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Assistance protocol for patients with acute coronary syndrome at "Hospital de Fuerteventura" during the COVID-19 pandemic

Protocolo de atención a pacientes con síndrome coronario agudo en el Hospital de Fuerteventura durante la pandemia de COVID-19

José A. Gómez Guindal, MD

Servicio de Cardiología, Hospital General Docente Roberto Rodríguez Fernández. Morón, Ciego de Ávila, Cuba.

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To the Editor:

The current pandemic caused by SARS-CoV-2 respon-sible for COVID-19 poses a challenge to health systems that is threatening to collapse their functioning[1]. This situation hampers the practice of all routine processes –non strictly COVID-related ones– and we must assume that the way to manage cases will be different from those currently required by clinical practice protocols and guidelines. It is mandatory to optimize the use of resources and promptly reduce the possibilities of infection both in patients and professionals[2]. The way to interpret indications for percutaneous coronary intervention (PCI) and the time-frames usually considered to be optimal will dramatically change, particularly in the treatment of acute coronary syndrome (ACS)[3].

✉ *JA Gómez Guindal*
Serv. de Cardiología. Hospital General de Fuerteventura
Ctra. del Aeropuerto, Km 1
Puerto del Rosario 35600, Las Palmas, España.
E-mail address: jgomgui@gobiernodecanarias.org

With this paper we intend to design a emergency plan to deal with a possible saturation of our reference center *Complejo Hospitalario Universitario Insular - Materno Infantil* (CHUIMI) from Las Palmas de Gran Canaria (Canary Islands, Spain) which may seriously hinder the referral of patients scheduled to undergo interventional procedures; that so far have been performed in compliance with clinical practice guidelines[4,5] and the "Infarction Code" protocol[6]. Such patients cannot remain indefinitely in our center just waiting to be referred and even less so in the face of a pandemic, as there is a risk of infection.

It is worth noting that COVID-19 increases the risk of myocardial infarction. It may also aggravate, decompensate and even lead to cardiac involvement. This viral disease has been associated with decompensation of patients with heart failure and can lead to myocarditis due to direct involvement of the heart muscle, since the virus not only causes viral pneumonia[1,2], and therefore coronary angiography is frequently required in patients infected with COVID-19 –either by known or suspected ACS– who could mimic it, (chest pain and elevated troponins not related to coronary thrombosis). Furthermore, the low oxygen saturation in patients suffering from this

condition could lead to type II infarctions[7]. The Spanish and European Societies of Cardiology, as well as various international societies, advise not to perform elective procedures but only preferential or urgent ones[8,9].

The *Hospital de Fuerteventura* refers its patients to the CHUIMI where these procedures are performed. This means that not only the environment, but also airborne equipment and CHUIMI's hemodynamics room could likely become infected. In addition, patients must return to Fuerteventura at a time when the number of commercial flights has been dramatically reduced to only one per direction, to and from Gran Canaria, with only 50% seats available.

Current scenario, with no COVID-19 pandemic

Until now, the management of acute coronary syndrome at this health care facility has been divided into two groups in line with clinical practice guidelines [4,5,10]:

- ST-segment elevation ACS: systemic fibrinolysis and early referral to CHUIMI for coronary angiography within the first 24 hours. These patients are admitted to the Intensive Care Unit.
- Non-ST-segment elevation ACS:
  - Very high risk: Early referral to CHUIMI for immediate coronary angiography.
  - High risk: Referral to CHUIMI for coronary angiography within the first 24 hours.
  - Moderate risk: Same as in the first 3 days.
  - Low risk: Ischemia testing is performed and action is taken based on results.

This is a rough overview. Unfortunately, these times cannot always be met in the non-ST-segment elevation ACS whereas they are usually met in virtually all those with ST-segment elevation ACS.

Action protocol suggestions for patients with ACS during the COVID-19 pandemic

Figures 1 and **2** show decision-making flow charts depending on the type of ACS and presence or not of COVID-19, faced with the threat of collapse in the CHUIMI.

Usual protocols will be maintained for non-infected ST-segment/non-ST-segment elevation ACS patients being at high, very high or low risk. Medical treatment will be chosen for those at moderate risk. Both risks and actual need for coronary angiography will be considered in terms of their outcomes.

The treatment for ACS patients infected with COVID-19 has not been fully clarified and is based on the Chinese experience with Wuhan patients[2]. But this is quite arguable and possibly the differences in health systems and cultural values may lead us to disagree. Hence, we present the guidelines of the consensus document of the Associations of Interventional Cardiology and Ischemic Heart Disease of the Spanish Society of Cardiology[9].

ST-segment elevation ACS and negative COVID

Reperfusion treatment should maintain the "Infarc-

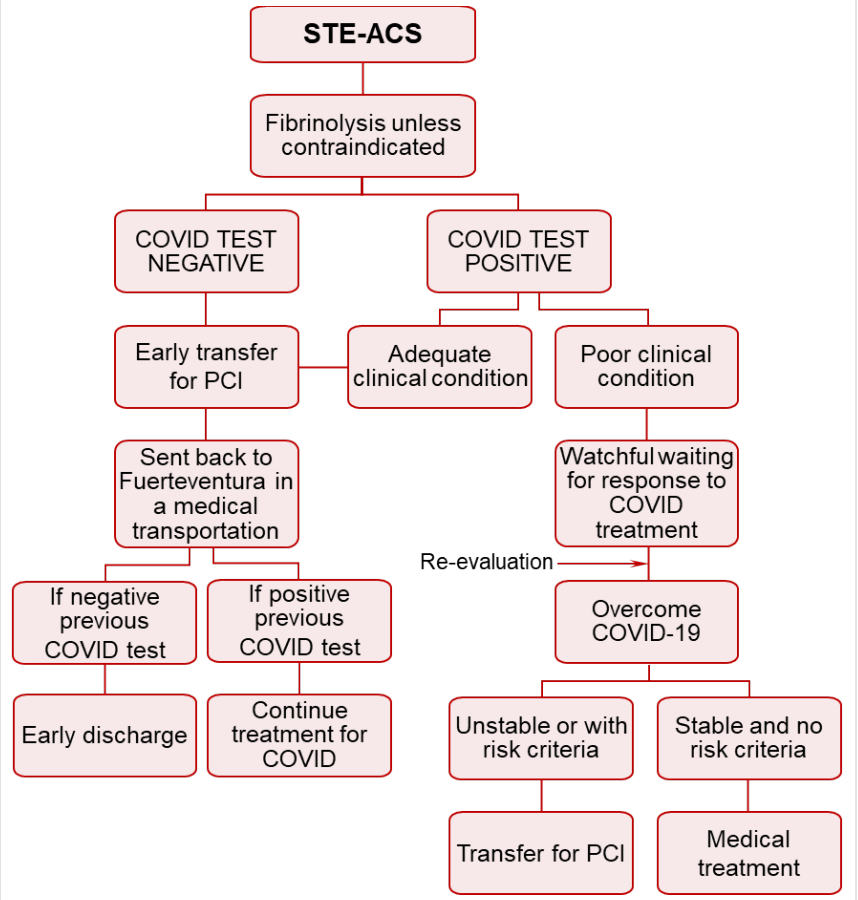

Figure 1. Assistance protocol for patients with ST-segment elevation acute coronary syndrome (STE-ACS) during COVID-19 outbreak. PCI, percutaneous coronary intervention.

tion Code" strategy in the Fuerteventura area. That is, systemic fibrinolysis within 10 minutes of diagnosis, if there are no contraindications (**Figure 1**). In case the referral hospital (CHUIMI) could not admit patients scheduled for possible PCI and there is evidence of reperfusion, with good clinical outcome, the transfer should be avoided. If transfer and PCI are carried out, the patients will be sent back to Fuerteventura in a medical transportation (as there is no reasonable possibility of commercial flights) and early discharge will be weighed up depending on their outcome.

ST-segment elevation ACS and positive COVID

Reperfusion treatment may not be entirely beneficial in individuals with poor clinical status. Hence, it could be considered not to transfer early for PCI and simply wait for COVID-19's eventual clinical course. This would avoid the risk of complications arising from the transfer of an unstable patient, and the risk of infection both for the transfer team and the interventional staff; as well as possible contamination of the transportation means and the hemodynamics and interventional cardiology room. If the patient survives the infection, PCI will be reevaluated (if high risk or poor prognosis criteria persist).

Clinical management for patients in good clinical condition should be akin to that for non-infected ones, but always taking extreme measures to protect the teams engaged in transfer and PCI.

In patients with Left bundle branch block, diagnosis of ACS should be verified and agreed upon to avoid inappropriate patient transfers. It is not advisable to perform early coronary angiography in survivors of resuscitated sudden death.

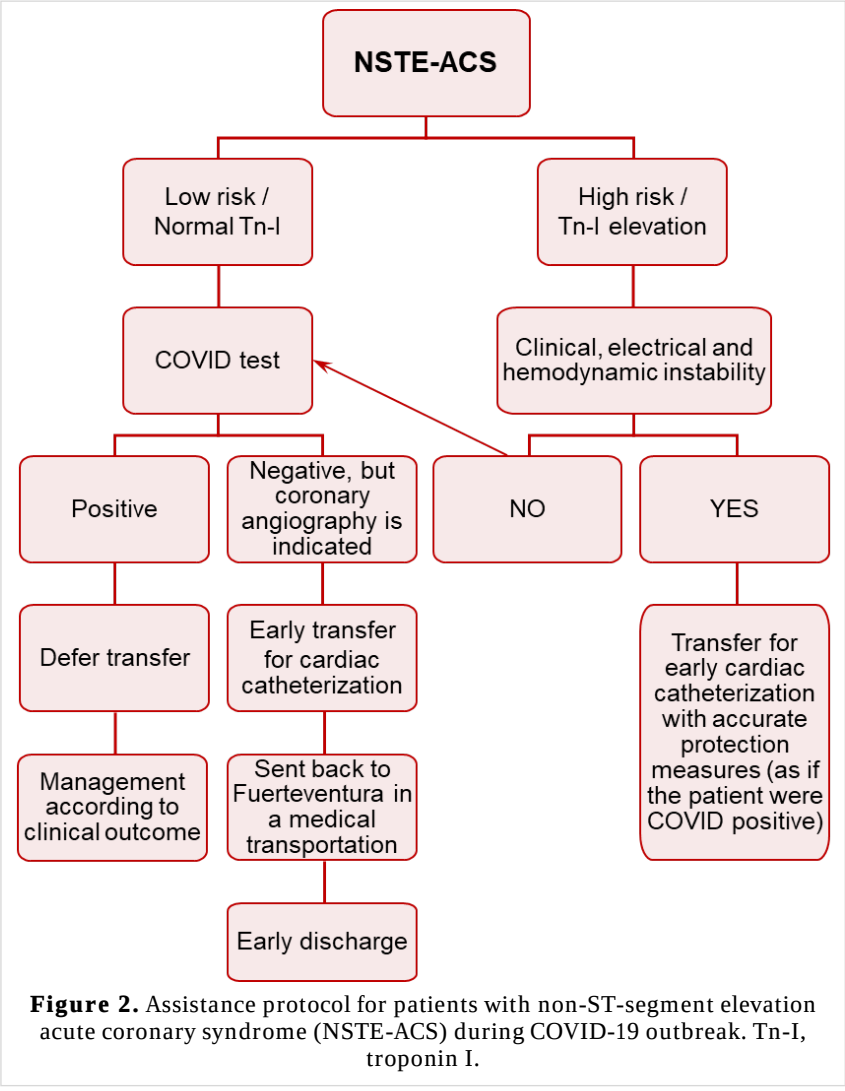

Figure 2. Assistance protocol for patients with non-ST-segment elevation acute coronary syndrome (NSTE-ACS) during COVID-19 outbreak. Tn-I, troponin I.

Non-ST-segment elevation ACS

There is a high percentage of COVID-19 positive patients with elevated troponins (8-12%), even without ACS. Moreover, COVID-19 may cause myocarditis, condition that is also able to increase the serum levels of these myocardial injury markers. It is therefore critical to perform the differential diagnosis before granting a diagnosis of non-ST-segment elevation ACS[9-11]. Consequently, invasive coronary angiography is not recommended for COVID-19 positive patients with elevated troponins if symptoms do not suggest ACS (**Figure 2**). This procedure should be restricted to high-risk patients with a high suspicion of ACS, with recurrence of ischemia despite medical treatment, and when prognosis, based on the infection, is favorable[9].

In medical facilities where Interventional Cardiology Services are not available, conservative treatment and early discharge would be advisable; except if there are high or very high risk criteria (**Box**) [9,10]. In that case:

- If the patient is at high risk and suspected of being COVID-19 positive: early transfer for coronary angiography within 2

Box. Risk criteria for non-ST-segment elevation ACS and course of action[9,10].

Very high risk
Hemodynamic instability or cardiogenic shock
Recurrent Ischemia
Malignant ventricular arrhythmias or resuscitated sudden death
Mechanical complications
Ventricular Dysfunction
Electrocardiogram changes suggestive of left coronary artery disease
High risk
Typical troponin curve compatible with infarction
ST-segment and T-wave dynamic changes
GRACE score >140
Moderate risk
Diabetes mellitus
Renal failure (glomerular filtration < 60 ml/min/1,73m^2)
Left ventricular ejection fraction <40% or congestive heart failure
Early postinfarction angina
Previous percutaneous coronary intervention or coronary artery bypass grafting
GRACE score 109-140

hours should be accomplished, taking extreme measures to protect the equipment, the transfer means of transportation and the interventional cardiology laboratory.

- High risk criteria: a diagnostic test for COVID-19 should be performed, as in these cases the indication for coronary angiography is within the first 24 hours, by which time the results should be available.
- COVID-19 negative patients: should be transferred for early PCI and discharge.

Cardiogenic shock

If cardiogenic shock is considered to be a consequence of ACS, the indication is for immediate PCI and therefore the patient should be transferred[9,10]. In these cases, as COVID-19 test results are not available in time, they should be treated as positive in the context of both referral and procedure. Orotracheal intubation, where indicated, should be performed prior to arrival in the hemodynamics room[9].

Drugs

Finally, it is important to note that there may be interactions between drugs used for ACS and those for COVID-19 treatment. Romaguera *et al*[9] provide a figure, as a contingency table −which we recommend reviewing− on possible interactions between the most commonly used drugs in cardiology and possible treatments for COVID-19.

Basically, aspirin, unfractionated and low molecular weight heparins, nitroglycerin, furosemide and inotropic/vasopressor drugs such as adrenaline, noradrenaline, dobutamine and dopamine have no significant interactions. On the other hand, with respect to $P2Y_{12}$ receptor inhibitors, which are essential for post-PCI dual antiplatelet aggregation, prasugrel should be prioritized, since lopinavir/ritonavir and darunavir/cobicistat enhance the effect of ticagrelor and reduce that of clopidogrel.

CONFLICT OF INTERESTS

None declared.

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