



GUIDELINES FOR SURGEONS WITH COVID-19 PATIENTS IN PAKISTAN

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1. BACKGROUND:

The whole world is going through an unprecedented period during the pandemic of COVID-19. This pandemic has affected all aspects of daily life with far-reaching implications, especially in most aspects of healthcare. Practice of surgery across the globe is in a standstill as of now. When we restart surgical practices across world, we have to bring new protocols and practices in place to combat the transmission. This article discusses the major changes in surgical practice, which need to be brought in. This article is based on scientific information about transmission of virus

Based on high quality surgery and scientific data, surgeons are committed to protecting patients as well as healthcare staff and hereby provide this Guidance to address the special issues circumstances related to the exponential spread of the Corona virus disease 2019 (COVID-19) during this pandemic.

The aim is to take responsibility and to provide guidance for surgery during the COVID-19 crisis in a simplified way addressing the practice of surgery, healthcare staff and patient safety and care. It is the responsibility of the surgical team to specify what is needed for the protection of patients and the affiliated healthcare team. During crises, such as the COVID-19 pandemic, the responsibility and duty to provide the necessary resources such as filters, Personal Protective Equipment (PPE) consisting of gloves, fluid resistant (Type IIR) surgical face masks (FRSM), filtering face pieces, class 3 (FFP3 masks), face shields and gowns (plastic ponchos), is typically left up to the hospital administration and government.

Various clinicians from disparate specialties provided a Pandemic Surgery Guidance for surgical procedures by distinct surgical disciplines such as numerous cancer surgery disciplines, cardiothoracic surgery, ENT, eye, dermatology, emergency, endocrine surgery, general surgery, gynecology, neurosurgery, orthopedics, pediatric surgery, reconstructive and plastic surgery, surgical critical care, trans-plantation surgery, trauma surgery and urology, performing different surgeries, as well as laparoscopy, thora-coscopy and endoscopy etc.

Although COVID-19 is not primarily a surgical disease, it has significantly affected surgical practice in multiple ways. A number of organizations have released recommendations and guidelines for addressing the COVID-19 pandemic.

2. GENERAL CARE FOR SURGEONS

Generally the following ways to protect Surgeons caring for patients with COVID-19

1. Minimize chance for exposure

It is important to ensure facility policies and practices are in place to minimize exposure to respiratory pathogens including 2019-nCoV. These measures should be implemented before patient arrival, upon arrival and throughout the duration of the affected patient's time in the health care setting.

2. Adhere to precautions

Follow standard precautions, to assume "every person is potentially infected or colonized with a pathogen that could be transmitted in the health care setting."

It is important to pay attention to training on correct use, proper "donning and doffing," and disposal of personal protection equipment. All health professionals who enter the room of a patient with known or suspected COVID-19 should adhere to standard, contact, and airborne precautions, including the use of eye protection.

3. Manage visitor access and movement

Create procedures for monitoring, managing and training visitors. For known or suspected patients with COVID-19, physicians and other health professionals should restrict visitors from entering the room. Alternative options for interactions between patient and visitor include video-call applications on mobile devices or tablet computers.

4. Implement engineering controls

Health care organizations should also consider designing and installing engineering controls to reduce or eliminate exposures by shielding physicians, other health professionals and patients

from infected individuals. For example, physical barriers or partitions can help guide patients through triage areas.

5. Monitor and manage health personnel

For physicians and other health professionals who are ill or exposed to 2019-nCoV, movement and monitoring decisions should be made with guidance from public health authorities. When providing care to patients with COVID-19, health care organizations and facilities should implement sick leave policies that are nonpunitive, flexible and consistent with public health guidance.

6. Train and educate health professionals

Everyone should be provided with job- or task-specific education and training on preventing transmission of infectious agents prior to caring for a patient. Whenever respirators are required, all health professionals must be medically cleared, trained and fit-tested for respiratory protection device use.

7. Implement environmental infection control

Use dedicated medical equipment for patient care. Clean and disinfect all non-dedicated, non-disposable medical equipment according to the manufacturer's instructions and facility policies. Detailed information can be found in CDC's guidelines for environmental infection control.

8. Establish reporting to public health authorities

Implement mechanisms and policies that will help to promptly alert all appropriate members of the team, such as infection control or facility leadership, about a known or suspected COVID-19 patient.

You should also continue to communicate and collaborate with public health authorities. Specific persons within the health care organization should be designated for communication with public health officials and dissemination of information to health professionals.

3. ADVISORY FOR HOSPITALS AND MEDICAL INSTITUTIONS

The medical infrastructure in the country needs to be prepared for any possible influx of patients on account of COVID 19. In this context, the following interventions are proposed. These will be reviewed as per the evolving situation.

Indoor Facilities:

1. Non-essential elective surgeries should be postponed.
2. Some beds should be set apart and prepared for creating isolation facilities in every public and private hospital.
3. All hospitals should mobilize additional resources including masks, gloves and personal protection equipment. Healthcare personnel should be trained for dealing with any foreseeable emergencies.
4. All doctors, nurses and support staff in different specialties, including pre and para clinical departments, should be mobilized and trained in infection prevention and control practices.
5. Hospitals must procure sufficient numbers of ventilators and high flow oxygen masks in preparation for future requirements.
6. All hospitals must ensure that they have adequate trained manpower and resource pools for ventilator/ ICU care.
7. Hospitals may ensure that stable patients are discharged as early as possible while further new admissions (of stable patients) are also restricted.
8. Number of patient attendants should be strictly restricted to 'one' only.

IEC Activities:

9. Patients must be educated about cough etiquette, Do's and Don'ts, proper use of masks instead of using them indiscriminately and inefficiently; and personal hygiene. Hospitals should put up posters etc. to increase awareness amongst patients on Do's and Don'ts regarding COVID 19.

10. Patients must be counseled against attaching any kind of stigma to Corona virus patients or to facilities where such patients are admitted. They must be made aware that quick disclosure of symptoms and undergoing testing if advised is the surest way of battling COVID 19.

Administrative:

11. All hospitals should carry out a preparedness drill on Sunday, 22nd March 2020. Guidelines for this drill will be made available on the Health Ministry website.

12. Non-essential audits of hospitals by various regulators and accreditation agencies may be postponed.

13. All hospitals must provide treatment free of cost to any medical personnel who pick up infection while treating patients.

14. No suspected COVID 19 patient should be turned away from any hospital and the admission of any such patient should be notified to NCDC or IDSP immediately.

15. Similarly, all pneumonia patients must also be notified to NCDC or IDSP so that they can be tested for COVID 19.

16. Hospitals to ensure social distancing in their premises.

17. All ongoing examinations may be rescheduled after 31.03.2020.

18. All evaluation work may be rescheduled after 31.03.2020.

19. All Educational Institutions and Examination Boards are requested to maintain regular communication with the students and teachers through electronic means and keep them fully informed so that there is no anxiety amongst the students, teachers and parents.

20. Institutions are also requested to notify help-line numbers/e-mails which students can access for their queries.

21. All unauthorized/ authorized shops (excluding pharmacies) and eateries in the vicinity of hospitals should be compulsorily shut.

22. Leave of all kinds (except under emergency and unavoidable circumstances) may be cancelled immediately.

OPD:

23. All patients may be advised not to come for routine visits to the OPD if it can be avoided or postponed.

24. OPDs may be organized in such a manner that patients exhibiting flu like symptoms are attended separately from other patients and spaced out so as to avoid overcrowding.

25. Patients suffering from chronic diseases and minor ailments may be advised to utilize OPDs in primary/ secondary care facilities rather than crowding tertiary care centres.

26. Pharmacy counters may be increased and queue management systems to be followed by engaging Indian Red Cross/ NDRF volunteers.

4. OUTPATIENT CLINICS

A. Before attendance at outpatients

- Develop a system, prior to attendance (e.g. phone call, SMS); to ask patients whether they've been overseas or have had close contact with a person with confirmed COVID-19 while infectious, in the 14 days before the scheduled outpatient appointment.
- If the patient meets the above criteria:
 - Consider alternate of methods of conducting the appointment if appropriate (e.g. telephone or tele-medicine)
 - If it is not possible to conduct the appointment in an alternate way, reschedule their appointment unless it is medically necessary
 - Reschedule the appointment for as soon as possible after the 14-day exclusion
 - Remind them they are to self-isolate at home for 14 days after they returned or if they have had close contact with a person with confirmed COVID-19 while infectious
 - Remind them if they develop respiratory symptoms or fever to call helpline direct on 1166.
- Note, facilities will need to develop a system to implement the above steps; including appointing an appropriate person to assess whether or not it's safe to defer the outpatient appointment.

B. Outpatient Management

Most hospitals have to cancel or reduce non-urgent outpatient visits as part of their COVID-19 containment strategy.

Surgeons should prioritize urgent or emergency visits and procedures. Elective and non-urgent admissions should be rescheduled. Patients who will face life threatening consequences if treatment is delayed should be prioritized for outpatient visit, phone call, or virtual consultation by a member of the surgical team. From China's experience, it is advisable to set up a separate triage area or fever clinic to screen for respiratory symptoms in any surgical patient. Patients with respiratory symptoms should call before they leave home, so staff can be prepared to care for them when they arrive.

Any patient with respiratory symptoms and flu-like symptoms should visit the fever clinic in advance. Patients with suspected or confirmed COVID-19 should be assigned private rooms with door closed and should be provided surgical face masks or face masks without exhalation valve. Social distancing is essential within clinics and hospitals. Doctors and patients should stay 6 ft apart except during examinations; it may be necessary to forego all but the most essential elements of the physical exam to minimize risk of transmission.

In addition to collecting routine disease-related information, staff should take a detailed epidemiologic history. Relevant questions include recent travel history (of patient and family) and contact history with people from endemic regions. The staff should also screen for common symptoms of COVID-19 such as fever, dry cough, and dyspnea. According to the Chinese national guidelines, it is recommended that blood test for COVID-19 and chest CT scan should be used as routine examinations for patients requiring admission. Even in other countries, it is desirable to test for COVID-19 among all patients being admitted to hospital for surgery.

If there is a history of suspicious symptoms or contact, the patient should be assessed in a designated COVID-19 clinic in accordance with strict infection control principles. It is critical to bear in mind that some patients can be highly contagious even when they have mild or no symptoms. After a highly suspected or confirmed case is identified, the patient should be isolated and reported to the infection control department immediately.

5. HIERARCHICAL PREVENTION AND CONTROL OF INPATIENTS

Surgical patients may be classified into three risk categories for COVID-19: confirmed and suspected patients, high-risk patients, and low-risk patients. They are defined as follows:

(1) Confirmed and suspected patients: COVID-19 was confirmed when real-time reverse transcriptase (RT)-PCR diagnostic panels or serological (IgM and IgG) test results was positive. The definition of suspected cases falls into two categories.

A. The first category will have contact history and meet any two of the clinical manifestations (fever and respiratory symptoms) with the typical findings of COVID-19 in the chest CT scan. The total number of white blood cells in the early stage of the disease is normal or decreased, and the lymphocyte count is reduced.

B. The second category is without a clear epidemiological history and shows three of the clinical manifestations (fever and/or respiratory symptoms, with the typical findings in the chest CT. The blood count will be as described above.

(2) High-risk patients: Patients who had traveled to high-risk areas or contacted patients with confirmed or suspected COVID-19 (who has developed fever and/or symptoms of acute respiratory illness within 14 days).

(3) Low-risk patients: Patients with no history of close contact with confirmed and suspected COVID-19 patients and with no fever or respiratory symptoms and without CT manifestations of COVID-19 within 14 days.

Confirmed and suspected patients have a higher risk of severe events that may require admission to the intensive care unit, ventilation support, and death. Elective surgeries for these patients should be rescheduled, and they should be assessed daily. For high-risk patients, surgeons should consider both medical and logistical needs. For low-risk patients, elective surgeries should not be abandoned unless there are constrained health resources. For cancer patients who have to delay surgery, alternative treatment approaches to delay surgery can be considered, such as neoadjuvant chemotherapy or additional chemotherapy.

The risk level of all surgical patients should be evaluated before, or immediately after, admission to hospital. The treating team should evaluate the patient's risk level daily. High-risk, confirmed, and suspected patients must be kept in a single room, and all the necessary disinfection and isolation measures should be implemented. Emergency isolation wards need to be set up in all hospitals to treat newly admitted high-risk, confirmed, and suspected patients.

6. PREVENTION MEASURES FOR HEALTHCARE WORKERS

Given the limited supply of personal protective equipment (PPE) in many centers, their use by healthcare workers should be determined by the risk level of each patient. Healthcare workers must take prevention measures in strict accordance with the epidemic assessment level. From the experiences of some hospitals in Wuhan, surgeons are at high risk of infection. In times of extreme shortages, alternatives to PPEs may need to be considered.

(1) When entering the ward of low-risk or high-risk patients for daily activities and rounds, primary protection (disposable surgical cap, surgical mask, work uniform and disposable latex gloves or/and disposable isolation clothing if necessary) is needed.

(2) When carrying out routine activities and rounds with confirmed and suspected patient wards, secondary protection (disposable surgical cap, N95 mask, work uniform, disposable medical protective uniform, disposable latex gloves and goggles) should be used.

(3) For special procedures such as collecting airway samples, tracheal intubation, airway care, and sputum suction, tertiary protection measures (disposable surgical cap, N95 mask, work uniform, disposable medical protective uniform, disposable latex gloves, full-face respiratory protective devices or powered air-purifying respirator) should be implemented as aerosol or spray may occur in airborne infection isolation rooms.

Healthcare workers shall strictly follow the procedures for putting on and taking off personal protective gear, and it is forbidden to wear PPEs when one leaves the contaminated area.

Sanitation and disinfection need to be implemented according to the regionalized zoning management system and patient epidemic classification, and different PPE should be worn according to the working area.

7. PROTOCOLS FOR EMERGENCY SURGERY

Surgeons, anesthesiologists, and nurses need to be trained in the use of PPE. Surgeons should schedule surgery based on the severity of threat to the patient's life and health. During the epidemic, need for emergency surgery should be considered as a priority for admission.

All suspected patients who need emergency surgery need to complete COVID-19 blood test and chest CT scan before admission; pharyngeal swab sampling should be completed before surgery. Patients should be placed in the transitional area while waiting for results. All surgery should be performed in a quick and efficient manner. After admission, different protocols will be applied based on the COVID-19 risk level of patients.

(1) For confirmed and suspected patients, surgeons need to report to the hospital's epidemic management department (if any), infection control department, and operating theater before surgery and then transfer to a negative pressure operating theater via a path. Tertiary protection measures are needed for anesthesia and surgical procedures. After the operation, patients are transferred to the isolation area.

(2) For high-risk patients, after the preoperative preparation is completed, the anesthesiologist, nurse, and surgeon should follow tertiary protection measures for anesthesia and surgical procedures. After the operation, the patients are returned to the original isolation ward according to the original transfer route.

(3) For low-risk patients, the general protection measures are needed for anesthesia and surgical procedures. After the operation, patients are transferred to the original ward according to the original transfer route.

8. PROTOCOLS FOR ELECTIVE SURGERY

The logistics of triage for cancer surgery is challenging. From the recommendations of the Society of Surgical Oncology, decisions must be made on an individual case basis considering the biology of each cancer, alternative treatment options, and waiting time for rescheduled surgery. The American College of Surgeons (ACS) advises to postpone nonurgent surgeries during the beginning of the pandemic of COVID- 19. They have classified surgeries into various tiers according to the urgency of surgery. Up to Tier 2b (most elective surgeries like hernia); they are advising postponing of surgery. For Tier 3a and 3b, where most cancer surgeries will fall, ACS is not advising postponement at the moment though it may change.

Patients undergoing elective surgery should be given reasonable recommendations regarding follow-up, and patient should be shifted to high care facility if COVID-19 is suspected, and test should be ordered. According to guidelines from the Indian Council of Medical Research, all high-risk patients undergoing elective surgery (All symptomatic contacts of laboratory-confirmed cases and asymptomatic direct and high-risk contacts of a confirmed case should be tested once between day 5 and day 14 of coming in his/her contact) should undergo PCR test for COVID-19 before surgery.

(1) If the patient's RT PCR test is twice negative, according to the patient's current epidemic level, surgeons can proceed with surgical protocols.

(2) If the patient's RT PCR test is positive, then the patient needs to be transferred to the isolation ward to complete the preoperative preparation. Elective surgery should be deferred until the patient recovers. If we have to operate emergently on such patients for any reasons, all the precautions mentioned earlier for operating COVID-19- positive cases as emergency should be strictly followed. The tertiary protection measures should be taken during the anesthesia and operation. After the operation, patients are returned to the isolation area.

9. PREPARATION FOR SURGERY

A. Location

Designated COVID operating areas (COA) must be allocated to COVID patients' urgent/emergent operating. The OR closest to the entrance of the theater block entrance should be the first one designated to COVID patients. When multiple procedures must be simultaneously performed, operating rooms must be utilized in order of proximity to the theater block entrance in order to minimize environmental contamination in the theater block.

B. Patient transport

Patient transit to and from the COA must be as quick as possible. A pre-defined direct path must be kept as short as possible and away from other patients and people in general within the hospital in order to minimize the chances of infection. If inter-hospital patient transfer or transfer from other buildings within the hospital is required, a dedicated vehicle should be used. Transfer personnel should be specifically trained and equipped with PPEs. The patient's compartment in the transport vehicle is ideally kept separate from the driver. A Biocontainment unit may be utilized. If a patient is taken to the COA from any adjacent premise, a stretcher might be used for transport. All precautionary measures apply to the use of the stretcher and to the personnel responsible for the transfer (**Table 1, Fig. 1**) both during and after transport is completed, with immediate sanitization required (**Tables 2 and 3**). Utilized lifts must be sanitized. If any unexpected contamination occurs during transport (i.e., patient vomiting or else), adequate dedicated sanitization should take place. A dedicated specifically trained 24/7 cleaning team from the local contracted cleaning service might prove a valuable resource.

Fig. 1 COVID – 19 Surgical patients management flow chart


	Transfer	COA entrance	OR set-up	Anesthesia	Surgery	Recovery	
Personal	Full PPE worn						
	Same personal allocated to the single patient for all the different phases						
				Once the patient inside OR no staff transit in-out			
Route	Fixed paths Shortest possible Away from public Sanitize lifts and anywhere appropriate as required (i.e. unexpected vomiting) Set-up a waiting room for patients admitted to ED before transfer to OR						
Material			All replaced before starting each procedure Dedicated trolleys or metal basket The bare necessary Whenever possible try to not refill during surgery				
Patient		Directly on operating bed	Directly and quickly to OR Not move up to the end of the recovery phase to send him/her back to the ward/ICU				
OR		Dedicated OR, the closest to COA entrance	Close after patient entering, clear alert signal on the doors				
			Material replenishment by PPE-equipped personnel from outside OR				
			High rate of air exchange cycles (>25 exchanges/hour)				
Devices	Dedicated stretcher Dedicated ambulance (Fisical separation for driver, Biocontainment unit)		Dedicated device to be sanitized after each use or after each potential high viral load contamination				
							
During each phase PPE change must occur following predetermined procedure Each surface and electromedical device must be cleaned following predetermined procedure Safe and defined protocols used to dispose of material							

Table 1 Necessary 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

Table 2 Sanitization sequence

Surface and electromedical sanitization sequence
1. Clean with chloro-derivate solution
2. Rinse and dry
3. Disinfect with chloro-derivate solution in a concentration \geq 0.1% or 1000 ppm; time of contact must be superior to 1 min

ppm parts per million

Table 3 COVID-19 surgical patients' management

Key aspects in COVID-19 surgical patient management
All suspected or infected patients must be managed with the maximum attention.
All personnel in contact with the patient must wear PPE.
Transfers must be protected.
Infected patients must be moved as little as possible through the Hospital
Transfer routes must be precisely planned and be as short as possible.
The COVID operating area should be in a dedicated and possibly separate area.
COVID operating room must be dedicated and as close as possible to the entrance of the theater block
Disposable material should be preferred.
Minimal material should be used for each intervention.
Transport personnel should be the same from transport origin to destination.
Once the patient has entered, the OR doors must be closed
Operators (i.e., surgeon, anesthetist, nurses, technicians) should enter the OR in a timely manner to minimize exposure to infected patients.
Personnel involved in the intervention should not leave the OR during

the procedure.
High OR air exchange cycles are recommended (> 25 exchanges/h).
Clinical documentation must remain outside the OR
At the end of each intervention all disposable materials must be disposed of and all surfaces and electromedical devices accurately cleaned and disinfected.
PPE must be removed and disposed of outside the OR in dedicated doffing areas ensuring the virus is not transmitted to the healthcare worker.
OR and surrounding donning/doffing areas must be sanitized as soon as possible after each procedure.
After each procedure, all involved personnel, whenever possible, should shower.
Recovery phase after surgery must be done in OR, before transfer the ward/ICU.

Any non-intubated patient must wear a surgical mask, disposable waterproof gloves, disposable cap, and shoe covers during transport. When possible, the patient’s hands should be sanitized before transport. Transport operators must sanitize hands and wear PPEs before transfer and should minimize contact with patients. Coded routes should be followed and hospital public areas avoided. Anyone crossing the path of an infected patient should be preemptively alerted in order to minimize contact. Well-organized logistics will contribute to minimizing disposables wastage. Dedicated well identifiable containers for infectious-risk health waste (IRHW) should be used for potentially infected disposables. Lastly, COVID patients should be transported in the most professional and confidential way possible in order to minimize unjustified alarmism. Dedicated areas allocated to infected patients awaiting transfer to the COA must be preemptively identified in the emergency department. The patient’s transfer from the emergency department to the COA should be streamlined in order to avoid all unnecessary contacts. Each hospital should provide a step by step, well-defined path pre-allocating some corridors and elevators to COVID patients.

C. COVID operating area

It is important to minimize the total number of operators working in the designated COA. Whenever possible, it is important to minimize to number of people working on a single infected

case; ideally, this should also apply to cases spanning over multiple shifts. Operations for COVID patients might be organized with a dedicated on-call shift. This might require overnight or out of hours activities to optimize resource usage. This approach might facilitate segregation between COVID and non-COVID patients, who will continue to require surgical care. PPEs and stock required for hand hygiene must be constantly replenished within the COA. A specifically allocated filter area designed for COVID patients to enter the COA must be equipped with PPEs, hand hygiene station, and a dedicated IRHW bins. Handling of potentially infected linen should be adequately managed too. The use of machinery intended to facilitate moving and transferring patients should be minimized. All COA doors must be kept closed (including accessory rooms, sterilization spaces), and any equipment not necessary for the intervention must be moved away from COVID patients transit route.

D. Taking charge of the patient in COVID operating area

Special attention should be given to what, in non- COVID times, is routine practice. Staff taking responsibility for positive or suspected infected patients must be limited to those who need to be primarily involved in each operation. A record must be kept of all operators involved in procedures on potentially infected patients. Personnel equipped with full PPEs must receive the patient in the COA, transfer the patient to the operating room minimizing environmental contamination and, after time-out, proceed to move the patient on the operating table in the allocated OR. All non-intubated patients must wear a surgical mask. Medical records must remain outside the OR and must be consulted and updated there after adequate doffing. Intraoperative document consultation is discouraged and should be minimized.

E. Operating room preparation

Negative pressure ORs would be ideal to minimize infection risk. However, ORs are normally designed to have positive pressure air circulation. A high air exchange cycle rate (≥ 25 cycles / h) contributes to effectively reduce the viral load within ORs. Equipment kept in each OR must be minimized to what is strictly necessary on a case to case basis. Once the operation starts, all efforts must be made to use what is available in the room and minimize staff transiting in and out the OR, in order to minimize infection risk. Standard anesthetic trolleys should be replaced with dedicated pre-prepared ones with minimal but adequate stock. All required surgical material (i.e.,

stitches, scalpel blades) must be preemptively prepared in a sterilizable steel wire basket. Dedicated IRHW containers must be used for infected and sharp disposable instruments. Alcoholic solution for hand hygiene must always be available. Avoiding non-strictly necessary commonly used non-disposable devices is recommended. Disposable material in general should be preferred, including linen. All operators (i.e., surgeon, anesthetist, nurses, technicians) should enter the OR timely, aiming to minimize time spent within the OR itself. Once in the OR, they should not leave until the operation is completed, and once out they should not re-enter.

F. Personnel dressing

All operators must wear the required PPE before meeting the infected patient. The patient's receiving personnel inside the COA filter area must perform hand hygiene and wear full PPE.

While taking care of infected patients, gloves should be changed immediately after contact with infected material (objects, surfaces, etc.) or if any damage occurs. Operator with a beard should exert special attention to the fit of the mask ensuring adequate protection.

Some procedures likely to generate aerosolized particles have been associated with increased corona virus transmission: tracheal intubation, non-invasive ventilation, tracheostomy, cardiopulmonary resuscitation, and manual ventilation before intubation and bronchoscopy. An FFP3 mask should be therefore worn by operators working closer to the patient during these procedures.

Given the conjunctiva's susceptibility to viral transmission, it is important to wear visors or goggles to protect the eyes from potential exposure of viral particles.

G. Anesthesiologic consideration

Careful anesthesiologic planning is recommended to minimize any infection potentially associated with unexpected complex endotracheal intubation procedures. A more liberal use of intubation might be justified in patients with acute respiratory failure, bypassing noninvasive ventilation techniques (e.g., CPAP or biPAP) in order to minimize the transmission risks. Disposable airway equipment should be preferred. Medical and nursing staff must be equipped with FFP3 filters during laryngoscopy and intubation. Intubations techniques with the highest chance of first-time success should be preferred to avoid repeated airway instrumentation. Awake intubation techniques should be avoided. At the end of these procedures, all staff directly

performing the procedure must immediately replace the first pair of gloves and other PPEs in case heavy contamination risk exists (i.e., in the event that vomiting, coughing, or else has occurred). Fiberscope intubation, unless specifically indicated, should be avoided as it may generate aerosolization. Rapid sequence intubation (RSI) should be considered to avoid manual ventilation and potential aerosolization. If manual ventilation is required, small current volumes should be used. If available, a closed suction system should be preferred during airway aspiration. Disposable covers should be used whenever possible to reduce equipment contamination. If a patient is transferred directly from the intensive care unit, a dedicated transport ventilator should be utilized. In order to reduce aerosolization risks, the gas flow should be turned off and the endotracheal tube clamped with forceps when switching from the portable device to the OR ventilator. When possible, a dedicated ventilator should be used in the OR for general anesthesia in positive or suspected positive COVID-19 patients. Invasive procedures like for example the placement of intercostals catheters, central venous catheters, or similar should be performed at the patient's bedside, rather than in the OR. When a general anesthetic is required, a HEPA (high-efficiency particulate air) filter should be connected to the patient end of the breathing circuit and another one between the expiratory limb and the anesthetic machine. Alternatively, for pediatric patients or other patients in whom additional dead space or the weight of the filter may be problematic, the HEPA filter must be placed at the expiratory end of the circuit (before the exhalation re-enters the ventilator). The gas sampling tube must also be protected by a HEPA filter. Both HEPA filters and soda lime must be changed after each case. At the end of the surgery, during the recovery phase, the patient must be assisted directly in the OR until ready to be transferred back to the inpatients place of stay. The time patients spend returning to wards must be reduced in order to minimize contact between COVID-positive patients and the surrounding environment.

10. MANAGEMENT DURING SURGERY (SUSPECTED EMERGENCY AND TEST POSITIVE ELECTIVE CASES)

During the operation, all objects that come in contact with patients including blood, secretions, and excreta should be considered as potentially contaminated. In particular, medical staff in operating theater should avoid exposure to aerosols generated while using electrosurgical

equipment. There are many examples that viruses do survive in surgical smoke created by electrosurgical instruments. Though it is not proven that corona virus can be transmitted via surgical smoke, it may be worthwhile to take precaution until we have evidence it does not. To reduce the hazards, surgical smoke should be minimized by suction device, and electrosurgical equipment should be used at the lowest effective power. In suspected cases, laparoscopy should be avoided as pneumoperitoneum high-pressure trocar leaks enhance the risk of exposure to aerosol to operating theater staff. Surgeons and nurses should avoid injuries such as stab wounds and needle stick injuries. All PPE is only used in the isolated area, and it is forbidden to leave the isolated area while wearing PPE.

Some airborne transmission happened in Wuhan because healthcare workers initially had little knowledge of the virus. After using the strict management measures for operating theater, airborne transmission ceased.

Intraoperative management

The OR door must be kept closed at all times and clear signs should discourage unnecessarily entering the room. Supplying materials to the OR during surgery should also be discouraged. The scout nurse, in collaboration with the operating surgeon, should anticipate what is needed during the operation before the same starts. Surgeons should preferably perform the operation with what is available in the OR once the operation started. Any essential retrieval of necessary equipment should be done by staff outside the OR. Personnel present in the OR during surgery must not leave the room. Electromedical devices (i.e., ultrasound) and surfaces must be used with adequate protective cover and adequately sanitized at the end of the operation. The surgical team will drape the patient according to the surgical procedure, replacing the surgical mask with FFP2 filter and wearing long shoe covers before doing so. All personnel in direct contact with the patient must wear a double pair of gloves at all times, even while operating. After the patient left the OR, logistics should allow as much time as possible before the next procedure takes place, to reduce possible air contamination. This time depends on the number of air exchanges/hour of the specific room. Air exchange cycles should be increased whenever possible to ≥ 25 exchanges/h. After the case, all areas at risk of contamination must be cleaned and disinfected (**Table 2**). Efforts should be made to minimize the contamination risk associated with specimens sent to the

pathology department. No data currently exist on COVID-19 viral load in bodily fluids or tissue samples.

11. POSTOPERATIVE MANAGEMENT

In the operating theater, laminar air flow is used, and air supply should be closed after operation. Peroxyacetic acid air is used for fumigation. The operating theater should be cleaned and disinfected and high-efficiency filter changed. Cleansing should be done using detergent and water followed by use of with 1000 ppm bleach solution for all hard surfaces in the operating theater. The disinfection time should be longer than 30 min. The operating theater should be closed for at least 2 h, and the next operation should be performed after laminar flow and ventilation being turned on.

For high-risk patients who develop cough with fever after surgery, a chest CT scan and RT PCR test should be performed. For suspected or confirmed patients, adequate oxygen therapy and nebulization should be given after surgery. Surgeons should pay attention to nutritional treatment and organ support treatment for postoperative patients. In patients with suspected or confirmed COVID-19, there is a greater risk of complications such as deep vein thrombosis (DVT) and secondary pulmonary infections.

For confirmed COVID-19 patients, once the temperature returns to normal for more than 3 days, the respiratory symptoms are significantly relieved, and the inflammation is clearly absorbed, the isolation can be released when the RT PCR and antibody test is negative on two consecutive occasions (sampling interval ≥ 24 h). Doctors then can transfer them to the general ward for treatment or discharge.

PPE undressing/removal

Staff not directly involved in the patient's care should leave the OR at the end of the operation and remove all PPEs in a dedicated doffing area following the sequence described below. A clean area should be accessed only after the doffing procedure is complete. All used PPEs must be disposed of through IRHW containers. Scrubs must be replaced after each procedure following showering, whenever possible. Personnel responsible for transferring the patient away

from the operating room must follow separate access routes and wear PPEs different from the ones worn in the OR.

Instructions for PPE removal

The healthcare professional must take all care not to become infected while removing PPE; this must be done through an adequate procedure preventing recontamination of the operator's clothing and hands. The first pair of gloves is likely to be heavily contaminated and must be removed first. All other PPEs must be considered infected as well and removed with care during the doffing procedure, especially if the patient had a cough. Protective suite, shoe cover, and head cap must be subsequently removed. Face mask and glasses must be then removed, taking care to handle the face mask by the ear laces and without touching its external side. The second pair of gloves must be removed as the very last PPE and hands disinfection with hydro-alcoholic solution must be accurately performed immediately after.

Environmental sanitization

The OR and surrounding exchange areas must be sanitized as soon as possible after each procedure, with particular attention to all objects used when caring for infected patients. Similarly, all areas where COVID patients have transited must be carefully sanitized too. All personnel must contribute to maintain a clean environment including floors and surfaces in general. All potentially infected single-use materials should be disposed of through IRHW containers. Reusable materials should be decontaminated, washed, dried, and or disinfected/sterilized, based on the likelihood of infection. Electromedical equipment (i.e., ventilator, radiological equipment) must be cleaned with chloro-derivate solution, rinsed and dried, and then disinfected with chloroderivate solution in a concentration $\geq 0.1\%$ or 1000 ppm (parts per million) with contact time superior to 1 min (**Table 2**). Full PPE must be worn during the sanitizing procedure. Disposable materials only (i.e., double gloves, paper towel) should be used for cleaning. Anything disposable kept inside the OR during the operation must be disposed of through IRHW containers, even if not used.

Waste disposal

It is advisable to set up a dedicated container for hazardous medical waste immediately outside the OR, to immediately dispose of all contaminated disposable material and PPEs. Containers

should be closed and sealed before being transferred to the collection point. All sharps should be disposed of in a dedicated rigid plastic container. PPE should be worn when closing and transporting containers and removed immediately after. Any visibly damaged or contaminated container must be promptly replaced.

Linen management

Linen can be contaminated and must therefore be handled and transported with care, aiming to prevent infection spread. Disposable laundry should be preferred, when possible. All linen (sheets, pillowcases, crossbars, etc.) should be handled wearing PPE during collection, not placed on surfaces or floors, but directly inside dedicated containers. These must be sealed and immediately sent for cleaning and sterilization, limiting them being left outside the OR.

12. SINGLE STEP - SOUND PRACTICAL VALUE

We review them here as each single step has sound practical value:

1. Operations should be done in a negative pressure OR with separate passage. Operation observation is forbidden.
2. Operation sheets should be waterproof.
3. PPE shall be in accordance with level III protection standards.
4. The wearing process of personnel on the operating table (wearing two-layer surgical caps, three-layer sterile gloves, two masks, two pairs of shoe covers, two disposable surgical gowns, one medical protective clothing, one goggles, one protective screen and one boot cover).

Step 1: Enter the OR, disinfect hands, change protective slippers, and enter the dressing room. Wash hands in seven steps, change personal clothes, wear hand washing clothes, remove personal articles such as jewelry, watches, mobile phones, etc., and wear disposable surgical caps.

Step 2: Wear medical protective mask and do tightness test.

Step 3: Wear goggles, shoe covers and disinfect hands.

Step 4: Enter the buffer zone after self-inspection. Hand disinfection, inspection of medical protective clothing (model, integrity, etc.), wearing disposable medical protective clothing.

Step 5: Disinfect hands, wear the first layer of sterile gloves, cover the cuff of protective clothing, and use adhesive tape to fix the cuff if necessary.

Step 6: Wear disposable surgical cap.

Step 7: Wear disposable surgical mask.

Step 8: Wear disposable surgical clothes.

Step 9: Disinfect the hands, wear the second layer of sterile gloves, and cover the cuff of disposable surgical clothes.

Step 10: Wear a protective screen.

Step 11: Wear waterproof boot cover.

Step 12: Wear outer shoe cover.

Step 13: Disinfect the hands, confirm the correct donning of clothing with the help of others, check whether all PPE is complete, intact and appropriate in size, ensure that the two layers of medical personnel are tightly protected and the body is not exposed, and enter the operating room after self-inspection in a mirror.

Step 14: Disinfect surgical hands (disinfect hands and wrists with hand sanitizer, i.e. the scope of the second pair of gloves), and wear disposable sterile surgical clothes.

Step 15: Wear the third layer of sterile gloves, and cover the cuff of sterile surgical gown.

5. Measures to prevent aerosol transmission.

The smoke generated by the use of the electrosurgical equipment will form aerosols. During the operation, an aspirator can be used to absorb the smoke, but the suction operation can also cause the generation of aerosols. Therefore, it is recommended to reduce the negative pressure suction operation during the operation, and use the electrosurgical smoking device to reduce the diffusion of aerosols.

Closed negative pressure suction system shall be used. The disposable negative pressure suction bag shall be added with effective chlorine containing disinfectant of 5000 mg/L – 10,000 mg/L before operation, and sealed after operation, and treated as infectious medical waste.

Endoscopic surgery should be minimized, because there is no evidence to rule out whether the leakage of pneumoperitoneum pressure in endoscopic surgery contributes to aerosol transmission

pathways, or whether there is the possibility of increasing the risk of infection of the operating personnel.

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