

Patient care protocols and personal safety measures for health care professionals in cardiac catheterization rooms during the COVID-19 outbreak in the National Institute of Cardiology

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Abstract

The COVID-19 was first described in late 2019 that quickly became a pandemic affecting every health system as we know it. The high transmissibility among humans represents a well-known high burden of morbidity and mortality not only for cardiovascular patients but also for a higher risk between health care professionals that must deliver high-quality care to them in any scenario, and cardiac catheterization rooms are no exception. This creates a new dilemma, minimize exposure to patients and health care professionals to COVID-19 while maintaining high quality in cardiovascular therapeutics. In order to achieve this, several international recommendations on treatment algorithms modifications and in safety measures in the catheterization room have been published, always aiming to solve this dilemma in the best possible way. Hereby, we present a summary of the most recent treatment algorithms in the most important cardiovascular interventions (acute coronary syndromes, structural and congenital heart diseases) as well as specific safety measures with a step-by-step preparedness before and after any interventional procedure during COVID-19 outbreak. The objective of this document is to inform and to train health care professionals that works in cardiac catheterization rooms on the risks as well on the plan for containment, mitigation, and response to the global situation of COVID-19 infection in order to apply this in their own local work environments.

KEYWORDS

acute coronary syndrome, cardiac catheterization, congenital heart defects, pandemics, valvular heart diseases

1 | INTRODUCTION

1.1 | Panorama

The COVID-19 (acronym in English: corona virus disease 2019) caused by the new virus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was first described in late 2019¹ and quickly became a public health emergency, declared a pandemic by the World Health Organization (WHO) on March 11, 2020.²

The first case in our country was diagnosed on February 28, 2020,³ however, on April 16, the estimated number of cases was 55,951.⁴ These numbers translate the high transmissibility that this virus has among humans, which represents a high burden of morbidity and mortality as well as a high risk of community contact. However, there is an increased risk of contagion among health professionals during the care of these patients, whether in a respiratory triage, intensive care unit or a cardiac catheterization room.

1.2 | Dilemma of risks in cardiological intervention

This disease and its high degree of contagion forces to adopt security measures to protect the health of all patients and health care professionals who are exposed to this disease. Cardiac catheterization rooms are no exception. This creates a new dilemma in the care of patients who will be taken to an invasive cardiovascular procedure. On the one hand, the exposure of patients at high risk to COVID-19 must be minimized, the strict prevention measures of health care personnel,⁵ the rational use of available resources,⁶ and all this while maintaining high quality in the cardiovascular therapeutics. On the other hand, cardiovascular intervention procedures that are necessary to influence the morbidity and mortality of patients with acute and chronic cardiovascular conditions that warrant an intervention must continue, even in times of contingency due to this new outbreak.⁷

1.3 | Aim of this document

The objective of this document is to inform and train personnel working in cardiac catheterization rooms on the risks as well as the plan for containment, mitigation, and response to the global and local situation of COVID-19 infection. The statistical guidance in this document is based on the most recent evidence worldwide and from medical and scientific sources that govern global health such as the WHO and the world's leading associations of cardiovascular professionals, who are currently affected or had pass the epidemic and others in advanced stages of the outbreak of this disease and who have the experience and evidence necessary to issue these recommendations, which have been adapted to our context and can be used universally applied.

2 | PATIENT CARE PROTOCOLS

2.1 | International recommendations

Multiple national and international societies have adapted their care and safety protocols according to what the WHO recommends. Highlights include recommendations from the Chinese Society of Cardiology,⁸ the London National Health System, as well as consensus from the American College of Cardiology and the Society for Cardiovascular Angiography and Interventions⁷ (including recommendations on structural procedures)⁹ and one of the Heart Rate Association and the Interventional Cardiology Association (ACI for its acronym in Spanish) and the Spanish Society of Cardiology (SEC for its acronym in Spanish).¹⁰

Combining the recommendations of the WHO^{5,6,11-15} and of all these and other associations,^{16,17} we describe below the care protocols of the three largest groups of patients who are cared for in the catheterization rooms, always taking into account that the safety and personal protection measures indicated below must be followed

all times and keeping in mind that all patients should be considered asymptomatic carriers until proven otherwise.

2.2 | Acute coronary syndromes

Priority should be given to primary percutaneous coronary intervention of ^{7,8,16}, especially those with an anterior location of less than 12 hr of evolution or those with major contraindication for thrombolysis. For patients with non-ST segment elevation (NSTEMI) or high-risk unstable angina, urgent percutaneous coronary intervention should be prioritized in cases with hemodynamic or electrical instability, and/or persistent chest pain. In failed thrombolysis patients, rescue percutaneous coronary intervention should be performed. Those patients with NSTEMI and severe pneumonia, myocarditis without hemodynamic instability, type 2 myocardial infarction due to sepsis, systemic inflammatory response or myocardial injury or low-risk NSTEMI, it is recommended to evaluate case by case and to estimate the possibility of deferring the percutaneous coronary intervention (Figure 1).

2.3 | Structural heart disease

Most centers with structural departments in the world have closed their programs; however, there are certain conditions in which the patient should be prioritized for these kind of procedures⁹: patients with severe aortic stenosis (AS) in the functional class III/IV of the New York Heart Association (NYHA) requiring a transcatheter aortic valve implant, patients with severe mitral regurgitation who cannot be discharged from the hospital according to the criteria from the group of experts in heart failure (HF), patients with severe post-infarction MI with very high surgical risk, patients with NYHA functional class III/IV paravalvular leak and/or hemolysis who cannot be discharged from the hospital according to the criterion of the group of experts in HF. In patients with severe asymptomatic AS, severe MI with an adequate response to medical treatment, and those with paravalvular leakage in functional class I-II, it is recommended to evaluate case by case and estimate the possibility of deferring the structural intervention (Figure 1).

2.4 | Congenital heart disease

It is recommended to treat patients hospitalized or transferred from another hospital (or outpatient) who require urgent cardiac catheterization due to hemodynamic compromise (or impending compromise), as well as patients who are waiting for a required cardiac catheterization prior to surgery or to be able to be discharged from the hospital.¹⁷ For significantly symptomatic outpatients in whom a deferral greater than 30 days could be deleterious, cardiac catheterization is also recommended.¹⁷ For those asymptomatic or slightly symptomatic patients in whom they could wait more than a month as outpatients, it is recommended to evaluate the case for their delay (Figure 1).¹⁷

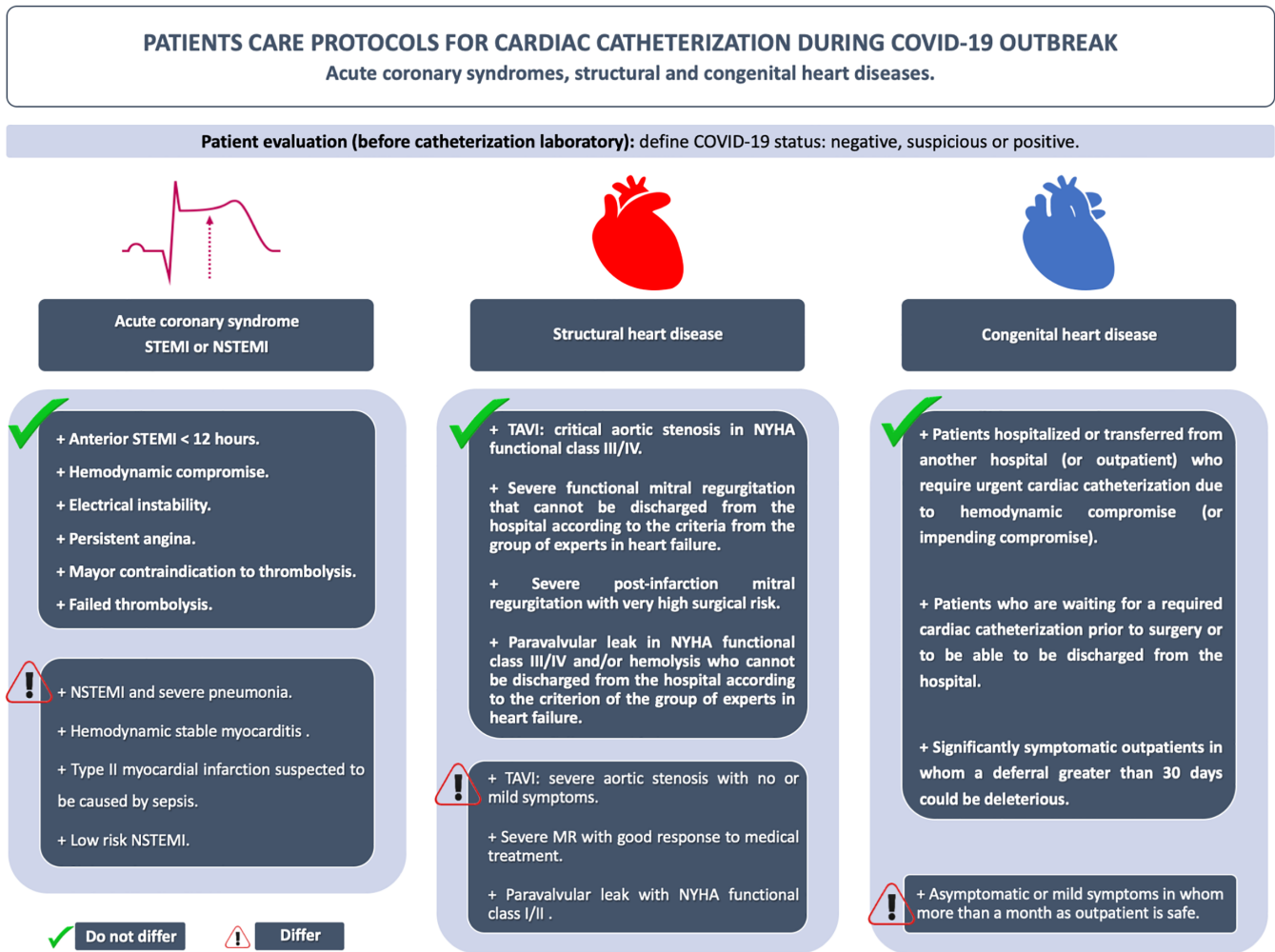


FIGURE 1 Patients protocols in case of acute coronary syndrome, structural, or congenital heart diseases during COVID-19 outbreak

3 | HEALTH CARE PROFESSIONAL'S SECURITY MEASURES

3.1 | The value of personal protection

There are multiple editorial releases and observational studies in which it has been shown that establishing safety protocols with the appropriate use of adequate personal protective equipment (PPE) reduces the risk of contagion for health professionals and, consequently, their risk of morbidity and mortality. In China, it has been reported up to 20% of positive cases of COVID-19 among health care professionals.¹⁸ Recently in Italy, the group of Tarantini et al., compared the COVID-19 transmission rate among health personnel from different health departments, specifically the cardiology service (including personnel from catheterization rooms), who had a security protocol against COVID-19 and compared them with other health areas where they did not have a safety protocol. After a 20-day follow-up, the health personnel of the services with safety protocols presented 1.2% of positive cases to COVID-19, while the health

personnel of the services without safety protocols presented 12.5% of positive cases ($p < .001$).¹⁹

3.2 | Special security considerations

Due to the epidemiological model used in our country, it will be difficult to know which patients are positive or negative, which is why, and justified by the high rates of infection, that during the COVID-19 outbreak, all patients should be considered as positive until proven otherwise. All elective procedures should be deferred and only urgent procedures or elective cases that cannot be deferred for an estimated time of 3–4 months should be performed.¹⁵

In case of having negative pressure catheterization rooms, priority should be given to using those rooms. In the case of having multiple catheterization rooms, focus patient care in the same room.¹⁰ All the transfers of patients should be carried out by patient transporters with adequate PPE and it would be these personnel who will place and remove the patient on procedural table.

Only those health professionals considered essential to carry out the procedure should enter the room,¹⁰ this includes one or two operators, a cardiovascular anesthesiologist, a nursing staff and a radiologist technician. Once the patient is on the procedure table and with the transfer stretcher outside the area of the interventional cardiology department, the team of health professionals who will participate in the procedure will begin with the dressing (donning) (see below), starting with the staff nurse, so that in this way staff nurse can enter the room with the patient at the very beginning of the procedure. The procedures must be carried out behind closed doors at all times, and during this time, no one should enter or leave the room.¹⁰ All the planned material (including balloons, stents, or other special materials as far as possible) should be selected and placed inside the room before starting the intervention.

It is important to evaluate all patients who will be taken to the catheterization room before their transfer.¹⁰ All patients should be questioned for symptoms or signs of COVID-19 as well as determine the presence or absence of fever.¹⁰ According to the U.S. Center for Infectious Disease Prevention and Control (CDC), the most frequent symptoms reported by hospitalized patients at the beginning of the disease are fever, cough, myalgia or fatigue, and dyspnea, however, up to 17 related symptoms have been reported, including diarrhea, anosmia, and dysgeusia.²⁰

3.3 | Personal protection equipment

The importance of using the appropriate PPE, in addition to the reasons previously stated, lies in the potential scenario of maximum contagion to which all health personnel involved in these procedures would be potentially exposed.⁶ During any invasive procedure in a cardiac catheterization room, there is a possibility that any patient may present cardiorespiratory impairment that warrants airway management and urgent orotracheal intubation, as well as advanced cardiopulmonary resuscitation maneuvers, scenarios defined by the WHO as very risk of contagion and those that deserve maximum personal protection.⁶ This is why maximum safety PPE is required,^{6,10,16} as well as it is recommended that any other invasive procedure that can be performed outside the catheterization room, be performed before in the emergency room or in the coronary care unit such as placement of central lines, flotation catheters, aortic balloon pump, temporary pacemaker, and must importantly, invasive mechanical ventilation as appropriate. (Figure 1).

The following PPE is recommended for all health care personnel (in order of placement—see below): disposable surgical uniform, lead apron, one pair of disposable boots, disposable N95 (or higher effectiveness) mask, disposable surgical mask, polycarbonate goggles that allow airtight seal (ideally with antifog cover), disposable cap, two pairs of gloves (surgical sterile gloves for operators, for other personnel, will be nonsurgical and nonsterile) and disposable waterproof gowns (which will be sterile in the case of operators).^{6,10,14,16}

3.4 | Donning and doffing

It is advisable to arrive to the hospital with casual clothes, which must be changed for surgical uniform and plastic shoes once inside the facilities of the interventional cardiology department. No jewelry or accessories should be worn and, before the protective equipment, verify that the PPE is complete and in good condition^{10,16} (Figure 2).

3.4.1 | Donning

A dressing area should be designated for all health personnel. In this area, all the PPE must be ready before any procedure. Once in this area, the team will start with the universal technique of hand washing with soap and water to proceed with the placement of the disposable surgical uniform on top of the cloth uniform. After this, you continue with the PPE in an ascending fashion (see Figure 2 for more details). At this time, these staff can now enter the catheterization room. For operators, before donning the first pair of gloves, they must perform the surgical hand wash. The first pair of sterile surgical gloves will then be donned, followed by the sterile disposable waterproof gown. Once dressed in this manner, the operator will be able to enter the catheterization room. Once inside and without having touched any surface, the second pair of sterile surgical gloves will be put on (Figure 2).

3.4.2 | Doffing (inside room)

Once the procedure is completed, the doffing has to be done in two stages, one inside the room and the other outside it.^{10,16} The doffing steps apply to all the health care personnel who entered the room. Inside the room, it begins with preresmoval of the external pair of gloves, always with a pinch technique (without touching the internal part of the gloves). Next, preresmoval of the gown, which is collected and rolled up on itself, in order to avoid that the external surface is in contact with the medium. Proceed in a single movement to remove gown and external gloves, which will be deposited in a container of contaminated waste inside the room. Subsequently, and by performing this as a transfer between a contaminated area and a clean area between the interior and exterior of the room, supported by a bench, the disposable boots will be removed one by one, in such a way that, when the first boot is removed, one would move that foot outside the room (to the uncontaminated area) and after this, follow the same steps for the other foot.

3.4.3 | Doffing (outside room)

In this way, the health personnel are now out of the room. Now the equipment will be removed in the opposite fashion, from top to bottom (see Figure 2 for details). Caution must be taken when removing the PPE. The goggles removal should be performed with eyes closed and taking the strap from the back. Once removed, deposit them in a 10% chlorinated water container (where they should remain for

SAFETY PROTOCOL FOR AN INTERVENTIONAL CARDIOLOGY PROCEDURE DONNING AND DOFFING

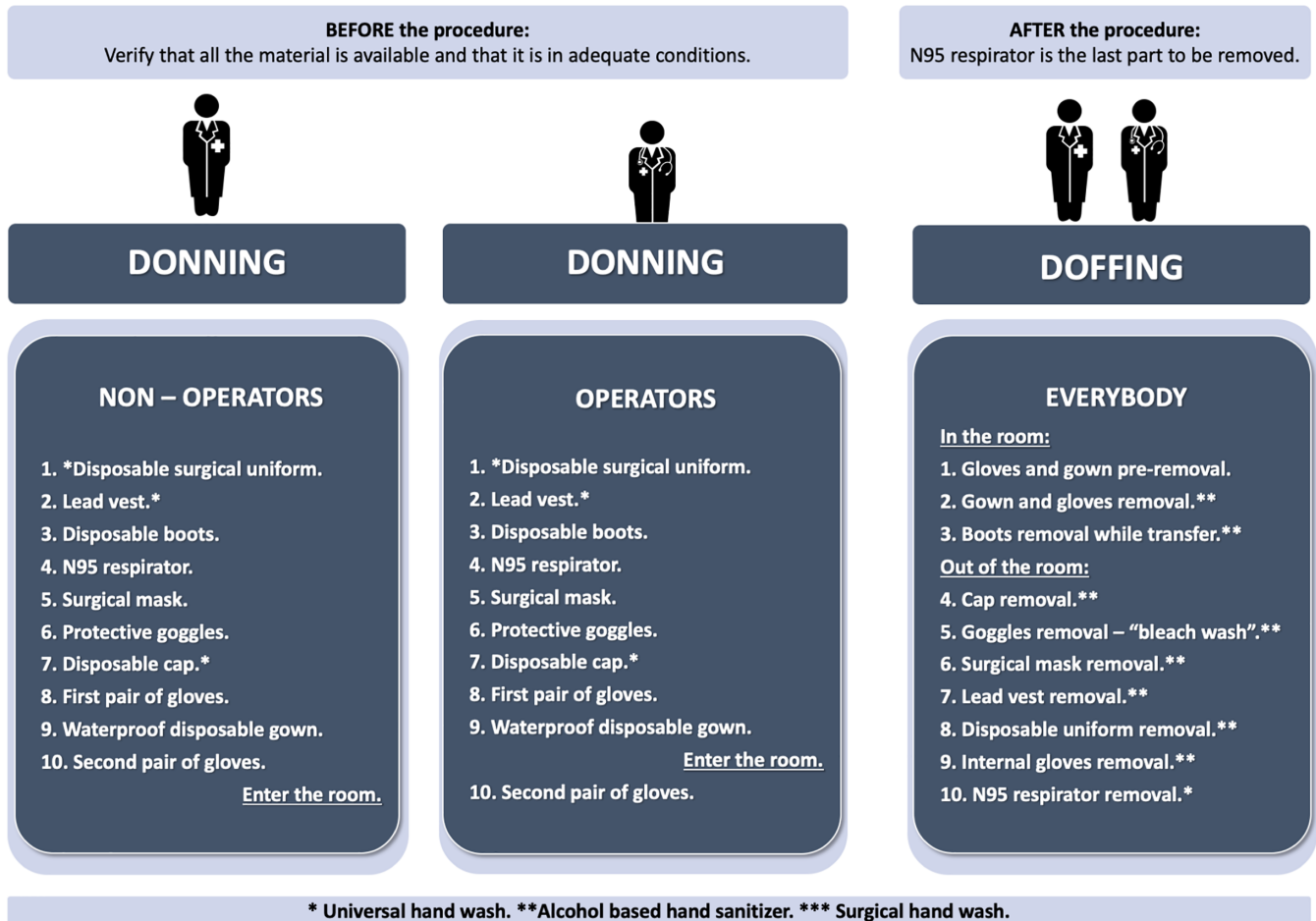


FIGURE 2 Donning and doffing before and after any percutaneous cardiovascular intervention during COVID-19 outbreak

approximately 20 min and then cleaned with soap and water for the next usage). When removing surgical mask, it should be taking it from the posterior ends of the ears and closing the eyes during removal. The lead apron should be placed in a container. The last to be removed will be the N95 respirator, which, depending on its availability, may require reuse (see below). It is vitally important that, between each step of the undressing, including between boot and boot, you should wash your gloves with alcohol gel for about 20–30 s. Once all the equipment has been removed, carry out a hand wash that extends to the arms, in order to finish with the safety protocol^{10,16} (Figure 2).

3.5 | Sanitization of the protection equipment and the catheterization room

Once the procedure is completed and the health care team is outside the room (except nursing and anesthesiology personnel if

necessary, who will remain in the room until after the patient leaves the room), the patient transfer personnel will pass on the patient from the procedure table to the stretcher and from there to his hospital bed. At this time, the remaining staff starts with doffing protocol.^{10,16}

All material used in the procedure has to be disposed properly and never exit the room. It is important to wait an hour after completing the procedure so that the cleaning staff can initiate decontamination of the room, for which, complete PPE must be carried all the time.¹⁰

In case of limited disposition of PPE, particularly N95 respirators, several techniques are now recommended by the WHO,^{6,14} CDC,²¹ and endorsed by the U.S. National Institutes of Health.²² This can be used to disinfect these respirators effectively and without considerably damaging the material or its effectiveness, such as ultraviolet light, heat treatment or vaporized hydrogen peroxide.^{6,14,21,22}

4 | CONCLUSIONS

The journey that the pandemic has taken throughout the world has similarly impacted in most countries and has forced the modification of the protocols for the care of cardiac patients who enter a cardiac catheterization room, this with goal to find a balance in the dilemma of quality care and reduction of risks for the patient and health professionals. The most important message is to continue with quality care in cardiac catheterization rooms, minimizing the risks of contagion for patients and health personnel, risks that have been shown to be reduced up to 10 times with the use of safety protocols and appropriate PPE.

CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

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REFERENCES

- Zhu N, Zhang DY, Wang WL, et al. A novel coronavirus from patients with pneumonia in China, 2019. *N Engl J Med*. 2020;382:727-733.
- World Health Organization. Coronavirus disease 2019 (COVID-19) Situation Report – 51. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports>. Accessed March 11, 2020.
- Secretaría de Salud. Gobierno de México. Conferencia de prensa por COVID-19 del 28 de febrero de. <https://coronavirus.gob.mx/noticias/>. Accessed 2020.
- Secretaría de Salud. Gobierno de México. Conferencia de prensa por COVID-19 del 16 de abril de. <https://coronavirus.gob.mx/noticias/>. Accessed 2020.
- World Health Organization. Infection prevention and control during health care when novel coronavirus (nCoV) infection is suspected. Interim guidance. [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). Accessed April 6, 2020.
- World Health Organization. Rational use of personal protective equipment for coronavirus disease (COVID-19) and considerations during severe shortages. Interim guidance. [https://www.who.int/publications-detail/rational-use-of-personal-protective-equipment-for-coronavirus-disease-\(covid-19\)-and-considerations-during-severe-shortages](https://www.who.int/publications-detail/rational-use-of-personal-protective-equipment-for-coronavirus-disease-(covid-19)-and-considerations-during-severe-shortages). Accessed April 6, 2020.
- Welt FGP, Shah PB, Aronow HD, et al. American College of Cardiology's (ACC) interventional council and the Society of Cardiovascular Angiography and Intervention (SCAI). Catheterization laboratory considerations during the coronavirus (COVID-19) pandemic: from ACC's interventional council and SCAI. *J Am Coll Cardiol*. 2020;75:2372-2375.
- Han Y, Zeng H, Jiang H, et al. CSC expert consensus on principles of clinical Management of Patients with severe emergent cardiovascular diseases during the COVID-19 epidemic. *Circulation*. 2020;141:e810-e816.
- Shah PB, FGP W, Mahmud E, et al. Triage considerations for patients referred for structural heart disease intervention during the coronavirus disease 2019 (COVID-19) pandemic: an ACC /SCAI consensus statement. *Catheter Cardiovasc Interv*. 2020;96(3):659-663. <https://doi.org/10.1002/ccd.28910>.
- Romaguera R, Cruz-González I, Ojedac S, et al. Gestión de salas de procedimientos invasivos cardiológicos durante el brote de coronavirus COVID-19. Documento de consenso de la asociación de cardiología intervencionista y la asociación del ritmo cardiaco de la sociedad española de cardiología. *REC Interv Cardiol*. 2020;2:106-111.
- World Health Organization. Coronavirus disease (COVID-19) outbreak: rights, roles and responsibilities of health workers, including key considerations for occupational safety and health. Interim guidance. [https://www.who.int/publications-detail/coronavirus-disease-\(covid-19\)-outbreak-rights-roles-and-responsibilities-of-health-workers-including-key-considerations-for-occupational-safety-and-health](https://www.who.int/publications-detail/coronavirus-disease-(covid-19)-outbreak-rights-roles-and-responsibilities-of-health-workers-including-key-considerations-for-occupational-safety-and-health). Accessed March 19, 2020.
- World Health Organization. Considerations in the investigation of cases and clusters of COVID-19. Interim guidance. <https://www.who.int/who-documents-detail/considerations-in-the-investigation-of-cases-and-clusters-of-covid-19>. Accessed March 19, 2020.
- World Health Organization. Considerations for quarantine of individuals in the context of containment for coronavirus disease (COVID-19). Interim guidance. [https://www.who.int/publications-detail/considerations-for-quarantine-of-individuals-in-the-context-of-containment-for-coronavirus-disease-\(covid-19\)](https://www.who.int/publications-detail/considerations-for-quarantine-of-individuals-in-the-context-of-containment-for-coronavirus-disease-(covid-19)). Accessed March 19, 2020.
- World Health Organization. Advice on the use of masks in the context of COVID-19. Interim guidance. [https://www.who.int/publications-detail/advice-on-the-use-of-masks-in-the-community-during-home-care-and-in-healthcare-settings-in-the-context-of-the-novel-coronavirus-\(2019-ncov\)-outbreak](https://www.who.int/publications-detail/advice-on-the-use-of-masks-in-the-community-during-home-care-and-in-healthcare-settings-in-the-context-of-the-novel-coronavirus-(2019-ncov)-outbreak). Accessed April 6, 2020.
- World Health Organization. Critical preparedness, readiness and response actions for COVID-19. Interim guidance. <https://www.who.int/publications-detail/critical-preparedness-readiness-and-response-actions-for-covid-19>. Accessed March 19, 2020.
- Tarantini G, Fracarro C, Chieffo A, et al. GISE. Italian Society of Interventional Cardiology (GISE) position paper for cath lab-specific preparedness recommendations for healthcare providers in case of suspected, probable or confirmed cases of COVID-19. *Catheter Cardiovasc Interv*. 2020;96(4):839-843. <https://doi.org/10.1002/ccd.28888>.
- Murray BH, Gordon BM, Crystal MA, et al. Resource allocation and decision making for pediatric and congenital cardiac catheterization during the novel coronavirus SARS-CoV-2 (COVID-19) pandemic: a U.S. multi-institutional perspective. *J Invasive Cardiol*. 2020;32:E103-E109.
- Remuzzi A, Remuzzi G. COVID-19 and Italy: what next? *Lancet*. 2020;395(10231):1225-1228.
- Tarantini G, Masiero G, Fovino L. Impact of a rules protocol on COVID-19 hospital-related transmission. Insights from Padua University Hospital, Italy. *Circ Cardiovasc Interv*. 2020;13(5):e009279. <https://doi.org/10.1161/CIRCINTERVENTIONS.120.009279>.
- Center for Disease Control and Prevention (CDC). Evaluating and Testing Persons for Coronavirus Disease 2019 (COVID-19). <https://www.cdc.gov/coronavirus/2019-nCoV/hcp/clinical-criteria.html>. Accessed March 14, 2020.
- Center for Disease Control and Prevention (CDC). Decontamination and Reuse of Filtering Facepiece Respirators. <https://www.cdc.gov/coronavirus/2019-nCoV/hcp/ppe-strategy/decontamination-reuse-respirators.html>. Accessed April 9, 2020.
- Fischer R, Morris D, Doremalen N, et al. Assessment of N95 respirator decontamination and re-use for SARS-CoV-2. *medRxiv*. 2020; 20062018. <https://doi.org/10.1101/2020.04.11.20062018>.

How to cite this article: Eid-Lidt G, Farjat Pasos JI. Patient care protocols and personal safety measures for health care professionals in cardiac catheterization rooms during the COVID-19 outbreak in the National Institute of Cardiology. *Catheter Cardiovasc Interv*. 2021;97:E686–E691. <https://doi.org/10.1002/ccd.28979>