

# Peri-operative and critical care concerns in coronavirus pandemic

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## ABSTRACT

World Health Organization (WHO) declared novel coronavirus outbreak a “pandemic” on March 11<sup>th</sup>, 2020. India has already reached Stage 2 (local transmission) and the Indian Government, in collaboration with the Indian Council of Medical Research (ICMR), is taking all necessary steps to halt the community transmission (Stage 3). Anaesthesiologists and intensivists around the globe are making untiring efforts akin to soldiers at the final frontier during war. All efforts pertaining to adequate staffing, Personal Protective Equipment (PPE) and strict adherence to hand hygiene measures are being stressed upon to prevent in-hospital transmission. In this article, all outbreak response measures including triaging, preparation of isolation rooms, decontamination and disinfection protocols as well as fundamental principles of critical care and anaesthetic management in Covid-19 cases is being discussed. All the recommendations have been derived from the past experiences of SARS (Severe Acute Respiratory Syndrome) and MERS (Middle East Respiratory Syndrome) outbreak as well as upcoming guidelines from the international health fraternity and Indian Health Services.

**Key words:** Anaesthesia, corona virus, Covid-19, intensivists

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## INTRODUCTION

Corona virus (COVID-19) has created havoc amongst people of all nationalities with disturbingly rising count of affected people worldwide. A large database study of 72,314 affected Chinese nationals has given a preliminary case-fatality rate of 2.3% with 81% experiencing mild flu symptoms, while rest of the 14% having severe symptoms and 5% being critically ill; death rate increasing exponentially with severity.<sup>[1]</sup> Although the fatality has till now been reported lower than previous outbreaks of Ebola, SARS and MERS it is expected to rise if IPC (Infection Prevention and Control) policies are not laid down and followed religiously. An estimated Maximum Likelihood (ML) of reproductive number of Covid-19 infection was calculated to be 2.28 with a serial interval of 7 days which can only be curtailed by strict quarantine measures.<sup>[2]</sup> As anaesthesiologists and intensivists, our prime involvement in resuscitation,

airway management, peri-surgical as well as critical care of such cases cannot be undermined. The need of the hour therefore is to update ourselves with clinicopathological spectrum of the deadly disease and provide evidence based medical services to all hospitalized cases with suspected Covid-19 infection. All the recommendations below have been influenced by the past experiences of corona virus outbreaks and desire improved measures for personal protection of health care workers and consequent prevention of nosocomial transmission of infection.

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## SEARCH STRATEGIES

A systematic literature search was made using search engines including PubMed, Google and Google Scholar with the use of the following single-text words and combinations: Anaesthesia, Corona virus, Covid-19, Intensivists from the year 2000 to 2020. The references of relevant articles were cross-checked and the articles containing all these keywords were thoroughly checked for imbibing the review. The data was also checked with national and international databases from internet and various newspapers.

### Indian problem statement

Indian health authorities have submitted a total record of 283 lab-confirmed cases- 2449 Indians, 39 foreign nationals and 22 cured and discharged post-quarantine till the time of writing this article i.e., 21<sup>st</sup> March, 2020.<sup>[3]</sup> The first three cases in India were students returning from China. They were successfully isolated in Kerala and declared negative. Till date, 4 deaths have been reported from our country as a result of this deadly virus with old age (more than 60 years), hypertension and male gender being stated as independent risk factors.<sup>[4]</sup> The real number of patients carrying the virus is very difficult to establish as many people are avoiding the tests and many are not disclosing at all. The real danger to us as intensivists and anaesthesiologists is from these patients who have not been tested despite being potentially positive for harboring the virus. In this scenario, it is prudent to follow the national and international guidelines and treat any suspected patient as positive and to take necessary precautions during anaesthesia and critical care of such patients.

### Screening for suspect cases

n-Cov is a positive sense, single-stranded RNA corona virus belonging to sub-group sarbecovirus which closely resembles two bat-derived SARS-like corona viruses but distant from SARS-Cov and MERS-Cov. Preliminary phylogenetic analysis suggests bats as the original host of this virus with human to human transmission confirmed via droplet, contact and fomites and average incubation period of 2-10 days.<sup>[5]</sup>

Since a vast majority of Indian institutions have anaesthesiologists as in charge of the emergency triaging and intensive care units, it becomes essential that our fellow colleagues should be aware of every minute details of this deadly pandemic. The following terminology has been standardized for isolation of a suspect case [Table 1].

Although Wuhan is considered the epicenter of outbreak, the increased number of cases being reported worldwide has abolished the diagnostic link with ban on all tourist visas to India with effect from 13<sup>th</sup> March 2020.

For tracing contacts and categorizing risk of procuring infection, refer to Table 2.

While the high and medium-risk contacts are advised immediate isolation with controlled local and air travel in medical transport vehicles with laboratory evaluation guided by symptomatology, low risk contacts are advised to avoid prolonged public exposure and if symptomatic get lab tests done when deemed appropriate. However, as anaesthesiologists and intensivists, the biggest challenge we will face in coming times is from the asymptomatic patients once Stage 3 of the disease is crossed. It becomes imperative that during all these times, we should see only emergency and critical patients with an emphasis on personal safety as well as taking all the universal precautions against corona virus. For any emergency surgery in such patients, planning of anaesthesia becomes very crucial while taking all the necessary precautions.

### Planning for anaesthesia and surgery in covid-suspect cases

Anaesthesiologists and intensivists are the soldiers at the final frontier of corona disaster as all patients landing up in the hospital with severe respiratory distress will be primarily seen under their domain. While applying all precautionary measures pertaining to health care workers treating Covid-infected individuals, necessary critical illness support needs to be provided using the current knowledge about the pathophysiology and management of Covid infection.

Some patients with mild-moderate symptoms can also be encountered by the anaesthesiologists while being posted for surgeries. Patients with mild symptoms resembling the symptomatology of other similar flu like illnesses are the real threat as chances of precautionary lapses are high in such cases. Further, accidental chances of getting infection becomes highest when the positive patients without any symptomatology are being treated like normal patients. Elective surgeries in these patients can be postponed till the resolution of symptoms while an emergency surgery undertaken with due risk consent as this is entirely a new clinical scenario for anaesthesia and surgery.

Table 1: Diagnostic criteria for Covid-19 infection

Type of case	Diagnostics symptomatology
Suspect case	Patients with fever, cough or shortness of breath requiring hospitalization with at least one of the following: History of travel to/ residence in any country reporting Covid-19 local transmission within 14 days of symptom onset or Patient working in an environment where pneumonia of unknown etiology are being cared for. Close contact with a confirmed or probable case of Covid-19 within 14 days of symptom onset. A case for whom testing for Covid-19 is inconclusive
Lab Confirmed case	A suspect with laboratory confirmed Covid-19 infection, regardless of clinical the clinical picture <sup>[6]</sup>

Table 2: Definition and Risk Categorization of Contact

Contact categorization	Risk category
Contact <sup>[6]</sup>	High Risk
Any person having positive history of one of the following with respect to Covid-positive individual	Living in the same household as or being an intimate partner of Covid-positive case Touched body fluids, washed linen or dishes of Covid-positive case Anyone including passenger in close proximity (within 3 ft) of Covid-positive case
Providing direct care without PPE	Low Risk
Staying in the same closed environment	Being in the same indoor environment or travelled together with Covid-positive case but not within 3 ft
Traveling in close proximity (1 meter)	

All suspect patients posted for surgery must be kept in isolation room till their shifting to OR (Operating Room). For the operative procedure, negative pressure isolation rooms with minimum 12 air exchanges per hour.<sup>[7]</sup> Temporary conversion of otherwise positive pressure ORs into negative pressure with independent provision for air conditioning and humidification should be preferred. The negative pressure can be created by reducing the amount of air volume entering the inlet duct, while maintaining the air volume exiting through the other duct. Two adjacent ORs with one being utilized for the procedure and other as anteroom for the staff and doctors to wear and dispose of all PPEs is ideal. The biggest challenge comes from the diversity of operation theater infrastructure set ups in our country which makes it difficult for the implementation of universal guidelines meant for such outbreaks. Therefore, such surgeries should be undertaken only in select centers with all the facilities. The policies for such clinical interventions have to be formulated by the appropriate health authorities at central government level which can be implemented uniformly across the nation. During such emergency surgeries, the following protocols should be followed religiously.

#### Pre-anaesthetic evaluation

This must be done in the isolation itself where the patient is kept. Various Personal Protective Equipment have been described for preventing aerosol and droplet transmission from patient to the anaesthesiologist. This includes-

#### Gown and shoe cover

Long length, full sleeved gown and shoe covers which are water resistant provide protection from any spillage of oral, nasal secretions or vomitus.

#### Full-face shield or mask, eye goggles, cap

It is essential for all suspect patients to wear surgical masks to prevent any droplet transmission while coughing or yawning. A plastic face shield to cover front as well as side of face, N-95 masks or PCM 2000 or Powered Air Purifying Respirators for mouth and nose, eye shields and head caps for peri-orbital mucous membranes and hair respectively must be worn to protect any transfer of virus emitted in patient's secretions to anaesthesiologist's body. All these protective equipment must be checked for proper-fit to prevent any uncovered zone.

#### Gloves

Double-gloving is advised to all health care workers providing care to such patients to prevent any cross-contamination. Once any procedure is done, the outer glove should be used to remove gown, shoe cover and face shield while the inner glove removed as soon as possible afterwards and disposed of with all other equipment in double-zip lock plastic container. Any evidence of soiling of the glove also reprimands its removal and replacement with fresh pair of gloves.

#### Hand washing

All the 9 steps of hand-washing with alcohol based hand rubs must be adhered to strictly before wearing gloves for any procedure, before and after touching any contaminated area, anaesthesia trolley, airway cart or

other instruments, and after removing gloves. Protocol of keeping alcohol based hand wash at the entrance of every ward and ICU helps in better compliance of health care workers. All PPEs after exposure should be locked in a double zip lock plastic bag and discarded in a touch-free disposal.<sup>[8]</sup> After taking due risk for the procedure, along with nil-per-oral instructions of 2 hours for clear fluids, it is important to counsel the patient's relatives regarding need for strict isolation as well as their own testing.

### Transportation to operation theatre

During transportation, Covid-19 infected patients must wear a surgical mask and be transported to the negative pressure OR in an evacuated passageway and elevator preferably covered by plastic disposable material to be disposed of thereafter. All the PPEs must be worn by the transporting nurse and doctor. These patients are highly anxious especially at seeing the level of protection worn by the team of doctors which gives them an impression of being doomed. Adequate premedication in the form of benzodiazepines like midazolam and alprazolam or opioids like fentanyl should be prescribed before shifting to OR. All ventilated patients must be intubated and transferred via special Bain's circuit connected with the tube via HEPA filter. The position of filter must be between the endotracheal tube connector and Y-limb to prevent any aerosol transfer from the patient to portable ventilator and vice-versa.<sup>[8]</sup> HFNC or Bi-PAP therapy should be avoided due to increased generation of aerosols.<sup>[9]</sup> The patient must be suctioned by closed suction apparatus before transfer and given intravenous sedation and muscle relaxation to prevent any coughing and movement which might lead to disconnection of tube and dispersion of droplets.<sup>[10]</sup> Adequate training regarding transport of such patients and mock drills should be done for proper implementation.

### Conduct of anaesthesia

After preparation of all drugs in disposable syringes, arranging for face mask, airway, endotracheal tube, stillete, bougie, laryngoscope blade, circuit, soda lime, etc. all in disposable form, the patient is taken in the OR and monitors attached. As all the health care workers have to cover themselves from head to toe, there is decreased heat loss and sweating. This can be mitigated by using a lower temperature setting of 20-22 degree Celsius in the operating room.<sup>[8]</sup> The leads for ECG, NIBP, SPO<sub>2</sub> and EtCO<sub>2</sub> should be single use or covered in sterile plastic cover to be discarded after use. In case of predicted difficult intubation,

disposable blade and C-Mac video laryngoscope should be kept standby while avoiding decision to conduct awake fiberoptic intubation due to potential of coughing during the procedure.<sup>[11]</sup> Intravenous cannulation must be done with sterile drape and gloves to prevent any spillage. It is recommended to administer anti-emetics or prokinetics in every case as prophylaxis for vomiting.<sup>[12]</sup> The patient must be preoxygenated with 100% O<sub>2</sub> for 3 minutes using the disposable circuit and HEPA filter barrier for denitrogenation. It is suggested to use total intravenous anaesthesia in place of inhalational due to lack of disposable vaporizers and cost concern.

RSI (Rapid Sequence Induction) is the procedure of choice for intubation to abolish need for mask ventilation and regurgitation. After administering appropriate induction agent in the form of propofol or thiopentone and muscle relaxant such as succinylcholine or rocuronium in desired doses, intubation is done by the most experienced anaesthesiologist in minimum possible time and confirmed using capnography. In cases of severely decreased PO<sub>2</sub>/FiO<sub>2</sub> ratio, modified RSI can be done with low pressure ventilation before intubation.<sup>[13]</sup> It is important to reemphasize the use of "double-glove" technique during intubation.

It is suggested to use total intravenous anaesthesia in place of inhalational for maintenance of anaesthesia due to lack of disposable vaporizers and cost concern. The maintenance of anaesthesia can be done using disposable 50ml syringes and PMO lines. The depth of anaesthesia should be maintained at all times to prevent any bucking in between the procedure. The setting of ventilatory parameters should be in accordance with the lung protective strategies with optimal PEEP and P<sub>plat</sub> < 35 mmHg to achieve an SpO<sub>2</sub> > 90% and admissible hypercapnia.<sup>[14]</sup>

In case devices like point-of-care ultrasound (USG) have been used during the procedure, the machine and the probe along with the wire must be covered with a plastic sheath which is removed and discarded after use. Any invasive procedures like epidurals or putting a central venous line should be done under USG guidance to prevent chances of failure.

After the surgery, the decision to extubate should only be taken ideally in asymptomatic patients and threshold for keeping the patient intubated kept low in order to avoid any procedure with assumed dispersion of infective material in the environment.<sup>[15]</sup> In case of

decision to extubate, the bucking on the tube should be avoided by “deep plane of extubation” along with anti-aspiration prophylaxis.

After the patient is transported back to isolation, OR should be kept closed with adequate air exchanges before allowing for subsequent patient care. All the PPEs and materials used by the operating team and anaesthesiologists must be removed and sent for disposal. The left-over drugs and plastic sheets must be discarded.

### Peri-operative considerations of Covid-19 in special populations

The pregnant, elderly and patients with co-morbid conditions have been implicated much more than general healthy population in terms of risk of infection and severity. Considerations for all these high-risk populations are similar to those advocated during SARS and MERS outbreak. The individuals must be vaccinated against influenza and pneumonia causing bacteria to prevent secondary LRTIs.<sup>[15]</sup> The patients with cardiovascular disorders are advised guideline-directed statins and diuretics to prevent potential risk of acute coronary syndrome and heart failure. Other co-morbidities must be managed with respective treatment guidelines aggressively to improve outcome.

In pregnant females, there is an additional risk of premature rupture of membranes, preterm birth, low birth weight and fetal distress in case of confirmed infection especially in the third trimester. As a precautionary measure, pregnant females should refrain from unnecessary travel and public transport together with practicing good personal hygiene. Hence, any confirmed case coming in pregnant state must be screened for fetal well-being and advised betamethasone therapy for fetal lung maturity if anticipating pre-term delivery. The timing of delivery is entirely dependent on the condition of the mother and the fetus, wherein stable cases can be delivered at term vaginally, while critically ill mothers delivered earliest possible. As no shedding of virus has been found in the amniotic fluid, vaginal delivery can be performed but for early cord clamping and maternal separation for 2 weeks postnatally to prevent direct contact transmission.<sup>[16]</sup> Till date, no guidelines have been issued regarding the anesthetic management of infected pregnant patients for caesarean section. However, spinal anaesthesia have been reported to be safe in one patient undergoing emergency C-section

in Wuhan.<sup>[17]</sup> There is no advisory issued against breastfeeding, but direct suckling from mother’s breast is not advocated. Rather expression of mother’s milk and palade feeding is suitable.

### CRITICAL CARE MANAGEMENT

After prompt diagnosis based on aforementioned criterion, case must be reported by the provisional public health authorities to the national body within 24 hours in their own jurisdiction and transferred to negative pressure isolation cabin in the ICU. As most of the ICUs are not equipped with negative and positive pressure regulations in India, an alternative approach is using HEPA-Carbon-Photo-catalysis air purification systems as alternate means of source control.<sup>[14]</sup> The financial considerations for current ICU models running in India to meet international standards in terms of quality assurance and workforce is humongous which can only be met by public-private partnership in health sector and generous GDP devoted to health.

The clinical spectrum of Covid-19 suspected patients can range from mild flu like symptoms to those mimicking community acquired pneumonia. In very severe cases, patients can present as ARDS (Acute Respiratory Distress Syndrome) with refractory hypoxemia requiring mechanical ventilation. The historytaking, sampling for detection of all viral, bacterial pathogens involved in upper respiratory tract infection in the form of oropharyngeal or nasopharyngeal swabs and lower respiratory tract by sputum, endotracheal aspirate, or broncho-alveolar lavage must be sent for RT-PCR or nucleic acid detection.<sup>[14]</sup> Throat swab to be collected for all virological examination should be stored in three-shelled receptacle for avoiding any spillage. More than one specimen is found to yield better results. Viral RNA has also been found in stools, urine and serum of infected individuals, hence can be used as alternate specimens.<sup>[14]</sup> The nasopharyngeal specimen and suction tip specimen must be sent for other bacteriological examination to rule out any secondary infection.

Decreased lymphocyte count, CD4 and CD8 cells along with increased CRP, ESR, IL-6 and normal PCT have been most consistent findings with this viral etiology.<sup>[18]</sup> ABG analysis, liver, cardiac and kidney functions must be monitored for overall assessment of severity of infection. The radiological findings reported in these cases range from diffuse segmental

or sub-segmental ground-glass opacities signifying interstitial oedema seemingly like “paving-stone” with extensive exudation into alveolar cavities leading to patchy areas of consolidation. The recent reports confirm more sensitivity of CT-scan than RT-PCR (98% versus 71%) for diagnosis of Covid infection.<sup>[19]</sup>

Supportive therapy in the form of supplemental oxygen and antipyretics should be immediately started in patients with SARI. Liberal fluid administration should be avoided for risk of worsening oxygenation and periodic hemodynamic assessment used to guide goal-directed therapy. Along with it, adequate nutritional support with balanced proportions of proteins, carbohydrates, vitamins and minerals boosts immunity to fight the infection.

Empirical antimicrobials must be given within one hour based on the clinical diagnosis, local epidemiology and susceptibility data to cover all likely pathogens causing community acquired pneumonia even if suspected to have Covid.<sup>[20]</sup> A typical coverage would involve injection ceftriaxone 2gm i/v bd, azithromycin/levofloxacin 500mg od and doxycycline 100mg bd. De-escalation must be practiced after microbiological evidence. Neuraminidase inhibitor like oseltamivir can be initiated for influenza when there is local circulation or other risk factors.

Systemic corticosteroids have controversial role in reducing mortality with viral pneumonia or ARDS. However, in rapidly progressing severe diseases, they provide symptomatic relief and faster resolution of pulmonary lesions, so advocated by many.<sup>[21-23]</sup> A landscape of therapeutic agents are being questioned and tested for use against 2019-Cov with priority research on remdesivir and lopinavir/ritonavir + interferon beta. DGCA body in India has put a nod on “restricted use” of chloroquine Phosphate 500mg bd, lopinavir/ritonavir (400 mg/100 mg) for treating the virus.<sup>[24,25]</sup> The samples must be repeated at least every 2-4 days for viral clearance until there are two consecutive negative results 24 hours apart in a clinically recovered patient.

Recognition of patients in respiratory distress not responsive to oxygen therapy must be swift and anaesthesiologist strained in endotracheal intubation and all necessary equipment must be kept standby if need arises. Post intubation by RSI, lung protective strategies involving use of lower tidal volumes (4-8 ml/kg predicted body weight), high PEEP

and lower inspiratory pressures (plateau pressure <30 cmH<sub>2</sub>O) for meeting the pH goal of 7.30-7.45 have been postulated to prevent volutrauma, barotraumas, atelectrauma and biotrauma.<sup>[26,27]</sup> Deep sedation in the form of midazolam, propofol or fentanyl infusions are recommended to curb patient’s respiratory drive and prevent dyssynchrony. The few indications of continuous neuromuscular blockade in the setting of severe ARDS has been agreed upon like ventilator dyssynchrony, inability to achieve target tidal volumes or refractory hypoxemia/hypercapnia.<sup>[28]</sup> In fulminating cases, prone ventilation for 12-18 hours per day and use of iNO (Inhaled Nitric Oxide) for bronchodilatation is recommended, failing which ECMO (Extra Corporeal Membrane Oxygenation) is the only modality for survival. It should only be offered in expert centres with a sufficient case volume to maintain expertise and that can apply the IPC measures required for Covid patients.

Along with mechanical ventilation, periodic hemodynamic assessment by static procedures like passive leg raising and dynamic procedures like serial stroke volume measurements, variations in pulse pressure, inferior vena cava size, or stroke volume changes with intrathoracic pressure during mechanical ventilation must be done for guiding fluid therapy and achieving optimal response. In resuscitation of adults with septic shock, 30 ml/kg of isotonic crystalloid like ringer lactate must be administered in the first 3 hours for volume repletion.<sup>[29]</sup> If MAP target is not fulfilled on fluid loading and signs of volume overload appear, discontinuation of fluid administration is advised. Vasopressors should be then initiated, norepinephrine being the first-line in adult patients. Epinephrine or vasopressin can be added if first line drug fails. All these therapies must be instituted timely to prevent multi-organ dysfunction which carries grave prognosis.<sup>[30,31]</sup>

## CARDIO PULMONARY RESUSCITATION

A term called “Protected Code Blue” had come into existence during SARS outbreak which emphasize on the use of PAPRs rather than N-95 masks and specialized PPEs during resuscitation owing to the dynamic nature of the procedure with high risk of airborne transmission. The need for resuscitation should always be anticipated to allow for preparation of isolation room, disposable resuscitation packages instead of trolley and formation of four members team with designated roles. All the team members should

wear PPEs checked by infection control coach and then enter the isolation bringing the defibrillator and packages along with.<sup>[31]</sup> Along with standard code blue protocol, each action should be considered in the lines of risk of aerosol transmission versus benefit to the patient.<sup>[32]</sup>

### Future research and perspective

Beyond all these general measures, research is underway in different phases of completion would soon elaborate on candidate vaccines and therapeutic agents like hydroxychloroquine against Covid. Presently numerous false alarms are being raised from one city to another and from one country to another but nothing concrete or any definite vaccine has been developed till date. The laws of nature will definitely take their own course but till then human beings will be the worst sufferers. This is neither the first challenge nor the final one which humans have to face when the natural ecological milieu is disturbed. At present best prophylaxis is conveyed by one sentence being used globally “stay home, stay safe” apart from taking other recommended precautions.

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### Conflicts of interest

There are no conflicts of interest.

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