evaluated by the main anaesthetic attending. When personal protective equipment (PPE) is scarce, doctors and nurses may treat numerous patients at once by sharing gowns and extending the usage of surgical masks or N95 respirators. Elective procedures that call for the use of PPE should be delayed, and alternatives to non-washable PPE should be explored [19].

Fig. (1) shows how to put on and remove surgical garments in the right way before and after an operation [20].

Components	Recommendations
Oxygen	Make sure an adequate supply of oxygen is available and prepare a separate oxygen tank in the room
Machine	Make sure an anesthesia machine or an ICU ventilator is functional
Suction	Make sure suction (with backup) is functional and available
Monitor	Make sure pulse oximetry, electrocardiography and noninvasive blood pressure monitors are functional
Drugs	Have all drugs for sedation, anesthesia induction and muscle relaxation available
Intravenous access	Flush and make sure intravenous access is functional
Airway Supplies	Make sure the video laryngoscope (with backup) is functional and prepare a difficult airway cart

Control of Anesthesia

Methods of Inducing Sleep (1) Overall sedation or anaesthesia

Reducing oral and nasal droplet transmission is indicated for individuals with suspected or confirmed COVID-19 (e.g., the risk of patients coughing and bucking, which can generate airborne material and droplets). Depending on the nature of the operation and the needs of the patient, several forms of anaesthetic may be used. If the patient is not intubated, they must wear a surgical mask or N95 mask while in the operating room. To protect workers from inhaling the droplets and aerosols, a "Negative Pressure Airway Hood" should be used if at all practicable. Apply the induction and paralysis agent in rapid succession after adequate preoxygenation; for severely agitated individuals, 1–2 milligrammes of intravenous midazolam may be used for sedation. Airway reflexes may be effectively suppressed during endotracheal intubation with intravenous lidocaine, 1.5 mg/kg [21].

Medical personnel risk greater exposure to COVID-19 because tracheal intubation might

result in the patient spraying secretions or blood, or producing droplets or aerosols [22].

Two, epidural vs spinal

When a woman with COVID-19, general anaesthesia is still the best option for a caesarean section. A surgical or N95 mask must be worn at all times by the infected mother. The oxygen mask is used over the surgical mask or N95 mask in case more oxygen is required. An alternative to spinal anaesthesia is general anaesthesia, which may be utilised if spinal anaesthesia does not work or if intraoperative conversion to general anaesthetic is necessary [6].

Methods of Inducing General Anesthesia

The use of a quick sequence induction is recommended, with the same standard precautions used before inducing an ordinary patient. Bag mask ventilation may enhance the possibility of aerosolizing airway secretions, making exposure to and transmission of viruses more likely. After ensuring that everyone in the operating room is wearing appropriate safety gear, induction may begin. The full check consists of both a self-check and, more crucially, a check by a different coworker [23].



Fig. (1) A coworker checking their own PPE after it was checked by the employee.

In certain hospitals, the most senior anesthesiologist on duty will be the principal intubator on a given day and will be required to employ N95 respirators, goggles, and other protective equipment. Anesthesiologists should

employ video laryngoscopy to increase the distance between the intubator and the airway and ensure that all connections on the standard breathing circuit are secure before beginning the operation [24].

Two layers of moist gauze should be used to cover the patient's nose and mouth during intubation for patients with COVID-19 to reduce secretions and ensure the airway is not blocked. If you relax your muscles, you won't cough. It is advised to use a long-acting muscle relaxant, inflate the cuff prior to ventilation, check correct tube location with end-tidal CO₂, and have a backup ventilator on hand before attempting extubation [25]. It is recommended that patients have their airways intubated orally using a fiberscope, video laryngoscope, or bronchoscope, using single-use fiberscopes for each patient or meticulous cleaning of reusable fiberscopes between uses. It is recommended to change hands after each airway manipulation and to cover the anaesthetic cart with plastic sheets to prevent the spread of germs. To minimise the spread of viruses, it is preferable to use a closed airway suction system, with just the minimum number of suction required. Patients with COVID-19 should be extubated in the operating room after they are deemed stable, rather than in the post-anesthesia care unit. After two hours of routine oxygen treatment, high-flow nasal catheter oxygen therapy, or noninvasive ventilation in the ICU, respiratory distress, high breathing frequency, and low oxygenation index are criteria for tracheal intubation [26].

Transferring a Patient:

After extubation in the operating room, a patient with COVID-19 should be transported back to the negative-pressure ward or isolation ward if they are stable and do not satisfy the criteria for admission to the ICU. Outside of the operating room, the circulating nurse and anesthesiologist must wear protective gear throughout the transfer. Using a special entrance and elevator, the patient should be moved to the negative-pressure or isolation ward, where they will be covered with a single disposable surgical sheet. A surgical or N95 mask is required for the patient to wear during the transfer. It's important to tidy up the hallways and elevator's interior [27].

A breathing bag intended for a single patient must be used if the patient wants to remain intubated. Using a ventilator during transport is not advised [28].

Disposal of Medicinal Waste and Maintenance of Post-Operative Equipment

Following surgical procedures, double-bagging and labelling medical waste as "COVID-19" with department, institution, date, time, and category information should be done as soon as possible. Single-use and safe disposal are essential for contaminated anaesthetic tools such video laryngoscope blades and reinforced tubes. All trash bags

must be double bagged or treated with chlorinated disinfectant before leaving the hazardous area. The PPE used by surgical staff must be removed in a precise sequence and disposed of in a specific trash can. Medical waste bags should be used for packing and storing equipment that is not disposable [29].

Maintenance of Anesthesia Gear

All video laryngoscope blades, reinforced tubes, and anaesthesia masks should be single-use goods since they come into close contact with the patient's skin or mucosa during anaesthetic procedures. It's crucial to follow correct procedures for cleaning and disinfecting. Anesthesia machines need regular maintenance, including the replacement of the carbon dioxide absorber and the disinfection of the respiratory circuit after each case and at the conclusion of the shift. Dismantling anaesthetic machine ventilators for high-temperature sterilisation or disinfection with 12% hydrogen peroxide or ozone is recommended [30].

The anaesthetic cart, any non-disposable equipment surfaces, and the laryngoscope handles must also be cleansed. Proper training for cleaning staff and the use of hydrogen peroxide sprays and other prescribed disinfectants are essential for preventing the spread of the COVID-19 virus in the operating room utilised for these patients. Following proper protocol for removing PPE, such as washing one's hands afterward, and having an observer present helps reduce the likelihood of cross-contamination. The recommended time for washing one's hands with soap and water or an alcohol-based hand massage is 20 seconds [31].

Intubation of the Trachea:

Patients infected with 2019-nCoV had a high rate of needing tracheal intubation outside of the OR. More than 70% of COVID-19 patients in the intensive care unit in Wuhan, China, are intubated, according to estimates. Due to the often-emergent nature of tracheal intubation outside the operating room and the inadequate intubation situation, the risk of exposure to healthcare personnel seems to be greater than in the operating room. Therefore, it is very necessary to take measures while managing an airway outside of an operating room [32].

Endotracheal Intubation: When to Do It

If a patient is unable to recover after 2 hours of high-flow oxygen treatment or other forms of noninvasive ventilation, or if they have lost consciousness and/or are unable to defend their airway, we consider them to be in acute respiratory distress and recommend intubation [32].

The Steps Before Intubation

As mentioned in the "Preoperative Preparation" section of "Anesthesia Management in the Dedicated Operating Room," endotracheal intubation is a high-risk aerosol-producing procedure that should be performed in an airborne isolation room with all involved healthcare workers wearing appropriate airborne/droplet personal protective equipment. Intubation should be performed by seasoned anesthesiologists with the help of another physician to reduce the number of failed attempts and the amount of material released into the air. Standard intubation instruments and medications should be prepared in advance, although access may be restricted owing to the small area and eye shield condensation [33]. Familiar airway equipment, such as disposable video laryngoscopes or flexible video bronchoscopes, should be selected. When caring for a patient with COVID-19, it is important to employ a high-efficiency breathing circuit filter and follow the disinfection procedures outlined in "Anesthesia Equipment Care and Operating Room Disinfection." To lessen the spread of viruses via the air, using a closed airway suction device is advised [19].

Intubation Safety Measures

In order to decrease the number of intubation attempts and the patient's risk of exposure, intubation should only be performed by trained anesthesiologists. The use of a video laryngoscope or bronchoscope for oral intubation is desirable, whereas utilizing a direct laryngoscope necessitates additional caution to prevent the patient from coughing. In cases when oral intubation is not a viable option, transnasal bronchoscopic intubation may be performed. When intubation is complete, the crew should immediately switch to new outer gloves [34].

A mask seal and minute alveolar breathing are essential for adequate oxygenation before intubation. Using high-flow oxygen may enhance viral droplet and aerosol formation, hence caution is suggested. Two layers of moist gauze should be used to cover the patient's mouth and nose before placing on the preoxygenation mask. Preoxygenation with 100% oxygen for 5 minutes without adjusting ventilatory settings is advised for patients undergoing noninvasive mechanical ventilation [35]. Patients with a normal airway should have a modified fast sequence induction, which aims to induce unconsciousness as quickly as possible while still providing enough muscular paralysis. Midazolam combined with etomidate or

propofol, and opioids for laryngeal reflex suppression, are examples of induction drugs that take hemodynamics into account. Patients with COVID-19 who are already in critical condition should be treated with care when succinylcholine or rocuronium is delivered. During expected difficult airways, appropriate sedation and topicalization may be required for awake intubation with fiberoptic or video laryngoscopy [36].

After Intubation, Managing the Airway

After intubation, a closed suction system should be used for oral or tracheal suctioning. Transmission may be reduced by regularly cleaning and disinfecting patient care equipment and ambient surfaces. When discarding PPE, readers are directed to the section under "Disposal of Medical Waste." Under the watchful eye of a person trained in infection control, PPE should be taken off in the correct manner. After removing PPE, it is imperative to wash one's hands. Clean your hands before touching anyone's hair or face. After taking off protective gear, you should take a shower to clean your whole body, including your mouth, nose, and ears. The intubation region is considered a contaminated location, hence any PPE used during the procedure must be left there [37].

Handling of exposed medical personnel:

Workers in the healthcare industry who suspect they may have been exposed to COVID-19 should conduct a risk assessment in accordance with US CDC standards and promptly notify their supervisor or occupational health services.

76 High-risk healthcare personnel should avoid all patient contact for 14 days following their last day of exposure to a patient proven to have COVID-19, undergo testing for COVID-19, and remain in quarantine for 14 days [38].

Temperature and respiratory symptoms are checked regularly during the observation period. However, after consulting with occupational health services, it is acceptable for a health care worker who has been exposed to work if there is a significant shortage of medical personnel and all other options for enhancing staffing have been tried. When at the hospital, they should always wear a mask, stay away from patients who are critically immunocompromised, and practise good hand hygiene and respiratory hygiene [39].

Low-risk healthcare personnel should self-monitor temperature and respiratory symptoms daily for 14 days following the last day of exposure to a COVID-19 patient, report any symptoms that may be related to COVID-19 promptly to the health care institution, and reinforce contact and droplet precautions.

Since it is unknown whether individuals who have recovered from COVID-19 have the capacity to transmit SARS-CoV-2 [40], follow-ups are necessary even in medical procedures when no confirmed COVID-19 patients are present.

Anaesthesia Assessment After COVID Release 19

There are no comprehensive protocols for screening and monitoring COVID-19-recovered patients undertaking elective operations, despite recommendations for elective surgery were published by major anaesthetic and surgical associations throughout the epidemic. Reports reveal that COVID-19 infections after surgery may have long-lasting consequences on organs even after the patient has fully recovered. During the first pandemic wave in 2020, researchers found that COVID-19 survivors made up a sizable percentage of elective surgery patients [41]. In-person pre-anesthetic checks (PAC) with strict PPV were regarded safe for these patients, according to survey respondents. The majority of responders also agreed that elective procedures in COVID-19 survivors may go forward within two weeks after negative COVID-19 results, with precise scheduling suggestions depending on symptom intensity and comorbidities gleaned from previous coronavirus infections. These suggestions are a pragmatic reaction to the lack of strong evidence-based recommendations for elective procedures after COVID-19 [42]. There was no increased risk of postoperative complications in a Brazilian study of 49 asymptomatic COVID-19 recovered individuals who received oncological operations about 25 days after COVID-19 diagnosis. The risk of pulmonary problems and death after cancer surgery was shown to be lowest four weeks after the first COVID-19 positive swab, according to a research conducted in the United Kingdom. Patients with persistent symptoms had a greater death rate after a delay of 7 weeks or more after a COVID-19 diagnosis, according to a survey done before the release of the COVIDSurg Collaborative and GlobalSurg Collaborative investigations [43]. Those who have healed from COVID-19 but still have some symptoms are encouraged to undergo a thorough preoperative examination and optimization, as recommended by a number of different associations and institutions. Most respondents (80%) believe that functional capacity tests like the six-minute walk test and the breath-holding duration should be part of the preoperative evaluation after COVID-19. Due to COVID-19's procoagulant properties, chest

X-rays, electrocardiograms, and coagulation profiles are also advised. Due to the virus's effect on breathing, assessing the lungs is essential, although the severity of irreversible pulmonary fibrotic alterations, especially in elderly individuals, is unknown [44].

Patients who had recovered from COVID-19 and were receiving curative cancer surgery had a greater risk of postoperative pulmonary problems, according to a UK research that used a propensity score matching model. Because of their uncertain clinical significance in perioperative outcomes [42], pulmonary function tests and arterial blood gases have been excluded from the preoperative assessment protocol developed by Bui et al. (2021) for COVID-19 recovered patients. Instead, they have included a complete metabolic panel and ambulatory pulse oximetry measurement.

Patients who have recovered from COVID-19 should have thorough cardiac examinations due to the risk of cardiac sequelae such as myocarditis, myocardial infarction, cardiomyopathies, arrhythmias, shock, and cardiac arrest. Several abnormalities in electrocardiograms and echocardiograms have been described accompanying elevated troponin levels in individuals with COVID-19 [45].

Depending on the patient's condition, further cardiac testing (such as NT proBNP and stress tests) may be necessary. While children often have a healthy cardiac laboratory profile, these heart problems are more common in the elderly. Few studies have examined the long-term mortality and morbidity associated with COVID-19-related cardiac problems. Some anaesthesia societies have called for prioritisation policies and periodic protocol reassessment in light of emerging COVID-19 data [46], while others have argued that preoperative assessment for COVID-19 recovered patients should be individualised based on factors such as infection severity, post-recovery functional status, comorbidities, and surgical urgency and risk.

Protocol for Making Suggestions:

Prior to any elective surgery or operation requiring general anaesthesia, individuals who have tested positive for SARS-CoV-2 must first receive a thorough preoperative history and physical examination [47].

Complete alleviation of COVID symptoms and sufficient clinical recovery time are prerequisites for surgery. Recognizing that there is presently a paucity of evidence on the duration of recovery, we settled on a minimum recovery period of 4 weeks for patients who

had asymptomatic SARS-CoV-2 infection and 6-8 weeks for those who had developed symptoms. The history and physical section places special emphasis on the patient's COVID course, the presence of any subclinical complications, the determination of whether or not the patient has returned to their "pre-COVID" baseline health, an evaluation of their functional capacity, and an ambulatory measurement of their oxygen saturation. The Edmonton Frail Scale [48] is used to evaluate the level of frailty in patients who are 65 or older, or who have been hospitalised due to COVID therapy.

Additional testing is done dependent on the severity of symptoms during COVID infection, the intricacy of the operation, and the necessity for general anaesthesia, in addition to these fundamental necessities (Table 2). Cardiopulmonary function, coagulation state, inflammatory markers, and nutritional status may all be determined from

Pre-Op Objective Assessment Protocol for COVID-19 Survivors, by Surgical Procedure and Index Illness Severity [50] Table 2.

Step/test	Minor procedures and/or without general anesthesia		Major procedures	
	Asymptomatic	Symptomatic	Asymptomatic	Symptomatic
CXR	No—if pulmonary exam and O ₂ sat normal	No—if pulmonary exam and O ₂ sat normal	Yes	Yes
EKG	Yes	Yes	Yes	Yes
Echo	No—if cardiac exam and vitals normal	No—if cardiac exam, NT-pro-BNP, and vitals normal	No—if cardiac exam, NT-pro-BNP, and vitals normal	Determined by H&P
CMP	Yes	Yes	Yes	Yes
CBC, with diff	Yes	Yes	Yes	Yes
PTT	No	Consider based on severity of illness	Yes	Yes
D-dimer	No	Yes	Yes	Yes
Fibrinogen	No	Consider based on severity of illness	Yes	Yes
NT-pro-BNP	No	Yes	Yes	Yes
LDH, ferritin, prealbumin	No	Consider based on severity of illness	No	Consider based on severity of illness

Patients who have normal findings following this evaluation may go on when the required time has passed. Any major irregularities, however, would prompt a roundtable discussion and, if necessary, discussions with other disciplines. Non-elective procedures when time is of the essence will be carried out according to protocol. After that, the patient would have extensive pre-operative risk-benefit counselling and/or goals-of-care conversations [50].

Perspectives and suggestions for the future:

To encourage healthcare personnel to conduct their jobs in healthy conditions, further research and clinical investigations are essential to produce effective immunisation and therapies for COVID-19 [51].

Until then, we had to work on developing and updating guidelines and recommendations for the management of COVID-19 positive patients and patients under investigation to lessen the likelihood of viral exposure and

the results of these tests. Because COVID has been shown to affect various systems, an aberrant number may indicate that the illness has not been fully treated, increasing the likelihood of intra- or postoperative problems [49].

Since the complete metabolic panel (CMP) and ambulatory oxygen measurement give identical data without the danger of hematoma, nerve damage, or arterial injury, Bui et al. (2021) opted not to do arterial blood gases (ABG). Although some research has linked the severity of disease in cured COVID-19 patients to a lower diffusing capacity for carbon monoxide (DLCO), the therapeutic importance of this finding in terms of perioperative outcomes remains unclear. Since pulmonary function tests (PFT) are not generally advised for use in non-thoracic procedures, we have decided to leave them out of our protocol for the time being.

transmission among anaesthesia workers and other healthcare professionals, thereby conserving valuable human resources during a pandemic [52].

2. Conclusions

The Patients who have healed with COVID-19 may be posted for elective procedures within 0-2 weeks after receiving negative results for SARS-CoV-2. As more and more COVID-19 survivors become surgical candidates, it becomes imperative to do a thorough preoperative examination and risk assessment before admitting them. In the lack of strong scientific data on outcomes for these individuals following elective procedures, integrating excellent clinical skills and a range of diagnostic studies may allow us to evaluate each patient.

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