

COVID-19: Infection prevention and control guidance for all ultrasound practitioners

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Abstract

The severe acute respiratory syndrome coronavirus (SARS-CoV-2), an enveloped virus, is the causative agent of the disease known as COVID-19 (coronavirus disease-2019). Proper infection prevention and control measures and good hygiene practices are essential to prevent spread of COVID-19 and protect both patients and the healthcare worker. These guidelines are relevant to all ultrasound practitioners and provides guidance on cleaning and disinfection of ultrasound equipment, the environment and PPE (protective personal equipment) during the COVID-19 outbreak in the Australasian region.

Keywords: COVID-19, disinfection, guidelines, imaging, infection prevention, IPC, SARS-CoV-2, ultrasound; PPE.

Introduction

The severe acute respiratory syndrome coronavirus (SARS-CoV-2), an enveloped virus, is the causative agent of the disease known as COVID-19 (coronavirus disease-2019). The virus is transmitted via the droplet and contact route,¹ and there is a higher risk of virus transmission when aerosol-generating procedures are performed. The median incubation period for COVID-19 is approximately 5 days² with symptoms appearing 2–14 days post-exposure.

There are also increasing reports of asymptomatic carriers of the disease,³ who can potentially be a latent infection source of COVID-19 during the incubation period.⁴ It is this latter group that poses an increased risk to ultrasound practitioners. Of residents infected with COVID-19 in a region of Italy, 50–75% were asymptomatic.⁵ Healthcare workers who wore no personal protection equipment (PPE) have been infected after treating asymptomatic patients.⁶

The Communicable Disease Network of Australia (CDNA), defines two key circumstances whereby risk of COVID-19 is the highest: close and sustained personal contact.⁷ The simplest control measures to interrupt droplet and contact

transmission is social distancing, or keeping at least 1.5 to 2 m apart, and implementing hand hygiene. When close contact with an infected patient is required, personal protective equipment (PPE) should be worn, for example, a surgical mask, eye protection, gown and gloves. When aerosol-generating procedures (AGPs) are performed, such as transoesophageal echocardiography, and higher risk procedures such as exercise echocardiography or vascular studies using a treadmill, the surgical mask may be replaced with a P2/N95 respiratory protection mask.

To date, there have been a number of international position statements released for ultrasound practitioners in the context of COVID-19.^{8–11}

This guidance document provides advice on cleaning and disinfection of the environment, ultrasound equipment and wearing of PPE by ultrasound practitioners during the COVID-19 pandemic for the Australasian region.

It is relevant to all ultrasound practitioners (sonographers, sonologists, nurses, allied health professionals etc) utilising ultrasound for diagnostic imaging during the COVID-19 pandemic. It has been written to protect both patients and healthcare workers, particularly when scanning COVID-19-suspected or COVID-19-confirmed patients. As the evidence base for COVID-19 is rapidly evolving, this document is current at time of publication and further updates may be provided as new evidence emerges.

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doi: 10.1002/ajum.12210

This document is intended to be a helpful resource for ultrasound practitioners and not an exhaustive guide. Please refer to jurisdictional information to stay compliant with their requirements.

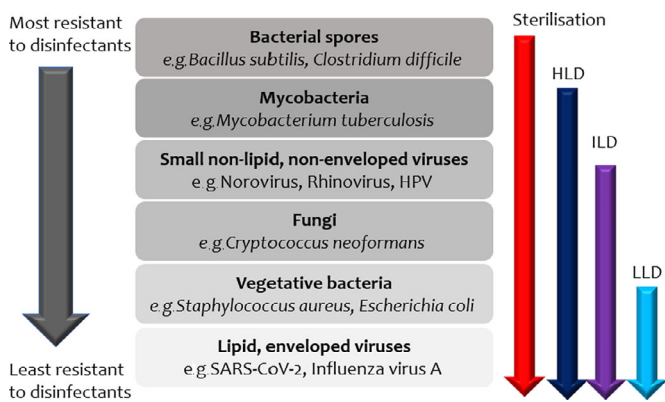


Figure 1: Levels of resistance to disinfectants by microorganisms

Survival of SARS-CoV-2 virus on surfaces

The SARS-CoV-2 virus can survive on surfaces for up to 3–7 days depending on the type of surface and humidity.^{12,13,14} Due to the lipid bilayer structure of SARS-CoV-2, the virus is susceptible to low-level disinfectants (Figure 1).

Selection of disinfectants for COVID-19

When selecting a disinfectant, it is important to consider whether it is suitable for the surfaces that need to be disinfected (e.g. environmental or medical instrument/device). In simple terms, *hospital-grade disinfectants* can be used to disinfect hard surfaces after cleaning and *instrument-grade disinfectants* can be used to disinfect medical devices after cleaning.

Disinfectants can be categorised as high-level (HLD), intermediate-level (ILD) or low-level (LLD) according to the spectrum of activity.

Based on other human coronaviruses, studies have shown that SARS-CoV-2 is easily denatured by standard low or intermediate level disinfection methods including the use of 70% ethanol, 0.5% hydrogen peroxide, 0.1% sodium hypochlorite and 0.05–0.2% benzalkonium chloride.¹¹

Environmental surface cleaning and disinfection

Environmental surface cleaning and disinfection is a critical component of infection prevention. In general, thorough cleaning with detergent and water or a detergent impregnated wipe is suitable for frequently touched surfaces; however, during this pandemic inclusion of a disinfection step is recommended to minimise risks for transmission of COVID-19.¹⁵

According to the Australian Therapeutic Goods Administration (TGA), hospital-grade disinfectants with virucidal claims are suitable for use on pre-cleaned, hard surfaces to eliminate SARS-CoV-2. Commonly used products include sodium hypochlorite at a dilution of 1000 ppm and products with TGA approved, specified virucidal claims.

Cleaning and disinfection can be achieved by using a 2-step process, that is cleaning followed by disinfection or by using a

2-in-1 product, that is a combined detergent/disinfectant wipe or solution.

When using any cleaning or disinfection product, the manufacturer's instructions for use must be followed including:

- Any cleaning advice (how to remove debris before disinfection)
- Dilution of the product (if applicable)
- Application method
- Contact time, or 'wet' time which states how long the product needs to be on the surface to inactivate microorganisms.

The ultrasound room should be cleaned thoroughly each morning, and all areas should be wiped with a hospital-grade disinfectant. Particular care should be given to high touch surfaces such as door handles, stretcher rails/bed edges and light switches.

If possible, all fabric covered chairs should be replaced with hard surface chairs that can be easily disinfected. To ensure a clean working environment, it is recommended that all unnecessary accessories in the ultrasound room be removed or stored in cabinets.

Gloves should always be used when cleaning and disinfecting any equipment, and protective eyewear may be necessary in situations where there is a risk of splashing. Hand hygiene is essential and should be practised in accordance with the 5 moments,¹⁸ including after removal of gloves.

Ultrasound probe and machine disinfection

As the SARS-CoV-2 is denatured easily by disinfectants, the exposed components of the ultrasound unit and all ultrasound probes used for external, non-critical procedures must be cleaned and then disinfected with an approved low- or intermediate-level instrument-grade disinfectant. It is important to ensure that the disinfectants are approved for use on ultrasound probes and has proven virucidal efficacy.

In the context of COVID-19 pandemic, there is no change in practices for cleaning and high-level disinfection of probes that are used for intracavity ultrasound; or probes used on critical aseptic fields or probes that have been contaminated through contact with blood, mucous membranes or bodily fluids during use.

Cleaning and disinfection steps for external probes include the following:

Step 1: Cleaning: remove all debris (e.g. ultrasound gel) with paper/cloth then use a neutral detergent, that is wash with detergent and water, rinse and dry thoroughly or use a detergent impregnated wipe approved for use on medical devices.

Step 2: Disinfection can be achieved with an approved low- or intermediate-level instrument-grade disinfectant wipe or solution.

The manufacturer's instructions for use must be followed, and all products must be approved for use on ultrasound probes.

It is important to clean and disinfect the entire ultrasound machine, particularly the keyboard, screen and ultrasound probe cord with an approved ultrasound machine detergent/disinfectant wipe or solution. Consideration could also be given to using disposable barriers to minimise surface contamination. These would be disposed of after use, followed by cleaning and disinfection.

The ultrasound machine has many components, some of which can be difficult to disinfect. In the hospital environment, where possible, a dedicated ultrasound machine for scanning COVID-19-positive patients should be allocated.

Workstations

The same cleaning and disinfection steps need to be applied to computer workstations and desks used by the ultrasound practitioner for reporting. If possible, a policy of one person per workstation and one person per scanning room per day should be applied. These workstations should also undergo routine environmental cleaning.

Personal protective equipment

The spread of the SARS-CoV-2 virus is known to occur via contact and respiratory droplets. According to the recommendations from the CDNA,⁷ and due to the nature of performance of ultrasound in close proximity to the patient and for a prolonged period of time, standard PPE such a surgical mask along with gowns, gloves and hand hygiene measures should be considered for all ultrasound practitioners.

Recommendations for healthcare workers are as follows:

- 1 Gloves: After performing hand hygiene, clean non-sterile gloves should be donned upon entry into the patient room or care area. Once the ultrasound examination is complete, remove and discard gloves and immediately perform hand hygiene.
- 2 Masks: As ultrasound practitioners are in close contact with patients, surgical facemasks are recommended to offer protection when performing ultrasound examinations on any patient.¹⁶ The NSW Government have listed the use of Level 1 surgical masks for healthcare workers performing any procedure involving minimal risk of exposure to droplets or other body substances. Correctly fitted masks must be put on before entry into the patient room or care area. P2 or N95 respirators should be used instead of a surgical mask when performing or present for an aerosol-generating procedure (AGP), particularly for use in the intensive care unit. It is important not to touch masks once they have been put on and to perform hand hygiene after removal of masks.
- 3 Protective eyewear: Must be worn for all contact with suspected or confirmed COVID-19-positive patients. For COVID-19-suspected or COVID-19-confirmed patients, goggles or a disposable face shield that must be put on when entering the patient room or care area. When practising

Standard Precautions during ultrasound examinations on any other patient, eyewear should be worn when there is anticipated risk for splash or spray of blood or body substances or when an aerosol-generating procedure is being conducted. Reusable eye protection must be cleaned and disinfected according to manufacturer's reprocessing instructions prior to re-use. Disposable eye protection should be discarded after use

- 4 Gowns: For COVID-19-suspected or COVID-19-confirmed patients, wearing a clean isolation gown upon entry into the patient room or care area is essential. Reusable gowns should be discarded in a soluble plastic bag before being placed in the laundry container or linen receptacle. Disposable gowns should be discarded after use in to general or clinical waste according to usual practices.

If there are shortages of gowns, they need to be prioritised for aerosol-generating procedures and high contact patient care activities that provide opportunities for transfer of pathogens to the hands and clothing.

Note: Additional training on PPE for healthcare workers is advised and should include donning and doffing guidance.¹⁷

In regions where the number of COVID-19-positive cases are low, and where instances of community transmission are not reported in a local area, ultrasound practitioners may choose to use standard precautions during ultrasound examination and not wear an isolation gown and surgical mask. Appropriate management and risk assessment should continue to be implemented should this change or require contact tracing in the future.

Hand hygiene

Performing hand hygiene is an essential component for the prevention of an infection. All ultrasound practitioners should perform hand hygiene¹⁸ before and after all patient contact, contact with potentially infectious material (e.g. bed linen and patient gowns), and before and after removing personal protective equipment (PPE) including gloves.

Hand hygiene should be performed using an alcohol-based hand rub that has been entered on the Australian Register of Therapeutic Goods or washing hands with soap and water for at least 20 seconds. If hands are visibly soiled, use soap and water.

Clothing

Personnel who will come into contact with COVID-19-positive or COVID-19-suspected patients, especially those working in high-risk environments (e.g. ICU/emergency depts) should don a uniform or scrubs that are not taken home for laundering.

Ultrasound practitioners should routinely wear closed-toe shoes constructed in a material that can be easily cleaned, and these should be wiped regularly and immediately after coming into contact with a COVID-19-positive patient.

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1. Ensure that all non-essential items in the ultrasound examination room have been removed or stored away, and essential items are already prepared in the room, such as tissues, cleaning and disinfection wipes, gloves, ultrasound gel.
2. Disinfect the ultrasound examination room and unit before each scan (if not already completed after previous patient):
 - a) Ultrasound unit and probe: use approved instrument grade disinfection wipes or spray to clean all exposed parts of the ultrasound unit & workstation. For example: ultrasound probes, monitors/screens, keyboards, handles, gel bottles, gel holder, control panels, leads etc
 - b) General environment: use a hospital grade disinfectant to clean and disinfect the patient bed, chairs, benches, door handles and any high touch surfaces.
3. Ensure you are wearing appropriate PPE prior to scanning the patient.
4. Ensure the patient bed is prepared and the patient has changed into a gown (if required for the examination).

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1. Ensure you are wearing appropriate PPE for cleaning and disinfecting the ultrasound examination room. avoid unnecessary physical interaction.
2. Any written notes for pre-scan history can be taken during the examination but note to disinfect writing tools post examination.
3. Complete scan as per normal ultrasound examination, however, if there are options to face the patient away whilst scanning, incorporate this but ensure comfort and safety of the patient whilst doing so.
4. Send patient to change cubicle (if required) and dispose of used patient gown into the laundry receptacle.
5. Ensure proper removal of PPE after the ultrasound examination and hand hygiene, if leaving room to accompany the patient.

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1. Ensure that you are donned with appropriate PPE for cleaning and disinfecting the ultrasound examination room.
2. Disinfect the ultrasound examination room and unit after each patient leaves the room
 - a) Ultrasound unit and probe: use approved instrument grade disinfection wipes or spray to clean all exposed parts of the ultrasound unit & workstation. For example: ultrasound probes, monitors/screens, keyboards, handles, gel bottles, gel holder, control panels and leads.
 - b) General environment: remove any used bed linen or paper lining and dispose of appropriately. Use a hospital grade disinfectant to clean and disinfect the patient bed, chairs, benches, door handles and any high touch surfaces. If appropriate, ensure disinfection of the change cubicle.
3. Ensure proper removal of PPE after the ultrasound examination and hand hygiene.

Figure 2: How to prepare for an ultrasound examination in the context of COVID-19

Changes to comprehensive ultrasound examination protocols

To minimise risks of personnel exposure to SARS-CoV-2, triaging of requests for ultrasound examination should be considered, for example, assessing referrals with respect to whether the examination itself is warranted, whether the examination is essential to provide a diagnosis or would change patient management versus an examination request where the finding would not change patient management or is used to confirm a previous finding.

Consideration should also be given to a truncated examination to answer the clinical question posed. Where an examination is truncated, this should be documented in the report to ensure the referrer and patient are aware of this change and should symptoms change, or the clinical question requires further investigation, it is not assumed that the comprehensive examination was performed.

General considerations for ultrasound practitioners to minimise risk

Since the ultrasound examination requires close contact between the healthcare worker and patient, there is a need to protect both from unnecessary exposure. Figure 2 outlines general preparation recommendations for before/during/after an ultrasound examination for COVID-19-confirmed or COVID-19-probable patients.

The following are additional considerations to minimise risk:

- Patients should be screened and triaged at the time of making the booking and on arrival at the clinic or hospital. The booking screening questions should include the following:
 - Have you travelled interstate or overseas in the past two weeks or have been in close contact with someone that has?
 - Have you been in contact with someone with suspected or confirmed COVID-19?
 - Do you have any symptoms of illness such as fever, cough, sore throat, headache, loss of smell or fatigue?
 - Taking the patients temperature could be considered in high-risk environments.
- In order to reduce the risk of transmission, it is important to:
 - respect the time of scheduled visits,
 - space the seats in the waiting room to meet physical distancing requirements.
- If the status of a patient is confirmed as COVID-19-positive, it would be preferable to scan at the end of the clinic list so that the equipment and room undergo vigorous cleaning and disinfection. It is also advisable that confirmed COVID-19-positive patients wear a surgical mask at all times.
- During the pandemic, it is reasonable not to allow trainees or students to participate.
- Accompanying persons should be limited in the examination room unless warranted for the purpose of the examination, for example paediatrics or patients requiring extra care. Attendance by accompanying persons should be minimised and managed

proactively by individual practices in consultation with staff. However, consideration should be given to the patient and the need for support where bad news is to be delivered.

All accompanying persons should be assessed for any increase in risk to the staff or other patients, with attendance tracked in line with the patient assessment.

Conclusion

The ultrasound workforce provides an important valuable clinical service but is particularly vulnerable because of their close physical contact with patients and prolonged examination times. This guideline is presented as a resource to enable those practitioners to perform an ultrasound examination in a safe manner and to minimise the risk of spread of COVID-19 both to patients and the ultrasound practitioner.

Funding

No funding information is provided.

Conflict of interest

There is no financial support or conflict of interest to declare.

Author contribution

The authors acknowledge that the manuscript conforms with the journal's authorship policy and all authors are in agreement with the content of this manuscript.

References

- 1 World Health Organisation. <https://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations>
- 2 Lauer SA, Grantz KH, Bi Q, Jones FK, Zheng Q, Meredith HR, et al. The Incubation Period of Coronavirus Disease 2019 (COVID-19) from publicly reported confirmed cases: estimation and application. *Ann Intern Med.* 2020; 172(9): 577-582. <https://doi.org/10.7326/M20-0504>
- 3 Bai Y, Yao L, Wei T, Tian F, Jin D-Y, Chen L, et al. Presumed asymptomatic carrier transmission of COVID-19. *JAMA* 2020; 323: 1406.
- 4 Ye F, Xu S, Rong Z, et al. Delivery of infection from asymptomatic carriers of COVID-19 in a familial cluster [published online ahead of print, 2020 Apr 2]. *Int J Infect Dis.* 2020; 94: 133-138. <https://doi.org/10.1016/j.ijid.2020.03.042>
- 5 Day M. Covid-19: identifying and isolating asymptomatic people helped eliminate virus in Italian village. *BMJ* 2020; 368: m1165.
- 6 Heinzerling A, Stuckey MJ, Scheuer T, Xu K, Perkins KM, Resseger H, et al. Transmission of COVID-19 to health care personnel during exposures to a hospitalized patient — Solano County, California, February 2020. *MMWR Morb Mortal Wkly Rep* 2020; 69: 472-476.
- 7 CDNA National Guidelines for Public Health Units. <https://www1.health.gov.au/internet/main/publishing.nsf/Content/cdna-song-nov-el-coronavirus.htm>
- 8 Poon LC, Abramowicz JS, Dall'Asra A, Sande R, ter Haar G, Marsal K, et al. ISUOG Safety Committee Position Statement: safe performance of obstetric and gynecological scans and

- equipment cleaning in the context of COVID-19. *Ultrasound Obstetrics Gynecol*; 55: 709-712 (accepted, in press). <https://doi.org/10.1002/uog.22027>
- 9 Abramowicz JS, Basseal JM. WFUMB Position Statement: How to perform a safe ultrasound examination and clean equipment in the context of COVID-19. *Ultrasound Med Biol* 2020; S0301-5629(20): 30149-6. <https://doi.org/10.1016/j.ultrasmedbio.2020.03.033>
 - 10 Abramowicz JS, Basseal JM, Brezinka C, Dall'Asta A, Deng J, Lee JCS, et al. ISUOG Safety Committee Position Statement: COVID-19: Personal Protective Equipment (PPE) and mitigating hazard in relation to SARS-CoV-2 for practitioners undertaking obstetric and gynecological ultrasound. *Ultrasound Obstetrics Gynecol* (accepted, in press). <https://doi.org/10.1002/uog.22035>
 - 11 ASE guidelines. <https://www.asecho.org/ase-statement-covid-19/#protection>
 - 12 van Doremalen N, Bushmaker T, Morris DH, et al. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. *New Engl J Med* 2020;382(16): 1564-1567. <https://doi.org/10.1056/NEJMc2004973>
 - 13 Chin AWH, Chu JTS, Perera MPA, Hui KPY, Yen H-L, Chan MCW, et al. Stability of SARS-CoV-2 in different environmental conditions. *Lancet Microbe* 2020. [https://doi.org/10.1016/S2666-5247\(20\)30003-3](https://doi.org/10.1016/S2666-5247(20)30003-3)
 - 14 Kampf G, Todt D, Pfaender S, Steinmann E. Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. *J Hosp Infect* 2020; 104(3): 246-251. <https://doi.org/10.1016/j.jhin.2020.01.022>.
 - 15 Australian Government Department of Health Corona Virus Disease (COVID-19) Environmental cleaning and disinfection principles for health and residential care facilities 26/03/2020. <https://www.health.gov.au/resources/publications/coronavirus-covid-19-environmental-cleaning-and-disinfection-principles-for-health-and-residential-care-facilities>
 - 16 NSW Government COVID-19 Resources. Recommended Guidance on Mask Use in NSW 19/03/2020. <http://www.cec.health.nsw.gov.au>
 - 17 NSW Government COVID-19 Resources. PPE training videos. <http://www.cec.health.nsw.gov.au/keep-patients-safe/COVID-19>
 - 18 World Health Organisation. Five moments for Hand Hygiene. https://www.who.int/gpsc/tools/Five_moments/en/