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SHORT EDITORIAL

Lessons Learned from Cardiac Complications of COVID-19 and the Value of the Electrocardiogram

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Editorial referring to the article: Frequent Cardiovascular Manifestations Associated With SARS Cov-2 Infection: Experience at a Tertiary Hospital In Cali, Colombia

Since the declaration of the coronavirus disease 2019 (COVID-19) pandemic in March 2020, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus, much has been learned about the epidemiology, pathophysiology, clinical characteristics, and predictors of poor prognosis. Furthermore, cardiovascular implications have emerged as significant contributors to morbi-mortality. In this sense, the recently published work of Galindes-Casanova et al. reinforces existing evidence on acute COVID-19 infection, cardiac complications, and electrocardiogram (ECG) manifestations.[1]

By the end of 2023, COVID-19 had already caused more than 770 million confirmed cases and 7 million deaths worldwide.[2] The disease is characterized by an acute phase that lasts up to 4 weeks. Symptoms and complications could occasionally extend up to several months, called post-acute COVID-19.[3] The main clinical manifestations are fever and respiratory symptoms. Less commonly, extrapulmonary involvement can also occur, involving different organs and systems secondary to direct and indirect viral damage, the latter through the dysregulation of the immune system, a hyperinflammatory state, endothelial dysfunction, coagulopathy, a prothrombotic state, and an imbalance of the renin-angiotensin-aldosterone system. These complex mechanisms, added to the injury of different organs and the adverse effects of COVID-19 treatments, favor the development of cardiac complications (Figure 1).[4]

Observational studies, reviews, and consensus agree on the following points: (a) the presence of pre-existing conditions (advanced age, obesity, diabetes mellitus, high blood pressure, history of cardiovascular or cerebrovascular disease, among others) is associated with cardiac events, worse prognosis (severe COVID-19, multi-organ involvement, requirement of intensive care unit [ICU] and invasive mechanical ventilation [IMV]), and higher mortality); (b) patients who develop a cardiac complication during the acute phase of COVID-19 are at increased risk of poor outcomes and death.[3-7]

Acute cardiac events are common in patients hospitalized with COVID-19, with myocardial injury and heart failure being the most prevalent (21% and 14-22%, respectively), followed by arrhythmias (10-16%) and acute myocardial infarction (6.5-16%).[3,6] Less frequent are myocarditis, pericarditis, pericardial effusion, and Takotsubo syndrome.[3,6,7]

Regarding the features of the ECG in the acute phase of COVID-19, multiple alterations have been described that could be grouped as follows: bundle branch blocks and other QRS complex disorders, ST-T abnormalities, prolongation of the corrected QT (QTc) interval, specific patterns related to a cardiac complication (for example, right ventricular strain as a marker of right ventricular dysfunction, defined by ST segment depression and T-wave inversion in leads V1-V4, II, III, aVF), and arrhythmias. Within this last category, the list is extensive, with supraventricular arrhythmias being the most frequent, followed by ventricular arrhythmias and

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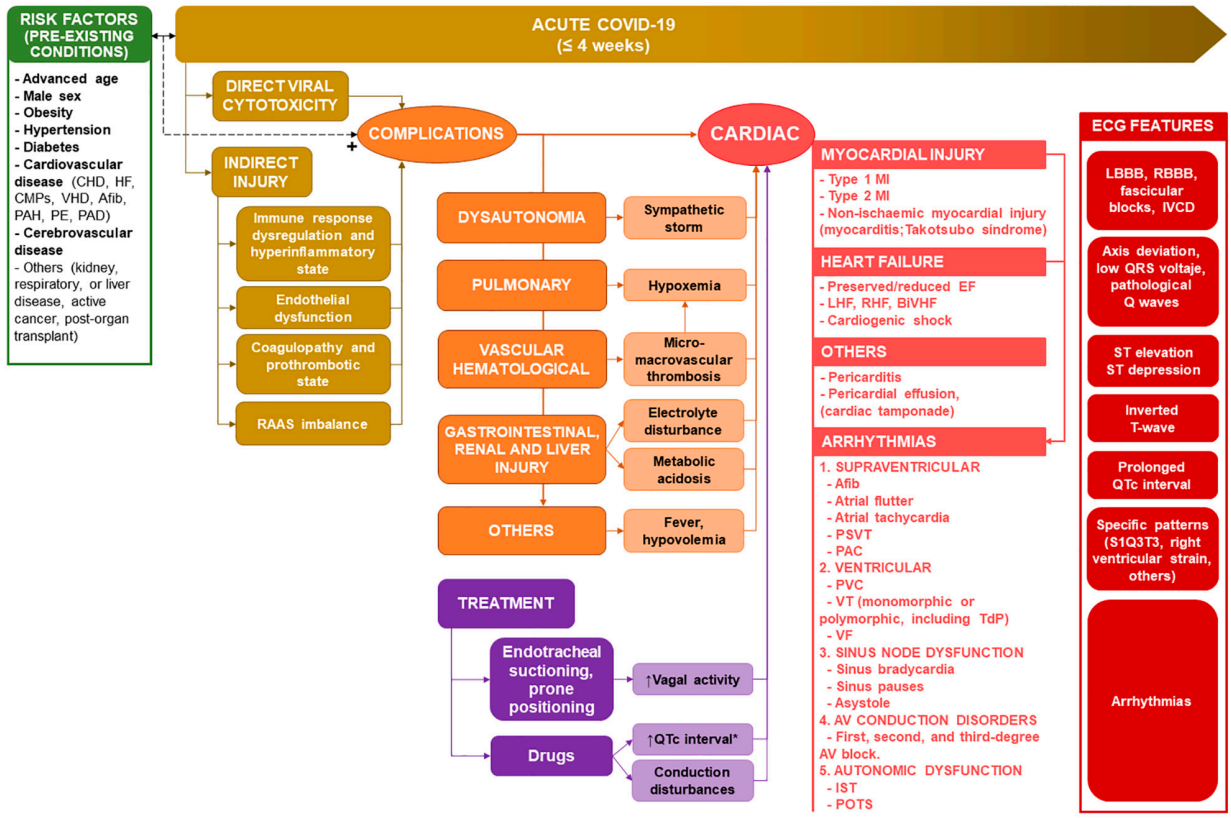

Figure 1 – Risk factors and mechanisms leading to cardiac complications and ECG abnormalities during acute COVID-19.
*Note that myocardial injury and heart failure could cause arrhythmias (red arrows), and ECG anomalies would depend on the cardiac complication type. *QTc interval prolongation may occur due to other causes (e.g., electrolyte and metabolic disturbances, virus infection).*
CHD: coronary heart disease; HF: heart failure; CMPs: cardiomyopathies; VHD: valvular heart disease; Afib: atrial fibrillation; PAH: pulmonary arterial hypertension; PE: pulmonary embolism; PAD: peripheral arterial disease; RAAS: renin–angiotensin–aldosterone system; QTc: corrected QT; MI: myocardial infarction; EF: ejection fraction; LHF: left heart failure; RHF: right heart failure; BiVHF: biventricular heart failure; PSVT: paroxysmal supraventricular tachycardia; PAC: premature atrial contraction; PVC: premature ventricular contraction; VT: ventricular tachycardia; TdP: torsades de pointes; VF: ventricular fibrillation; AV: atrioventricular node; IST: inappropriate sinus tachycardia; POTS: postural orthostatic tachycardia syndrome; LBBB: left bundle branch block; RBBB: right bundle branch block; IVCD: intraventricular conduction delays.

bradyarrhythmias, and less frequently those secondary to autonomic dysfunction (Figure 1).[8-11] One lesson learned from scientific evidence could be summarized with the following statement: an abnormal ECG during hospitalization for COVID-19 is not uncommon (reported frequency: 21-57%)[12,13] and is associated with a higher prevalence of comorbidities, severe infection, worse prognosis, cardiac complications, and higher mortality.[8,12-15] It should be clarified that the definition of abnormal ECG is variable. Several studies conclude that sinus tachycardia or atrial fibrillation (Afib), detected upon admission ECG, are independent predictors of poor prognosis and mortality.[11,12,15] Another study demonstrated that a pathological ECG performed within 6 hours of hospitalization predicts ICU admission and in-hospital mortality within 30 days, regardless of pre-existing conditions.[13] A systematic review and meta-analysis by Alsagaff et al. revealed that several ECG manifestations in admitted patients with COVID-19 (prolonged QTc interval, longer QRS duration, faster heart rate, left bundle branch block, premature atrial contraction, premature ventricular contraction, T-wave inversion, and ST segment depression) were significantly associated with poor outcome, defined as a composite of ICU admission, severe illness, and mortality.[14] In this sense, the ECG once again confirms its usefulness as a non-invasive, low-cost, widely available medical tool that can help as a prognostic marker for decision-making (inpatient vs. outpatient management, performing complementary cardiovascular studies, among others) of individuals with COVID-19.

The observational study by Galindes-Casanova et al. included 183 patients hospitalized in Colombia with COVID-19. They concluded that age over 75 years, the presence of comorbidities (cancer, ischemic heart disease, heart failure, or cerebrovascular disease) or superinfection, and the need for IMV for more than two days were associated with a mortality event. Moreover, myocardial injury prevalence was more common among the following: non-survivors, individuals with pathological ECG, and those who required ICU admission. Regarding the ECG features, 64% of the study population presented some kind of alteration, with sinus tachycardia and bradycardia being the most frequent and Afib the most prevalent arrhythmia (8.8%). However, no specific ECG marker of worse outcomes was identified.[1]

Much has been learned from the COVID-19 pandemic through the scientific community's contribution. Research in Latin America is essential in order to analyze the virus's behavior in this environment and establish similarities and differences with the rest of the world. Today, there is a better understanding of the complex pathophysiology of cardiovascular complications, the implications of pre-existing conditions, and the value of the ECG as a universal diagnostic and prognostic tool.

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