



COVID-19: CLEANING AND DISINFECTION OF HOSPITAL SURFACES AND EQUIPMENT

Author: Casey Marnie, Dr Micah DJ Peters

Date: July 16 2020

Question: What is the best available evidence regarding the cleaning and disinfection of hospital surfaces and/or equipment contaminated by COVID-19?

***ALERT* Evidence regarding COVID-19 is continually evolving. This Evidence Brief will be updated regularly to reflect new emerging evidence but may not always include the very latest evidence in real-time.**

Key messages:

- The evidence for disinfection and cleaning of hospital surfaces and equipment to sterilise against COVID-19 is largely informed by recommendations for similar coronaviruses such as SARS and MERS.
- 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 using hospital grade virucidal agents; 0.1% sodium hypochlorite or 70% ethyl alcohol solutions.
- The contact time for disinfectants to surface should always exceed one minute as a minimum.
- Cleaning and disinfecting of equipment should follow the recommendations of the manufacturer or relevant WHO guidelines for the disinfection of hospital grade equipment.
- Equipment should be single use where possible, however where it cannot be, equipment should be cleaned between patients using 70% ethyl alcohol solutions.
- Any equipment used in the treatment of COVID-19 patients should be dedicated to COVID-19 treatment areas where possible.
- Evidence suggests that the COVID-19 virus denatures at temperatures similar to other closely related coronaviruses and so textiles should undergo hot wash with standard laundry detergent at temperatures in excess of 70°C for sterilisation. Where this is not possible, a cooler wash with a bleach solution may be recommended.

Summary

Overall the evidence for the disinfection and cleaning of surfaces to sterilise against SARS-CoV-2, the virus responsible for COVID-19, is largely based on research conducted in regard to other Coronavirus' such as SARS, MERS, and 229E. Cleaning and disinfection procedures should follow a correct and consistent routine based on standard procedures for hospital grade disinfection. Specifically, these cleaning procedures should involve an initial clean with a water and detergent solution, followed by the use of a hospital grade virucidal disinfectant, 0.1% sodium hypochlorite solution or a 70% ethyl alcohol solution. The contact time of disinfectants to surface should at a minimum always exceed one minute.

Background

COVID-19 pandemic

COVID-19 (from 'severe acute respiratory syndrome coronavirus 2' (or 'SARS-CoV-2') is a newly discovered (novel) corona virus first identified in Wuhan, Hubei province, China in 2019 as the cause of a cluster of pneumonia cases.¹ Coronaviruses are similar to a number of human and animal pathogens including some of those which cause the common cold as well as more serious illnesses including Severe Acute Respiratory Syndrome (SARS or SARS-CoV-1) and Middle East Respiratory Syndrome (MERS). Since discovery, COVID-19 has spread to many countries and was declared a global emergency by the World Health Organization (WHO) on January 30, 2020,¹ and a pandemic on March 11.²

Summary of Evidence

Transmission of SARS-CoV-2

While evidence regarding the specific transmission mechanisms of SARS-CoV-2 are still emerging, it appears that it follows similar droplet and environmental contamination patterns to other respiratory viruses with some evidence suggestive of the potential for transmission via smaller airborne droplets which may also collect on surfaces. The virus has been detected in upper and lower respiratory tract excretions as well as faeces.³ Viral ribonucleic acid (RNA) has also been identified in some blood samples however, there is no evidence to date suggesting that it is bloodborne or transmitted in faecal matter. In literature to date the virus is most commonly observed to be transmitted through the inhalation of respiratory droplets or deposition on mucosae (mouth, nose, and eyes).⁴

Surface and airborne persistence of SARS-CoV-2

The presence and persistence of SARS-CoV-2 in the clinical environment is currently unclear, however experiments conducted under controlled laboratory conditions have provided some indication of its survivability in different environmental conditions.⁵ Research conducted specifically on SARS-CoV-2 found it to be most stable on plastic or steel substrates with viable traces of the virus detectable after 72 hours. There was no viable trace of the virus remaining on cardboard after 24 hours and when applied to copper, the surface was no longer infectious after four hours. When purposefully aerosolised the study found the virus to have remained airborne after three hours.⁵

In the absence of sufficient evidence in regard to SARS-CoV-2, a review of 22 studies looked to summarise available data on the persistence of other closely related coronaviruses such as SARS and MERS.⁵ The review identified that human coronaviruses are able to persist on inanimate, room temperature surfaces for up to nine days.⁶ While there was no evidence for the transmissibility of the coronavirus under these conditions, a study of parainfluenza virus 3 and Influenza A indicated that an infected surface transmitted 1.5 percent and 30.6 percent of a viral load respectively, within five seconds of hand contact. Disinfection was suggested to be an effective method to reduce the viral load on surfaces and other studies provided further evidence to suggest that the disinfection of hospital surfaces and equipment would be an effective measure in reducing the risk of exposure to healthcare workers and inhibiting the spread of coronaviruses.⁶

As SARS-CoV-2 may travel in small aerosolised droplets (<5µm) as well as larger droplets (>5-10 µm), surfaces where these droplets settle require disinfection.

Disinfectants

Peak organisations make similar recommendations on the application of disinfectants to surfaces potentially infected with SARS-CoV-2, most of these recommendations however are made based on evidence provided in relation to coronavirus related to SARS-CoV-2 and not to the virus itself.

The WHO recommends the thorough cleaning of surfaces with water and detergent, followed by the application of a hospital grade disinfectant such as sodium hypochlorite.⁷ This advice does however appear to be based on recommendations made in consideration of potentially scant resources, and so other disinfectants may also be viable.⁸

The European Centre for Disease Prevention and Control (ECDC) recommend the ventilation of rooms in conjunction with the cleaning of surfaces, which should be achieved using a neutral detergent followed by the use of a virucidal disinfectant. Where virucidal disinfectants are not available the ECDC recommends the use of 0.05% sodium hypochlorite solution or an ethanol based disinfectants with an ethanol concentration exceeding 70%.⁴ Studies described below found this concentration of sodium hypochlorite to be insufficient to effectively inactivating coronaviruses.

The Centers for Disease Prevention and Control (CDC) recommend routine cleaning and disinfection procedures similar to those recommended by WHO and the ECDC, i.e. using detergent and water to pre-clean surfaces followed by the application of a hospital-grade disinfectant.⁹ In conjunction with this recommendation the CDC also recommend the use of Environmental Protection Agency (EPA) approved disinfectants. The EPA have published a list of disinfectants approved for use against COVID-19 however the listed disinfectants have not been directly tested against COVID-19 and have only proven effective against killing 'hardier virus' or other similar human coronavirus'.^{10, 11}

In line with the recommendations of the above bodies, the Australian Government Department of Health also indicates the use of any disinfectant on the Australian Register of Therapeutic Goods that makes a virucidal claim as being sufficient to inactivate the virus including bleach (such as sodium hypochlorite).¹²

Kampf and colleagues identified the use of either a 62-71% ethanol, 0.5% hydrogen peroxide or 0.1% sodium hypochlorite solution as effectively disabling a human coronavirus' within one minute of application when the application of the disinfectant was incorporated into a thorough decontamination procedure.⁶ Another study by Lai and colleagues found the use of common disinfectants such as sodium hypochlorite and sodium lauryl ethyl sulphate was effective in eliminating the SARS-CoV-1 virus from surfaces within five minutes of application, where the surface was not overtly contaminated with secretions or excreta.¹³ In support of these findings a review of evidence has described coronaviruses other than SARS-CoV-2 as being efficiently inactivated in the presence of the above described disinfectants however notes that the efficacy of these agents against SARS-CoV-2 specifically had not been tested.¹⁴ Notably, Hulkower and colleagues identified a 0.06%, 1:100 solution of sodium hypochlorite, mixed in accordance with manufacturer recommendations, as effectively inactivating coronaviruses.¹⁵ The study recommends increased concentrations of 0.1 - 0.5% be applied and contact time ensured for at least one minute. These recommendations echo findings of other studies suggesting that a 0.1% concentration of sodium hypochlorite effectively inactivated the virus.¹⁶

Consistent and Correct cleaning of Surfaces and Equipment

Many institutions for disease control, inclusive of the WHO and the US CDC make clear recommendations for the routine cleaning of surfaces potentially contaminated by SARS-CoV-2. The disinfection is to be conducted consistently and correctly in adherence to standard disinfection procedures and may be applicable to all areas inclusive of those where aerosol generating procedures have been carried out. It is important however to ensure these areas are effectively ventilated and that appropriate Personal Protective Equipment (PPE) is worn by cleaning staff.^{4, 7, 9, 12}

Standard cleaning procedure should involve an initial cleaning of infected or potentially infected surfaces using a water and detergent mix to ensure the area is free of organic matter. Evidence suggests that the presence of organic matter inhibits the effectiveness of subsequently applied disinfectants such as sodium hypochlorite through a mechanism of oxidant demand created by the proteinaceous medium in which the virus would naturally be found.¹⁵ Following the initial clean, surfaces should then be subsequently wiped with a hospital grade disinfectant such as those described previously, and a contact time of at least one minute adhered to.⁴

Cleaning of hospital equipment should be conducted in line with manufacturers recommendations and/or by following the Decontamination and Reprocessing of Medical Devices guidelines as set out by the WHO;¹⁷ disinfectants recommended for the cleaning of equipment include virucidal treatments or 70% ethyl alcohol disinfectant. Although single use equipment should be prioritised, where it cannot be, equipment should be cleaned between patients using the above mentioned disinfectants and where possible confined to use in COVID-19 treatment areas.^{4, 7, 9}

Other general recommendations to be followed over the course of cleaning include:^{4, 7}

- The cleaning of toilets, bathrooms, sinks and other wet areas to be done with caution to ensure that no splashes are caused.
- Cleaning equipment should be separated for different healthcare settings and where cleaning equipment is in short supply the cleaning process should move from cleanest areas to the dirtiest.

All textiles should be washed in a hot water cycle only with regular laundry detergent at a minimum wash temperature of 90°C. Where textiles cannot undergo a hot wash then bleach or equivalent decontamination additives should be used. SARS-CoV-2 has been found to be inactivated under laboratory conditions at temperatures in excess of 56°C after 30 minutes and at temperatures in excess of 70°C after five minutes. The virus was also found to be inactive in solutions of bleach and other household disinfectants after five minutes of incubation.¹⁸ Further laboratory testing confirms that the use of heat is effective in denaturing the SARS-CoV-2 virus.¹⁹

References

1. World Health Organization. Rolling updates on coronavirus disease (COVID-19): World Health Organization; 2020. Available from: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen>.
2. World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020. Available from: <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>.
3. Wu Y, Guo C, Tang L, Hong Z, Zhou J, Dong X, et al. Prolonged presence of SARS-CoV-2 viral RNA in faecal samples. *The Lancet Gastroenterology and Hepatology*. 2020.
4. European Centre for Disease Prevention and Control. Disinfection of environments in healthcare and non-healthcare settings potentially contaminated with SARS-CoV-2: European Centre for Disease Prevention and Control. 2020. Available from: https://www.ecdc.europa.eu/sites/default/files/documents/Environmental-persistence-of-SARS_CoV_2-virus-Options-for-cleaning2020-03-26_0.pdf.

5. Doremalen Nv, Bushmaker T, Morris DH, Holbrook MG, Gamble A, Williamson BN, et al. Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. 2020.
6. Kampf G, Todt D, Pfaender S, Steinmann E. Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. *Journal of Hospital Infection*. 2020;104(3):246-51.
7. World Health Organization. Infection prevention and control during health care when novel coronavirus (nCoV) infection is suspected: World Health Organization; 2020. Available from: [https://www.who.int/publications-detail/infection-prevention-and-control-during-health-care-when-novel-coronavirus-\(ncov\)-infection-is-suspected-20200125](https://www.who.int/publications-detail/infection-prevention-and-control-during-health-care-when-novel-coronavirus-(ncov)-infection-is-suspected-20200125).
8. Centers for Disease Control and Prevention and ICAN. Best Practices for Environmental Cleaning in Healthcare Facilities in Resource-Limited Settings. Atlanta: US Department of Health and Human Services; 2019.
9. Centers for Disease Control and Prevention. Interim Infection Prevention and Control Recommendations for Patients with Suspected or Confirmed Coronavirus Disease 2019 (COVID-19) in Healthcare Settings: Centers for Disease Control and Prevention; 2020. Available from: https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-ncov%2Finfection-control%2Fcontrol-recommendations.html.
10. Environmental Protection Agency. How does EPA know that the products on List N work on SARS-CoV-2? : Environmental Protection Agency; 2020. Available from: <https://www.epa.gov/coronavirus/how-does-epa-know-products-list-n-work-sars-cov-2>.
11. Environmental Protection Agency. List N: Disinfectants for Use Against SARS-CoV-2: Environmental Protection Agency; 2020. Available from: <https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2>.
12. Australian Department of Health. Environmental cleaning and disinfection principles for health and residential care facilities. 2020.
13. Lai MYY, Cheng PKC, Lim WWL. Survival of Severe Acute Respiratory Syndrome Coronavirus. *Clinical Infectious Diseases*. 2005;41(7):e67-e71.
14. Lai C-C, Shih T-P, Ko W-C, Tang H-J, Hsueh P-R. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges. *International Journal of Antimicrobial Agents*. 2020;55(3):105924.
15. Hulkower RL, Casanova LM, Rutala WA, Weber DJ, Sobsey MD. Inactivation of surrogate coronaviruses on hard surfaces by health care germicides. *American Journal of Infection Control*. 2011;39(5):401-7.
16. Sattar SA, Springthorpe VS, Karim Y, Loro P. Chemical disinfection of non-porous inanimate surfaces experimentally contaminated with four human pathogenic viruses. *Epidemiol Infect*. 1989;102(3):493-505.
17. World Health Organization. Decontamination and Reprocessing of Medical Devices for Health-care Facilities. 2016.
18. Chin AWH, Chu JTS, Perera MRA, Hui KPY, Yen H-L, Chan MCW, et al. Stability of SARS-CoV-2 in different environmental conditions. *Lancet Microbe*. 2020.
19. Pastorino B, Touret F, Gilles M, De Lamballerie X, Charrel RN. Heat Inactivation of Different Types of SARS-CoV-2 Samples: What Protocols for Biosafety, Molecular Detection and Serological Diagnostics? *Viruses*. 2020;12(7):735.