



10 Commandments on Enhanced Quality and Safety at the Echocardiography Laboratory Amidst Emerging Infections

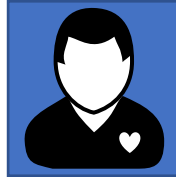
Executive Summary of the PSE Interim Guidelines for Enhanced Quality and Safety at the Echocardiography Laboratory Amidst Emerging Infections

Philippine Society of Echocardiography, Inc. and the Philippine Heart Association Council on Echocardiography



APPROPRIATENESS

Check all requests against established clinical appropriateness use criteria.



PATIENT PREPARATION

Ensure that the patient is stable, safe, and properly-equipped (e.g. mask and gown).



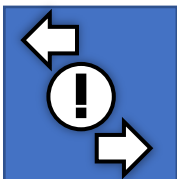
INTENSIFIED SCREENING

Enforce heightened screening measures amidst emerging infections.



SCANNING PROTOCOLS

Recommend focused over full scanning protocols (when applicable) to minimize exposure time.



SEGREGATION

Use dedicated rooms, machines, and staff (if possible) for studies with high risk of infection transmission.



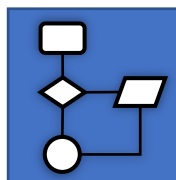
DISINFECTION PROTOCOLS

Implement standard and intensified disinfection protocols for the scanning area, machines, and staff.



STAFF PROTECTION

Ensure sonographers and allied staff have proper protective equipment.



READING WORKFLOW

Consider reading templates, digitize workflow, and maximize remote interpretation and data sharing.



EQUIPMENT HANDLING

Apply protective material over ultrasound unit and transducer. Do time- rather than ECG-gated studies.



EDUCATION and TRAINING

Formulate strategies for continuous staff education and training.

This executive summary is intended to quickly highlight key principles in enforcing quality and enhancing safety for patients and healthcare personnel in the course of echocardiographic studies amidst the COVID19 pandemic. Best practices from local and international institutions were consolidated and recommendations were made equally mindful of ideal as well of limited-resource settings. The Philippine Society of Echocardiography also recognizes the evolving patterns of disease and healthcare settings and is keenly open to revisions of this document as new evidence and real-world experience arise.





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I. APPROPRIATENESS

- All requests for echocardiography must satisfy recognized appropriate use criteria for the adult^{1,2} and pediatric^{3,4} populations.

II. INTENSIFIED SCREENING

- Studies with urgent indications for echo must be prioritized (Appendix A).^{5,6} Elective procedures are discouraged and can be rescheduled;^{5,7} if such are still highly-indicated, these must undergo strict screening and be aligned with hospital or institutional directives.
- Advanced echo procedures such as transesophageal or stress echocardiography are discouraged due to the higher risk of aerosol generation and must only be performed if crucial in altering clinical management.^{5,8}
- All requests must first be tagged for suspected or confirmed COVID diagnosis.⁹ Those with no available confirmatory tests but with alert signs and symptoms suggestive of COVID infection, as well as those with pneumonia or acute respiratory distress syndrome must be strongly flagged.
- Echo labs are advised to enforce clinical pathways or algorithms (Appendix B).^{4,8,10,11,12,13,14}

III. SEGREGATION

- Bedside echocardiography is recommended to avoid cross contamination from patient transport.⁵
- Ideally, machines used for inpatients and outpatients should be different. If there are at least two echo machines, one is ideally dedicated for persons-under-investigation (PUI) and COVID requests. If there is only one machine, rigid disinfection measures must be in place and succeeding echo studies well-spaced out.¹⁰ Such dedicated machines should be properly labelled and docked at dedicated and isolated stations.
- If human resource permits, sonographers assigned to handle PUI/COVID requests preferably should not handle non-PUI/COVID requests.¹⁰

IV. STAFF PROTECTION

- The basic minimum protective strategy for all healthcare personnel at the echo lab include: 1) regular hand hygiene (soap and water; 70% alcohol-based rub), 2) proper cough etiquette, 3) medical/surgical face mask, 4) gloves (Appendix C).
- No PPE, no echo study. All sonographers and personnel handling PUI/COVID patients must be in full personal protective equipment. This includes: 1) cap, 2) goggles/face shield. 3) N95 respirator (or higher protection), 4) impermeable full body gown, 5) multi-layer gloves, 6) shoe cover (Appendix C).
- The echo lab must have a steady supply and inventory system for rational PPE use and have visual aids for proper donning and doffing (Appendix C).^{14,15,16}

V. EQUIPMENT HANDLING

- Dedicated echo machines (portable units) must be prepared prior to use for PUI/COVID studies.
- Preferably, the entire unit is covered in at least 2 layers of impermeable plastic (waterproof material); inner layer may consist of stretchable plastic (e.g. cling wrap) which can align to contour of unit and not significantly compromise screen view; outer layer may be a 1-piece plastic that covers up to the lower parts of the unit (e.g. possibly up to the wheels).^{8,10} (Appendix D)
- Transducer covers can be condoms or commercial transducer covers as long as they fulfill institutionally set infection control guidelines and procedure sterility requirements.¹⁷

VI. PATIENT PREPARATION

- If the patient is comfortable, a plain surgical/medical facemask should be the bare minimum protection. A mask of higher protective rating is preferred.
- If the patient requires supplemental oxygen, a well-fitting face mask is recommended. For those intubated and mechanically-ventilated, proper ventilator settings must minimize risk of aerosol-generation.
- Usual standard care is expected, such as adequate thermoregulation using blankets, proper gowning for optimal image acquisition while ensuring patient privacy, and bed railings to prevent falls. Most importantly, the patient should be fairly stable clinically and hemodynamically to be allowed to undergo the focused procedure without interruption.



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VII. SCANNING PROTOCOLS

- Recommend focused over full scanning protocols (particularly for PUI/COVID studies) to minimize exposure time for both patient and sonographer. A study of 5 minutes or less is preferred.
- Be mindful of the specific indication and do targeted study (limited views) to answer the clinical question. The following are the acceptable indications for urgent echo of adults based on international appropriate use criteria: 1) hemodynamic instability or shock (e.g. hypotension, arrhythmia-related instability), 2) acute chest pain syndromes (e.g. myocardial infarction, pulmonary embolism), 3) chest trauma, 4) acute aortic syndromes, 5) acute heart failure (e.g. cardiomyopathy and myocarditis), and 6) acute valve dysfunction (e.g. severe mitral regurgitation, prosthetic valve dysfunction).⁶ (Appendix A). For patients with COVID, the echo examination should be targeted to assess: 1) regional and global left ventricular function in the setting of acute coronary syndromes or myocarditis, 2) right ventricular size and function especially in suspected acute pulmonary embolism, 3) pericardial effusion amidst inflammatory conditions (myopericarditis), 4) abnormal septal motion or contractility due to new-onset arrhythmias.
- For pediatric patients, only urgent or emergent studies will be performed. The following are some of the other accepted indications for patients with no COVID: 1) cyanotic newborns, 2) transferred patients requiring urgent diagnosis, 3) symptomatic patients seen at the emergency room, 4) pre- or post-surgical patients who require prompt imaging for decision-making.⁴
- Do not connect ECG cables and instead do time-gated studies. Adjust acquisition time to 3 seconds only.
- The following views are recommended: parasternal window PLAX, PSAX of great vessels; apical window (2-, 3-, 4-, and 5-chamber views) and subcostal window 4-chamber. Added subcostal and suprasternal windows are unnecessary unless they serve as the most optimal windows for acquisition. (Appendix E)
- Consider Spectral Doppler only for very specific indications (e.g. significant stenosis, regurgitation or pulmonary hypertension).
- All measurements must be done offline and not at bedside. Maximize vendor-specific software and technologies to streamline scanning protocol and perform measurements at the workstation.

VIII. DISINFECTION PROTOCOLS

- All ultrasound machines shall undergo standard disinfection on a daily basis, or intensified disinfection after every use with a patient suspected or confirmed to have COVID-19 infection (opportunities for cleaning/disinfection: at bedside, at the hallway outside the room, and at the docking station).
- The transducer and its cables are most prone to contamination and accumulation of dirt and infective agents. They must be cleaned carefully and diligently using vendor-compatible disinfecting solutions.
- Internal transducers used for invasive procedures (TEE) require routine high-level disinfection, while external transducers used for transthoracic studies require the minimum low-level disinfection.
- Only designated and well-equipped staff (with appropriate PPE) will be allowed to perform the intensified disinfection procedures for the ultrasound machine and the room.
- The reading area/workstation (keyboards, monitors, external devices, chairs, phones, desktops, and door knobs) should be frequently cleaned and disinfected on a daily basis.

IX. READING AND REPORTING WORKFLOW

- Consider reading templates, digitize workflow, and maximize remote interpretation and data sharing.
- Limit traffic and congestion in the reading room (consider decking schedules). Only the designated echo reader/s (fellow or consultant) for the day should stay in the reading room at any time, taking into consideration proper physical distancing.
- Rapid review and reporting is recommended, with most critical results relayed promptly to the team.

X. EDUCATION and TRAINING

- All healthcare staff must be well-updated regarding such guidelines and well-versed specifically in the use of personal protective equipment.
- Institution-specific protocols and guidelines are recommended, but best practices in close collaboration with other teams and subspecialty societies is likewise encouraged.
- The PSE is committed to uphold quality and safety in echocardiography and shares such a vision with its local and international counterparts.



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15. Sequencing for Personal Protective Equipment (PPE). Centers for Disease Control and Prevention; CS250672-E. Available at <http://www.cdc.gov/hai/pdfs/ppe/ppe-sequence.pdf>
16. Liang T and Yu L, editors. (2020). Handbook of COVID-19 Prevention and Treatment. Zehjiang University School of Medicine.
17. American Institute of Ultrasound in Medicine. Guidelines for Cleaning and Preparing External- and Internal-Use Ultrasound Transducers Between Patients, Safe Handling, and Use of Ultrasound Coupling Gel. Nov. 3, 2018. (https://www.aium.org/accreditation/Guidelines_Cleaning_Preparing.pdf)

ONLINE RESOURCES

1. Philippine Society of Echocardiography: <http://philechosoc.org/guidelines/pse-covid-resource-center>
2. American Society of Echocardiography: <https://www.asecho.org/covid-19-resources/>
3. Philippine Heart Association: <https://philheart.org/index.php/education/pha-covid-resource-center>



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APPENDIX A


Appropriate use Criteria for Urgent Transthoracic Echocardiography

Appropriate use Criteria for Urgent Transthoracic Echocardiography for patients with suspected or confirmed COVID infection


- Urgent or emergent echocardiography refers to the use of cardiac ultrasound for prompt imaging of patients with acute or unstable cardiovascular conditions. These examinations are generally performed to answer the immediate clinical question and/or to identify causes of acute symptoms. As such, these are focused cardiac ultrasound or point-of-care ultrasound (POCUS) examinations where limited views are acquired to provide targeted information for the rapid detection of significant cardiac pathology. Furthermore, these examinations are often performed in 'undesirable' environments (i.e. performed at the bedside under bright lights with the patient supine and often being treated simultaneously). Therefore, these examinations must be distinguished from elective comprehensive echocardiograms which are performed in better examination conditions and do not require the element of time or urgency.
- For patients who have suspected or confirmed COVID infection, the threshold for doing echocardiography is much higher than usual scenarios, because of the high risk of infection transmission between patient and staff. As such, all studies must be highly appropriate (AUC score of 9; based on international AUC scoring systems), acute, and aim-oriented or focused. If an echocardiogram indeed is clinically indicated, a focused echocardiogram is recommended to minimize exposure time. If the immediate clinical question can be answered with a focused examination, a comprehensive study can be delayed and repeated when the patient has recovered. The decision to extend the focused examination to a full comprehensive study must be carefully weighed considering the risk to the operator in performing a longer examination.




shock/
instability




chest pain
syndromes




chest
trauma




aortic
syndromes



heart
failure



acute valve
dysfunction



- Clearly-indicated and highly-appropriate
- With potential to alter treatment and clinical outcomes

APPROPRIATE

- Done for patients with acute cardiovascular conditions
- Performed for urgent or emergent scenarios

ACUTE

- Focused to answer a specific clinical question
- Targeted scanning with limited views and exposure

AIM-ORIENTED

Urgent Echo for patients with COVID

Appropriate use Criteria for Urgent Transthoracic Echocardiography (The ACUTE-COVID Guidelines)

Magno JD, Uy-Agbayani C, Obillos SM, Ragasa R, Anderson B. March 30, 2020. Appropriate use Criteria for Urgent Transthoracic Echocardiography for patients with suspected or confirmed COVID infection (The ACUTE-COVID Echo Guidelines). UP PGH Division of Cardiovascular Medicine, Section of Echocardiography. Unpublished internal document. [icon artwork by Samson A.]

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Main reference: ACCF/AHA/ASA/ASNC/HFSA/HRS/SCAI/SCCM/SCCT/SCMR 2011 Appropriate Use Criteria for Echocardiography. J Am Soc Echocardiogr. 2011;24(3):229–267. doi:10.1016/j.echo.2010.12.008



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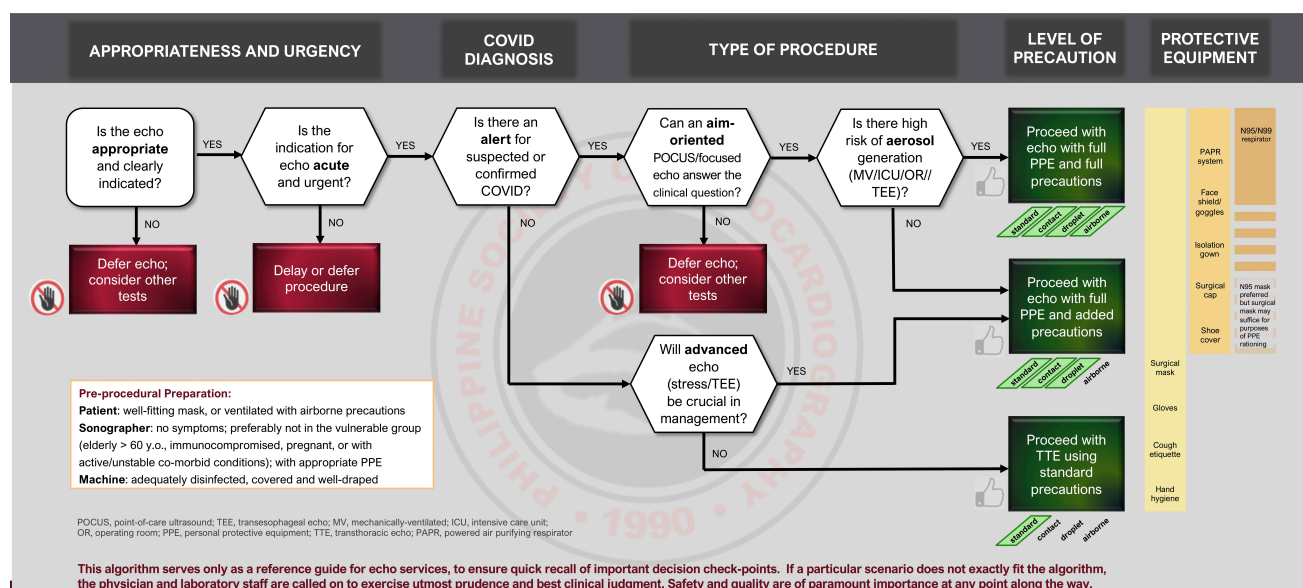
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APPENDIX B

General Algorithmic Approach to Echo amidst COVID infection

Guide to interpretation of the algorithm

- **Appropriateness and urgency.** All echo requests must first be appropriate to be considered. As a matter of enhanced screening, those with urgent indications will be prioritized and performed. Elective procedures can be delayed or re-scheduled.
- **COVID diagnosis.** If there is any doubt as to COVID diagnosis, the staff are encouraged to handle as COVID and utilized full PPE.
- **Type of procedure.** Stress and transesophageal echocardiography are generally discouraged at this time. However, the decision to perform such advanced tests for patients with NO COVID will be left to the discretion and best judgment of the clinician.
- **Level of precaution.** Standard precautions are universal for any healthcare-related encounter. Added precautions considers possibility of contact and droplet transmission. Full precautions entail consideration of all possible modes of transmission (contact, droplet, airborne).
- **Protective equipment.** The ideal PPE set must conform to DOH/CDC/WHO quality standards. The type and extent of protective gear will depend on the level of precaution required by the situation.



Algorithmic Approach to Echocardiography amidst COVID19

Procedures, precautions and protection during echocardiography

PSE Interim Guidelines for Enhanced Quality and Safety at the Echocardiography Laboratory Amidst Emerging Infections. Summary Recommendations from the Task Force on Quality and Safety during Echocardiography of the Philippine Society of Echocardiography, Inc. and the Philippine Heart Association Council on Echocardiography. (April 2, 2020)

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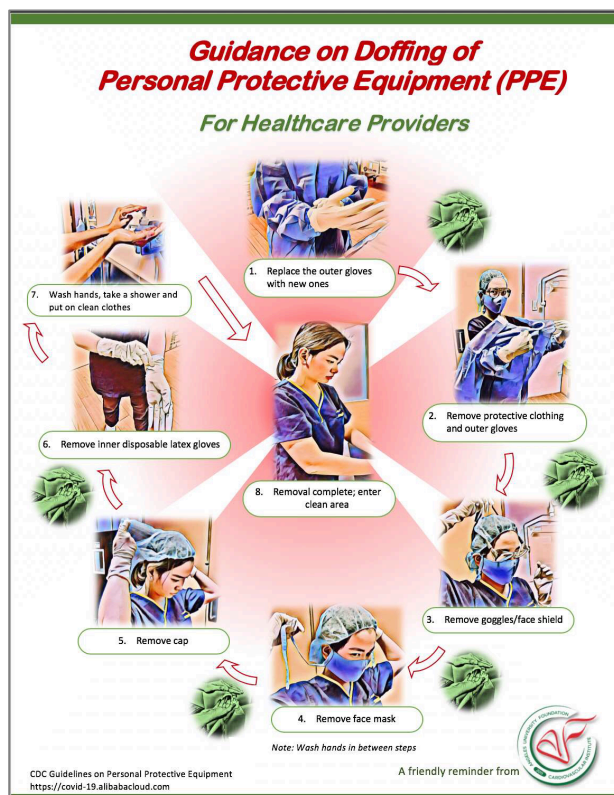
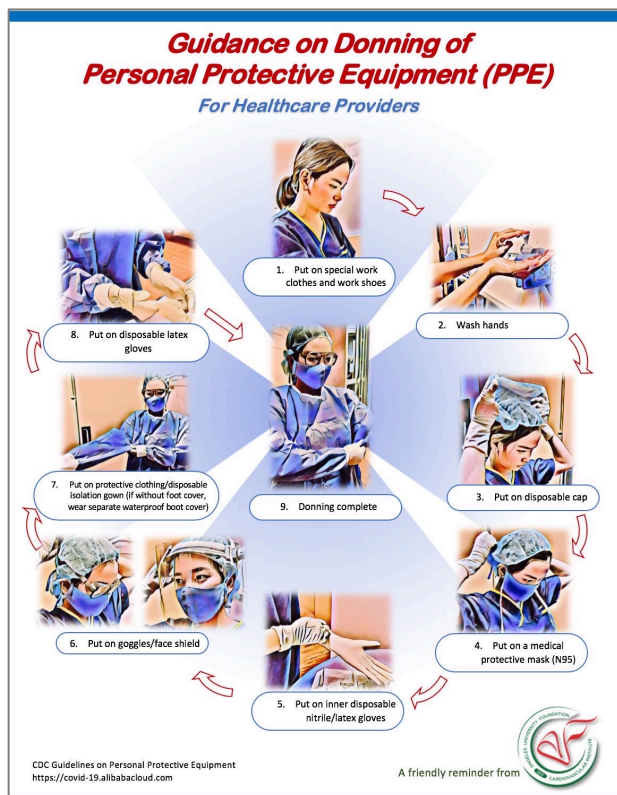
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APPENDIX C

Personal Protective Equipment during Echocardiography



PPE donning and doffing infographics adopted with permission from the AUF Cardiovascular Institute. Artwork and design courtesy of Dr. Rayzen Canono.

References:

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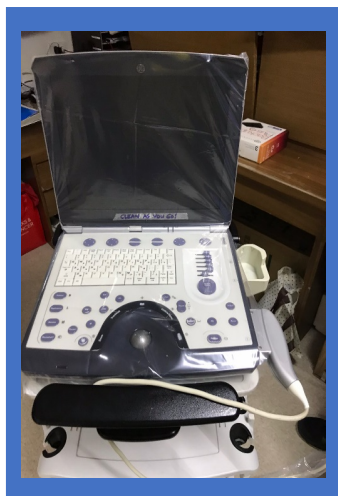
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APPENDIX D

Handling of Equipment for Echocardiography



Apply 1st layer of protective plastic (e.g. cling wrap) over screen and keyboard.



Apply 2nd layer of thicker protective (disposable) plastic over entire machine.



Cover wires and transducer cable with plastic (e.g. cling wrap).



Cover transducer (including footprint) with tight plastic wrap (transducer cover or condom) and gel



Create a plastic barrier (acrylic board or plastic sheet) between sonographer and patient. Do not connect ECG cables. Minimize contact with patient and patient's bed.

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APPENDIX E

Streamlined Echo Scanning Protocol

BASIC REMINDERS

- Know the test indication and the clinical question to be answered.
- Ensure that you have proper personal protective equipment.
- Do time-gated rather than ECG-gated studies.
- Perform the entire study preferably at bedside in 5 minutes or less.
- Do targeted acquisition (3-second clips) with measurements performed offline.
- If necessary, do color Doppler studies in dual mode (simultaneous or compare) to minimize scan time. Consider limited Spectral Doppler if with significant stenosis, regurgitation or pulmonary hypertension.



Parasternal long axis (PLAX)

- 2D and color Doppler (dual)
- Check: wall motion, pericardial effusion, mitral and aortic valves
- Optional: focused aortic root



Parasternal short-axis (PSAX)

- 2D and color Doppler (dual), quick sweep of level of great vessels, mitral valve and papillary muscles
- Check: wall motion, pericardial effusion, valves
- Optional: view at level of LV apex



Apical 2-, 3-, 4-, 5-chamber

- 2D and color Doppler (dual); spectral Doppler for MV inflow, LVOT, AV
- Check: chamber size (visually), wall motion, thrombus, quick diastology, MV and AV, adequate views for offline EF calculation, focused RV view
- Optional: consider spectral Doppler if indicated



Subcostal 4-chamber

- 2D and color Doppler (dual)
- Check: IVC caliber and collapsibility
- Optional: shunt interrogation

MV, mitral valve; LVOT, left ventricular outflow tract; AV, aortic valve; EF, ejection fraction; RV, right ventricle; IVC, inferior vena cava

Note: The echo study may not necessarily be limited to the windows and views above, depending on the clinical question being addressed and the specific echo information needed.

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APPENDIX F Disinfection Procedures

Ultrasound machines and transducers

- **Types of Ultrasound Transducers**
 - External: come into contact with clean, intact skin but not mucous membranes (e.g. transthoracic)
 - Interventional percutaneous: used for percutaneous needle or catheter placement (e.g. echo-guided pericardiocentesis, vascular access)
 - Internal: come into contact with mucous membranes (e.g. transvaginal, transesophageal)
- **Disinfection of Transducers.** Levels of Disinfection
 - Low-level: destroys most bacteria, some viruses and fungi (bare minimum for external transducers)
 - Mid-level: inactivates *M. tuberculosis*, bacteria, and most viruses and fungi
 - High-level: destroys/removes all microorganisms except bacterial spores (required for interventional/intraoperative and internal transducers)
- **General Cleaning of Transducers.** Transducers must first be disconnected from the ultrasound scanner prior to any disinfection procedure. They must be cleaned after every use with soap and water or quaternary ammonium sprays or wipes. Upon removal of a transducer cover (recommended especially in COVID situations), running water may be used to remove residual debris from the transducer head and handle. A damp and nonabrasive cloth using nonabrasive liquid soap (e.g. dishwashing liquid) is used to thoroughly clean the transducer.
- **High-level Disinfection.** Transducers that require regular high-level disinfection (HLD) must be handled with great care and caution. Only FDA- and vendor-approved disinfecting agents may be used. Some of the HLD agents used include: hydrogen peroxide, glutaraldehyde, hypochlorite/hypochlorous acid,
- **Operator.** All personnel tasked to perform cleaning and disinfection procedures must wear adequate protective equipment (e.g. gloves, mask, impermeable gown).

Laboratory or procedure area

- **Floors and walls.** Thoroughly disinfect the floor and walls with a properly-formulated solution (e.g. 1000 mg/L chlorine-containing agent) by mopping, spraying and wiping. The disinfectant must be allowed to stay on for at least 30 minutes, and the procedure done regularly (3 times a day, if possible) and as needed depending on the presence of new debris or contaminants.
- **Objects and surfaces.** Wipe the surfaces of objects with the disinfectant (e.g. 1000 mg/L chlorine-containing agent) or wipes with effective chlorine; rinse the said surface with clean water after letting the disinfectant stay for at least 30 minutes. The sequence of wiping should be as follows: cleanest surfaces (and those infrequently touched or handled) to dirtiest (and most frequently handled) surfaces. Do not reuse wipes.
- **Air disinfection.** If available, plasma air sterilizers are used continuously in places with high human traffic. Alternatively, ultraviolet lamps can be utilized (1 hour duration in unpopulated area) for 3 times in a day.

References:

1. American Institute of Ultrasound in Medicine. Guidelines for Cleaning and Preparing External- and Internal-Use Ultrasound Transducers Between Patients, Safe Handling, and Use of Ultrasound Coupling Gel. Nov. 3, 2018. (https://www.aium.org/accreditation/Guidelines_Cleaning_Preparing.pdf)
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