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The Iranian Society of Echocardiography (ISE) Statement on Performing Echocardiography During the COVID-19 Pandemic

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Abstract: Corona virus disease 2019(COVID-19) pandemic has caused a significant burden on the global health system. Considerable cardiovascular involvement has been reported among COVID-19 patients with higher ICU admission and mortality rates among patients with cardiovascular comorbidities. Consequently, diagnostic cardiovascular evaluations such as echocardiography are a crucial part of the disease management. On the other hand, providing safety for the patients and the healthcare personnel is a matter of great concern in the pandemic state. In this document, we have provided recommendations on performing echocardiography in hospital echocardiography labs and outpatient echocardiography clinics during the current COVID-19 (Coronavirus disease of 2019) outbreak. (Curr Probl Cardiol 2020;45:100620.)

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Objective

This statement contains recommendations on how to perform echocardiography in hospital echocardiography labs and outpatient echocardiography clinics during the current COVID-19 (Coronavirus disease of 2019) outbreak.

Note that the statement contains recommendations which are mostly based on expert opinions and since there is not enough established evidence, they should not be relied on as the only source for clinical decision making.

Transthoracic echocardiography (TTE), stress echocardiography, and transesophageal echocardiography (TEE) are procedures with close contact with the patient, with TEE also considered as a droplet and aerosol generating procedure.

The recommendations herein are similar for hospital echocardiography labs and outpatient echocardiography clinics. However, in case of self-check in of suspicious or confirmed cases to out-patient clinics, echocardiography should not be performed and the patients should immediately be referred to the nearest medical center assigned for the triage of COVID-19 patients.

Recommendations are classified into 2 categories based on patient characteristics:

- 1) Asymptomatic (nonsuspicious);
- 2) Suspicious for COVID-19, and patients with confirmed COVID-19.

Triage

- All elective ambulatory and routine follow-up visits should be delayed, and nonurgent echocardiography requests should be postponed.
- Triage sections should be separated from patients by engineering control measures such as glass windows or temporary plexiglass barriers in order to reduce the risk of exposure.
- Triage of patients with respiratory symptoms should be prioritized.
- All patients referred to echocardiography labs should be evaluated for the following¹:
 - Detailed history of fever, cough, sore throat, chills, diarrhea, headache, malaise and new dyspnea in the past few days.
 - Residence in or recent travel to high-risk areas in the past 2 weeks.
 - History of close contacts with suspicious or confirmed COVID-19 patients in the past 2 weeks.

After the initial evaluation, the patient's temperature should be checked. Significant fever is defined as an oral temperature of more than 37.3°C AM, 37.8°C PM.

If feasible, O₂ saturation should be screened. A saturation level of less than 93% should prompt further evaluations for COVID-19.

Echocardiography in standard conditions according to pandemic situation can be performed if all the aforementioned criteria are negative. Otherwise, the protocol for suspicious/definite COVID-19 patients with advanced personal protective equipment (PPE) should be implemented only if echocardiography is essential based on the recommendations regarding echocardiography indications.

Echocardiography Standards During the COVID-19 Pandemic

Waiting Room

- Patients should not gather in the waiting room. For instance, it is advisable that they remain outside the hospital until they are called in for their appointment. Note that presence of patient companions should be strongly prohibited unless their presence is somehow essential.
- If feasible, a separate waiting area should be dedicated for patients with suspicion for and those with a definite diagnosis of COVID-19.
- Patients or their companions/caregivers should comply with social distancing and keep a distance of 6 feet (2 meters) while seating in the room.
- Patients and their companions/caregivers, as well as healthcare personnel, should use surgical masks while in the waiting room/triage area. They should also be advised to avoid touching their masks.
- Hand sanitizer, wipes, disinfectants and tissues should be adequately at hand.
- Special hazardous infectious material litter bins should be readily available for the disposal of used materials.
- Cough etiquette should be taught to patients and their companions/caregivers.
- Educational Infection Prevention and Control posters such as cough etiquette are very helpful and should be in full view in the room.

Echocardiography Room

- Since most echocardiography rooms are not equipped with negative ventilation, a room with a window facing outdoors is preferred in order to maintain natural ventilation, especially for confirmed or suspicious cases.²
- During echocardiography, the door to the corridor should remain closed and the window to the outdoor area should be half-open.
- It is recommended to limit the presence of the staff in the room when a suspicious/definite COVID-19 patient is undergoing echocardiography.
- Large hospitals and especially, referral centers for COVID-19 patients should dedicate 1 room with 1 echocardiography machine for suspicious/definite COVID-19 patients. Note that any other machines in the specified room should be either used for COVID-19 patients or be relocated.
- After each echocardiography, all equipment in direct and indirect contact with the patient, and the room should be properly disinfected as per local Infection Prevention and Control (IPAC) guidelines. This includes high touch areas in the room such as door knobs, light switches, keyboard, computer screen, patient bed and surfaces.
- All disposable materials such as gowns, surgical masks, bed sheets, and O₂ masks should be discarded in specified bins. Reusable equipment such as face shield should be wiped properly.

Patients

- Patients are advised to perform hand hygiene with Alcohol Based Hand Rub before entering the room.
- If patients leave the room during the echocardiography examination for any reason, it is necessary that they once again disinfect their hands upon re-entering the room.
- All patients are advised to wear surgical face masks. The use of surgical gowns is not mandatory unless the physician deems it beneficial or the patient's outfit is unclean.

Physicians and Health Personnel

- Physicians should perform hand hygiene with Alcohol Based Hand Rub (or with soap and water for at least 20 seconds) both before entering the room and after performing echocardiography.

- The echocardiographer and other healthcare personnel in the room should choose PPE based on the patient and procedure type.
- During the pandemic limited re-use or extended use of N95 masks are allowed with special considerations in cases of supply shortages.³ However, this dispensation is not permitted for gloves and gowns.
- The safe sequence of wearing and removing PPE should be properly taught and implemented by the healthcare personnel in order to avoid contamination with potentially infectious materials.^{4,5}

PPE for TTE in nonsuspect asymptomatic patient

- Full PPE, including surgical face masks, gloves and goggles/face shield is recommended. If available surgical fluid-repellent gowns and respirator masks could be used by the echocardiographer. Hand disinfection before putting on and after removing gloves is recommended.

PPE for TEE in nonsuspect asymptomatic patient

- TEE is an aerosol and droplet-generating procedure. Therefore, use of advanced PPE, comprised of long-sleeved surgical fluid-repellent gowns, nitrile or latex gloves (which should cover the sleeve cuffs of the gown), respirator N95, N99 or FFP2, FFP3 masks, and protective goggles or ideally face shields, is recommended to the echocardiographer, the anesthetic technician, and the nurse in charge whom are in close contact (within 2meter distance) with the patient.
- Valsalva and cough maneuvers should be strictly avoided. (Studies for the evaluation of the patent foramen ovale should be postponed.)

Additional Precautions Regarding Echocardiography on Suspicious/confirmed COVID-19 Patients

- Vis-à-vis suspicious/definite COVID-19 patients, it is strongly recommended that echocardiography not be performed in outpatient clinics or offices.

- Echocardiography should be performed only in case of evident indication.
- Use of Ultrasound assisted physical examination and point of care cardiac ultrasound exams which are performed bedside and by the clinicians who are already in charge of the patient is an interesting option which can be useful in centers with the required advanced resources. Images are acquired without exposing any additional medical personnel. Furthermore, the acquired images can be stored and be remotely evaluated by echocardiography experts later.⁶

PPE for TTE on suspicious/confirmed COVID-19 patients

It is preferred to use advanced PPE as noted above, consisting of long-sleeved surgical fluid-repellent gowns, nitrile or latex gloves (which should cover the sleeve cuffs of the gown), respirator N95, N99 or FFP2, FFP3 masks, and protective goggles or ideally face shields⁷ Full PPE is also acceptable as the procedure is a nonaerosol producing procedure.

PPE for TEE on suspicious/confirmed COVID-19 patients

- Enhanced PPE, comprised of consisting of long-sleeved surgical fluid-repellent gowns or protective coveralls, double nitrile or latex gloves (which should cover the sleeve cuffs of the gown), respirator N95, N99 or FFP2, FFP3 masks, and protective goggles or ideally face shields, shoe covers, and head covering, is strongly urged. Note that no skin should be exposed.
- It is recommended to use nylon covers for TEE probes in suspicious/confirmed COVID-19 patients.
- Bedside TEE on intubated patients with COVID-19 should be performed in an isolated room or if not possible, in a special ward for COVID-19 patients.
- Recommendations regarding the cleaning of echocardiography equipment are presented later.

Indications for Echocardiography in COVID-19 Patients

There have been reports of significant cardiovascular involvement among COVID-19 patients. An earlier study reported rates of 7.2% for myocardial injury, 8.7% for cardiogenic shock, and 16.7% for

arrhythmias in this group of patients.⁸ Furthermore, ICU admission and mortality rates appear to be higher among COVID-19 patients with previous cardiovascular comorbidities. This comprises a significant number of patients as a meta-analysis on 1527 COVID-19 patients reported a prevalence rate of 16.4% for cardiovascular disease.⁹⁻¹¹

The precise indication of the echocardiography and the required data in that regard should be considered prior to the exam. A goal oriented and rapid study should then be performed, acquiring only the necessary views in order to minimize the exam duration as much as possible.

Recommended indications for performing echocardiography are as follows:

- Shock state
- New arrhythmias (except for isolated premature ventricular contractions [PVCs] or premature atrial contractions [PACs]) or block in the electrocardiogram (ECG)
- Cardiomegaly in computed tomography (CT) scan
- More-than-mild pericardial effusion in CT scan
- Elevated cardiac biomarkers defined as¹²
 - NT-pro-BNP more than 450 pg/dL in patients aged below 50 years
 - NT-pro-BNP more than 900 pg/dL in patients aged between 50 and 75 years
 - NT-pro-BNP more than 1800 pg/dL in patients aged over 75 years
 - An otherwise unexplained elevated high-sensitivity cardiac troponin I level of more than the 99th percentile
- New ischemic changes in ECG
- Generalized edema
- Unexplained deterioration in the clinical status of patients with previous cardiovascular disease
- It is also reasonable to perform echocardiography at the discretion of the consultant cardiologist while considering the appropriateness criteria.
- As TEE bears a high risk of transmission due to droplet and aerosol generating properties, it is highly recommended to perform the procedure only if it is vital, concerning the diagnostic or treatment plan of the patient.
- *A CT scan should be performed before echocardiography in patients presenting with fever and suspicious of infective endocarditis if there are respiratory symptoms, O₂ saturation levels of less than 93%, or lymphopenia.*

Disinfection of Echocardiography Machines

- The person in charge of disinfection should use advanced PPE.
- Monitors, probes, probe holders, control panels, ECG leads and cables, and plastic covers of echocardiography machines are the parts amenable to disinfection.

Cleaning the Machine

- All parts of the echocardiography machine should be cleaned from any external debris and then dried before disinfection.
- Echocardiography machines should not be exposed to high UV sources, including direct sunlight.
- Ultrasonic cleaning is not recommended.
- It is highly recommended to choose the compatible disinfectant based on the manufacturer's recommended list.
- Disinfectants containing surfactants, methanol, ethanol, benzyl or methyl alcohol, bleaches, methyl or ethylparaben, polyethylene glycol, oil-based lotions, acetone, ammonia, iodine compounds, and solutions with a pH of 5 or greater may cause damage to the transducer and their use should be avoided.
- Daily cleaning of the echocardiography machine is recommended. However, in the case of suspicious/definite COVID-19 patients, cleaning should be performed right after echocardiography is done.

Cleaning the Probe

Low-level disinfection

- This type of disinfection is used when the probe is in contact with intact skin and not mucosa.
- The probe should be disconnected from the unit.
- The coupling gel and any external debris should be wiped with a soft cloth.
- The probe and its cable should then be wiped with a soft cloth sprayed with a recommended disinfectant liquid. Note that the liquid should not be sprayed on the probe.
- Cleaning the probe should be performed with caution so as not to cause any damage to the surface of the lens.

- The cleansing material should be wiped off the probe after about 30 seconds to prevent any damage.
- Sodium hypochlorite (concentration $\approx 0.6\%$), quaternary ammonium ($< 0.8\%$ concentration), accelerated hydrogen peroxide (maximum concentration = 0.5%), and alcohol-based solutions (maximum concentration should not exceed 70%) are some of the low-level disinfectants that are generally compatible for use.¹³
- Note that the only parts that may be cleaned with isopropyl alcohol are the connector housing, the transducer housing, and the lens of the TTE probe and the connector housing and the control housing of the TEE probe.

High-level disinfection

- This type of disinfection, which is considered after mucosal contact, results in the elimination of all microorganisms except for a few bacterial spores.
- Common high-level disinfectants include glutaraldehyde, orthophthalaldehyde, hydrogen peroxide, and peracetic acid. It is highly recommended that the manufacturer's recommendations be followed for the type of disinfection.
- The probe should be disconnected from the unit.
- The probe surface should be dried and wiped with a soft cloth.
- The exposed part is then placed in the specified germicide for the desired duration as recommended by the manufacturer.
- The germicide is thereafter rinsed from the probe. It can be dried with a towel or air-dried afterward.^{12,14} The rinsing of the TEE probe can be repeated up to 3 times to make sure that there is no residual disinfectant on the probe since it can cause skin/mucosal irritation.
- *We recommend high-level disinfection of the probe after both TTE and TEE on suspicious/confirmed COVID-19 patients.*

Authors' contribution

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