

GUIDELINES FOR VASCULAR AND INTERVENTIONAL RADIOLOGY UNITS DURING THE COVID-19 OUTBREAK

A consensus statement from the Spanish Society of Vascular and Interventional Radiology (SERVEI)



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Guidelines for vascular and interventional radiology units during the COVID-19 outbreak: a consensus statement from the Spanish Society of Vascular and Interventional Radiology (SERVEI)

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ABSTRACT

The World Health Organization (WHO) recently declared the outbreak of COVID-19, caused by infection with the SARS-cov2 virus, a global pandemic.

To ensure that vascular and interventional radiology units in Spain continue to work optimally through the changing situations during this public health emergency, the Spanish Society of Vascular and Interventional Radiology (SERVEI) elaborated a consensus statement.

Based on the recommendations from the WHO, the Spanish Ministry of Health, regional health departments in Spain, and various hospitals, these guidelines aim to orient professionals in organizing units and managing patients during the COVID-19 outbreak to help ensure patients' and professionals' safety.

The implementation of these guidelines will depend on the particular circumstances and resources available at each unit.

Keywords

COVID-19, prevention, coronavirus, interventional radiology suite

INTRODUCTION

The appearance of the SARS-coV2 virus and outbreak of COVID-19 has important implications for vascular and interventional radiology units. The first confirmed case of SARS-CoV-2 infection in Spain was identified in January 2020, and the first death attributed to COVID-19 occurred on February 13. On March 11, the WHO declared COVID-19 a pandemic [1], and on March 15 the Spanish government declared it a national health emergency.

In Spain, although the pandemic has been especially concentrated in certain areas (Madrid, Basque country, Rioja, and Navarra, and to a lesser extent in Valencia and Catalonia), cases have been reported in all regions.

Like other coronaviruses, COVID-19 **primarily causes respiratory symptoms**, running from mild syndromes similar to a common cold to systemic inflammatory response syndrome with severe interstitial bronchopneumonia leading to respiratory failure, septic shock, and death. Although 80% of patients have only mild symptoms, thousands of others have died.

Risk factors for developing more severe disease include advanced age (patients aged > 60 have increased risk and those aged >80 years have the highest mortality from COVID-19), hypertension (the virus enters cells by binding to ACE-2 receptors on the cell membrane), cardiorespiratory disease (it seems the virus is especially cardiotropic), immunodepression, and diabetes.

Because some infected individuals remain asymptomatic and can transmit the disease, it is impossible to know how contagious or lethal the virus is until a reliable estimate of the number of people who have been infected becomes available.

VIR teams play an important role in the clinical and therapeutic management of a wide spectrum of diseases. The outbreak of COVID-19 and orders from local and national health authorities have drastically deranged the operation of the vast majority of VIR units. The Spanish Society of Vascular and Interventional Radiology (SERVEI) is committed to ensuring the best possible outcomes for all patients. Given the threat posed by the current situation, SERVEI recognizes the need to define protocols for managing patients with confirmed COVID-19, those with suspected but unconfirmed COVID-19, and those without any signs or symptoms of the disease [6].

VIR teams comprise few, highly specialized professionals (nurses, technicians, aides, and physicians) who work together in compact spaces, so the risk of contagion among professionals is high. Infection of a single professional could result in the quarantine of many team members, threatening the unit's ability to provide care for the patients who need it.

To guarantee the safety of patients and professionals and the quality of care in VIR units, the SERVEI has elaborated the following guidelines.



DEFINITIONS (Source: Procedures to follow in patients infected with the new coronavirus COVID-sars-2. Ministry of Health of the Government of Spain. 15 March 2020)

- **CONFIRMED** infection: case fulfilling laboratory criteria: PCR positive for a specific gene [RdRp or S] or positive for ≥ 2 genes used for screening [E or N].
- **PROBABLE** infection: case with inconclusive laboratory findings for SARS-CoV-2; these cases are sent to the National Microbiology Laboratory for confirmation.
- Infection **RULED OUT**: case in which laboratory findings are negative for SARS-CoV-2.
- **POSIBLE** infection: patient with mild acute respiratory symptoms that do not meet the criteria for diagnostic testing.
- **CLOSE CONTACT** case:
 - Anyone who has provided care for a patient with a probable or confirmed infection while the patient was symptomatic: healthcare professionals without adequate protective measures interacting with the patient and family members or other individuals in close physical contact with the patient.
 - Anyone who has been within 2 meters of a person with a probable or confirmed infection in a confined space (e.g., cohabitants or visitors).
 - Anyone on an airplane seated within a radius of two seats from a person with a probable or confirmed infection while that person was symptomatic, as well as crew members who had direct contact with that person.

The preventive medicine or occupational health department at each hospital will assess each professional's situation individually, taking into account aspects related to the working environment as well as the type and duration of exposure.

PLANNING AND STRATEGY FOR VIR UNITS

When possible, VIR units should be organized into independent teams that do not interact with each other, so that if one team must be quarantined, the remaining team(s) can continue to provide care.

It is highly recommendable to distribute work into morning and afternoon shifts on alternative days to ensure that the different teams have different schedules and do not interact with each other.

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Whenever possible, professionals should be isolated from possible contact with the contagion; thus, it is important to facilitate remote working (e.g., reporting CT angiograms from home), possibly with professionals rotating in weekly shifts. If this approach is unfeasible, it is recommended that professionals be organized in different teams dedicated to different, cyclical activities (e.g., one group reporting vascular/oncologic studies and the other carrying out activities in the suite) and that members of different teams maintain a safe social distance (1.5 m) from one another.

If the unit has more than one angiography suite, one or more should be reserved for patients with probable or confirmed infections and the other(s) for those in whom infection has been ruled out.

Protective measures must be updated to comply with guidelines and protocols based on the latest scientific evidence about transmission. It is essential for all professionals to have the appropriate protective equipment for all procedures.

PATIENTS TO BE ATTENDED

Given the extreme scarcity of available hospital beds due to this health emergency, activity should be limited to medical emergencies and high-priority procedures (e.g., oncologic patients). No interventions should be done unless beds are available. All elective or nonessential procedures should be postponed.

Units should establish a list of procedures that should be considered urgent or maximum priority (Annex II).

Oncologic patients account for more than 40% of the activity in VIR units. The VIR team must reach a consensus with the patient's attending team regarding the degree of urgency and the possibility of postponing treatment or of alternative treatments on a case-by-case basis taking into consideration the availability of hospital beds.

Likewise, it is fundamental to coordinate with the department of anesthesia and reanimation to assess the availability of resources and the foreseeable duration of hospitalization for each candidate for treatment.

Given the scarcity of hospital beds and difficulty of admission to intensive care units, it is essential to weigh the risk of complications in elective oncologic procedures.

Standard care pathways based on safety and quality regulations must not be altered to allow immediate discharge after procedures in cases requiring surveillance (core biopsy of visceral organs, tumor ablation, etc.).

PREVENTIVE MEASURES AND REGULATIONS

General

- To avoid unnecessary deployment of resources, VIR nursing staff in coordination with ward nursing staff must complete a safety checklist before transferring patients to the VIR suite; this checklist must include the classification of the patient's SARS-CoV-2 status as **infection ruled out or confirmed or possible-probable infection** (cough, fever, sore throat).
- Patients transferred from wards to the VIR suite must wear surgical masks from the time they leave the ward until they return to the ward (i.e., during transfer to the VIR suite, during procedures, and during transfer back to the ward). Likewise, orderlies transporting patients must wear masks and gloves.
- All professionals must wear surgical scrubs and surgical masks throughout the work shift. Street clothing is FORBIDDEN in VIR departmental areas.
- All professionals must wash their hands frequently
- Workstations must be individualized as far as possible: each station should be assigned to a single professional (or if this is unfeasible, to two professionals), and professionals should use only the station to which they have been assigned, Workstations must be spaced at least 1.5 meters apart. It might be useful to plastic keyboard covers to facilitate cleaning.
- It is essential to remove personal protective equipment and to wash hands thoroughly before using consoles and before using computers to review images or to write reports.
- If voice recognition software is used for reporting on shared workstations, professionals should wear surgical masks when dictating reports.
- Protective aprons and thyroid shields must be cleaned daily with at least 1 minute exposure to ethanol (62%-71%).
- As far as possible, consultations with professionals from other departments should be done remotely.

ATTENDING PATIENTS CONSIDERED LESS LIKELY TO HAVE COVID-19 (SARS-COV-2 INFECTION RULED OUT OR POSSIBLE)

It may be necessary to treat patients who are asymptomatic or have mild symptoms but have not been tested for COVID-19. In these cases, it is essential to exercise extreme caution to ensure preventive and protective measures, especially when patients are referred from the emergency department, intensive care unit, or group living facilities (e.g., nursing homes, long-term care facilities, prisons, etc.).

Recommendations

- **PATIENTS:** must wear surgical masks from the point of referral. Patients' hands should be sanitized before entering the VIR suite.
- **PHYSICIANS, NURSES, AND NURSES AIDES:** must wash their hands and wear conventional surgical masks (if possible with a plastic screen), sterile waterproof gowns, sterile gloves, disposable head coverings (never cloth head coverings), and radiological goggles. Full face shields are recommended only for procedures that involve a risk of generating aerosols.
- VIR procedures that could generate aerosols include percutaneous gastrostomy; placement or dilation of an esophageal, gastric, duodenal, or tracheal stent; embolization of bronchial arteries; procedures in tracheostomized patients; and procedures requiring intubation.
- In high-risk epidemic foci or when a situation of **community transmission** has been declared, some scientific societies and workgroups recommend performing chest CT in urgent patients for whom previous verifiable information about possible symptoms is unavailable and in those who have been in contact with infected persons. Nevertheless, there is no wide consensus about the need for chest CT in these patients and the decision to perform chest CT should depend on the situation in the local community (high risk: community transmission) and be taken together with attending physicians and thoracic radiologists.

ATTENDING PATIENTS CONSIDERED LIKELY TO HAVE COVID-19 (SARS-COV-2 INFECTION PROBABLE OR CONFIRMED)

General recommendations

- Only professionals who are absolutely necessary for the procedure should be involved in the patient's care.
- The doors to the VIR suite must be kept closed.
- Laminar air flow in suites should be turned off during procedures to avoid spreading contagions to areas outside the suite.
- Only fundamental material should be brought into the suite. To minimize movements in and out of the suite, it is important to place accessory material that might be necessary to deal with eventualities nearby and to have a nurse or aide bring this material into the suite if it is required. It could be helpful to have packs of material ready to deal with the most common emergencies (e.g., embolization pack, nephrostomy pack, stroke pack, etc.).
- All packages delivered to the VIR unit should be opened with gloves on and packaging material should be removed after the contents have been removed.
- Professionals should avoid leaving the VIR suite with any contaminated item of personal protective equipment.
- All used and unused material must be disposed of in dedicated waste receptacles: **class 3 containers** inside the suite as well as in the room through which the suite is exited.
- It is important to protect the anesthesia station, the injector, and the monitoring apparatuses with clear plastic covers that allow them to be used without direct contact.
- To minimize the movement of patients with a high risk of being infected, ultrasound-guided procedures (e.g., placing drainages or vascular accesses) should be performed at bedside whenever possible, following established protocols (see the Spanish Ultrasound Society guidelines).

Recommendations for moving patients from gurneys to operating tables

- Professionals moving patients between beds and operating tables must wear high-risk personal protective equipment (i.e., head covering, FFP2 mask, face shields, waterproof gown or plastic apron, and gloves).
- Once the patient has been transferred, personnel must remove the equipment, following the instructions provided below.



Personal protective equipment

- **PATIENTS:** should be provided with surgical masks, not with FFP2 masks. FFP2 masks are designed to protect the wearer, not to function as a barrier. The air expelled through the FFP2 mask valve can be contaminated.
- **PHYSICIANS AND NURSES:** must comply with hand-cleansing protocols, wear waterproof gowns (unless a plastic apron can be worn), two pairs of gloves, protective goggles or plastic face shield, head coverings, and FFP2 or FFP3 masks with surgical masks over them, especially if materials are in short supply and must be reused (recommended by the Ministry of Health). Annex III lists the filtrating capacity of the different types of masks.

Recommendations for putting on personal protective equipment

1. Remove rings and jewelry. Avoid wearing nail polish.
2. Place shoe covers over footwear. Wear only closed clogs.
3. Tie hair back and put on protective head covering.
4. Put on radiological protective gear (lead glasses, apron, thyroid shield).
5. Carry out hand hygiene according to surgical protocol.
6. Put on FFP2-FFP3 mask, adjusting the metallic band over the bridge of the nose and placing one elastic band over the top of the ears and the other below the ears. Make sure that there are no leaks: place your hand over the valve to check sealing.
7. Put on goggles or face shield.
8. Put on a surgical cap.
9. Place a standard surgical mask over the FFP2-FFP3 (when materials are scarce).
10. Cleanse hands with sanitizer.
11. Put on the first pair of gloves.
12. Put on a sterile surgical gown.
13. Put on the second pair of gloves.



Recommendations for removing personal protective equipment

Inside the suite:

1. Remove your gown and outer pair of gloves simultaneously, and place these items in the designated waste receptacle (class 3 container). To avoid generating aerosols, keep movement of the gown to a minimum.
2. Remove the external head covering and place it in the class 3 container.
3. Remove shoe covers and place them in the class 3 container.
4. On leaving the suite, stand with both feet on the bleach-impregnated cloth.

Outside the suite:

1. Remove the inner pair of gloves.
2. Wash your hands.
3. Remove goggles or face shield while keeping your eyes closed.
4. Sanitize your hands with gel.
5. Remove your mask (touching only the elastic bands).
6. Wash your hands again.

IMPORTANT!

1. Gowns and external gloves should NEVER leave the suite.
2. It is forbidden to be in the suite without an FFP2-FFP3 mask.

Finalizing the procedure

1. Put on a clean pair of gloves and disinfect the goggles/face shield with sanitizing wipes or disinfectant. It is recommendable to keep all goggles in a single basin and that only one person handle and clean them (first with soap and water or disinfecting wipes and then with sanitizing fluid).
2. All the material used in the procedure must be discarded in the group 3 container.
3. Consider changing scrubs.
4. Patients must wear surgical masks AT ALL TIMES.
5. Orderlies must wear masks (preferably FFP2-FFP3) and gloves AT ALL TIMES.

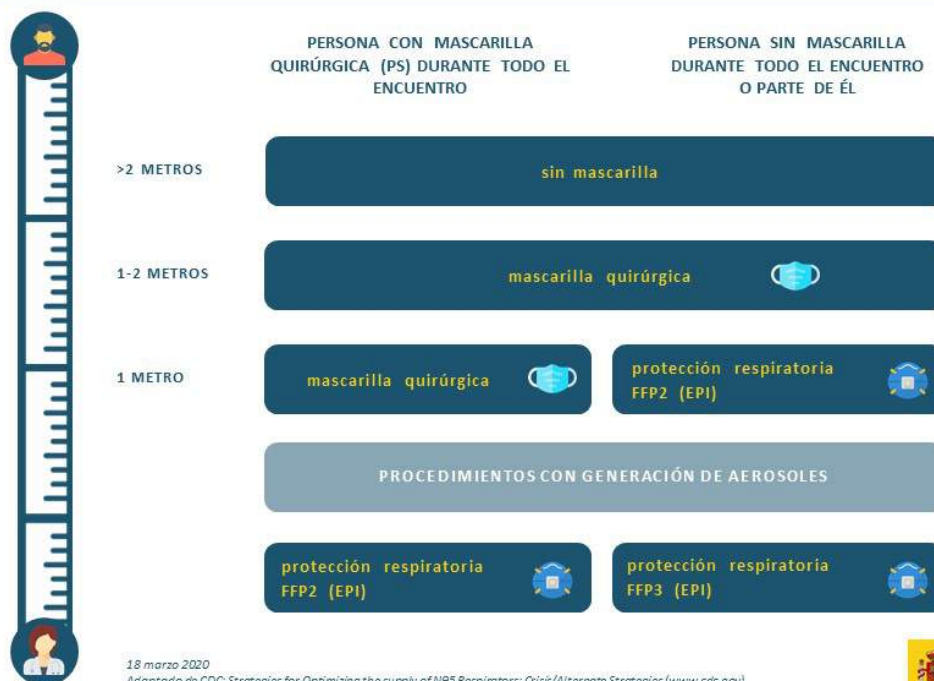
Cleaning the suite

- Cleaning staff must wear personal protective equipment (if available).
- The suite must be cleaned and disinfected according to protocol (using specific procedures to protect cleaning staff from contact with airborne pathogens and pathogens on surfaces).
- All areas that may have come in contact with the patient must be cleaned.
- To reduce the risk of the presence of aerosols, it is recommendable to wait until 30 to 60 minutes after the procedure before cleaning the suite.

HOW TO PROCEED IF MATERIAL IS LACKING (Ministry of Health (Government of Spain); March 18, 2020)

Priorización de uso ante la escasez de mascarillas en COVID-19

Recomendaciones según distancia con la persona sintomática



18 marzo 2020
Adaptado de CDC: Strategies for Optimizing the supply of N95 Respirators: Crisis/Alternate Strategies (www.cdc.gov)

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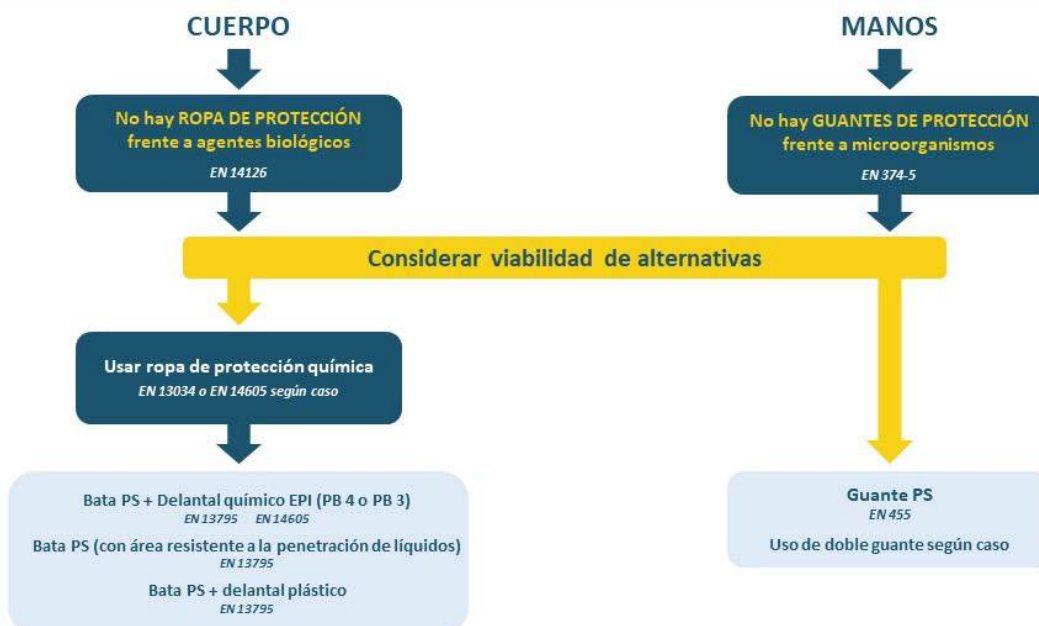
Estrategia ante la escasez de Equipos de Protección Individual (EPI)



(1) **Uso extendido de mascarillas autofiltrantes:** Se refiere a la práctica de usar la misma mascarilla en encuentros repetidos de contacto cercano con varios pacientes diferentes, sin quitarse la mascarilla entre ellos. El uso extendido es muy adecuado en situaciones en las que varios pacientes tienen el mismo diagnóstico de enfermedad infecciosa y se agrupan (por ejemplo, se alojan en la misma unidad hospitalaria).
 (2) **Uso de EPI más allá de la vida útil designada por el fabricante:** Es necesario tener en cuenta que las mascarillas (EPI) fuera del plazo de caducidad pueden no cumplir con los requisitos para los cuales fueron certificadas. Con el tiempo, los componentes como las cintas y el material del puente nasal pueden degradarse, lo que puede afectar la calidad del ajuste. Inspeccione visualmente la mascarilla para verificar que sus componentes no se hayan degradado.
 (3) **Reutilización limitada:** Se refiere a la práctica de usar la misma mascarilla para encuentros múltiples con pacientes pero retirándola después de cada encuentro y siempre haciendo uso de guantes. La reutilización ya se ha recomendado como una opción para conservar la protección respiratoria durante brotes y pandemias de patógenos respiratorios previos y podría ser necesaria cuando se atiende a pacientes con COVID-19. Sin embargo, se desconoce cuál es la contribución potencial de la transmisión por contacto para el SARS-CoV-2, y se debe tener precaución.
 (4) **Priorizar el uso por tipo de actividad:** Este enfoque de priorización es apropiado cuando los equipos de protección respiratoria (EPR) son tan limitados que ya no es posible que todo el personal sanitario use EPR de manera rutinaria cuando atiende a un paciente con COVID-19. Se debe priorizar el uso de EPR con las exposiciones de mayor riesgo, incluida la presencia en la sala durante los procedimientos con generación de aerosol realizados en personas sintomáticas.

Priorización de uso ante la escasez de material en COVID-19

Ropa de protección y guantes



18 marzo 2020
Adaptado de CDC: Strategies for Optimizing the supply of N95 Respirators: Crisis/Alternate Strategies (www.cdc.gov)

ANNEX I - USE OF MEDICATION IN THE SARS-COV-2 SCENARIO

Although the data regarding many of the supposed interactions with antiretrovirals and with hydroxychloroquine are inconclusive and are not backed by sufficiently robust evidence, the following general terms can help orient clinicians on the use of medication in patients who might be infected with SARS-CoV-2¹⁴:

The following drugs are **NOT CONTRAINDICATED**:

- AAS
- Tirofiban
- Heparin sodium
- rtPA
- Tenecteplase
- Omeprazole
- Mepivacaine
- Ranitidine
- Metoclopramide
- Adrenaline
- Atropine
- Phenylephrine
- Ephedrine
- Dopamine
- Dobutamine
- Propofol
- Paracetamol
- Although there is no evidence that angiotensin-converting enzyme inhibitors or angiotensin II receptor antagonists should be contraindicated, it is recommended that they be replaced with other drugs in patients hospitalized for COVID-19.
- Labetalol can be used in combination with antiretrovirals but NOT with hydroxychloroquine.

As far as possible, the following drugs **SHOULD BE AVOIDED**:

- Dexamethasone/methylprednisolone
- Clopidogrel and ticagrelor (use prasugrel instead, but NOT in cases of ischemic stroke because it increases the risk of intracranial bleeding).
- Beta-blockers because they interact with hydroxychloroquine
- Ondansetron.

The following drugs can be **USED WITH CARE**:

- Intravenous midazolam (oral administration is contraindicated because retrovirals increase serum levels of midazolam).

ANNEX II - PROCEDURES CONSIDERED URGENT AND LEVEL I PRIORITY

It is important to reduce the non-urgent workload because infection-control measures prolong the time required for procedures and require the intervention of more professionals. Most cases will be patients with suspected rather than confirmed infections.

CITATION PLAN IN COVID-19 SITUATION IN IR SUITES (source: RSNA)

PROCEDURES THAT CAN BE SCHEDULED	PROCEDURES THAT SHOULD BE RESCHEDULED OR POSTPONED
Emergencies	Interventions for chronic venous disease
Paracentesis / Thoracocentesis	Prostatic artery embolization
Percutaneous drainage of abscesses	Uterine fibroid embolization
Percutaneous nephrostomy	Embolization for pelvic congestion syndrome
Percutaneous biliary drainage	Endoleak embolization
Interventions related to dialysis accesses	Embolization of pulmonary arteriovenous malformations
Placement of ICD filters**	Removal of ICD filters
Percutaneous ablation of lesions*	Transjugular biopsy
Transarterial chemoembolization*	TIPS for refractory ascites
Central venous access*	Replacement of functioning catheters
Lymphatic interventions*	Venograms for planning internal arteriovenous fistulas
Organ biopsies*	
* Assess on a case-by-case basis, considering the need for beds.	
** If presurgical, confirm that the schedule for the operation has not been changed.	



ANNEX III - CLASSIFICATION AND CHARACTERISTICS OF FACEMASKS¹⁵






CLASSIFICATION OF FFP FACEMASKS			
Europe		USA	
Type	FE*	Type	FE*
FFP1	78%		
FFP2	92%		
		N95	95%
FFP3	98%		
		N99	99%
		N100	100%

* % FE (Minimum Filtration Efficiency) = * FE (minimum filtration efficiency) = minimum percentage of airborne particles $\geq 0.3 \mu\text{m}$ filtered

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	CHARACTERISTICS OF THE MASK	EFFICIENCY OF THE MASK	USE
N95 masks without respirator valve 	Also known as N95 respirators, these masks effectively filter airborne particles and provide adequate protection against airborne transmission of respiratory infections.	They block $\geq 95\%$ of particles $\geq 0.3 \mu\text{m}$	They can be reused or used for long periods of time. They should be discarded when damaged, deformed, wet, or dirty.
N95 masks with respirator valve 	The characteristics of these masks are the same as those of N95 masks without respirator valves. The respirator valves have several delicate parts that allow exhaled breath to flow out but do not allow particles to flow in. This design facilitates exhalation and helps reduce the accumulation of heat and moisture.	Their efficiency is similar to that of N95 without respirator valves; they block $\geq 95\%$ of particles $\geq 0.3 \mu\text{m}$	Like N95 masks without respirators, they can be reused or used for long periods of time. They should be discarded when damaged, deformed, wet, or dirty.
Surgical masks 	These masks are used to provide healthcare professionals or related staff with basic protection. They protect wearers' from splattering and droplets that can contain germs.	The filtration efficiency of surgical masks varies. In general, they can filter particles $\geq 5 \mu\text{m}$. They have an external layer that repels water, preventing drops from entering the mask, and an intermediate layer that filters particles.	Single use.
General medical masks 	These disposable masks are designed for general medical procedures, mostly in ordinary environments to block particles (e.g., pollen) rather than pathogenic microorganisms.	These masks do not fulfill the minimum requirements for filtering particles and microorganisms; they are less efficient than surgical masks and FFP masks.	Single use.
Cotton masks 	These masks are used to maintain heat and block larger particles such as dust.	These masks only filter large particles like soot or dust.	Washable and reusable.

The information in this document is valid for the current scenario (27 March 2020). No one knows how the situation will develop. Although models based on what has happened in other countries are available, each country is unique and differs from others in many respects.

ACKNOWLEDGEMENTS

The authors thank the Spanish Society of Cardiology, especially the authors of the consensus document published in REC Interventional Cardiology in March 2020.

We also thank our colleagues responsible for the following documents that were consulted in elaborating these recommendations.

- "Managing vascular and interventional radiology suites used for interventional neuroradiology procedures during the COVID-19 outbreak", a protocol from the Hospital Universitario Virgen del Rocío (Seville).
- Vascular and interventional radiology protocol from the Hospital Parc Taulí (Sabadell).
- Vascular and interventional radiology protocol from the Hospital Universitario de Basurto (Bilbao).
- "Action Protocol for Vascular and Interventional Radiology departments during the coronavirus outbreak (COVID-19). Consensus Document", published in *Revista Intervencionismo*.

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