



Disinfection of Environmental Surfaces and Articles Used for COVID 19 Patient

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Abstract: Disinfection of environment surfaces and articles used for COVID 19 patient plays an important role in reducing indirect transmission of SARS-CoV-2 – the virus responsible for COVID-19. Depending on the type of surface, SARS-CoV-2 can remain viable between eight hours to several days. The surfaces are contaminated when virus-containing droplets land on surfaces, or when someone with contaminated hands touches these surfaces. Virus contamination in both health care as well as non-health care settings can be reduced by good disinfection practices. Cleaning and disinfection is fundamental because it kills any remaining germs on the surface and thereby reduces the spread of germs. Therefore disinfection of the health care environment is vital in reducing infection rate. Following strict cleaning and disinfection protocols is the key to make sure that the patient as well as the health care worker remains safe. It is also important to increase awareness on how to clean and disinfect the articles used for Covid patient, so that the disease not spread to other patients and at the same time health care workers are protected. The disinfectant and its concentration should be carefully selected to avoid or minimize toxic effects on household members and also avoid damaging surfaces.

Keywords: Disinfection, Equipments, Sodium Hypochlorite, Glutaraldehyde Solution

1. Introduction

COVID-19 is an acute respiratory disease caused by a novel Coronavirus (SARS-CoV-2) It is transmitted through contaminated surfaces/objects as well as through respiratory droplets. [1]

Environmental high touch surfaces in health-care settings: furniture items such as tables, chairs, walls, light switches and computer peripherals, electronic equipment as well as the surfaces of medical equipment such as blood pressure cuffs, stethoscopes, wheelchairs and incubators carry risk of transmission of virus. Though the virus survives on environmental surfaces for varied period of time as shown in table 1, but it gets easily inactivated by chemical disinfectants. [2]

Table 1. Viability of SARS-CoV-2 on different surfaces.

Type of surface	Viability
Aerosols	Up to 3 hours
Stainless steel	Up to 72 hours
Cardboard	Up to 24 hours
Plastic	Up to 72 hours
Copper	Up to 4 hours

Coming into contact with contaminated surfaces and subsequently transferring the virus to mucous membranes may transmit the virus and infection. Therefore it is important to limit the spread and transmission of the virus by:

- Regular cleaning and disinfection of high touch surfaces like switches, countertops, handles, telephone, door knobs, tables etc
- Practicing hand hygiene
- Avoiding touching the face
- Using appropriate personal protective equipment (PPE).

The main objective of this review article is to provide updated information about disinfection of environmental surfaces and articles in context of the ongoing COVID 19 pandemic. It will also guide health-care professionals and health authorities in developing policies and standard operating procedures (SOP) on the cleaning and disinfection of environmental surfaces used for COVID-19 patient.

2. Principles of Environmental Cleaning and Disinfection

Cleaning is a first step in any disinfection process because it helps to remove pathogens on contaminated surfaces. Cleaning with water and soap/chemicals helps in physical removal of pathogens or any organic material (blood, secretions and excretions) from the surfaces. Therefore, a chemical disinfectant, such as chlorine or alcohol, (prepared and used according to the manufacturer's recommendations for volume and contact time) should be applied after cleaning to kill any remaining microorganisms. SARS-CoV-2 is sensitive to ultraviolet radiation, Heat (56°C for 30 minutes) and disinfectants as mentioned below. [3, 4]

Table 2. Guidelines for Preparation of sodium hypochlorite solution.

Disinfectant name	Stock solution / available concentration	Composition	End product/chlorine
Sodium hypochlorite (household bleach)	3.5%	1 litre (1 volume) of bleach to 2.5 litres. (2.5 volume) of water 1:2.5	1%
Sodium hypochlorite (household bleach)	5%	1 litre (1 volume) of bleach to 4 litres. 4 volume of clean water 1:4	1%
Sodium hypochlorite (household bleach)	6%	1 litre (1 volume) of bleach to 5 litres. (5 volume of clean water 1:5	1%
Sodium hypochlorite (household bleach)	10%	1 litre (1 volume) of bleach to 9 litres. (9 volume of clean water 1:9)	1%
Bleaching powder			
70% 7g g to 1	70%	7g to 1 litre water	1%
litre water	25%	80gm to 1 litre water	1%
bleaching powder chloramines powder			

According to CDC guidelines, hypochloride solution should be prepared fresh in a ventilated area with a contact time at least 10 minutes and avoiding direct contact with the skin and eyes. The fresh prepared solution should be prepared and stored in plastic containers as it is corrosive to metal surfaces.

The other important points to be kept in mind while using hypochlorite solution is to always check the concentration of sodium hypochlorite in bleach and prepare as recommended. Cleaning staff should be attired in suitable PPE. Do not use disinfectants spray on potentially highly contaminated areas as it may create splashes. Avoid mixing the bleach solution with acidic solution as it may release ammonia which can be very toxic. [6]

3.2. Alcohol Based Disinfectant

The European Centre for Disease Prevention and Control (ECDC) recommends alcohol based disinfectants with an concentration 60-80% (Ethyl alcohol or isopropyl alcohol) which is a potent virucidal agent inactivating all of the lipophilic viruses. 70% isopropyl alcohol works as intermediate level germicidal agent to disinfect non critical items in hospital settings like BP cuff, thermometer, skin asepsis before any aseptic procedure. Isopropyl alcohol volatility changes with the storage time specially when exposed to light. Since alcohol is flammable, it should be used in well-ventilated spaces only. When alcohol are used repeatedly for Prolonged period of time, it can cause discoloration,

3. Common Chemical Disinfectants

Sodium hypochlorite solution, alcohol based disinfectants, Glutaraldehyde solution and Hydrogen peroxide 0.5% are the *common chemical disinfectants* which break the chain of transmission of infection of SARS-COV-2

3.1. Sodium Hypochlorite Solution

Sodium hypochlorite is used for a variety of cleaning and disinfecting purposes as a common bleaching agent.

Table 2 shows Guidelines for Preparation of sodium hypochlorite solution as recommended by WHO. [5]

swelling, hardening and cracking of rubber and certain plastics. [7]

3.3. Glutaraldehyde Solution

Glutaraldehyde solution (2.45%) is a high-level disinfectant which is most commonly used for disinfection of medical equipment such as endoscopes, spirometry tubing, dialyzers, transducers, anesthesia and respiratory therapy equipment, hemodialysis dialysates, and reuse of laparoscopic disposable plastic trocars. The contact time of at least 20 minutes (at or above 20°C) is effective for this high-level disinfectant solution. It has shelf life of 14 days when gets activated (by use of alkalinizing agents to make pH 7.5–8.5). The benefits of using Glutaraldehyde is that it is noncorrosive to metal and also does not damage lensed instruments, plastics or rubber. [8]

3.4. Hydrogen Peroxide

Kampf G, Todt D, Pfaender S, Steinmann E; 2020 have shown effective disinfection activity of Hydrogen peroxide at a concentration of 0.5% within less than 3 minutes against Corona-virus. Hydrogen peroxide 0.5% is shown with microbicidal activity against this virus within 1-minute exposure time. Hydrogen peroxide is a stable and effective disinfectant for inanimate surfaces like disinfecting soft contact lenses, tonometer biprisms, ventilators, fabrics and endoscopes. [9]

4. General Recommendation for Disinfection

4.1. Surface Disinfection

- i. Cleaning and disinfection should follow a consistent and correct routine in line with standard hospital grade disinfection procedure. The cleaning routine should involve an initial wash with a water and detergent solution followed by disinfection agents.
- ii. Cleaning should start from the cleanest to the dirtiest areas and higher surface to lower surfaces.

Disinfectant solutions must be prepared and used according to the manufacturer's recommendations for volume and contact time. [10]

- iii. Follow the manufacturer's instructions to ensure that disinfectants are prepared and handled safely, wearing the appropriate personal protective equipment (gown, heavy duty gloves, medical mask, eye protection (if risk of splash from organic material or chemicals), and boots) to avoid chemical exposure.
- iv. When preparing a disinfectant solutions, it should always be prepared in well-ventilated areas. Combining disinfectants, both during preparation and usage should be avoided as may cause respiratory irritation.
- v. Chlorine solutions should not exposed to direct sunlight. Freshly prepared chlorine solutions should be used every day.
- vi. *High touch surfaces in health care settings (Bed rails, Bed frames, Moveable lamps, Tray table, Bedside table, door handles, IV poles, Blood-pressure cuff, Wall area around the toilet in patient room, Mobile and telephone, Computer, mouse, key board, Lift buttons, Hand rails (stair case), and side rails of Chair arm etc.) should be cleaned and disinfected with 1% Sodium Hypochlorite or 70% isopropyl alcohol, more frequently (4 hourly or earlier) or after COVID + patient contact. 70% alcohol is used to wipe down metallic surfaces like door handles, security locks, keys etc. where the use of bleach is not suitable.*
- vii. For room cleaning, use a steady sweeping motion to prevent the creation of aerosols or splashing.
- viii. For floor cleaning, use detergent and 1% Sodium Hypochlorite. Three buckets, one with plain water and one with detergent solution; one bucket for 1% sodium hypochlorite. First mop the area with the warm water and detergent solution after mopping.

- ix. Ceilings and walls should be damp dusted with 1% Sodium Hypochlorite and doors should be washed with brush after cleaning with 1% Sodium Hypochlorite

The cleaning of toilets, bathrooms, sinks and other wet areas to be done with caution to ensure that no splashes are caused. [6]

4.2. Terminal Cleaning of COVID 19 Patient's Room [11]

- i. Detergent or disinfectant solutions must be discarded after each use in areas with suspected/confirmed patients with COVID-19. Freshly prepared solutions should be used every day or for each cleaning shift.
- ii. Buckets should be washed with detergent. Soaked the bucket in bleach solution or rinse in hot water to disinfect it. It should be dried and stored inverted to drain fully when not in use.
- iii. The inner and outer surface of containers/bins/trolleys should be disinfected with 1% sodium hypochlorite solution.
- iv. After cleaning, all washable items of textiles (pillow, linen, curtains) before laundering, placed in 1% hypochlorite up to 30 minutes and then, packed and sent to laundry.
- v. All textiles should be washed in a hot water cycle only with regular laundry detergent at a minimum wash temperature of 90°C. However textiles that cannot undergo a hot wash, additives such as then bleach or equivalent decontamination should be used.
- vi. Mattresses / pillows after spraying with 1% hypochlorite should be allowed to get dry (both sides) in bright sunlight for upto 3 hrs each.
- vii. Wipe down all accessible surfaces of walls as well as blinds with bleach solution.
- viii. Remove PPE, discard in a disposable PPE in color coded bag dedicated to COVID 19 disposals bag and wash hands with soap and water. [12]

4.3. Articles Disinfection. [13, 14]

Patient care items that can contribute to the spread of infection include Stethoscopes, Blood pressure cuffs, Monitors, X ray machine, USG machine, Stretchers, backboards, and immobilization devices, Laryngoscope blades, beds/ railings, ventilators, cardiac monitors etc. Table no 3 shows the cleaning and disinfection of articles used in care of COVID 19 patient.

Table 3. Cleaning and Disinfection guidelines of articles.

Item	Agent	Method
Stethoscope	Alcohol based rub/ Spirit Swab	Should be cleaned detergent and water. Should also be wiped with alcohol based rub/spirit swab before each patient contact
BP Cuffs & Covers	Alcohol based disinfectant	Cuffs should be wiped with alcohol- based disinfectant and regular laundering is recommended for the cover/ cuff
Thermometer	Wipe with alcohol rub in between each patient use	Should be stored dry and Clean with detergent and tepid water and wipe with alcohol rub in between patient use. Preferably one thermometer for each patient
Injection & Dressing	Detergent and water & 70% Alcohol	Clean Daily with detergent & water. After each use, should be wiped with

Item	Agent	Method
Trolley		disinfectant.
Ventilator, Monitor, Defibrillator, USG machine Mobile phones and landline phones	70% isopropyl Alcohol or Bacillol-25 spray <i>Alcohol wipes</i>	Disinfectant will work only when detergent removes the organic matter Twice per shift and also before leaving workplace. Switchoff during wiping.
Ventilator tubings	<i>ETO or plasma sterilization</i> <i>Gluteraldehyde 2.5%</i>	Enzymatic cleaning should be done first and then send for ETO /plasma sterilization
Ventilator-Suction apparatus	<i>Gluteraldehyde 2.5%</i>	Discard the suction fluid as per BMW rule, then immerse in detergent followed by water and finally in <i>Gluteraldehyde 2.5% for 30 min</i>
Tracheostomy tubes	<i>Gluteraldehyde 2.5%</i> <i>Isopropyl alcohol 70%</i>	Clean the tubing for any secretions. Immerse in <i>Gluteraldehyde 2.5% for 25 to 30 minutes and rinse with tap water before reuse. If Isopropyl alcohol is used then after cleaning of secretions, immerse in 70% alcohol for at least 5 minutes</i>

4.4. Ambulance Disinfection in Health Care Setting: [13, 14]

There should be designated ambulances for transporting COVID suspect/ confirmed cases only. Ensure strict adherence to cleaning and decontamination protocols.

1. Complete PPE are recommended for sanitation staff cleaning the ambulance.
2. Clean all contact surfaces (e.g., stretcher, rails, control panels, floors, walls and work surfaces) using 1% Sodium Hypochlorite solution
3. Allow contact time of 30 minutes and allow air dry.
4. Damp mop floor with 1% sodium hypochlorite disinfectant
5. Discard disposable items and Infectious waste in a Bio/Hazard bag.
6. Remove gloves and wash hands.

Clean and disinfect reusable patient-care equipment before use on another patient with alcohol based rub.

5. Discussion

There are various articles which supports the importance of proper disinfection as the effective means to reduce the spread of the disease.

Adrija Roy, Swayam Pragyan Parida, Vikas Bhatia suggested that surface disinfection and handwashing with soap and water is the fastest, easiest, and most effective way to halt or reduce the spread of SARS-CoV-2 the virus resulting in the coronavirus disease (COVID-19). [15]

The importance of Disinfection was suggested by Kampf G, Todt D, Pfaender S, Steinmann E. to be an effective method to reduce the viral load on surfaces. [9]

The Australian Government Department of Health claimed that virucidal agent such as hypochlorite solution is sufficient to inactivate the virus. [16]

Hulkower and colleagues recommend that 1:100 solution of sodium hypochlorite, mixed in accordance with manufacturer recommendations, as effectively inactivating coronaviruses. [17]

6. Conclusion

Disinfecting of the environmental surfaces and the article used for covid19 patient will not only reduce the spread of disease but also will bring a significant change in reduction

in the infection rate among health care workers.

It is paramount to ensure availability of recommended disinfectant and cleaning materials in health care settings. Cleaning staff should also be trained as per the WHO recommended procedures and hospital protocols on decontamination practices.

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