COVID OPERATION THEATRE PREPARATION AND MANAGEMENT

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INTRODUCTION:

- Corona virus disease 2019 (COVID-19) caused by SARS-CoV-2 has spread worldwide and has affected millions of people.
- Patients with COVID-19 have to undergo elective or emergency surgical procedures under local or general anaesthesia.
- It is advisable to postpone elective surgeries even if they are asymptomatic
- Till the time they test negative for this virus.
- There are higher incidence of morbidity and mortality in COVID infected patients following surgery.

Emergent surgeries would be required to be carried out, like

- Cesarean sections
- Acute abdominal conditions,
- Pediatric and neonatal emergencies,
- Trauma,
- Tracheostomies in intensive care unit (icu) .

- Such emergency surgical procedures necessitate setting up of dedicated *COVIDOPERATION THEATRES (COVID OT).*

COVID TESTING BEFORE SURGERY:

- RT-PCR is the gold standard for diagnosis of covid-19 infection.
- It has high specificity with less sensitivity.

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- In case of emergency surgeries,
- Rapid antigen testing and CT chest can be done.
- CT-CHEST is to be done to look for pulmonary changes associated with covid infection.

Preoperative assessment

History:

- Presence of dry cough, fever, shortness of breath
- Travel history to high-risk area, close contact with COVID-19 patients
- Occupational exposure
- Contact history
- Cluster phenomenon

Physical examination and investigation:

- Check for presence of fever
- Check blood pressure and pulse to look for presence of shock, check SpO_2 for desaturation
- Auscultate for crepitations and wheezing
- Look for leukopenia, lymphocytosis and lymphopenia from complete blood count
- Assess organ function from liver function test and renal function test
- Look for consolidations on chest x-ray
- If CT-thorax available, look for presence of multi-lobar ground glass appearance

SETTING UP COVID-OT:

Name of Operation Theatre

- Dedicated Operation Theatres are to be used for all confirmed or suspected COVID-19 infected patients.
- These operation theatres should be labelled as “COVID-19 Operation Theatre(COVID OT)”.
- Large clear bill boards visible from a distance, should be placed outside such Ots.

Number of Operation Theatres

- Ideally, there should be 2 COVID OTs:
- Obstetrical surgical procedures
- General surgery/orthopaedics/other surgical procedures .

Location

- The operation theatres should be located in the dedicated COVID Block/Centre.
- No adjoining inhabited buildings within 20 meters.
- Preferably located near to COVID ICU, High Dependency Unit (HDU),Isolation ward and Emergency ward.

Changing Room

- Separate changing rooms for male and female heath care workers with attached toilet and shower facilities.
- There should be provision for opening the doors with feet or elbow without touching the handles.

Donning Area

- There should be a dedicated donning room adjacent to the scrub room.
- The pre-sterilized Personal Protective Equipment (PPE) Kits should be available in adequate number in donning area. It should have chairs and hand sanitization facility.

Doffing Area

- There should be a dedicated doffing room with hand sanitization facility and waste collection bins.
- Used PPEs should be disposed as per the Bio Medical Waste Management guidelines.

Separate Entry and Exit

- The entry to the donning area and the exit from the doffing area should be separate.

Air Conditioning of OT

Airborne infection isolation requirements have to be strictly enforced

The virus laden airborne should not leak out of room occupied by covid 19 patient

Maintain the concentration of virus particle inside the covid 19 OT room to minimum

Control of spread of infections and protect the healthcare worker

- As it is in normal practice, most of the Ots would be served by a Heating, Ventilating, Air Conditioning (HVAC) system that would be of a recirculatory type.
- where in the air from the OT is taken back to the air handling unit (AHU) for thermal conditioning and brought back.

To convert an existing OT into a COVID OT, it is first necessary to convert the OT into a non-recirculatory type

Figure 2

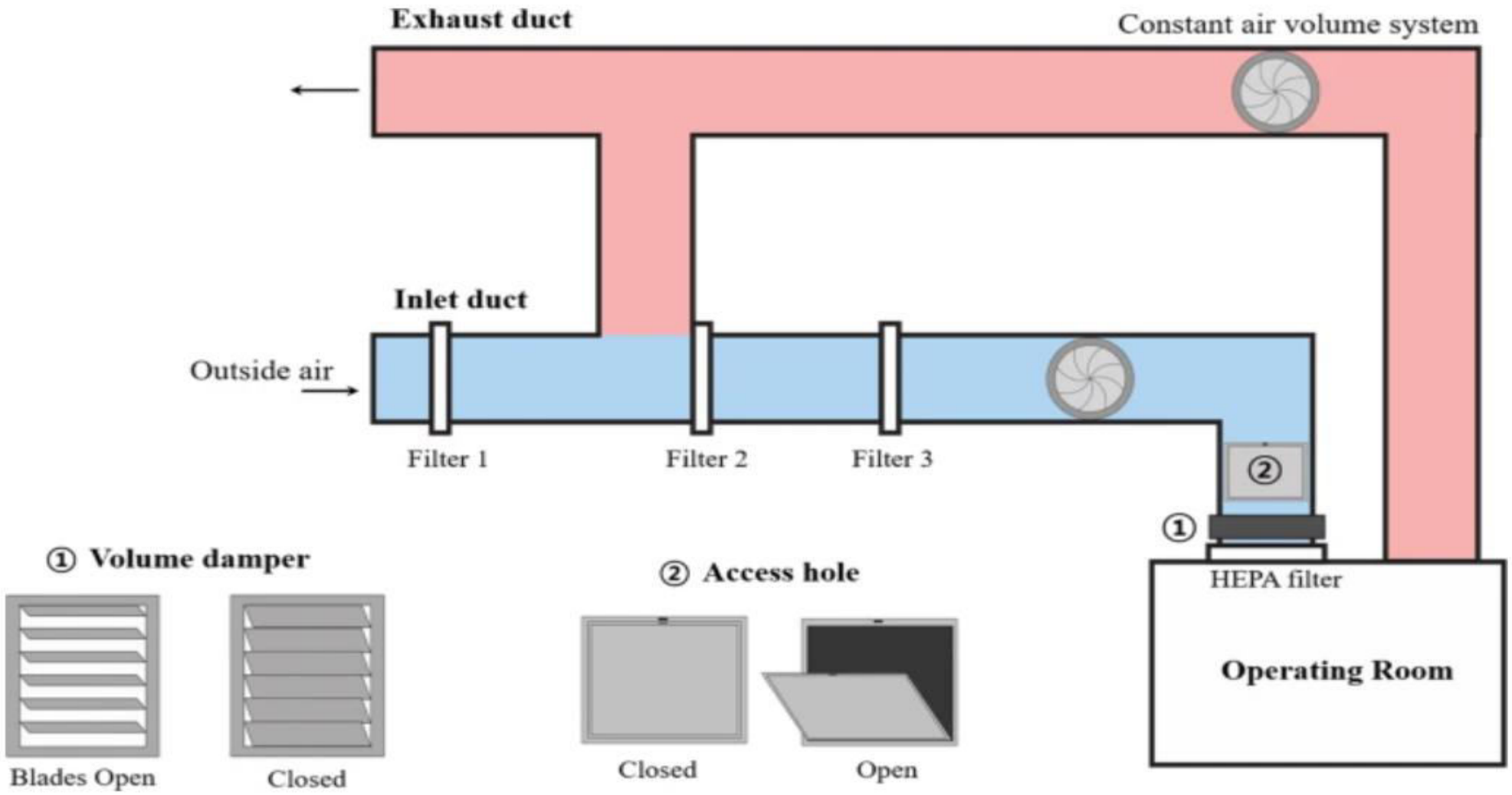
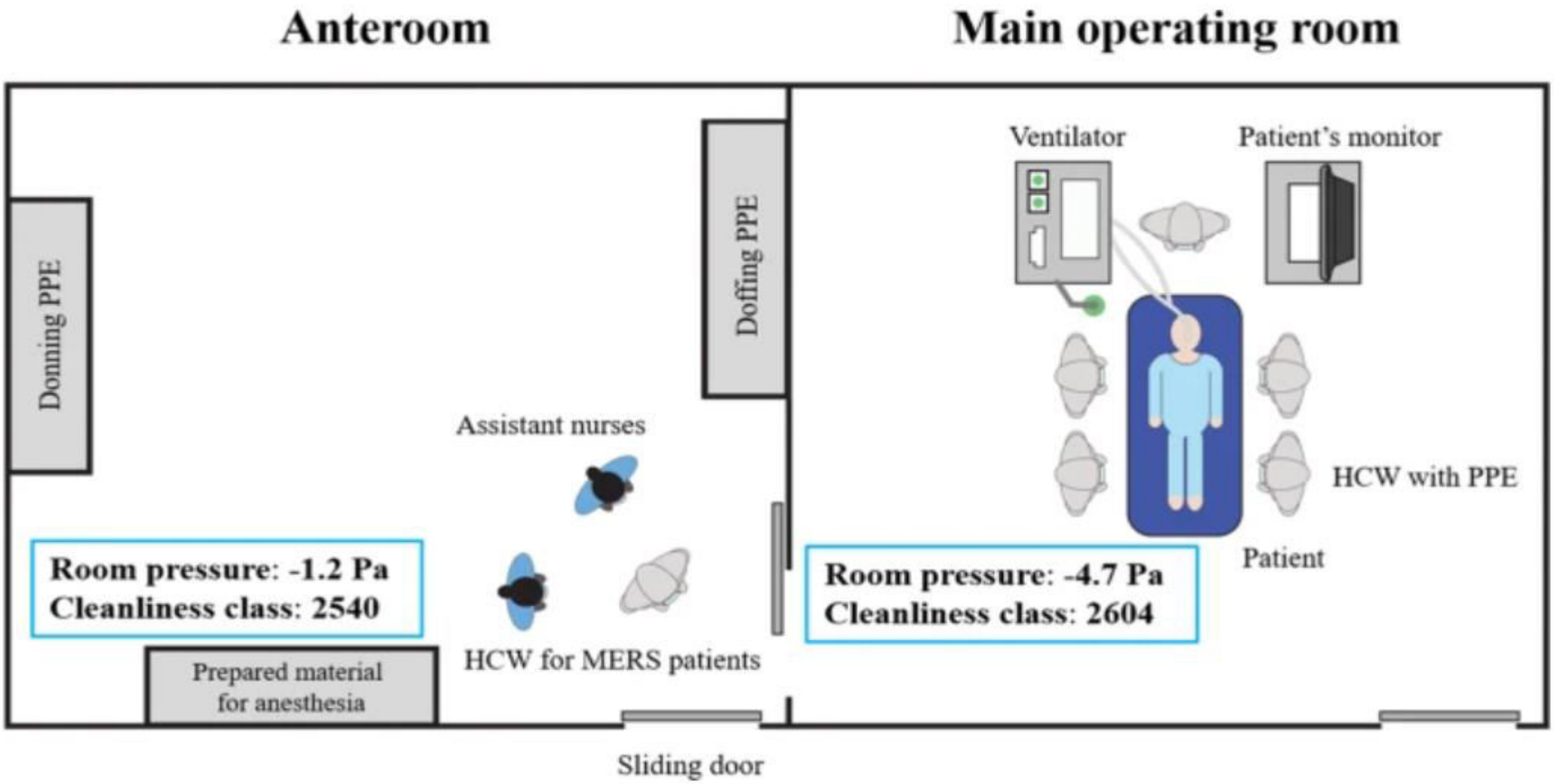

Exhaust duct
Constant air volume system
Inlet duct
Outside air
Filter 1
Filter 2
Filter 3
②
①
HEPA filter
Operating Room
① Volume damper
Blades Open
Closed
② Access hole
Closed
Open

Figure 3


Anteroom
Main operating room
Donning PPE
Doffing PPE
Ventilator
Patient's monitor
Assistant nurses
HCW with PPE
Patient
Room pressure: -1.2 Pa
Cleanliness class: 2540
Room pressure: -4.7 Pa
Cleanliness class: 2604
HCW for MERS patients
Prepared material for anesthesia
Sliding door

On an emergency basis,

- This can be achieved by blanking (blocking) off the return air vents in the OT.
- Additionally, an independent exhaust blower shall be provided to extract the room air and exhaust it out into the atmosphere, preferably, after suitable exhaust air treatment.
- The exhaust air quantity should be greater than the supply air quantity so that a negative pressure of minimum 2.5 Pa (preferably >5 Pa) is achieved in the room.
- The supply air quantity should provide a minimum of 12 air changes per hour.
- The position of the extract air duct in the OT should be just above the head of the patient.

As a next best possible option,

COVID OT can have stand alone room air-conditioners.

- Room air conditioners re-circulate air within a single occupied zone.
- Two split air conditioners of 2 tons refrigeration capacity per OT

- Recirculation of cool air by room air conditioners, must be accompanied by outdoor air intake through slightly open windows

- Fresh air intake through a fan filter unit will prevent outdoor dust entry
- FAN filter avoids high levels of PM 10 and PM 2.5 particles
- Exhaust fans should be kept operational

- Set the room temperature between 24°C and 30°C
- Maintain relative humidity between 40% and 70%.
- In humid climates set the temperature closer to 24°C for de-humidification
- In dry climates closer to or at 30°C and use fans to increase air movement

- This will make working somewhat comfortable while wearing

  PPE, especially during the summers.

- Negative pressure could be created by putting up 2-3 exhaust fans which will drive air out of the room.

- Treatment of exhaust air can be done preferably by high efficiency particulate air (HEPA) filtration.

- The another way to treat exhaust air shall be let off into the atmosphere through an upward plume at a height of 3 m above the tallest point of the building,
- Thereby lowering the viral load concentrations to insignificant levels by dilution.
- This exhaust discharge shall be well away from other air intake points or any populated places.

Exhaust air treatment can also be done by

- Ultraviolet (UV) irradiation (15 minutes) .
- Heating (45 min at a temperature of 75°C).

Remove all non-essential equipment and gadgets

- Only essential items should be inside the operation theatre.
- Place all equipment and drugs essential for the anaesthetic management in a tray
- Avoid handling of the drug trolley during the case.
- Similarly, the surgical equipment, linen and dressings which are essential should be kept ready on separate trolley

Transparent Plastic Sheet Covers

- Cover all monitors, cables, anaesthesia work station/machine, cautery, operation table, patient trolley, etc with transparent,water resistant plastic sheets.

- These plastic coverings should be removed and changed after each case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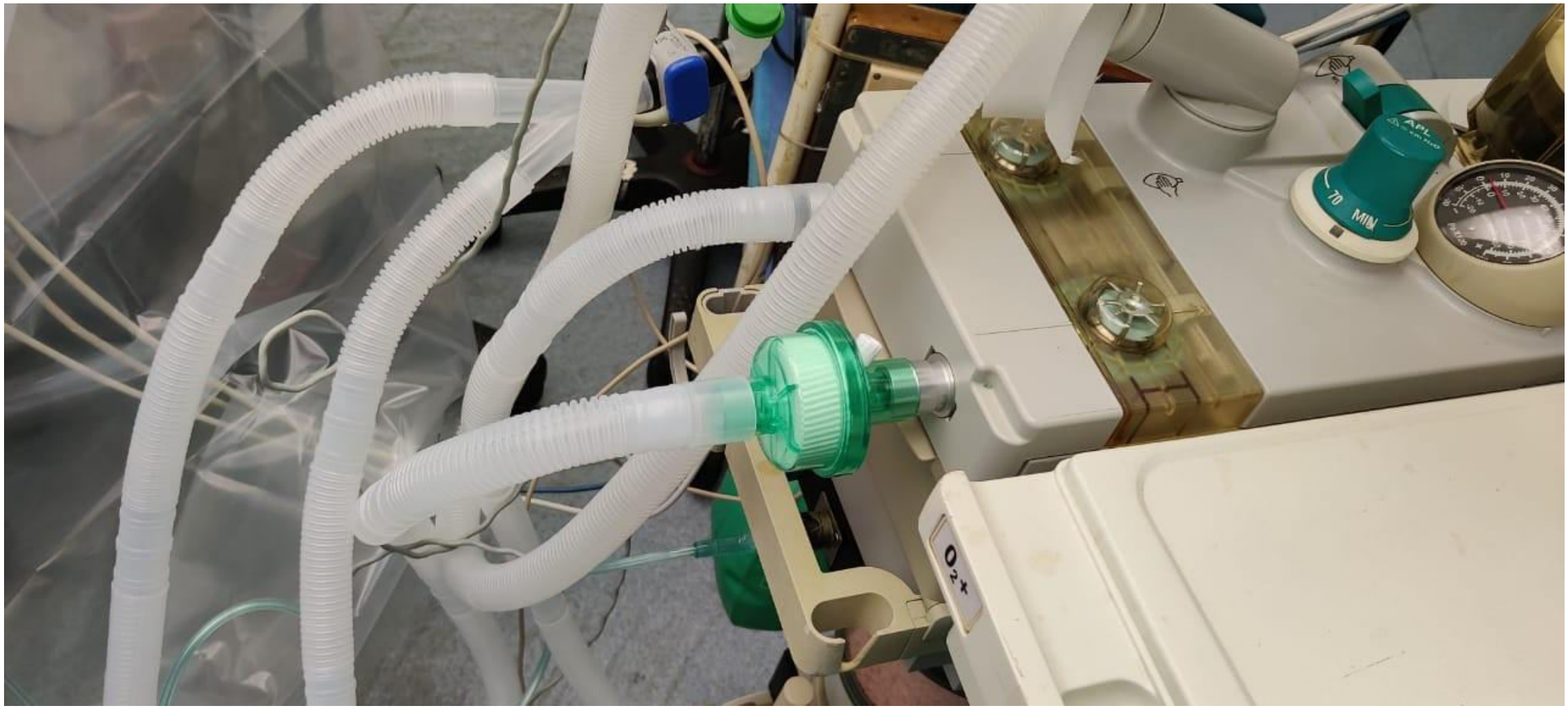
Disposable equipment

- Use disposable equipment as far as possible, like-breathing circuits, face mask, tracheal tubes, etc

Heat and Moisture Exchanger with Viral Filters(HMEFs)

- Place two high quality Heat and Moisture Exchange Filters (HMEFs).
- First, between tracheal tube and breathing circuit; and the second between expiratory limb and anaesthesia machine.
- These HME filters can remove up to 99% of airborne particles of size 0.3 microns or greater, thus helping in preventing contamination of OT atmosphere.

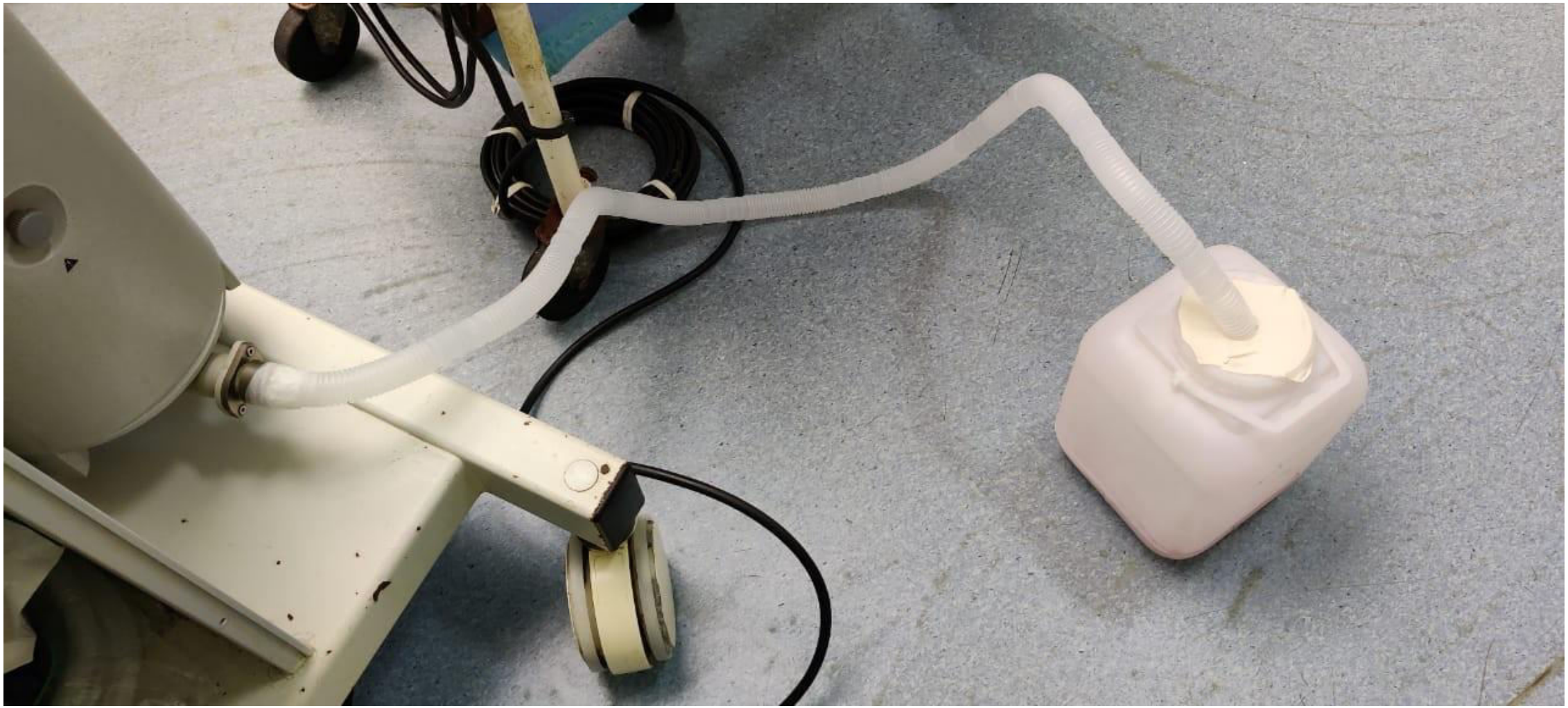

70
MIN
O2+

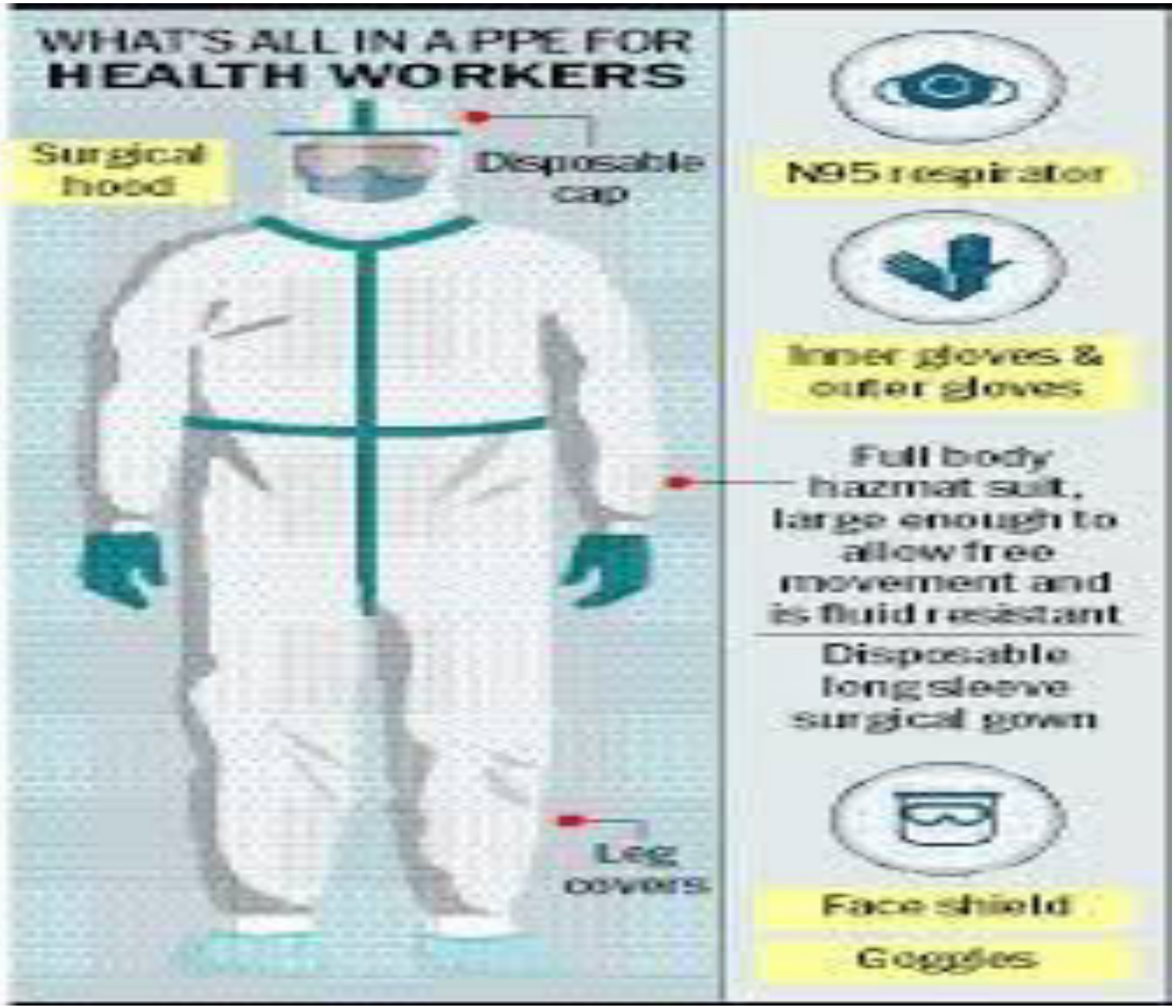
Scavenging

- It is suggested that corrugated tubing can be applied to the scavenging port and that can be dipped in a bucket with 1% hypochlorite solution.
- Suitable PPE should be used while handling the hypochlorite solution and direct contact with skin and eyes should be avoided.

Aerosol generating procedures (AGP)

- Aerosol generating medical procedures are tracheal intubation and extubation,suctioning, nebulization, CPAP, BiPAP or high-flow nasal oxygen therapy, bronchoscopy.
- Aerosolization is also increased when more than one attempt at intubation is required.
- During AGPs, all health care workers should always wear full component of proper PPE Kit (Cover all gown, N95 mask, eye shield, cap, double gloves, shoe cover)

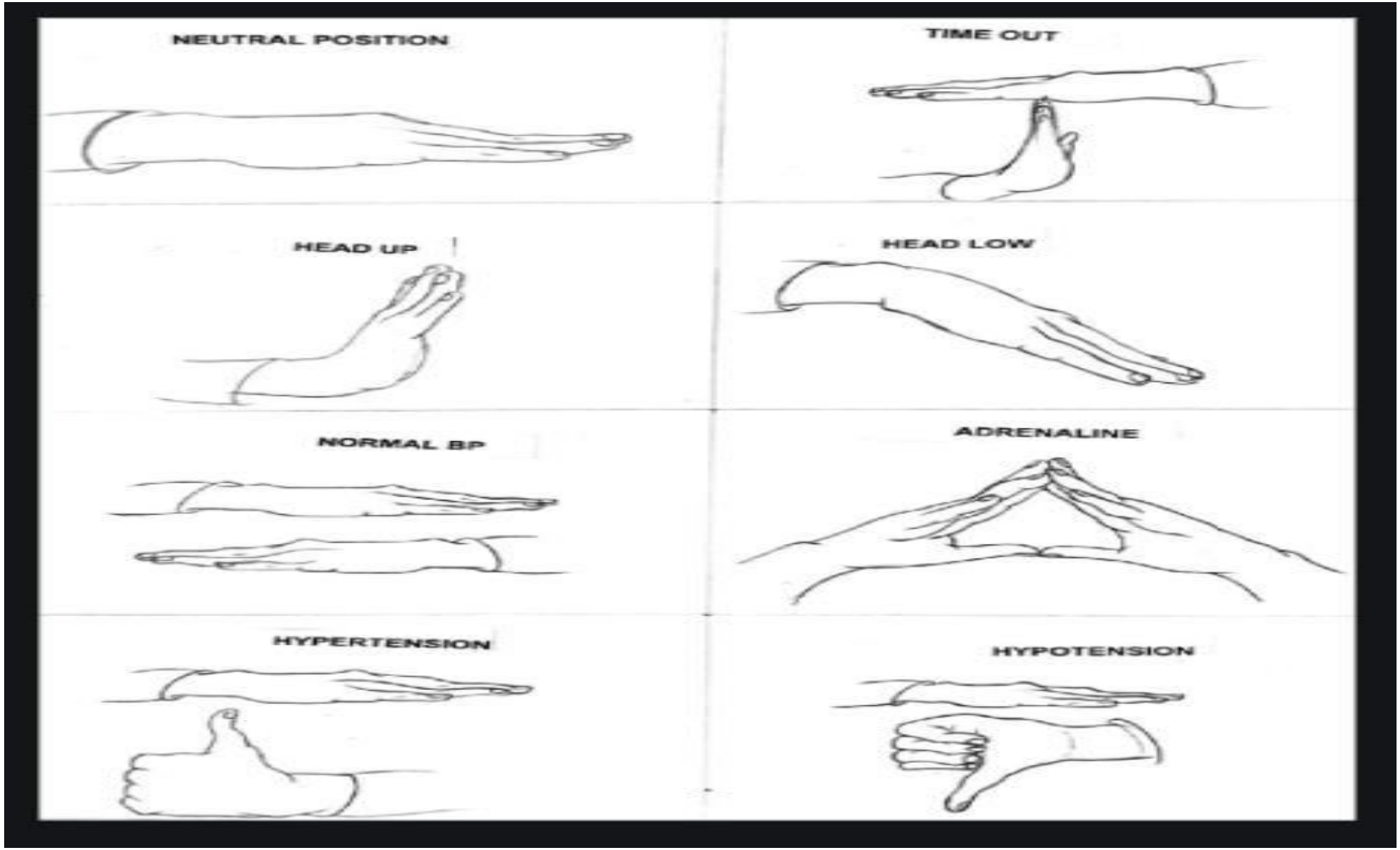



WHAT'S ALL IN A PPE FOR HEALTH WORKERS
Surgical hood
Disposable cap
Leg covers
N95 respirator
Inner gloves & outer gloves
Full body hazmat suit, large enough to allow free movement and is fluid resistant
Disposable long sleeve surgical gown
Face shield
Goggles

- There should be minimum required personnel inside the COVID OT.
- It is difficult to communicate with PPE on, so the team should practice sign language for easy,quick and correct communication.
- If intercom facilities are not available inside the OT, then one mobile phone with transparent plastic covering can be used for communicating with medical personnel and support staff outside the OT.

Oxygen Supply

- There should be adequate oxygen reserve.
- Any oxygen/nitrous oxide cylinder inside the OT should be considered as infected.
- It should be cleaned with 1% sodium hypochlorite before being sent for refilling.


NEUTRAL POSITION
TIME OUT
HEAD UP
HEAD LOW
NORMAL BP
ADRENALINE
HYPERTENSION
HYPOTENSION

Sterilization and Decontamination

- There should be enough time between two cases (approximately one hour) .
- The agents used in decontamination are

  Hydrogen peroxide spray ,

  1% Sodium hypochlorite solution,

  75% Alcohol
- All floors and walls to be cleaned with 1% sodium hypochlorite solution.
- Before starting the decontamination, the staff has to remove the outer hand gloves.

- Discard breathing circuit, mask, tracheal tube, HME filters, gas sampling line and soda lime after every surgery.
- Water trap to be changed if it becomes potentially contaminated.
- All unused items on the drug tray and airway trolley should be assumed as contaminated and to be discarded.
- Seal all used airway equipment in a double zip-locked plastic bag. It must then be removed for decontamination and disinfection

- The metallic equipment to be kept in 1% sodium hypochlorite solution for half an hour.

Wheeling In the patient

- COVID-19 infected patient is wheeled through a separate/isolated corridor to the OT.

- No stay in premedication room .

- The patient should wear autoclaved operation theatre clothes, cap, surgical/N95 mask and should be covered with a plastic sheet.

Wheeling Out the patient

- Tracheal extubation should be done on the table, as far as possible.
- Immediately place the surgical mask/N95 mask over the patient after tracheal extubation.
- The patient is observed postoperatively in the OT itself. The patient should not be kept in recovery room and should be transferred directly to the isolation ward.

- If tracheal extubation is not feasible, then shift the patient to designated ICU.A single patient use Ambu bag with HME viral filter attached must be used during transfer.
- The transport personnel removes the existing PPE and cleanse the hands. He then wears fresh PPE.

Use of Blood Products

- There have been no reported or suspected cases of transfusion-transmitted COVID-19.
- Routine blood donor screening measures are used and ensure that blood donors are healthy, feeling well and free of respiratory illness symptoms.
- There are no contraindications of blood transfusion to a COVID 19patient.

NEONATAL RESUSCITATION

- With regard to vertical transmission (transmission from mother to baby antenatally or intrapartum), emerging evidence now suggests that vertical transmission is probable.

- Although the proportion of pregnancies affected is yet to be determined.

- It is preferable to do neonatal care/resuscitation after a cesarean section in the second OT (if available) or just outside the COVID OT to minimize the exposure to the neonate and pediatrician.

LAPROSCOPIC PROCEDURES

- Insufflation is usually achieved using carbondioxide. On desufflation, a surgical plume is created ,which is a source of biological contamination including blood cells, cell debris and potential viruses.
- Specifically for laparoscopic surgery, desufflation of pneumoperitoneum must be performed by an appropriate suction device attached to a HEPA filter to prevent venting into the operating room.

MOCK DRILLS

- Do mock drills for correct donning and doffing of Personal Protective Equipment (PPE) including cover all gown, N 95/FFP3 face mask, eye shields/face shields/visor and gloves.
- Mock drill of a surgical procedure from wheeling in to wheeling out the patient from operation theatre should also be done to get accustomed and know practical problems.

STANDARD OPERATING PROCEDURE (SOP) FOR CONDUCTING ANAESTHESIA FOR A SURGICAL PROCEDURE IN COVID OT

1. After putting on the OT clothes, go to scrub room and scrub
2. After scrubbing, go to the Donning Room and wear pre-sterilized Personal Protective Equipment (PPE).
3. Standard routine anaesthesia monitoring to be instituted.
4. Prefer regional anaesthesia, where ever possible.
5. In case supplementary oxygen is needed, the oxygen mask is applied over the surgical mask or N95 mask.
6. For general anaesthesia, pre-oxygenate for five minutes with 100% oxygen. Avoid high flow oxygen to prevent aerosolization.


Monitoring
insp.
exp.
O2
50
30
%
N2O
0
0
%
No
Agent
MAC
age 40
0.0
Hudson mask over surgical mask
54
64
0
0
0.0
etCO2
15
mmHg
inCO2
1
Freq.
9
PEAK
PLAT
PEEP
No fresh-gas delivery!
Hudson mask under surgical mask

7. Instruct the patient not to cough.
8. It is prudent to cover the patient’s nose mouth with two layers of wet gauze to block some of the secretions.

In premedication, antitussives & antihistamines can be used.

8 The choice of induction drugs is dictated by haemodynamic considerations.

Midazolam with etomidate or propofol, depending upon patient's haemodynamic condition, can be used for induction.

Fentanyl is recommended for analgesia.

If no contraindications are present, succinyl choline 1 mg/kg should be administered for tracheal intubation.

9 Tracheal intubation should be done by experienced anaesthesiologists

Limit the number of anaesthesia team Personnel (maximum three) inside the OT.

Second clinician with PPE can be available outside the OT for immediate assistance

10. Rapid sequence induction and tracheal intubation (with cricoid pressure) to be done in the first attempt. Ensure adequate neuromuscular blockade to avoid bucking that can increase aerosolization.
11. Intravenous lignocaine has been used to prevent cough following premedication with an opioid, such as fentanyl before tracheal intubation. It has also been used to prevent emergence coughing during tracheal extubation.
12. Avoid manual ventilation to prevent aerosolization of virus from airways. If manual ventilation is required, apply small tidal volumes.
13. Immediately inflate the tracheal tube cuff before starting ventilation to prevent aerosolization. Immediately block/clamp the tracheal tube. Apply the HMEF on tracheal tube itself, if feasible.

14. Use Intubation box , if available and feasible.

15.Use plastic transparent sheets to cover the patient completely. Tracheal Intubation can be done by placing hands under the clear transparent plastic sheet, thus minimizing exposure to aerosolized virus.

16.Avoid awake fibre-optic intubation whenever possible. Nebulization with local anaesthetic will aerosolize the virus.

17.Video laryngoscope is preferred for tracheal intubation to increase the distance between the patient's airway and that of the anaesthesiologist who performs the intubation. It also improves intubation success rate and avoids multiple attempts at tracheal intubation.

18.Resheath the laryngoscope blade immediately post intubation with the outer glove worn by the operator.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19 Proper positioning of tracheal tube is confirmed by EtCO2 monitoring and chest rise.

Auscultation of chest is to be avoided

20 Use low gas flows and closed circuits. Limit the ventilatory disconnections

21A closed airway suction system, if available, is preferable to decrease viral aerosol production.

22 Supraglottic airway devices should be used only in ‘cannot ventilate’ situations. This will avoid manual bagging and provide rescue oxygenation.

23 Prophylactic administration of antiemetic drug is preferred to reduce the risk of vomiting and viral spread.

24 Vomiting is usually accompanied by coughing, which increases aerosolization.

25 Go to the designated Doffing Room and remove the protective equipment.
After removing the protective equipment, avoid touching your hair or face before washing hands.

26 Go to the change room, discard OT clothes. All staff members have to take shower before leaving the OT and resuming their regular duties

In resource limited settings, where adequate personal protective equipment are not available, it is imperative to refer the patient to a centre with such facilities

Modifications in regional procedures

➢Use droplet and contact level precautions at the minimum, bearing in mind the possibility of converting to general anaesthesia should regional anaesthesia fails. Airborne precautions are necessary if the patient requires high flow oxygen.

➢ Surgical masks should be worn by the patient throughout the procedure.

➢Use a pencil-point spinal needle for spinal anaesthesia. It may reduce the risk of introducing viral material into the CNS, as there is less tissue coring compared with cutting tip spinal needles.

➢ Full-length sheaths/covers for ultrasound probes to minimise contamination.

➢ Hand hygiene before and after procedure.

Donning of PPE:

1 Surgical scrubs to be worn. These will need to be changed with each case if a COVID-positive case is treated or there is any concern about soiling.

a. No jewellery to be worn

b. Scrub top to be tucked into scrub pants.

2 Thorough washing of hands for at least 20 seconds prior to initiating the donning process

3 -Shoe covers to be initially donned.

Thereafter, prior to scrubbing, don the N95 respirator mask with the surgical scrub cap over the N95 mask .

4 - A second method for eye protection should be used and worn over the respirator and scrub cap.

We recommend a surgical mask with a visor be used for eye protection. Disposable face shields may also be used.

Surgical safety goggles can be used as an alternative but will need to be sterilized after each case

a. Healthcare workers should ideally have N95 respirator masks fit-tested and the correct size respirator mask should be used

b. The scrub cap should cover both ears.

c. Prescription glasses/lead glasses on their own are not enough for protection.

d. The visor should adequately cover both eyes and provide some protection to the side of the face.

5- Thoroughly scrub hands to the level of the elbows using an anti-bacterial surgical scrub and warm water and prepare to gown.

6- Disposable surgical gown to be worn.

a. Take care to ensure that gown sleeves do not go beyond wrists as it is put on

b. Ensure that the top of the gown covers as much of the exposed neck area as possible.

7-. We recommend a two-glove technique. Put on two pairs of gloves ensuring that both gloves fit snugly and cover the sleeves of the gown.

Doffing of PPE:

There is a very high risk of contamination and therefore another individual should watch you doffing the PPE and alert you to any possibility of contamination.

i. Wash/clean the outer pair of gloves in water and thereafter remove the outer pair without touching the outside surface of the inner pair of gloves, and discard into a medical waste bin.

ii. Remove shoe-covers and discard (performed more easily if sitting on a chair).

iii. Cleaning hands between every step of the procedure is recommended.

iv. Clean internal pair of gloves with alcohol.

v. Remove the visor without touching the front/exposed surface of the visor and dispose directly into medical waste bin.

vi. Clean internal pair of gloves with alcohol.

vii. Remove the disposable gown by grasping the inside surface of the gown at the collar and rolling the gown away from you without touching the exposed surface of the gown.

viii. Clean internal pair of gloves with alcohol.

ix. Remove scrub cap.

x. Clean internal pair of gloves with alcohol and then remove.

xii. Clean hands with alcohol.

xiii. Remove N95 respirator mask by pulling the elastics over one's head and discard the mask without touching the exposed surface of the mask. The respirator is removed last to reduce the likelihood of exposure to aerosolized droplets during doffing.

xiv. Wash hands with soap and warm water.

xv. The chair used during doffing of overshoes should be cleaned with an alcohol scrub.

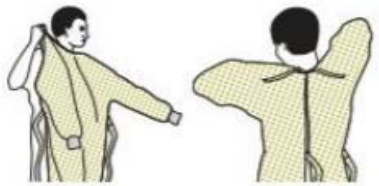
xvi. There is a recommendation that you then take a shower, but we aim to shower only before leaving the hospital.

SEQUENCE FOR PUTTING ON PERSONAL PROTECTIVE EQUIPMENT (PPE)

The type of PPE used will vary based on the level of precautions required, such as standard and contact, droplet or airborne infection isolation precautions. The procedure for putting on and removing PPE should be tailored to the specific type of PPE.

1. GOWN

- Fully cover torso from neck to knees, arms to end of wrists, and wrap around the back
- Fasten in back of neck and waist

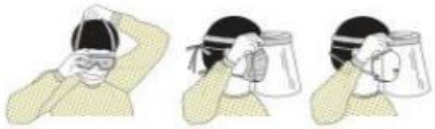


2. MASK OR RESPIRATOR

- Secure ties or elastic bands at middle of head and neck
- Fit flexible band to nose bridge
- Fit snug to face and below chin
- Fit-check respirator

3. GOGGLES OR FACE SHIELD

- Place over face and eyes and adjust to fit



4. GLOVES

- Extend to cover wrist of isolation gown

USE SAFE WORK PRACTICES TO PROTECT YOURSELF AND LIMIT THE SPREAD OF CONTAMINATION

- Keep hands away from face
- Limit surfaces touched
- Change gloves when torn or heavily contaminated
- Perform hand hygiene

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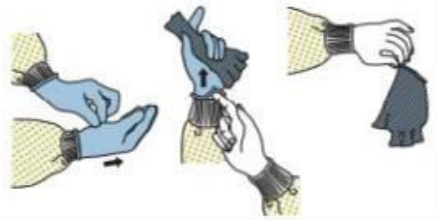
HOW TO SAFELY REMOVE PERSONAL PROTECTIVE EQUIPMENT (PPE) EXAMPLE 1

There are a variety of ways to safely remove PPE without contaminating your clothing, skin, or mucous membranes with potentially infectious materials. Here is one example. **Remove all PPE before exiting the patient room** except a respirator, if worn. Remove the respirator **after** leaving the patient room and closing the door. Remove PPE in the following sequence:

1. GLOVES

- Outside of gloves are contaminated!
- If your hands get contaminated during glove removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Using a gloved hand, grasp the palm area of the other gloved hand and peel off first glove
- Hold removed glove in gloved hand
- Slide fingers of ungloved hand under remaining glove at wrist and peel off second glove over first glove
- Discard gloves in a waste container



2. GOGGLES OR FACE SHIELD

- Outside of goggles or face shield are contaminated!
- If your hands get contaminated during goggle or face shield removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Remove goggles or face shield from the back by lifting head band or ear pieces
- If the item is reusable, place in designated receptacle for reprocessing. Otherwise, discard in a waste container

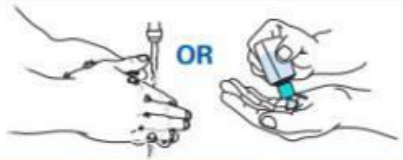
3. GOWN

- Gown front and sleeves are contaminated!
- If your hands get contaminated during gown removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Unfasten gown ties, taking care that sleeves don't contact your body when reaching for ties
- Pull gown away from neck and shoulders, touching inside of gown only
- Turn gown inside out
- Fold or roll into a bundle and discard in a waste container

4. MASK OR RESPIRATOR

- Front of mask/respirator is contaminated — DO NOT TOUCH!
- If your hands get contaminated during mask/respirator removal, immediately wash your hands or use an alcohol-based hand sanitizer
- Grasp bottom ties or elastics of the mask/respirator, then the ones at the top, and remove without touching the front
- Discard in a waste container

5. WASH HANDS OR USE AN ALCOHOL-BASED HAND SANITIZER IMMEDIATELY AFTER REMOVING ALL PPE



PERFORM HAND HYGIENE BETWEEN STEPS IF HANDS BECOME CONTAMINATED AND IMMEDIATELY AFTER REMOVING ALL PPE

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THANK YOU