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OPERATION THEATRE SAFETY AND PRECAUTIONS TO BE TAKEN BY HEALTHCARE WORKERS IN THE COVID 19 PANDEMIC

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ABSTRACT

The novel coronavirus (COVID-19) has the ability to infect healthcare workers. An algorithm was developed by us to be followed by the institution. It's aim is to protect the operating room team members during the COVID-19 pandemic and rationally conserve personal protective equipment (PPE). Although surgical specialties are fairly not much involved in the management of this pandemic but best practices models are unavoidably created for surgical specialties. COVID-19 is a new threat, hence we are trying to prove that by developing an easy-to-follow decision tree algorithm for the operation theatre safety, we can ensure optimal healthcare worker safety.

INTRODUCTION

On the 11th of March 2020, Covid 19 was established as a pandemic. The novel corona virus (COVID-19) was identified in early December in Wuhan, China **[19]**. The clinical spectrum of Covid19 is very heterogeneous. On 30 January 2020, first cases of Covid were detected in India. It was in three Indian medical students from Kerala who had returned from Wuhan. As the number of cases of Covid 19 have been rising worldwide, the likelihood to operate cases, both elective and emergency

surgeries with the coronavirus infection is also growing **[20]**.

Due to the predicted rise of patients infected with COVID-19 and because there was a need to rationally use personal protective equipment (PPE) while we continued to provide with emergency surgical interventions, institutional and hospital guidelines were developed for precautions for operating theatre team members for the COVID-19 pandemic. While the most of evidence suggests that COVID-19 is droplet spread, there is also literature to support spread by aerosol **[6, 7]**. After consulting the infectious disease experts, the hospital guidelines were made based on the predicted patterns of spread of the disease, the risk of exposure, and conservation of PPE and other protective gear.

Two things have to be considered by the health care authorities as the pandemic is progressing. The growing probability of COVID positive emergency cases coming to the hospital for surgical intervention and elective procedures that will be operated during the pandemic. With the confirmed contagious qualities of the virus and with the viral load of the virus, surgical safety is needed to be framed and implemented accordingly. From the literature obtainable, it is seen that there is a high probability of catching COVID-19 in hospitals and the healthcare workers are at the supreme risk there **[6-9]**.

Thousands of healthcare providers have been infected with COVID-19 even though they adhere to all the infection control measures. And hereafter there has to be vigilant and functional consumption of fiscal and social resources. Conserving workforce is important in this condition. An effort should absolutely be made to curtail infection amid the operation theatre staff. Even though it is correct that the surgical specialities are not at the lead of dealing with the pandemic. But there are two very significant facts have to be remembered with these specialities **[24]**.

1. The chance of getting infected the operation theatres is inconsistent and excessive.
2. The training period of a surgeon is very extensive and substituting the surgeon is not an easy or a practicable task.

METHODS

A Covid19 taskforce working in the operating theatre and endoscopy was made by the medical college, hospital leadership and management and tasked with developing a common algorithm for PPE use and precautions to be taken, to be used throughout the institute. This taskforce comprised members from each interventional stakeholder group like doctors, nursing staff, support staff and

cleaning staff. The main goal was to have a set of guidelines and rules created by the Covid19 taskforce. These were approved and understood by hospital leadership, and implemented across the interventional platforms (operating theatre and endoscopy). Before beginning work on the algorithm, a set of guiding principles and practically possible ideas were agreed upon to ensure common vision throughout the process.

The data pertaining to COVID-19 transmission in the hospital and nonhospital settings was reviewed and studied. An orderly evaluation of the literature that was accessible was done, using the keywords like "COVID-19", "Coronavirus", "surgeon", "health-care workers" and "protection". An amount of peer-reviewed articles were found and taken into account. Randomized controlled trials, prospective and retrospective studies, reviews and case reports, were used in this study to create the easy to follow decision tree algorithm **[20]**. The Covid19 taskforce members also used the already published decision making algorithms and assessments of operating theatre risk that were developed during outbreaks of severe acute respiratory syndrome (SARS) and Ebola virus disease **[10-12]**. The draft algorithm was then reviewed and approved by experts from infection control and infectious disease, and then approved by hospital leadership and management to ensure accuracy and compliance with hospital policies. The practicality and usability of the algorithm set by the Covid19 taskforce was assessed by feedback from healthcare providers and workers in our institution. The current and anticipated PPE and safety protocols were reviewed and models developed for our current use rate and the implications of implementation of our guidelines were seen.

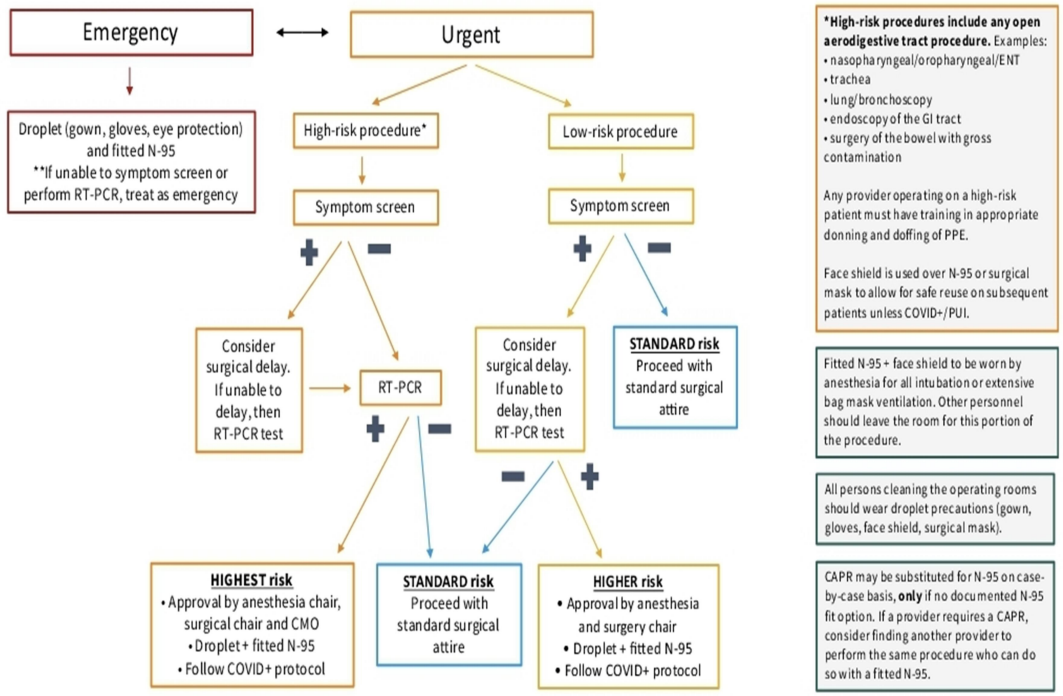

Figure 1. Algorithm describing institutional precautions for operating room team members (surgeons, nurses, technicians). CAPR, controlled air purifying respirator; CMO, chief medical officer; COVID, novel coronavirus 2019; GI, gastrointestinal; PPE, personal protective equipment; PUI, patient under investigation; RT-PCR, reverse transcription polymerase chain reaction.

DISCUSSION

A decision tree algorithm describing our hospital guidelines for precautions for operating theatre team members was prepared (**Fig. 1**). The underlying assumption was that every patient is potentially infected with COVID-19 until proven otherwise if Rapid Antigen Tests could not be done in an emergency situation. This is based on growing community spread of COVID-19. Patients were initially triaged into urgent and emergency procedures. For elective procedures, patients were admitted and posted for procedure after doing a RTPCR test. And the positive cases were not posted until the quarantine period was not over. Rapid testing for COVID-19 virus could not be done for all emergency procedures. In such situations, every patient taken for emergency surgery was presumed to have the COVID-19 infection till confirmed otherwise. In case of Rapid Antigen test positive patients, the Covid positive protocol was followed.

The entire team managing emergency cases is to don a fitted N95 respirator mask in addition to droplet PPE (gown, gloves, eye protection) which is the basic PPE requirement.

Use of Personal Protective Equipment and Use of N95 masks

Education and training on proper donning and doffing of PPE is important for healthcare worker safety. Improper doffing can be a high-risk and dangerous procedure for healthcare workers. There was mandatory training programme on proper donning and doffing of PPE for all healthcare workers and operation theatre staff, in addition to a donning and doffing buddy system for healthcare providers when managing COVID patients. Usage of personal protective equipment is suggested by the Centers for Disease Control for all surgeries done in a patient with established COVID-19 infection or in a patient who is supposedly infected **[17, 18]**. N95 respirators or respirators having an advanced type of protection suggested while carrying out or when present for an aerosol-generating procedure like an OT patient intubation in COVID-19 or suspected infected patient were used **[43]**. Disposable respirators and facemasks ought to be taken off and castoff suitably in accord of the local hygiene policies. Practising of proper hand hygiene should be done after throwing the respirator or facemask.

Specific Operative Risk Issues and Classifying patients according to Risk

It is important to have only the needed and the least quantity of people in the operation theatre, at the time of intubation and also throughout the surgery. No visitors or observers must be permitted in the operation theatre. Smoke evacuator has to be utilised during the use the electrocautery. These protocols were followed throughout.

Emergency cases were classified as high- and low-risk procedures, depending on the anticipated viral burden at the surgical site and if the procedure would aerosolize virus which were classified as aerosol-generating procedures (AGP). All AGP of the aerodigestive tract (nasopharyngeal, oropharyngeal, tracheal, lung) were considered to be high risk as there is known viral load in these areas and the possibility for aerosolization as consistent with previous experience with SARS. COVID-19 virus RNA has been documented in the gastrointestinal tract also. So, there is also potential for aerosolizing intraluminal contents during endoscopy, and hence it is also considered a high-risk AGP. Due to the extended contact with the potentially high levels of virus despite of a lower risk of creating aerosol, any open or laparoscopic surgery on the bowel in the presence of gross contamination was categorised a high-risk AGP **[1, 13-15]**.

Patients were also classified based on their risk of having active infection. For patients who screened positive for symptoms like fever, cough, sore throat, the surgeon would actually consider delaying the operation. If surgical delay would result in unacceptable risk or potential death, then any patient with positive symptoms would undergo urgent reverse-transcription polymerase chain reaction (RT-PCR) testing and whenever possible a Rapid Antigen Test was done. If a patient's operation was unable to be delayed for testing, and if Rapid Antigen testing also couldn't be done then, the patient was re-triaged into the emergency category and presumed COVID positive. We decided to make RT-PCR testing of symptomatic patients compulsory, given the availability of in-house testing at our institution, within a twenty four hour period even if the patient is negative on Rapid Antigen Test. If a patient tested positive for Covid 19, the surgery would proceed only after approval by surgical team, department of anaesthesia, and the hospital leadership. In Covid positive cases, all members of the operating theatre are required to wear a fitted N95 respirator mask with droplet attire (gown, gloves, and eye protection). In case of symptomatic patients who tested negative on RT-PCR, operating theatre team members would use standard surgical attire **[17]**.

It is also important to note that our patient risk classification algorithm is dependent on both symptomatology and the ability to perform RT-PCR/Rapid Antigen Test to determine a patient's infection status and also recognizing the false negative rate of the test and concern for asymptomatic transmission. Because access to rapid testing is variable, any institutions adopting these guidelines will have to adjust them according to local testing availability. PPE availability, anticipated PPE use rates, and supply chain disruptions can also need modification in the algorithm.

Anaesthesia Risks and Intubation

Aerosolization and infection by droplet transmission of the COVID-19 virus are harmful for the surgical team. The hazard increases with operations and procedures like endotracheal intubation, tracheostomy, utilisation of gastrointestinal endoscopy for removal of pneumoperitoneum and removal of body fluids during any surgery done using laparoscope. Protocols were followed to avoid infection risk during intubation. Surgeons and staff that are not needed during intubation must stay out of the operation theatre till induction of anaesthesia and intubation are finished for cases with or supposed COVID-19 infection. Negative pressure operation

theatres should be used when available but were not available at our institute **[43]**.

Bag mask ventilation and endotracheal intubation are categorised as AGP, with a high-risk for virus transmission, irrespective of the COVID-19 status of the patient. In an event where the patient is both asymptomatic and tests false-negative, it is recommended to don fitted N95 respirators and face shields for intubation and extubation, at least. The face shield will protect the N95 from droplet contamination and is safe for reuse on multiple patients. This will also have less financial burden.

Zones in the Operation Theatre and Safety of Healthcare professionals and support staff

The operating theatre personnel's scrubbing routine has to be altered after going to the covid operation theatres. In the Zone 1, a not reusable surgical scrub suit, surgical shoes, waterproof shoes and a waterproof apron are put on. Surgical handwash scrubbing ought to be executed using chlorhexidine gluconate and water **[19]**. The operating surgical team ought to wear N95 or FFP 2 masks as per the standards set by the centres for disease control and prevention. They are successful in protection against covid 19 virus. Powered air purifying respirators [PAPR] are to be used for extensive surgeries. Two surgical masks are to be evaded from being used specially in aerosolized blood generating procedures.

Eye protection gear is vital for all aerosol-generating procedures. Complete face shield or safety glasses can be used.

In the zone 2, a surgical spacesuit or additional layer of sterile protective clothes ought to be ideally used. A surgical shield is also recommended. An aqueous alcohol solution can be used for scrubbing. [37] The first pair of surgical gloves are donned, after which a sterile surgical scrub suit and a second pair of surgical gloves are worn. Surgical gowns (AAMI) [association of the advancement of medical instrumentation] - Level III (seen in operation theatres) ought to be utilised in case of surgical and aerosolized-blood generating events. Surgical caps ought to be donned as per practice. Also, another option is to don a surgical hood which has ties for the head and neck for aerosol-generating events. Surgical boots ought to be waterproof. Two high cuffed surgical gloves must be favoured **[36]**.

Post operatively, the staff departs from the zone 4 where doffing is executed. In the zone 5 the scrub suit is taken off followed by a bath. Stringent and recurrent screening of the isolated OT staff is obligatory. The team of exposed staff must promptly inform in case of any symptoms of sickness

and should be instantly taken off duty. Other than that, every contact event amid the OT staff and patient ought to be documented for contact tracing. In case anyone of the isolated staff tests positive, infection control actions should be taken immediately, with great speed and easily. The operation theatre staff in our institute followed the zoning as per the institution facilities and according to institution policies.

To protect our cleaning staff at the conclusion of an operation, droplet precautions were implemented for all cleaning personnel. When the guidelines were created, we had few controlled air purifying respirators (CAPRs) which were also used **[17, 18]**.

Table 1 Zones of the operation theatre

Zone 1: Entry dressing room, where the basic PPE is donned
Zone 2: Anteroom, where the disinfection and surgical dressing take place
Zone 3: OR (COVID-19 room)
Zone 4: Exit room, where the PPE is removed
Zone 5: Exit dressing room, where the staff showers

Table 2 Personal protection equipment

Personal protection equipment
FFP2 facial mask
FFP3 facial mask (in case of maneuvers at high risk of generating aerosolized particles)
Disposable long sleeve waterproof coats, gowns, or Tyvek suits
Disposable double pair of nitrile gloves
Protective goggles or visors
Disposable head caps
Disposable long shoe covers
Alcoholic hand hygiene solution

FFP Filtering face piece

CONCLUSIONS

The current COVID-19 pandemic has caused quick development of new hospital guidelines and operation theatre guidelines. The surgical staff and healthcare workers need to be aware of the latest literature

pertaining to the safety measures to be taken during surgical procedures. COVID-19 is a new threat in this world, but with our study, we are trying to prove that by developing an easy-to-follow decision tree algorithm for the interventional platform teams, we can provide healthcare worker safety. The algorithm prioritizes patients based on disease severity, testing status, risk status and symptomology along with ensuring the rational use of PPE in a resource-constrained setting with a good financial use. This knowledge must evolve as new information comes along and the algorithm can be modified too. Infection or death of healthcare workers must be reduced and prevented so that they can work in any surgical emergency and related events that will take place or surge during any mass casualty.

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