



# Recommendations for the organization of electrophysiology and cardiac pacing services during the COVID-19 pandemic

Latin American Heart Rhythm Society (LAHRS) in collaboration with: Colombian College Of Electrophysiology, Argentinian Society of Cardiac Electrophysiology (SADEC), Brazilian Society Of Cardiac Arrhythmias (SOBRAC), Mexican Society Of Cardiac Electrophysiology (SOMECE)

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## Abstract

COVID-19 is a rapidly evolving public health emergency that has largely impacted the provision of healthcare services around the world. The challenge for electrophysiology teams is double; on one side preventing disease spread by limiting all nonessential face-to-face interactions, but at the same time ensuring continued care for patients who need it. These guidelines contain recommendations regarding triaging in order to define what procedures, device checks and clinic visits can be postponed during the pandemic. We also discuss best practices to protect patients and healthcare workers and provide guidance for the management of COVID-19 patients with arrhythmic conditions.

**Keywords** COVID-19 · Pandemic · Catheter ablation · Devices

## 1 Introduction

The rapid expansion of the current COVID-19 pandemic and the sudden, unexpected demand for medical care to treat infected patients has overwhelmed the capacity of health care systems in many countries where the disease has spread [1, 2]. Strict social distancing measures have been applied and hospitals around the globe have had to implement drastic and

quick changes to cope with the crisis. According to published statistics, a significant percentage of COVID-19 infections are acquired in hospitals [2], with the potential risk of cross-contamination among health care workers, which limits even further the capacity to respond to the pandemic. For these reasons, it is imperative to reorganize outpatient and in-hospital services in order to optimize the use of technical and human resources, but most importantly to protect patients, health care workers, and their families from the risk of transmission.

The Latin American Heart Rhythm Society (LAHRS), in collaboration with the Argentinian, Brazilian, and Mexican Societies of Electrophysiology (SADEC, SOBRAC, SOMECE) and the Colombian College of Electrophysiology, has decided to contribute to this effort with the formulation of practical recommendations to guide rational reduction of face-to-face clinical interactions to the strictly and absolutely necessary. The recommendations outlined in this document are in accordance with guidelines issued by international organizations to prevent the spread of COVID-19 infection [3–6] and have been adapted to the activities specific to our field. They will be in place while community-based measures are maintained by regulatory bodies at the international and local levels and could be modified in the short term depending on the

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behavior of the pandemic and the issuance of new global public health guidelines. In addition, we have proposed general recommendations for the antiarrhythmic management of patients with COVID-19 infection. In the absence of specific clinical studies guiding antiarrhythmic management in these patients, our recommendations are based on international consensus guidelines and are aimed to minimize unnecessary exposure risk while at the same time maintaining essential care for urgent arrhythmic conditions that, if untreated, could result in patient harm or clinical decompensation requiring hospital admission. The recommendations relative to remote consults and monitoring must conform to local regulations, which may vary between countries and institutions.

## 2 Objectives

1. Minimize the risk of COVID-19 transmission to patients, health care workers, and their families by reducing unnecessary person-to-person exposure and contact with surfaces or areas contaminated with the virus
2. Ensure the continuous provision of electrophysiology clinical care by protecting our team members from illness or mandatory quarantines
3. Optimize the use of personal protection equipment (PPE), prioritizing its use by frontline health workers
4. Rationalize the use of hospital technical and human resources, so they can be focused in the management of COVID-19 patients

## 3 Personal protection equipment

Person-to-person spread of SARS-CoV2 (severe acute respiratory syndrome coronavirus 2), the virus responsible for COVID-19, is thought to occur primarily via respiratory droplets produced when the infected person coughs, sneezes, or talks. Infection can also occur if a person touches an infected surface and then touches his/her eyes, nose, or mouth. The relevance of airborne transmission is currently uncertain.

1. Health care workers providing care for suspect or confirmed COVID-19 patient should adhere to standard precautions and use a respirator or facemask, gown, gloves, and eye protection (goggles or face shield) [7].
2. A respirator (N95 or higher-level respirator) should be used instead of a facemask for electrophysiology procedures requiring intubation or conscious sedation with high flow oxygen (considered aerosol generating procedures).

## 4 Follow-up of cardiac implantable electronic devices

1. We recommend a case-by-case triage of patients previously scheduled for in-clinic consult in order to determine if the visit can be postponed while social distancing measures are in place (Table 1). This decision should be based on analysis of the clinical history, data from last device interrogation, and information regarding clinical stability assessed by telephone contact. Telephone contact should include questions to identify suspected or confirmed COVID-19 cases (e.g., travel history, sick contacts, and respiratory symptoms).
2. We recommend postponing in-clinic follow-ups of patients with CIEDs that have been evaluated within the previous year if their clinical condition is stable and there are no device alerts.
3. In patients nearing battery depletion that cannot be followed remotely, the need for in-clinic assessment should be decided based on the battery estimated longevity measured at the last follow-up and pacing-dependence.
4. In patients with recently implanted devices, we recommend postponing in-clinic evaluation if their condition is stable and there were no findings during the implant warranting early follow-up.
5. Patients on remote monitoring should continue to be followed remotely. Patients with devices amenable to remote monitoring in which this function has not been activated, should be encouraged to switch to remote monitoring.
6. In patients with an implantable loop recorder (ILR) that cannot be followed remotely, we recommend postponing in-clinic evaluation if their condition is stable.
7. We recommend proper documentation of remote device follow-ups according to local regulations.

## 5 Outpatient arrhythmia clinics

1. We recommend a case-by-case triage of patients previously scheduled for in-person consultation in order to determine if the visit can be postponed while social distancing measures are in place. This decision should be based on analysis of the clinical history, results of diagnostic studies, and information regarding clinical stability assessed by telephone contact. Telephone contact should include questions to identify suspected or confirmed COVID-19 cases.
2. We recommend transitioning to virtual consultation (via telephone or video) for the majority of first assessments and/or follow-ups during the COVID-19 pandemic [8]. This would ensure uninterrupted care of patients with arrhythmic disorders, preventing clinical decompensation,

**Table 1** Risk stratification of patients followed in device clinic

High risk (evaluation needed)	Intermediate risk (case-by-case analysis)	Low risk (postpone until the pandemic has subsided)
<ul style="list-style-type: none"> <li>- Pacing-dependent patients nearing battery depletion</li> <li>- Suspected device malfunction</li> <li>- ICD shocks</li> <li>- Activated alarms</li> <li>- Lead alerts (new high threshold, high/low impedance, lead noise in ICDs)</li> <li>- Syncope of suspected cardiac etiology</li> <li>- Suspected device infection</li> </ul>	<ul style="list-style-type: none"> <li>- Non-pacing-dependent patients nearing battery depletion</li> </ul>	<ul style="list-style-type: none"> <li>- Asymptomatic, non-pacing-dependent patients with adequate battery longevity</li> <li>- Patients with primary prevention ICD</li> </ul>

or the need for emergency presentations. For institutions or medical groups that have not yet adopted virtual care, early implementation is encouraged.

3. We recommend proper documentation of virtual visits according to local regulations.
4. Priority in scheduling virtual consults should be based on the patient's clinical history, results of diagnostic studies, and information regarding clinical stability.

## 6 Postoperative assessment of surgical wounds or vascular access sites

1. We recommend virtual postoperative evaluation via telephone or videoconference for early detection of complications, according to local regulations.
2. Assessment of surgical wounds or vascular access sites can be done through remote photographic review.
3. For implantation of CIEDs, we recommend the use of absorbable suture materials to avoid the need for stitches removal.
4. We recommend proper documentation of remote postoperative evaluations according to local regulations.

## 7 Inpatient CIEDs interrogation/reprogramming

1. We recommend limiting inpatient device interrogation to the following scenarios: (a) high index of suspicion for device malfunction with ECG documentation, (b) recent implantable cardioverter defibrillator (ICD) shocks, (c) ICD audible alarms, (d) syncope of unknown etiology, (e) tachyarrhythmias without ECG documentation, or (f) decompensated HF in patients with cardiac resynchronization therapy (CRT) devices.

2. Reprogramming of CIEDs in patients undergoing surgery or magnetic resonance imaging studies should follow recommendations from clinical guidelines.
3. In pacemaker-dependent patients and patients with ICDs undergoing surgery, application of a magnet should be the first-line approach as long as it does not interfere with the sterile operating field. Otherwise, reprogramming can be performed.
4. Programmers, cables, and wands should be carefully disinfected with alcohol wipes after every patient to prevent cross-contamination.
5. For patients with CIEDs requiring imaging diagnostic studies, CT should be preferred over MRI as it is faster, limiting personnel exposure time, and avoids the need of device reprogramming.

## 8 Noninvasive investigations

1. We recommend postponing tilt table tests while social distancing measures are in place.
2. We recommend postponing Holter or event monitors of any duration, unless there is a high suspicion index for arrhythmic syncope. This recommendation is based on the potential risk of exposure for patients and healthcare workers during placement and removal of a device that has been in contact with the patient for  $\geq 24$  h. Monitors can also be shipped by mail to the patients, who set up the device themselves, but this option is not available in most centers.
3. In recent years, smartphones and wearable devices have incorporated technology capable of monitoring heart rhythm (e.g., Kardia and Apple SmartWatch) [9]. These devices are able to generate single-lead ECG recordings that can be exported into a PDF and emailed to the physician's office. When this technology is available, its use should be encouraged, according to local regulations.

## 9 Electrophysiology procedures in patients without suspected or confirmed COVID-19 infection

1. We recommend a case-by-case triage of patients previously scheduled for electrophysiology procedures in order to determine if they can be postponed while social distancing measures are in place. This decision should be based on analysis of the clinical history, results of diagnostic studies, and information regarding clinical stability assessed by telephone contact. Telephone contact should include questions to identify suspicious or confirmed cases of COVID-19 infection.
2. We recommend postponing implantation or extraction of CIEDs, except in case of life-threatening conditions on when there is a high probability of clinical decompensation requiring hospitalization in the short term (Table 2a). These include the following:
  - a. High-degree or complete atrioventricular block without reversible causes
  - b. Symptomatic sinus bradycardia or sinus pauses without reversible causes, especially if associated with syncope
  - c. Secondary prevention ICD implantation
  - d. Device extraction in patients with CIED infection associated with bacteremia or sepsis
  - e. Lead repositioning or replacement due to lead dysfunction that cannot be corrected with device reprogramming in pacing-dependent patients or in case of inappropriate ICD shocks
  - f. Generator replacement of devices with an estimated longevity  $\leq 1$  month in pacing-dependent patients, secondary prevention ICDs or CRT devices
3. We recommend postponing catheter ablation procedures, except in case of life-threatening conditions on when there is a high probability of clinical decompensation requiring hospitalization in the short term (Table 2b). These include the following:
  - a. Electrical storm refractory to medical therapy and without reversible causes
  - b. Incessant ventricular tachycardia (VT) refractory to medical therapy (including electrical cardioversion) and without reversible causes
  - c. Recurrent VT without reversible causes requiring frequent hospitalizations ( $\geq 2$  within a month) or frequent ICD therapies despite medical management
  - d. Incessant atrial fibrillation (AF) and flutter without reversible causes associated with significant symptoms despite medical management (including electrical cardioversion)
  - e. Paroxysmal AF and flutter without reversible causes requiring frequent hospitalizations ( $\geq 2$  within a month)
  - f. Incessant supraventricular tachycardia (SVT) without reversible causes associated with significant symptoms despite medical management (including electrical cardioversion)
  - g. Recurrent SVT without reversible causes requiring frequent hospitalizations ( $\geq 2$  within a month) despite medical management
  - h. Preexcited AF or Wolf-Parkinson-White syndrome with syncope of suspected arrhythmic etiology
4. In patients with indication of catheter ablation who are deferred due to the COVID-19 pandemic, we recommend initiation of betablockers and/or class I–III antiarrhythmic drugs according to clinical guidelines in order to prevent clinical decompensation or hospitalization due to recurrence of symptoms.
5. We recommend postponing ILR implants, CRT implants in stable patients, diagnostic electrophysiology studies in patients with stable brady- or tachyarrhythmias and percutaneous left atrial appendage closure procedures.
6. Consider same day discharge after device implantation to avoid risk of acquiring COVID-19 during hospitalization.

## 10 Evaluation and management of arrhythmias in suspected or confirmed COVID-19 patients

The occurrence of cardiac arrhythmias has been reported as one of the most frequent manifestations in patients admitted with COVID-19 infection and they can be secondary to hypoxia or metabolic, neurohormonal, and inflammatory factors related to the infection [10–13].

The clinical spectrum is broad and may include conduction disorders, AF/flutter, and malignant ventricular arrhythmias, which may represent exacerbation of chronic conditions or de novo arrhythmias with a potentially reversible mechanism.

As expected, to date there have been no clinical studies to guide antiarrhythmic management in patients with COVID-19 infection and our recommendations are based on the experience from management of critically ill patients with other infectious diseases. It should be noted that antiarrhythmic drugs may be another component of a pharmacological regimen that often includes antivirals, antibiotics, and immunomodulators, with potential for pharmacological interactions and risk of pro-arrhythmia.

1. We recommend coordination between the electrophysiology team and other hospital units in order to implement protocols

**Table 2** List of emergent/semi-urgent electrophysiology procedures

A. Devices	B. Catheter ablation
- Pacemaker implant for high-degree or complete atrio-ventricular block	- Electrical storm refractory to medical therapy
- Pacemaker implant for symptomatic sinus bradycardia or sinus pauses	- Incessant VT refractory to medical therapy.
- Secondary prevention ICD implantation	- Recurrent VT requiring frequent hospitalizations or ICD therapies despite medical therapy
- Device extraction in patients with CIED infection associated with bacteremia or sepsis	- Incessant AF/flutter associated with significant symptoms despite medical therapy
- Lead repositioning or replacement due to lead dysfunction in pacing-dependent patients or in case of inappropriate ICD shocks	- Paroxysmal AF/flutter requiring frequent hospitalizations
- Generator replacement of devices with an estimated longevity $\leq 1$ month in pacing-dependent patients, secondary prevention ICDs, or CRT devices	- Incessant SVT associated with significant symptoms despite medical therapy
	- Recurrent SVT requiring frequent hospitalizations despite medical therapy.
	- Preexcited AF or Wolf-Parkinson-White syndrome with syncope of suspected arrhythmic etiology

of remote consultation when possible, especially in areas such as the intensive care unit or the emergency department.

2. We recommend proper documentation of remote inpatient consults according to local regulations.
3. In patients with supraventricular and ventricular arrhythmias, secondary causes should be investigated and treated: hypoxia, metabolic and electrolyte imbalances, proarrhythmic effect of drugs, or myocardial ischemia.
4. In patients with new-onset ventricular arrhythmias and troponin elevation, myocarditis should be ruled out as a causal factor.
5. In patients with AF/flutter:
  - a. Betablockers are recommended as first-line therapy.
  - b. Use of amiodarone is reserved for patients with hemodynamic instability despite betablockers due to its potential interaction with other QT-prolonging drugs (hydroxychloroquine, azithromycin, lopinavir/ritonavir) used to treat COVID-19 infection.
  - c. In patients treated with amiodarone and especially with concomitant use of other QT-prolonging drugs (hydroxychloroquine, azithromycin, lopinavir/ritonavir), frequent electrolyte and QT monitoring is recommended to minimize the risk of pro-arrhythmia.
  - d. Early anticoagulation with unfractionated heparin is recommended for prevention of embolic events, reducing the need for transoesophageal echocardiogram (TEE) if electrical cardioversion is required.
  - e. In patients treated with antivirals or immunomodulators the use of oral anticoagulants should be avoided due to potential interaction.

6. In patients with VT/VF without reversible causes:

- a. Betablockers and/or amiodarone are recommended as first-line agents.
- b. Careful use of amiodarone is recommended, with frequent electrolyte and QT monitoring to minimize the risk of pro-arrhythmia, especially in patients with concomitant use of other QT-prolonging drugs (hydroxychloroquine, azithromycin, lopinavir/ritonavir).
- c. The use of amiodarone is contraindicated in patients with ventricular arrhythmias secondary to electrolyte imbalances and QT prolongation. These patients should be treated according to published guidelines.
- d. In patients with electrical storm not related to hypoxia, metabolic or electrolyte imbalances, or proarrhythmic effect drugs, management should include general anesthesia and betablockers in addition to amiodarone. In refractory cases, initiation of epidural anesthesia with bupivacaine could be considered.
- e. Patients with electrical storm refractory to the aforementioned measures should be evaluated in a case-by-case basis to decide possible escalation of therapies, including the use of ECMO.

7. In patients with active COVID-19 infection who develop symptomatic or hemodynamically unstable bradyarrhythmias, insertion of a temporary pacemaker is recommended due to their potentially transient nature.
8. When feasible, suspected or confirmed COVID-19 cases requiring electrophysiology procedures should be

scheduled at the end of the day as extensive disinfection/cleaning would be required post-procedure.

- Cardiopulmonary resuscitation (CPR) in COVID-19 patients with VF arrest involves a high risk of aerosolization and disease transmission. All participants should don full PPE for aerosol generating procedures (respirator, gown, gloves, and eye protection) before starting CPR in suspect or confirmed COVID-19 patients.

## 11 Electrical cardioversion

- Electrical cardioversion should be reserved for refractory cases of AF/atrial flutter or SVT not responding to optimal medical therapy. Postponing elective electrical cardioversion is recommended in stable and asymptomatic patients.
- Early anticoagulation is recommended in patients with AF/atrial flutter to avoid the need for TEE, which is an aerosol generating procedure, if electrical cardioversion is indicated.
- Performing CT instead of TEE could be considered to rule out left atrial appendage thrombus before electrical cardioversion in AF/atrial flutter patients with no optimal anticoagulation.

## 12 QT monitoring

Several drugs used to treat COVID-19 infection, including hydroxychloroquine, azithromycin and antivirals such as lopinavir/ritonavir, have the potential for QT interval prolongation and torsades de pointes [14].

- A 12-lead ECG to measure the QTc interval is recommended at baseline and after initiation of any QT-prolonging drug.
- Patients with a baseline QTc > 500 ms and those with a QTc prolongation > 60 ms post exposure to medications are at increased risk for torsades de pointes and a risk-benefit analysis should be undertaken [15].
- In patients with abnormal QT prolongation, we recommend correction of electrolytes abnormalities ( $K^+ > 4$  mEq/L,  $Mg^{2+} > 2$  mEq/L), discontinuation of unnecessary QT-prolonging drugs and continuous telemetry for monitoring of ventricular arrhythmias. If torsades de pointes is noted on telemetry, all QTc prolonging drugs should be discontinued.
- The US Food and Drugs Administration (FDA) has approved the use of KardiaMobile 6 L (AliveCore) to monitor the QTc duration in COVID-19 patients receiving QT-prolonging drugs [16]. This avoids exposure of ECG technicians to affected patients and unnecessary use of PPE.

## 13 Recommendations to minimize exposure in patients, health care workers, and their families

- We recommend limitation of all in-person interactions to the strictly necessary as the most effective and efficient measure to reduce the risk of COVID-19 spread.
- We encourage all electrophysiology team members to adhere to basic preventive measures including frequent handwashing, social distancing, and self-isolation or quarantine when appropriate.
- We recommend sharing the current recommendations with other hospital services through official channels.
- Before any in-person clinical interactions such as outpatient clinic appointments, inpatient consults, or electrophysiology invasive procedures, we recommend checking if the patient is suspicious or has tested positive for COVID-19 infection in order to take additional safety precautions.

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