Re-inventing anesthesia in times of Covid-19

It would not be an exaggeration to say that coronavirus disease-2019 (COVID-19) caught the world by surprise. From the first case being announced on December 31, 2019, to ravaging the entire world and infecting more than 17 in 10,000 people globally, by the second week of July, its spread has been alarming to say the least. India as a country faces massive challenges with limited availability of infrastructure and low resource settings being the norm rather than the exception.

COVID-19 has forced us to restructure our lives and work to combat the ever-growing threat that COVID-19 poses. Anesthesia, in particular, has had to face a massive appraisal and re-organization. Various anesthesia organizations have swung rapidly into action, and have developed protocols to ensure safety while keeping in mind the respective institutional limitations.

With the advent of COVID-19 pandemic, one of the first realizations that occurred was that anesthesia was at the forefront of the risk of both disease exposure and transmission, taking into account the number of surfaces available for aerosols to be deposited in the form of anesthesia machines, monitors and other equipment, and the proclivity of anesthetic procedures such as noninvasive ventilation (NIV), high-flow nasal cannula (HFNC), bag-mask ventilation, and endotracheal intubation to generate aerosols.\(^1\)

The risk of infection and transmission begins directly with the choice of operating rooms. The virus can survive on operating room equipment for several days and with positive ventilation, can spread over into adjacent rooms and hallways. Negative pressure rooms are recommended to avoid this contamination. Unfortunately, not many hospitals have such rooms. In the absence of these, the CDC recommends a 30-min interval between two cases to prevent cross-contamination.\(^2\) In the center with a lower number of air changes per minute, even longer intervals may be required to promote safety.

The other major sources of infections in the operating room are the fomites in the form of watches, rings, bangles, other jewelry, and cellular phones. It remains crucial now if it was not being implemented before to ensure that all health-care providers go “bare below the elbows” and cellular phones are left outside the operating room. While these seem simple enough to follow, the true difficulty arises when it comes to eliminating contact with consent forms and pens used for signatures. The recommendation would be to use electronic forms for signatures but in circumstances where these cannot be used, using an N95 mask and gloves, maintaining social distancing and wiping the pen with alcohol after use, even while taking signatures from patients and their relatives seems like a good way to start.\(^3\)

General anesthesia without doubt involves the bulk of the aerosol-generating procedures and bears the brunt of maximum disease transmission. From pre-oxygenation, mask ventilation, intubation, and then subsequent extubation, the anesthesiologist at the head end remains vulnerable to the infection. The details of modifications required in the anesthetic management are discussed in the accompanying articles of this online special issue.

With various institutions and societies formulating airway safety guidelines, there are some areas where the opinions remain conflicted, but for most, a global consensus seems to have been reached.\(^4,7\) The guidelines diverge for use of supraglottic airway devices (SGA). While Peng et al. recommend intubation over SGA, the Australian guidelines and Cheung et al. advocate the use of SGA, particularly second generation, to avoid laryngoscopy.\(^1,4\) Cheung et al. also recommend the use of SGA in difficult mask ventilation.

Regional anesthesia has obvious advantages over general anesthesia of avoidance of airway manipulation and prevention of the respiratory compromise that can be caused by general anesthesia. However, use of regional anesthesia does not completely eliminate the risk of acquiring COVID-19. In a retrospective study of spinal anesthesia in COVID-19 cases, 2.7% of the anesthetists tested positive for COVID-19 despite use of level 3 PPE, while 57.1% of the anesthetists who wore level 1 PPE, tested positive.\(^8\) Various precautions listed have been, the use of disposable drapes over the equipment to cover their whole length and ensuring PPE level 3 kits for those performing the procedure. The American Society of Regional Anesthesia (ASRA) guidelines recommend the use of paper drapes instead of plastic to avoid contact with cerebrospinal fluid, since the virus survives for longer on plastic.\(^9\)

Sedation and total intravenous anesthesia are often used for daycare procedures. However, the relative lack of control over the airway and the possibility of the patient coughing during the...
procedure make this technique quite dangerous. The ASRA and ESA agree that use of surgical masks on all patients restricts the droplet spread. An oxygen mask, with minimal flows is a superior alternative to nasal prongs since high-flow oxygen using nasal prongs can lead to aerosolization. A surgical mask over the oxygen mask limits aerosolization even further.

The expert opinion on high flow nasal oxygenation remains divided. In spite of there being evidence to suggest that with a proper fit, the leaks and thus the aerosol spread would be minimal, most advisories recommend the use of flows of oxygen <6 L/min, to reduce the chances of infecting personnel.

Tracheostomizing critically-ill patients with COVID-19 requiring long-term ventilation is a tricky procedure even in the best of hands. Pichi et al. recommend the following for safe tracheostomy: deep neuromuscular blockade, pushing the tube as caudally as possible, hyper-inflating the tube cuff to ensure lower airway isolation, stop ventilation before tube change, ventilation to be resumed only after cuff inflation and connecting to a closed breathing circuit.

A crucial issue that has been heralded as the chief setback in the fight against COVID-19 has been the scarcity of PPE. PPEs and most medical equipment used for infectious diseases are single use and require to either be incinerated or need to undergo plasma pyrolysis. The prohibitive costs of PPE and the carbon monoxide (CO) emissions due to incineration do not make this a viable option in the long-run, considering the protracted course of the pandemic. In a study comparing the costs of autoclaving and incineration, though the initial cost of installation was three times higher for an autoclave machine, in the long run, the incinerator cost more due to the costs required to run, power and maintain the machine. Additionally, the CO emissions could run as high as 4.5 times the World Health Organization (WHO) standards. This validates the increasingly urgent need to rapidly and comprehensively develop modalities to either sterilize the existing PPEs or develop PPE’s that are reusable, recyclable, and ecologically sustainable.

It also reiterates the fervent plea by the WHO to continue rational usage of PPEs while dealing with the pandemic. Local innovations to create low-cost protective equipment include the use of aerosol box and microscope cover to prevent contamination during intubation [Figure 1]. Though it remains undisputed that use of aerosol boxes, a reusable, easily sterilizable and easy to procure technique, will make intubation safer than use of PPE alone, it adds to the difficulty during the procedure due to restricted hand movements. We believe that transporting suspected or confirmed patients with COVID-19, either within the hospital or from one hospital to the other, use of this same acrylic box, along with a mask tied to their face would reduce the risk of transmission in patients with an unsecured airway.

Anesthesia has time and again proven its capacity to adapt to changing circumstances and evolve into an updated version of itself, which ensures, not only the efficient use of available resources but a science that has prioritized safety for its patients and personnel above else. This ability has undeniably been put to the test during this pandemic and it would be safe to say that anesthesia has successfully risen to the challenge and re-invented itself.

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