Evidence check

8 May 2020

Rapid evidence checks are based on a simplified review method and may not be entirely exhaustive, but aim to provide a balanced assessment of what is already known about a specific problem or issue. This brief has not been peer-reviewed and should not be a substitute for individual clinical judgement, nor is it an endorsed position of NSW Health.

Sanitising and covering large medical imaging equipment

Rapid review questions

1. Which method is most effective in sanitising large medical imaging equipment for COVID-19?
2. Which method is most effective in covering or protecting large medical imaging equipment for COVID-19?
3. Which method is most effective in sanitising linear accelerators and radiotherapy bunkers for COVID-19?

In brief

Sanitising large medical equipment

- There is a variety of options for disinfectants to use on medical imaging equipment. Most guidelines suggest compliance with equipment vendor guidance to find the safest disinfectant for each piece of equipment.
- Regulatory agencies (such as the Therapeutic Goods Agency) publish lists of approved disinfectants (Table 4).
- Expert consensus-based guidance suggest:
    - 60 minute down-time followed by cleaning protocol with approved cleaning agents, following a clockwise, linear, and top to bottom pattern for cleaning all visible surfaces.
    - sanitisation needs to include adequate cleaning of radiological instruments, particularly the detectors and of the protective equipment used by parents or carers.
    - CT examination rooms are disinfected according to regulations and air disinfection is conducted for 30 minutes before examining other patients.
- Specific disinfectants for machines during COVID-19 have included: isopropyl alcohol 70%, diluted bleach solution (6mg chlorine releasing disinfectant tablet to 1,000ml water), 2,000mg/L chlorine-containing disinfectant; 500 to 1,000mg/L chlorine containing disinfectant; and alcohol-containing disposable disinfectant wipes.
- Medical imaging machine manufacturers state that using cleaning agents that have not been evaluated or have not passed material compatibility testing could have an unknown or harmful impact if used on device surfaces. Impacts may include degrading cosmetic or functional performance, damaging device surfaces or labels, causing immediate equipment failure or even causing longer term latent failures.
- The Australian Commission on Safety and Quality in Healthcare guidelines recommend that shared equipment should be cleaned with a detergent solution after each use with cleaning

agents compatible with the piece of equipment being cleaned, as per manufacturer instructions. The Clinical Excellence Commission recommend cleaning and disinfection for environmental cleaning during COVID-19.

Covering or protecting large medical equipment

- There is limited evidence and the small amount of evidence available is contradictory around covering or protecting medical imaging equipment.
- Semi-permeable gowns or drapes have been recommended over plastic coverings, as plastics could potentially damage the machines due to a risk of overheating.
- Recommendations for using plastic covers are specifically for detectors, scan couches and detectors. However, use of plastic coverings for some machine components could also result in suboptimal images and prolongation of scan time.

Sanitising linear accelerators and radiotherapy bunkers

- There are some options for disinfectants to use on linear accelerators. Most guidelines suggest compliance with equipment vendor guidance to find the safest disinfectant for each piece of equipment in use. Manufacturer guidance includes guidance on sanitisation of their machines, noting that not every type of disinfectant can be applied to every component of the equipment.
- There was no published guidance or research evidence for sanitising radiotherapy bunkers.
- This rapid review does not consider in-room disinfecting systems, such as ozone or any type of misters, which are used to prevent damage to ‘linac’ (linear accelerator) machines.

Limitations

- There is a lack of research on the best sanitising method for large medical imaging equipment.
- Sanitisation methods are dictated by the type of equipment, equipment parts and materials being cleaned and also the list of manufacturer-tested and approved disinfectants. Some guidelines defer back to using regulatory agency lists of approved disinfectants.
- It is unclear how using non-company approved disinfectants may affect or damage the performance of machines, the materials of the machines and manufacturer warranties. Companies may not have tested regulator-approved disinfectants on their machines yet, particularly for use against COVID-19.
- This rapid review does not consider in-room disinfecting systems, such as ozone or any type of misters, which are used to prevent damage to ‘linac’ machines.

Background

There are varying infection control policies for COVID-19 between institutions and clinics. It is unclear what the best practices are for sanitising and protecting medical imaging equipment. In general, there are a few types of disinfectants: isopropyl alcohol, enzymatic cleaners, mild cleaners, diluted bleach, and mineral spirits. When considering medical imaging equipment, it is necessary to consider the various equipment parts and materials to be cleaned. For example, the recommended cleaning solutions for a CT machine differs for the control console, couch covers and bellows, couch runners, pained sheet metal, couch top, camera mount, touch screen, motion control buttons, bore, covers, phantoms and crosshairs. Individual companies also publish disinfection guides and cleaning procedures.

The Australian Commission on Safety and Quality in Healthcare guidelines for the prevention and control of infection in healthcare outline practical information for shared clinical equipment. Shared equipment should be cleaned with a detergent solution after each use with cleaning agents compatible with the piece of equipment, as per manufacturer instructions.

The Clinical Excellence Commission recommends cleaning and disinfection for environmental cleaning during COVID-19. Key principles include using a detergent and using a disinfectant.

Methods

Databases and grey literature sources were searched on 29 and 30 April 2020.

Results (Tables 1 – 4)

Table 1: Sanitising large medical imaging equipment

Title	Summary	Link
Peer reviewed literature		
Goh, et al. 2020 Operational Strategies to Prevent Coronavirus Disease 2019 (COVID-19) Spread in Radiology: Experience From a Singapore Radiology Department After Severe Acute Respiratory Syndrome. Journal of the American College of Radiology	• Surfaces are wiped down with isopropyl alcohol 70%. • Terminal cleaning of the scan room by housekeeping staff is also carried out by using diluted bleach solution (6mg chlorine releasing disinfectant tablet to 1,000ml water) to wipe down the machine, walls and floor. • Because there is no negative air pressure room, the CT scanner and the scan room is aired for at least 30 minutes to allow the cleaned surfaces to dry adequately before proceeding to scan another patient. • For portable X-ray machines, deep cleaning is performed twice a day using diluted bleach solution to wipe down the machine's exterior. • For parts of the machine that are delicate (e.g., collimators, control console, exposure buttons), isopropyl alcohol 70% rather than bleach is used for cleaning after every patient. • For detailed guidelines on equipment disinfection, staff should seek advice from their specific equipment vendors.	https://www.jacr.org/article/S1546-1440(20)30306-9/fulltext

Huang, et al. 2020
 	
The Battle Against Coronavirus Disease 2019 (COVID-19): Emergency Management and Infection Control in a Radiology Department. Journal of the American College of Radiology
	• General disinfection procedure:
	  ○ The floor and equipment in the CT examination room are disinfected according to regulations and air disinfection is conducted for 30 minutes before examining other patients. These CT scanners are considered non-contaminated (not fever-CTs) after these sterilisation procedures.
	• Equipment disinfection:
	  ○ The equipment in the contaminated area is wiped with 2,000mg/L chlorine-containing disinfectant. The DR and CT gantry in contaminated areas are wiped with 75% ethanol. The equipment in the buffer area is wiped with 500 to 1,000mg/L chlorine containing disinfectant or alcohol-containing disposable disinfectant wipes twice a day.
	• Fever-CT disinfection procedures:
	  ○ After Examination, in addition to the previous procedures, the examination bed and the ground is disinfected with 2,000mg/L chlorinated disinfectant.
		https://www.sciencedirect.com/science/article/pii/S1546144020302854?via%3Dihub

Title	Summary	Link
Peer reviewed literature		
Kooraki, et al. 2020 Coronavirus (COVID-19) Outbreak: What the Department of Radiology Should Know, Journal of the American College of Radiology	• Radiology departments should contact their equipment vendors to find the safest disinfectant for each piece of equipment.	https://www.jacr.org/article/S1546-1440(20)30150-2/fulltext
Mossa-Basha, et al. 2020 Radiology Department Preparedness for COVID-19: Radiology Scientific Expert Panel, Radiology, in press (16 March 2020)	• CT equipment may be out of commission for several hours for cleaning. • The room is cleaned and disinfected according to hospital protocols.	https://pubs.rsna.org/doi/10.1148/radiol.2020200988
Grey literature		
American College of Radiology, 2020, CR Guidance on COVID-19 and MR Use (8 April 2020)	• MR room cleaning and disinfecting protocols are quite varied and are subject to change with the unique clinical circumstances of that particular site (e.g., availability of PPE, emergent need for truly immediate access to the only available but not yet disinfected MR scanner for a non-COVID-19 patient, etc.). • General guidelines exist, such as 60 minute down-time followed by cleaning protocol with approved cleaning agents using a clockwise, linear, top to bottom pattern of cleaning all visible surfaces. However, these will be tempered by local guidelines and policies and especially the specific clinical needs of the patients and the site, and are likely to change over time.	https://www.acr.org/Advocacy-and-Economics/Advocacy-News/Advocacy-News-Issues/In-the-April-4-2020-Issue/ACR-Information-on-Field-Radiology-Care-During-the-COVID-19-Pandemic

American Institute for Ultrasound Medicine, 2020, Guidelines for Cleaning and Preparing External-	• Changes due to COVID-19 outbreak:
	  ○ Level of disinfection for external and interventional procedures, low-level disinfection is effective as per CDC guidelines.
	  ○ Currently, EPA approved disinfectants for use against COVID-19 (SARS-CoV-2) can be found online.
		https://www.aium.org/officialStatements/57

Title	Summary	Link
Peer reviewed literature		
and Internal-Use Ultrasound Transducers and Equipment Between Patients as well as Safe Handling and Use of Ultrasound Coupling Gel	○ If LLD agents are depleted soap and water should be used per CDC guidelines. ○ If indicated but no transducer covers are available, medical gloves or other physical barriers (e.g. compatible medical dressings) should be used. • Education and execution: ○ Dissemination of cleaning guidelines is essential and so is their proper execution. • Equipment: ○ Cleaning involves all ancillary equipment involved in the procedure at hand. ○ A cover sheet may be used as a physical barrier between the keyboard/console and the operator, in addition to LLD cleaning. ○ If possible, use a dedicated system (scanner and transducers) for COVID-19 positive or suspected patients. ○ COVID-19 is viable on plastic surfaces for up to 72 hours. ○ Special attention needs to be paid to COVID-19 and other respiratory infection cases requiring aerosolisation procedures, i.e. mechanical ventilation, aerosolisation application, etc. Here a transducer cover should be used and the entire equipment requires full LLD (top to bottom) as pathogens are likely to become airborne. ○ Always follow manufacturer guidance and institutional guidelines.	
American Society of Echocardiography, 2020, ASE Statement on COVID-19 (1 April 2020)	• Although SARS-CoV-2 is sensitive to most standard viricidal disinfectant solutions, care must be taken when cleaning. • Local standards vary but echocardiogram machines and probes should be thoroughly cleaned, ideally in the patient's room and again in the hallway. • Smaller, laptop-sized portable machines are more easily cleaned, but use of these machines should be balanced against potential trade-offs in image quality and functionality. • Please consult vendors' disinfecting guidelines, which are available on their websites, as procedures vary and could affect the functionality of machines. • TEE probes should undergo cleaning in the room (including the handle and cord), then be transferred in a closed container to be immediately disinfected according to the manufacturer's recommendations. The exact steps to be followed for disinfection of the TEE probe and equipment will depend on local institutional protocols that usually are guided by infectious disease experts and resource availability.	https://www.asecho.org/ase-statement-covid-19/

Title	Summary	Link
Peer reviewed literature		
Italian Society of Medical and Interventional Radiology, Italian College of Paediatric Radiology, 2020, Guidelines for the Management of Paediatric Patients in Emergency and Elective setting in COVID-19 Health emergency	• Sanitisation needs to include adequate cleaning of radiological instruments, particularly the cassettes (disposable plastic protections should be used) and of the protective equipment used by parents or carers (lead aprons).	https://www.sirm.org/wp-content/uploads/2020/03/Guidelines-for-the-management-of-paediatric-patients-in-COVID-19-health-emergency.pdf
Royal Australian and New Zealand College of Radiologists, 2020. Advice on appropriate use of CT throughout the COVID-19 pandemic – Updated 20 April 2020	• Equipment and rooms cleaned according to local protocols.	https://www.ranzcr.com/documents-download/other/5104-advice-on-appropriate-use-of-ct-throughout-the-covid-19-pandemic
Society for Cardiovascular Magnetic Resonance, 2020, SCMR's COVID-19 Preparedness Toolkit (as of 25 March 2020)	• Clean technologist should use the appropriate protocol in your institution to decontaminate the surfaces of the equipment and surrounding environment. • Follow manufacturer specific guidance on how to clean the scanner.	https://scmr.org/page/COVID19
Society of Radiographers, 2020, Covid-19 pandemic:	• Recent research suggests SARS-CoV-2 (coronavirus causing COVID-19) can persist on steel and plastic surfaces for up to 72 hours, reinforcing the need for appropriate decontamination of imaging equipment and rooms.	https://www.sor.org/news/covid-19-pandemic-summary-current-and-

Title	Summary	Link
Peer reviewed literature		
Summary of current and emerging issues for radiographers (3 April 2020)		emerging-issues-radiographers
USA Centers for Disease Control and Prevention, 2020. Interim Infection Prevention and Control Recommendations for Patients with Suspected or Confirmed Coronavirus Disease 2019 (COVID-19) in Healthcare Settings	• Dedicated medical equipment should be used when caring for patients with known or suspected COVID-19. • All non-dedicated, non-disposable medical equipment used for patient care should be cleaned and disinfected according to manufacturer's instructions and facility policies.	https://www.cdc.gov/coronavirus/2019-ncov/hcp/infection-control-recommendations.html

Table 2: Coverings for large medical imaging equipment

Title	Summary	Link
Peer reviewed literature		
Goh et al. 2020 Operational Strategies to Prevent Coronavirus Disease 2019 (COVID-19) Spread in Radiology: Experience From a Singapore Radiology Department After Severe Acute Respiratory Syndrome. Journal of the American College of Radiology	• Single-use disposable plastic sheets are used for lining of CT scan couches for case suspects.	https://www.jacr.org/article/S1546-1440(20)30306-9/fulltext

Title	Summary	Link
Peer reviewed literature		
Grey literature		
American Society of Echocardiography, 2020, ASE Statement on COVID-19 (1 April 2020)	• Some institutions cover probes and machine consoles with disposable plastic and forego the use of ECG stickers. It is important to note that the benefit of using protective covers must be balanced against the risk of potential for suboptimal images and prolongation of scan time. • Some institutions set aside certain machines or probes for use on patients with suspected or confirmed infection.	https://www.asecho.org/ase-statement-covid-19/
American College of Radiology, 2020, ACR Information on Field Radiology Care During the COVID-19 Pandemic (2 April 2020)	• Separate the X-ray tube from the patient with plexiglass in order to simplify terminal cleaning. • Avoid glass when possible to minimise beam attenuation.	https://www.acr.org/Advocacy-and-Economics/Advocacy-News/Advocacy-News-Issues/In-the-April-4-2020-Issue/ACR-Information-on-Field-Radiology-Care-During-the-COVID-19-Pandemic
GE Healthcare. COVID-19 Homepage > Frequently Asked Questions > Cleaning and Disinfection	• Question 18: Can I wrap the medical device in plastic to reduce possible contamination? Answer: No. The plastic will trap air and reduce airflow and possibly lead to overheating of electronic devices, which may lead to loss of function (e.g. imaging during a procedure). Some devices (e.g. ultrasound systems, patient tables etc.) could be wrapped in semi-permeable gowns or drapes, or custom coverings/drapes, which could provide added protection against large droplets or contamination.	https://www.gehealthcare.com/corporate/covid-19-faq-cleaning-and-disinfection
Italian Society of Medical and Interventional Radiology, Italian College of Paediatric Radiology, 2020, Guidelines for the Management of Paediatric Patients in Emergency and Elective setting in COVID-19 Health emergency	• Disposable plastic protections should be used on the cassettes of radiological instruments.	https://www.sirm.org/wp-content/uploads/2020/03/Guidelines-for-the-management-of-paediatric-patients-in-

Title	Summary	Link
Peer reviewed literature		
		COVID-19-health-emergency.pdf
Society of Radiographers, 2020, Covid-19 pandemic: Summary of current and emerging issues for radiographers (3 April 2020)	• Recent research suggests SARS-CoV-2 (coronavirus causing COVID-19) can persist on steel and plastic surfaces for up to 72 hours, reinforcing the need for appropriate barrier precaution (e.g. detector covers).	https://www.sor.org/news/covid-19-pandemic-summary-current-and-emerging-issues-radiographers

Table 3: General equipment disinfection guidelines

Title	Summary	Link
Grey literature		
USA Centers for Disease Control and Prevention	• CDC provides general guidance for cleaning and disinfecting equipment and facilities.	https://www.cdc.gov/coronavirus/2019-ncov/community/organizations/cleaning-disinfection.html
World Health Organisation	• The WHO provides general guidance on "Decontamination and Reprocessing of Medical Devices for Health-care Facilities" (2016).	https://www.who.int/infection-prevention/publications/decontamination/en/
USA Environmental Protection Agency	• US EPA provides a list of disinfectants for use against COVID-19.	https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2
European Centre for Disease Prevention and Control	• European Centre for Disease Prevention and Control has a technical report on 'Disinfection of environments in healthcare and non-healthcare setting potentially contaminated with SARS-CoV-2'. • This provides generic advice on disinfecting various surfaces and environments.	https://www.ecdc.europa.eu/sites/default/files/documents/Environmental-persistence-of-SARS_CoV_2-virus-Options-for-cleaning2020-03-26_0.pdf
Australian Government Therapeutic Goods Administration	• Disinfectants for use against COVID-19 included in the ARTG for legal supply in Australia (29 March 2020).	https://www.tga.gov.au/disinfectants-use-against-covid-19-included-artg-legal-supply-australia

Title	Summary	Link
Grey literature		
Australian Government Therapeutic Goods Administration	• Appropriate use of disinfectants: Information for consumers, health professionals and healthcare facilities (27 March 2020).	https://www.tga.gov.au/appropriate-use-disinfectants-information-consumers-health-professionals-and-healthcare-facilities
Australian Government Department of Health	• Australian Government Department of Health: Coronavirus (COVID-19) Environmental cleaning and disinfection principles for health and residential care facilities.	https://www.health.gov.au/resources/publications/coronavirus-covid-19-environmental-cleaning-and-disinfection-principles-for-health-and-residential-care-facilities
Public Health England	• Public Health England. Guidance: Reducing the risk of transmission of COVID-19 in the hospital setting (Updated 27 April 2020). • General guidance about cleaning equipment in hospitals.	https://www.gov.uk/government/publications/wuhan-novel-coronavirus-infection-prevention-and-control/reducing-the-risk-of-transmission-of-covid-19-in-the-hospital-setting#environmental-decontamination
Public Health England	• Public Health England. COVID-19: infection prevention and control guidance.	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/881489/COVID-19_Infection_prevention_and_control_guidance_complete.pdf
World Health Organisation	• The WHO provides general guidance on "Cleaning and disinfection of environmental surfaces in the context of COVID-19. Interim Guidance. 15 May 2020".	https://apps.who.int/iris/handle/10665/332096

Table 4: Disinfectants for use against COVID-19 included in the ARTG for legal supply in Australia

Product name	Manufacturer	ARTG ID
Clorox disinfecting wipes	The Clorox Company	333208
Fuzion	The Clorox Company	332716
Germicidal Wipes	The Clorox Company	335509
Total 360	The Clorox Company	332715
Oxivir FIVE16	Virox Technologies Inc	286618
Oxivir Tb	Virox Technologies Inc	165058
Oxivir Tb Wipes	Virox Technologies Inc	164850
Taskforce Commercial Grade Disinfectant	Custom Chemicals International Pty Ltd	334780
Trigene Advance Concentrates / Sterigene Concentrates	Tristel Solutions Limited (United Kingdom)	232937
Trigene Advance Solution / Sterigene Solution	Tristel Solutions Limited (United Kingdom)	233129
Virex II (J-flex / J-Fill)	Virox Technologies Inc	153031
Whiteley Industries Viraclean	Whiteley Corporation Pty Ltd t/a Whiteley Medical	69000
Zoono Z-71 Germkiller	Elitepac Ltd	224480

(Publication date: 5 May 2020. Date accessed: 8 May 2020. URL: https://www.tga.gov.au/disinfectants-use-against-covid-19-artg-legal-supply-australia)

Appendix 1

Search Terms

Population / condition search terms:

("COVID-19"[All Fields] OR "COVID-2019"[All Fields] OR "severe acute respiratory syndrome coronavirus 2"[Supplementary Concept] OR "severe acute respiratory syndrome coronavirus 2"[All Fields] OR "2019-nCoV"[All Fields] OR "SARS-CoV-2"[All Fields] OR "2019nCoV"[All Fields] OR (("Wuhan"[All Fields] AND ("coronavirus"[MeSH Terms] OR "coronavirus"[All Fields])) AND (2019/12[PDAT] OR 2020[PDAT])))

Intervention search terms:

Sanitation OR sanitise OR sanitize OR disinfect OR clean OR cover OR protect OR lining OR wrap

Searched Resources:

Databases: PubMed; TRIP Database

General search: Google.

Australian Sources:

- Australian Government Therapeutic Goods Administration
- Australian Government Department of Health
- Royal Australian and New Zealand College of Radiologists

Other Sources (e.g. regulators, peak bodies, and organisations):

- North America:
    - Centers for Disease Control and Prevention
    - Food and Drug Administration
    - Environmental Protection Agency
    - American College of Radiology
    - American Institute for Ultrasound in Medicine
    - American Society for Echocardiography
- Europe:
    - UK Medicines and Healthcare Products Regulatory Agency
    - European Centre for Disease Prevention and Control
    - Public Health England
    - Italian Society of Medical and Interventional Radiology / Italian College of Paediatric Radiology
- International
    - World Health Organisation
    - Society for Cardiovascular Magnetic Resonance

Companies:

- Canon/Toshiba
- GE Healthcare
- Philips
- Siemens Healthineers
- Varian

References

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- American College of Radiology, 2020, ACR Information on Field Radiology Care During the COVID-19 Pandemic (2 April 2020). URL: https://www.acr.org/Advocacy-and-Economics/Advocacy-News/Advocacy-News-Issues/In-the-April-4-2020-Issue/ACR-Information-on-Field-Radiology-Care-During-the-COVID-19-Pandemic
- American College of Radiology, 2020, CR Guidance on COVID-19 and MR Use (8th April 2020). URL: https://www.acr.org/Clinical-Resources/Radiology-Safety/MR-Safety/COVID-19-and-MR-Use
- American Institute for Ultrasound Medicine, 2020, Guidelines for Cleaning and Preparing External- and Internal-Use Ultrasound Transducers and Equipment Between Patients as well as Safe Handling and Use of Ultrasound Coupling Gel. URL: https://www.aium.org/officialStatements/57
- American Society of Echocardiography, 2020, ASE Statement on COVID-19 (1 April 2020). URL: https://www.asecho.org/ase-statement-covid-19/
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- Mossa-Basha, Meltzer, et al, 2020. Radiology Department Preparedness for COVID-19: Radiology Scientific Expert Panel, Radiology, in press (Mar 16 2020, https://doi.org/10.1148/radiol.2020200988). URL: https://pubs.rsna.org/doi/10.1148/radiol.2020200988

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