

Review Article

Anesthesiologist and COVID-19—current perspective

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Abstract

In the current situation when the world is grappling with COVID-19 that has taken a toll on humanity and is continuing to affect multiples of health-care workers all over the world in vast numbers, the pandemonium (mayhem) has led to grim concerns. We have made an effort to compile and present a review that provides an insight into the management of patients for the front-line anesthesiologists of the medical war, which is being fought to curb and contain this COVID-19 pandemic. We have tried to incorporate

the operating room locations, as well as the remote locations where anesthesiologist may be called upon for providing their services. Needless to say, it is of utmost importance to ensure the safety of the patient, as well as of the anesthesiologist who are involved in the patient care at this crucial juncture. The present article provides valuable information to anesthesiologists regarding handling the current pandemic in a protocolized and evidence-based manner.

Keywords: Anesthesiologist, COVID-19, Pandemic

Introduction

At the time of compiling this review (March/April 2020), almost the entire world, irrespective of geographical location, is infected and dealing with the coronavirus (COVID-19) pandemic. It has been observed that up to 15% of COVID-19 patients develop severe respiratory complications with ~5% of them requiring mechanical ventilation.^[1] Anesthesiologists are susceptible to increased risk that is stipulated to be 13 times more than the other health-care professionals by virtue of their involvement in perioperative and intensive care management of these patients that requires invasive airway management.^[2] We cannot undermine the contribution of famous “coronavirus intubation team racing against death” in Wuhan that determined the importance of anesthesiologist during this epidemic.^[3] Apart from the operation theater (OT) and intensive care units (ICU), anesthesiologists are also required in the management of these patients at locations that comprise emergency room, isolation wards, radiology, interventional radiology (IR) suite, labor room, and many more. This review will provide an insight of anesthesia care while dealing with COVID-19 patients in different locations of the hospital, whereas simultaneously ensuring the safety of both patients and anesthesiologists.

Epidemiology

COVID-19 is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) or beta coronavirus. It is the seventh virus of the coronavirus family to have inflicted mankind

as a pandemic.^[4] SARS-CoV-2 is a RNA virus that belongs to the sarbecovirus subgenus.^[5] As Coronaviridae family infects both humans and animals, it has been postulated that SARS-CoV-2 was initially transmitted to humans by an intermediary animal before human to human and community transmission happened.^[6] The incubation period varies from 1 to 14 days with a median of 5 days though as high as 24 days has also been reported.^[7,8] COVID-19 can be transmitted through respiratory and digestive tract, as well as mucosal surfaces. It has recently been postulated that coronavirus may be transmitted by asymptomatic carriers (superspreaders) that may constitute around four-fifth or almost half of the infected cases.^[9,10] Owing to the wide range of incubation periods, transmission is possible during the entire period, though the mechanism of the same is not understood as yet.^[8] Asymptomatic carriers may be responsible for the propagation of the outbreak and pose a daunting challenge to physicians for containment as well as resurgence of the disease.^[11] The clinical spectrum of disease pertaining to respiratory system varies from mild upper respiratory tract infection/pharyngalgia to severe hypoxic respiratory failure due to development of acute respiratory distress syndrome (ARDS).^[7,8] Certain patients may exhibit symptoms related to digestive system and may present as diarrhea only.^[12] The available literature also suggests the propensity and higher probability of the elderly patients with concomitant comorbidities to be more prone to disease and develop ARDS, thereby leading to higher mortality in this age group.^[13]

Anesthesia Preparation for COVID-19

Since COVID-19 has already been declared as an epidemic

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in India with a national emergency and advisory, it is highly likely that some of these patients may present as a surgical or interventional emergency in the near future. It is high time for an anesthesiologist to prepare a designated OT and design protocols for suspected and/or confirmed cases of COVID-19.

Designated operation theater

At least one operating theater with two operating rooms (ORs) should be designated as a dedicated COVID-19 OT which should preferably be located in the corner having a separate access and elevator from the emergency department. The corridor leading to COVID-19 OT should be labeled as COVID-19 corridor and elevator, respectively.^[13] All the suspected and positive cases who require surgical intervention must be transferred with a triple layer surgical mask and the doctors as well as other health-care workers (HCWs) responsible and involved in transfer should be wearing the personal protective equipment (PPE).^[14] The operative procedure should preferably be undertaken in negative pressure OR. If unavailable the OR may be altered by disconnecting the central air conditioning system and incorporating individual air conditioning with facility of separate atmospheric air inlets and exhaust system.^[14] If available the designated OT should contain a high-efficiency particulate air (HEPA) filter in each OR with at least 12/14 fresh air cycle changes that has an advantage of removing the viral particles (up to size of 0.3 μm) to almost 99% in addition to maintaining the acceptable limits of temperature and humidity.^[14,15] The filters must be serviced at regular intervals and replaced if need arises.^[16]

Anesthetic Management of COVID-19 Patient for Emergency Procedure

Certain pertinent precautions that need to be followed diligently while managing a suspected or confirmed COVID patient are enumerated as below:

- “Self-preservation is supreme law.” It basically implies taking care of one’s own self so as to provide appropriate care to the patient with strict adherence to infection prevention and control
- Minimize anesthesia team members in OR who should preemptively know about proper donning and doffing techniques with respect to PPE. For the ease of the team, donning doffing sequences may be readily available as flowchart in the separate designated rooms for the same. The protocol that is followed in our institute is being mentioned in the table as below [Table 1]
- Senior anesthesiologist should always be present and lead the anesthesia team through the entire perioperative procedure. The other members of the team shall include one more anesthesiologists and two anesthesia technicians

- Although role of hydroxychloroquine is still speculative and not very well substantiated due to paucity of clinical trials, anesthesiologist involved in management of suspected and confirmed COVID-19 patient may be asked to take hydroxychloroquine chemoprophylaxis.^[17,18] But the decision to implement the same shall be as per institutional advisory body for COVID 19. However, the chemoprophylaxis should not be considered as a substitute and replacement for the infection prevention control measures
- Always consider regional anesthesia over general anesthesia for the suspected or confirmed patients whenever feasible.^[19]

Team allocation

Preplanned team allocation is imperative and mandatory for the anesthetic management of the suspected or the confirmed cases. As discussed, the senior consultant anesthesiologist should lead the team. One health-care provider (HCP) should primarily be responsible to activate the team of COVID-19 OT immediately after receiving a call from the emergency department, which in our institute is performed by the nurse in-charge of the COVID-19 OT.^[13] The designated team should hand over all their belongings including the stethoscope to the nurse in-charge before proceeding to the changing/donning room after reaching the OT.

Each member of the team shall be responsible for the duties assigned to him/her, which should be defined preoperatively and be followed as tabulated [Table 2]. Closed-loop

Table 1: Donning and Doffing sequence

Donning sequence	Doffing sequence
Hand disinfection	Hand disinfection
↓	↓
Shoe cover	Remove shoe cover
↓	↓
First pair of gloves	Hand hygiene
↓	↓
Gown	Remove outer pair of gloves
↓	Hand hygiene
N95 (check for leakage)	↓
↓	Remove hood
Face shield	↓
↓	Hand hygiene
Hood	↓
↓	Remove gown
Second pair of gloves	↓
	Hand hygiene
	↓
	Remove face shield
	↓
	Hand hygiene
	↓
	Remove inner pair of gloves
	↓
	Hand disinfection

communication is the key to the successful execution and management of the procedure.

Preoperative preparation

Before commencing the preparation, all except one (AT2) members of the anesthesia team will undergo protocolized donning of enhanced PPE that comprise of PPE with N95 mask along with a face shield. After the donning exercise, anesthesiologist assigned to perform a quick preanesthetic checkup will do the same in a predesignated room inside the OT before going to the OR. The COVID-19 trolley and backup trolley preparation is primarily the responsibility of AT2 (as he has not donned as yet) and both will be wheeled into the OR after ascertaining the presence of requisite drugs and equipment in communication with A1. AT2 will perform the donning only after documentation and wheeling in of the COVID-19 trolley [Table 3]. The patient should be wheeled into the OR subsequent to the entire preparation.

Intubation

Endotracheal intubation is considered as an aerosol generating procedure (AGP); therefore, it is advisable that the procedure is performed in a brisk manner and preferably by a senior anesthesiologist.^[21] It is advisable to perform intubation in a sequential manner as described.

- No person except the three members of the anesthesia team and the patient should be allowed in the OR (not even the surgeons) and the entire team should be wearing double gloves except the intubating anesthesiologist who should wear three pairs of gloves^[22]
- Place a pair of wet gauze pieces around the nose and mouth of the patient to prevent aerosol escape to the atmosphere immediately after removal of the triple layer mask of the patient, before preoxygenation^[20]
- Preoxygenation is performed through an anatomical face mask connected to a closed circuit with a viral filter, using two hand technique at low flows of 4 l for 35 min^[23]
- It is advisable to administer intravenous lignocaine prior to rapid sequence induction (RSI) in the dose of 1.5 mg/kg to prevent opioid-induced coughing that can be deleterious in COVID suspected or confirmed case^[24]
- Standard RSI is recommended with no bag mask ventilation. If bag mask ventilation is required, use either low tidal volume with positive pressure ventilation or pressure support ventilation with support of 10 and positive end expiratory pressure of 5 cm of H₂O^[25]
- Depending on the availability, rocuronium or succinylcholine may be employed in the dose of 1.2 mg/kg and 1 mg/kg, respectively, to provide adequate neuromuscular blockade for intubation in 60 s^[26]
- Direct laryngoscopy with video laryngoscope/Macintosh

Table 2: constitution of team and respective role allocation

Anesthesia team members	Senior anesthesiologist (A1) Anesthesiologist (A2) Inner anesthesia technician (AT1) Outer anesthesia technician (AT2)
Role allocation	A1 Team leader Checks COVID-19 trolley, intubation trolley, backup trolley Does preoxygenation and performs intubation Handles the draped monitor screen and workstation Suction (if required)
	A2 Performs preanesthetic evaluation Secures iv access Gives medication during perioperative period Postextubation handovers the patient to dedicated transport team
	AT1 Checks anesthesia workstation and monitor and cover it with transparent drape Connect two viral HMEFs, one at patient end and another at the expiratory limb of closed circuit ^[20] Attach monitor Communicates with AT2 for any requirements arising during perioperative period. Discards the disposable and unused drugs at the end of procedure Post-surgery cleans and decontaminates multiparameter monitor cables
	AT2 Is stationed outside OR as a backup Prepares both COVID-19 and backup trolleys and tallies the checklist along with A1 Fulfills any requirement arising during perioperative period Will go inside OR only in case of cardiac arrest/emergency, thus requiring preoperative donning in the last

laryngoscope (depending upon the availability of former) should preferably be performed through a clear acrylic aerosol box, if available [Figure 1] and clamped endotracheal tube inserted till black mark is just beneath the vocal cord.^[25,27] The other anesthesiologist connects the endotracheal tube to the circuit assembly which contains closed suction catheter (to avoid repeated disconnection for suction that itself has AGP potential), HME filter, and end tidal carbon dioxide sampling line [Figure 2]

- The endotracheal tube cuff inflation should preferably be achieved using a cuff manometer and tube shall be declamped subsequently after circuit connection. Capnography and bilateral chest rise are utilized to guide correct ETT placement, before fixation.
- The laryngoscope should be wrapped by the anesthesiologist who performed laryngoscopy and intubation, in his/her outer gloves, and subsequently be placed on an intubation trolley.
- The other two members of anesthesia team should also discard their outer pair of gloves in the designated waste bag and wear second pair of gloves after hand hygiene.

Table 3: Anesthesia equipment for COVID 19*

COVID 19 trolley	Videolaryngoscope/Macintosh laryngoscope Appropriately sized oropharyngeal airways Endotracheal tubes of appropriate size Artery clamp with gauze piece Two pair of wet gauze pieces during intubation and extubation Adequate size anatomical face mask Stylete Bain's circuit as a backup circuit Tube fixing Closed suction catheter (if available) Gloves in appropriate number Prefilled syringes of lignocaine, midazolam, fentanyl, propofol/etomidate, succinylcholine/rocuronium, vecuronium, atropine, ephedrine Fluid as per requirement of anesthesia team IV cannula (18 and 20 G) with adhesive fixing Pen and plain paper for communication with AT2
Backup trolley	CPR tray having defibrillator, adrenaline, amiodarone, vasopressin, and syringes Difficult airway cart with backup laryngoscope Fluids-crystalloid, colloid Intravenous (iv) and blood transfusion (BT) set IV cannula-24 G, 22 G, 20 G, 18 G Suction catheter Gloves Nasogastric tube Glucometer with compatible strips Syringes-2 ml, 5 ml, 10 ml, 50 ml IV and tube fixing Infusion pumps Medicines including the emergency drugs

*List may be attached/pasted in area of preparation of trolleys to avoid omitting anything as well as preventing frequent movement from the OR

Perioperative management

Certain measures should be adopted assiduously during intraoperative management of COVID-19 patients for effective infection control. Only one anesthesiologist should touch the workstation already covered with the disposable drapes as an infection preventive measure.

- Try to avoid frequent intraoperative suctioning to prevent AGP
- Low flow anesthesia is recommended and should be employed during maintenance in COVID-19 patients in order to reduce the viral transmission to the entire OR staff.^[28] The search of literature has not revealed the use of total intravenous anesthesia in these patients, which appears to be an attractive preposition for future research
- Each person shall stick to the duties assigned and there shall be no overlap of work.

Extubation

- The decision to extubate is the discretion of the team leader according to the condition of the patient. All the team members will continue wearing double gloves till extubation. Extubation shall be performed preferably in a clear acrylic aerosol box used earlier for intubation
- Intravenous lignocaine may be administered before



Figure 1: Acrylic intubation box

extubation also for probable antitussive effect to minimize aerosol generation with cough^[24]

- Extubation shall be performed using a closed circuit with closed suction catheter in situ. Use of semi-closed or open circuits may be avoided at all the times. Postextubation, it is prudent to discard the outer pair of gloves in the designated bin
- Placing wet gauze around mouth and nose during extubation too minimizes the aerosol contamination and contact^[20]
- After extubation, place a new triple layer mask/N95 to the patient
- In case extubation is deferred owing to any complication or otherwise, the patient should be transferred on Bain's circuit or transport ventilator with HME filter attached to the patient end
- A2 will hand over the patient directly to shifting team, which shall also be wearing PPE thus by passing the post anesthesia care unit. From there the patient should directly be transferred to designated postsurgical isolation ward for COVID-19 patients or COVID-19 ICU as per the requirement
- Doffing by OR team has to be performed in a sequential manner in designated area in OT. Shifting team should perform doffing in postsurgical isolation ward for COVID-19/COVID-19 ICU.

Anesthesia for Radiology of COVID-19 Patient

It is advisable that a dedicated COVID-19 ICU should have separate portable ultrasound and X-ray machines to prevent unnecessary transfer of the infrastructure thereby reducing transmission of disease.^[29] However, in several patients, it may be necessary to conduct investigation like CT chest where the

anesthesiologist may be involved in the to and fro transport of the patient to the radiology suite and the conduct of the procedure. The transport and management of these patients in radiology suite has its own special concerns and have to be dealt in closed communication with the radiology department.

- Preinform/Notify the radiology department about transfer of the patient for imaging to give adequate preparation time to the concerned radiology team. It is preferable to have a dedicated radiology suite for these patients. However, if there is only one suite in the hospital, the withdrawal of all other patients and extra staff is of prime importance
- A dedicated patient trolley should be utilized to transport suspected/positive COVID-19 patients that have an oxygen cylinder with attached transport ventilator or oxygen nasal cannula. Bain's circuit shall be kept in case the need arise to ventilate the patient during transportation
- Oxygen therapy is indicated if oxygen saturation is $\leq 90\%$ which may be administered through nasal prong with a triple layer surgical mask worn by the patient over the prongs to reduce droplet spread.^[30,31] There still exists a controversy regarding the use of high flow nasal oxygen for COVID-19 patients with different anesthesia societies giving divergent views^[32]
- Anesthesiologist should assess the need for intubation prior to transport, if required should be done in an ICU or dedicated COVID-19 ward in a controlled environment
- Green corridor should be created for transport. A designated security personnel should lead the team for transportation^[33]
- All the HCWs involved in transport should wear PPE with N95 mask. Face shield if available will provide extra layer of protection. An anesthesiologist with an anesthesia technician should accompany the cases. The transport trolley should have the following items as per Table 4
- Only members of radiology staff that have been trained for infection prevention control measures should be present inside the radiology suite.

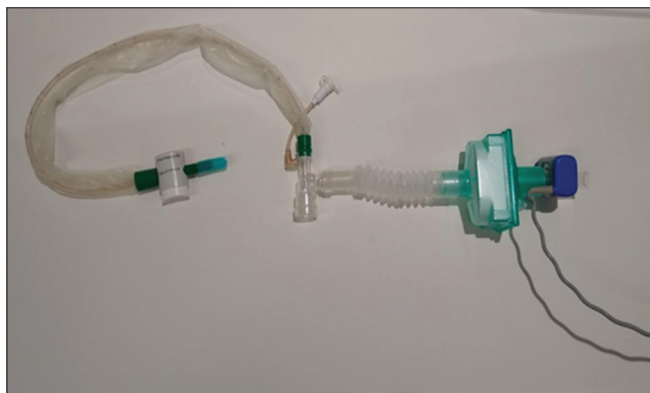


Figure 2: Closed suction catheter with HMEF

- If feasible, the transport monitor may be used for monitoring only instead of using anesthesia equipment present in imaging facility.

Anesthesia for interventional radiology suit

Except for ultrasound-guided biopsy and drainage, all other IR procedures require a dedicated IR suite with anesthesia backup. In the wake of COVID-19 pandemic, it is imminent to postpone the elective procedures in these suites.^[29] But there are certain exceptions that include emergencies such as coiling of ruptured aneurysm, mechanical thrombectomy in acute ischemic stroke patients, percutaneous coronary angioplasty in myocardial infarction, etc. Most of these emergency procedures usually require an anesthesia team backup and the presence that may range from only monitored anesthesia care (MAC) to airway management, if needed.^[34] Besides, the usual steps that are imperative to be taken care while performing anesthetic practices following are the additional protocols to be followed in these areas.^[35]

- The IR department should segregate patients and staff according to risk of infection transmission.^[36] It can be done by assigning one designated IR suite if feasible or by scheduling suspected or confirmed COVID-19 cases toward the end of the day and decontaminating it for the next day
- Transport of these patients will be similar to as stated in the above section
- The procedure may preferably be conducted under MAC, if feasible, to reduce the aerosol generation
- If during preprocedure evaluation of a patient, the anesthesiologist opines that the procedure needs to be performed under general anesthesia, the airway management including the intubation should be performed in designated COVID-19 OR or designated negative pressure room and subsequently the patient should be transferred to IR suite following the protocol as mentioned earlier. It is speculated that more number of patients will be administered general anesthesia instead of MAC in the wake of COVID-19 to avoid any airway manipulation during the intervention.^[37] Ideally, during IR anesthesia the anesthesia team should place themselves in the console room after administering anesthesia to limit the

Table 4: Requirements for transportation of COVID 19 patient

Content of transport trolley	Transport monitor with ECG, SpO ₂ , NIBP, EtCO ₂ cable Oxygen cylinder with nasal prongs Ambu bag with viral filter Bain's circuit Intubation tray containing face shield Emergency medicines
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radiation exposure and go inside only when required. But in these circumstances where anesthesiologist is dealing with COVID-19 patients, this in and out movement is not permissible.^[38] So two team members in enhanced PPE remain in the IR suite behind the lead screen. Support team comprising another anesthesiologist with an anesthesia technician remain in the console room to provide extra drugs and emergency help

- Strict adherence to infection prevention and control protocol is must. All the equipment should be thoroughly decontaminated after each procedure
- Any further cases should be inducted into the IR suite after an hour following decontamination as per the guidelines.^[39]

Mental health of anesthesiologist

Epidemics are always known to cause extreme psychological distress in the population with medical professionals being no exception.^[40] Anesthesiologists also suffer from posttraumatic stress disorder or fear of death during these epidemics. It is the responsibility of the senior anesthesiologist to allay fear of the new and young anesthesiologist and lead the front. He/She can allay this fear by sharing their experience of the SARS epidemic. Various anesthesiologist organizations in world are playing an active role to cater to the need of mental health among anesthesiologists; same can be done in India.^[3] Our institute is too providing mental health support specially during the COVID-19 epidemic through a 24-h helpline. Various measures include giving questionnaire and recording their responses regarding mental health to anesthesiologist involved in COVID-19 duty, sharing videos on mental health education and online counseling.^[41]

Conclusion

Although COVID-19 has emerged as a pandemic and has engulfed the entire globe with astounding mortality not encountered before, it is prudent to remember that this is not the first one that has affected the entire human race. The underline for the management of current scenario is following appropriate triage, precautions, treatments, and protocolized approach to the management of these patients which shall be beneficial to both HCPs as well the patients. As HCWs, we need to understand that the dissemination of the disease to the general population has to be minimized, especially from the health-care centers that can only be achieved by implementing and executing standard operating procedures for each designated specialty.

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Conflicts of interest

There are no conflicts of interest.

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